Brokerage Commissions, Perquisites, and Delegated Portfolio Management*

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Abstract

I use a simple three-agent setting to capture realistic features of the money management industry and highlight the importance of frictions in asset transactions. I explicitly model the price-setting process of a rational, profit-maximizing broker, who may pay the money manager perquisites ("perks") in exchange for his business. While commissions come directly out of the investor's portfolio, perks only benefit the manager and induce him to trade more. The contract that corrects the misalignments of interests produced by the broker is concave in portfolio payoffs. This concavity successfully reduces the manager's trading frequency, but compromises his incentive to gather information. I show that in equilibrium, the investor balances cost minimization and information acquisition by offering the manager a contract that is close to being linear, and this results in the manager trading excessively to maximize the likelihood of excess returns. Strikingly, I find that even if the broker does provide valuable research services in the bundle, as long as his personal costs for such services are low, investors are better off when the brokerage industry is less competitive. Instead of lowering commissions, brokers compete by raising perks and financing them with higher fees. These theoretical findings are consistent with many well-known facts such as the high levels of institutional trading and the underperformance of actively managed funds. Important empirical and policy implications are also discussed.

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"Yet when I think about today's soft dollar arrangements and their impact for investors, I keep coming back to the notion that fund advisers are paying their expenses with *other people's money*. Let's face it – extraordinary increases in volume over the last few years have generated revenues that are just as impressive for most brokers. So why haven't these increases produced more competitive full-service commission rates? Why hasn't the emergence of electronic markets – which offer execution five times cheaper – driven these commissions lower?"

Speech by former SEC Chairman Arthur Levitt: *Costs Paid with Other People's Money*, Nov. 3, 2000.

1 Introduction

The costs of institutional equity trades are economically significant.[1] Prior work on portfolio delegation focuses on the money manager's incentive to exert effort in gathering valuable information to improve portfolio returns. Trading costs and misalignments of interests during asset transactions are mostly ignored in assuming managers naturally take the most economic investment strategy. In this paper, I add a new party, brokers, to the analysis and investigate the role the brokerage industry plays in delegated portfolio management.

Brokers are intermediaries in asset transactions who execute orders for money managers and charge commissions for their services. The prevalent practice of "commission bundling" refers to the bundling of research-related services together with execution services and charging higher fees for the whole package. It is used by brokers as a means to attract order execution business from institutional money managers. Section 28(e) of the Exchange Act allows money managers to pay higher commissions than otherwise available using clients' money in exchange for such "brokerage and research services," which in principal should benefit the investors.[2] Ambachtsheer (1993) reports the combined U.S. and Canadian institutional stock commissions that do not directly relate to the purchase of execution services to be roughly $500 million per annum in the early 1990's. Now it should be much more.

Potential problems arise as this bundled-payment mechanism creates access to clients' money through means *not* subject to standard audit and accountability disciplines. As pointed out by Schwartz and Steil (2002), if a fund were to provide research and other services internally or pay a third party to do so, it must bear the expenses from its own capital and charge a management fee that makes such costs *explicit* to investors. Instead, if it accomplishes this through the trading process, the fund can outsource services while keeping the costs *unobservable* to investors. This leaves rooms for collusion between brokers and managers in taking clients' commission money for their own use. The lack of a systematic positive correlation between past and future performance[3]

[1] See, for example, Keim and Madhavan (1997, 1998), Carhart (1997), Wermers (2000).

[2] See Appendix A for a brief review of SEC laws and regulations regarding commission bundling.

[3] See, for example, Bernstein (1998), Berk and Green (2004).

prevents investors from detecting and punishing excessive trading activities through performance monitoring, thus strengthens fund managers' incentives to hide costs in returns rather than reveal them in expense reports.

Evidence shows that execution costs have declined significantly over the years, mainly due to advances in trading technology such as electronic trading and crossing networks. However, institutional brokerage commissions have not declined as the costs of institutional brokerage (in execution and clearing) have declined. Schwartz and Steil (2002) document a mere 10% decline in U.S. weighted-average commission rates despite a four-fold rise in trading volumes from 1994 to 1998. More notably, compared to the average commission of 5.8 cents per share, non-intermediated electronic trading commissions are only 0.25 to 2 cents per share. Yet, institutional ECN executions actually *declined* from 24% of Nasdaq volume in 1996 to 15% in 1998, even though total ECN executions rose to 30% of Nasdaq volume. For over 30 years, the SEC has devoted much attention to guiding and regulating client commission practices.[4] In particular, disclosure, transparency, and reporting of soft dollar brokerage commissions are at the center of debates.

I analyze the equilibrium of an economy in which brokers, fund managers, and investors interact in the securities market. The investor delegates portfolio management decisions to the fund manager to take advantage of his potentially superior information. The money manager exerts effort to gather information and then makes investment decisions. He can either hold the existing portfolio and realize a certain average return, or actively trade and earn a stochastic return, either outperforming or underperforming passive management. Should the manager decide to trade, he must go through a broker, who makes the market by offering order execution services. Each broker optimally chooses his commissions as well as perquisites paid to the fund manager as tokens of appreciation for his business. These perquisites can take the form of soft-dollar arrangements, hard-dollar rebates, or other types of perks. While commission fees come directly out of the fund, perks only benefit the fund manager. I emphasize the misalignments of interests created by the broker and study how such friction affects contract design and the resulting market equilibrium. In line with recent SEC proposals to impose more stringent disclosure rules on client commission usage, my model captures many realistic problems in the money management industry, which have not been addressed previously in the academic literature.

Introducing brokers into the model creates two sources of friction. One is the commission rates charged for trading, which create a barrier on the trading profits of the fund. The other is the perks the broker pays the fund manager for doing business with him, which distort the manager's trading incentives. I assume that both commissions and perks are privately arranged between the broker and the fund manager. Neither of them can be directly contracted upon by the investor, who must then make conjectures about both quantities.

[4] For more information, go to http://www.sec.gov.

The value created by the manager comes from the private information he can acquire. Through exertion of costly effort, the fund manager tries, but sometimes fails, to discover profitable trading opportunities. Although it is best to hold the existing position in the absence of good prospects, the manager might want to trade anyway for two reasons. First, he may have information suggesting a better-than-average chance of earning superior returns, although this information is not good enough to raise the expected payoff above trading fees. The manager receives rewards for exceptional performance, while he cannot be penalized for inferior return due to limited liability. Second, trading earns the manager personal benefits from the broker, while the commissions incurred during transactions come directly from the fund. Taking both factors into consideration, I first derive the optimal contract for exogenous fees and perks. I then analyze the market equilibrium and contrast it with one in which investors neglect the actions of the broker. Both a competitive and a monopolistic brokers are studied to illustrate how sell-side bargaining power affects the optimal contract and the equilibrium. In an extension of the model, I add the option for the broker to decide how much research service to provide in exchange for higher commissions at a personal cost. I show that results do not differ qualitatively as long as the broker's personal cost of research is low compared to the manager's cost of effort.

This paper produces two main results. First, investors in equilibrium choose to offer the money manager a (roughly) linear contract in portfolio payoffs, which results in the manager's trading heavily as a way to increase the likelihood of superior returns. This result is consistent with many empirical observations widely regarded as anomalous. Second, I show that as long as the use of client commissions remains obscure to the public, investors are worse off the more competitive the brokers. This result has important policy implications.

I distinguish three types of contracts. The first, the *frictionless contract*, refers to the optimal contract derived under zero commissions and perks. When commission fees are negligible, brokers have no incentive to offer perks. Maximizing returns net of fees is equivalent to maximizing the probability of outperforming passive management. In accordance with many previous studies,[5] I find that the optimal contract should consist of a base fee proportional to the investment payoffs and an incentive fee relative to a passive benchmark portfolio. Due to limited liability at the low end and the incentive fees at the high end, this type of contract is inherently convex in portfolio payoffs. The fact that the manager cannot be penalized enough for bad performance prevents investors from achieving the first-best outcome, even in the absence of distortions introduced by brokers. As commissions get significant, trading with a signal indicating higher payoffs than passive management does not necessarily generate profits because of the fees associated with trading. Indeed, to achieve return-maximization, the manager should trade only when his information is favorable enough to raise the expected payoff above all trading expenses. Moreover, as brokers

[5] Examples are Golec (1992), Dybvig, Farnsworth, and Carpenter (2004).

charge higher fees, they are more likely to offer perks to lure fund managers into trading. I show that keeping the same convex contract causes the manager to ignore substantive information indicating low returns and trade just for the sake of getting perks. As a result, investor welfare is reduced.

The second, the *aggressive-trading contract*, is derived when investors take perks into consideration but ignore commissions. I show that the investors' best response is to offer a close-to-linear contract in payoffs and forgo the incentive fees for superior performance. This lesser degree of convexity comes from the fact that the manager must be compensated for the loss in perks that results from holding the existing portfolio rather than trading with the broker. Such a contract prevents the manager from trading merely for the sake of perks, but does not deter the manager's trading aggressively to maximize his chance of getting a bonus. With nontrivial commissions associated with trading, this contract still produces more trading than is optimal and incurs unnecessary expenses for investors.

Lastly, the *economic-trading contract* is one in which investors completely eliminate the effects of both perks and commissions. It induces the manager to trade only when his conditional assessment of portfolio payoff is high enough to overcome trading expenses. In order to reduce the manager's trading frequency to this optimal level, investors must further raise the manager's compensation for holding the portfolio, thus forcing the payment function into *concavity.* This concave contract is efficient *given* the manager's information because it implements the most cost-effective trading strategy. However, the manager must exert costly effort to acquire information *before* making investment choices. The concavity in compensation reduces the manager's incentive to exert effort.

With exogenous trading commissions and perks, the optimal contract can take two forms, depending on the tradeoff between economic trading and information acquisition. When fees are high and perks are low, investors are most concerned with minimizing expenses. It is thereby optimal to reduce the manager's trading frequency by offering the concave contract. In the opposite scenario, investors care more about the quality of information. The linear contract becomes optimal despite the excessive expenses that are then incurred.

It is critical that both commissions and perks are paid only when trading actually occurs. In reality, fund managers may commit to pay brokerage fees even if they do not trade. In this alternative setting, doing business with the broker does not distort the manager's investment incentives. Rather, fixed costs are incurred which can by easily reversed by investors. As in a Modigliani-Miller scenario, brokerage commissions and perks matter only because they are paid some of the time but not all of the time. Investors cannot contract on the level of trading. Thus, they must de-convexify the compensation schedule in order to suppress the manager's tendency to trade, but this reduces the manager's incentive to gather information in the first place.

The investor's contract choice affects the trading behavior of the fund manager, and in turn, affects how the broker chooses his pricing scheme in equilibrium. In a perfectly competitive market, multiple brokers compete for order flow by raising perks and financing them with high fees. They earn zero profits themselves but allow the fund manager to benefit by extracting surplus from the fund and turning it into perks. The linear aggressive-trading contract is the investor's equilibrium choice, as it properly balances cost minimization and information gathering. In a monopolistic market, the broker has less of an incentive to give out tokens for trading. Since the concave economic-trading contract hinders the manager's trading frequency, it forces the broker to lower his commissions to improve the chance of a trade. This, however, is not an equilibrium. Given such low fees, investors always have incentives to deviate to the more optimal aggressive-trading contract, which encourages more information gathering. Similarly, offering the aggressive-trading contract would not produce an equilibrium either, as the resulting commissions become so high that the economic-trading contract becomes optimal. In fact, the only (pure-strategy) equilibrium is one in which the broker charges a fee that makes investors indifferent between choosing either contract. This implies that investors can offer a linear contract when the broker has more market power and get a more favorable commission rate, because they have the option to switch to the concave contract if fees get too high. Indeed, the option to switch to the economic-trading contract prevents the broker from extracting all the surplus of the trade, and leaves investors with some profits as well.

Although convexity in the compensation encourages high effort exertion from the manager, in equilibrium, the investor must offer a more linear contract in order to prevent the manager from trading excessively. This resulting linear contract is consistent with rewarding the manager a fraction of assets under management commonly used in practice. Although a concave contract would produce more cost-efficient trading by further deterring the manager's aggressive trading behavior, it reduces the manager's incentive to collect valuable information. The investor is therefore unable to completely eliminate the misalignments of interests created by the broker, which cause the manager to trade more relative to the optimal level. Consistent with empirical observations, my model predicts that money managers will trade with good information indicating a high probability of beating passive management, but not good enough to overcome the expenses incurred. As a result, actively managed funds make money from trading, but on average underperform their passive counterparts. However, this underperformance does not necessarily imply that managers lack skills or add no value. In my model, managers know perfectly well what is best for investors, but they only care about their own compensation. The fact that they trade suboptimally simply reflects the investors' inability to completely undo the distortions created by the broker in contract design.

Indeed, the empirical findings of Golec (1992) and Deli (2002) confirm that about 93% of mutual funds have advisory contracts based solely on a percent of assets. Moreover, Deli's crosssectional study of mutual fund advisory contracts and the time series analysis of the changes in advisory fees by Warner and Wu (2006) find that larger and older funds (and members of large and old fund families) tend to use more concave contracts, while smaller and younger funds use more linear compensation schemes. My theoretical results offer a possible explanation. Since larger and older funds tend to have better relationships with their brokers, motivating managers to trade economically is more important to these funds than inducing effort on information acquisition, thus making the concave contract more optimal.

Strikingly, I find that investors earn positive profits with a monopolistic broker, while they merely break even with a competitive one. This result still holds even when the broker does provide valuable research services in return for higher commissions, as long as the broker's personal cost of research is low. The fact that brokers compete for clients by turning commissions into perks has important policy implications. First, if perfect disclosure of commission usage becomes possible, brokers will no longer have incentives to offer perks. Competition will then effectively force commission rates to zero, or the true value of the research services provided. Therefore, encouraging competition among brokers improves investor welfare *only if* commissions are unbundled in the sense that the cost of the actual execution and the cost of each ancillary service are disclosed separately. My result also suggests that it is beneficial to investors when the money manager agrees to place a designated dollar value of brokerage commission business at a pre-arranged rate. The broker then provides the manager certain soft dollar credits equal to some percentage of the promised commissions, and the manager can use these credits without having to trade. Thus, committing to pay a fixed amount of commissions up-front prevents the manager from trading excessively purely for the purpose of generating perks. Finally, it is an implication of my model that funds that have in-house or affiliated brokers should perform better than those who use outside independent brokers, who are more competitive in attracting clients.

The rest of this paper is organized as follows. In section 2, I briefly review some of the most relevant work in the literature. The model is described in section 3. The equilibrium is derived in section 4 and compared with the first best benchmark and alternative settings. An extensions of the model in which the broker endogenously determines the amount of research service to provide is presented in section 5. In section 6, I summarize and discuss major implications of my results. Finally, the conclusion is presented in section 7. The background of commission bundling and the official policies and proposals regarding client commission practices are briefly reviewed in Appendix A. Derivations and proofs are given in Appendix B.

2 Related literature

It has been well documented that actively managed equity funds fail to match the performance of their passive counterparts.[6] At the same time, studies have shown that fund managers who actively trade do exhibit stock-picking abilities.[7] More disturbingly, good performance does not seem to persist.[8] Trading expenses may explain this apparent discrepancy. As Carhart (1997) points out, the more actively a fund manager trades, the lower the fund's benchmark-adjusted net return. According to Wermers (2000), funds that hold stocks that outperform the market by 1.3 percent underperform in net returns by 1 percent. Of the 2.3 percent difference, 0.7 comes from the underperformance of nonstock holdings, while 1.6 percent is due to expenses and transaction costs.

Brokerage commissions are major components of trading costs. Berkowitz et al. (1988) find that total NYSE transaction costs average 23 basis points of principal value, among which brokerage commissions account for 18 basis points while execution costs average only 5. A number of empirical studies have pointed out the inefficient usage of brokers by fund managers in order execution. Conrad et al. (2001) distinguish between institutional trades directed to soft-dollar brokers verses other types of brokers. The incremental implicit cost of soft-dollar execution is estimated to be 29(24) basis points for buyer- (seller-) initiated orders on average, and 41(30) basis points for large orders. Furthermore, explicit costs on soft-dollar transactions are four times higher than those on electronic systems and implicit costs are three times higher. Berkowitz et al. (1988) show that brokers do not incur consistently high or low transaction costs, but money managers do. Moreover, paying higher commissions does not yield lower execution costs even after adjusting for trade difficulty. More recently, Goldstein et al. (2006) report that the prior-period commission a fund pays is the strongest determinant of next period's commission. They find that institutions concentrate their order flow with a small set of brokers, and smaller funds concentrate more than large ones, pay higher commissions, and trade more frequently. They conclude that institutional commission is an average cost of engaging in a long-term relationship with the broker rather than a marginal cost of execution. Thus, incorporating trading expenses, especially brokerage commissions, in designing portfolio delegation contract is important. However, misalignments of interests created by brokers have not received much attention in the theoretical literature.

This paper is most similar in structure to that of Dow and Gorton (1997). Their paper focuses on solving for the optimal contract that separates out incompetent managers from talented ones. They find that talented managers are forced to trade blindly just to look busy, as only skilled people

[6] See Bernstein (1998), Gruber (1996), Ellis (1998), among others.

[7] Examples are Grinblatt and Tittman (1989, 1993), Chen, Jegadeesh, and Wermers (2000), Baker et al. (2004).

[8] Examples are Chevalier and Ellison (1997), Sirri and Tufano (1998), among others. See Berk and Green (2004) for a review.

should trade. My paper abstracts from the screening process for managerial ability. Rather, I show that in contracting with a fund manager, the investor's inability to undo the friction created by the broker causes too much trading by the manager. Other papers, such as Scharfstein and Stein (1990), Allen and Gorton (1993), and Truman (1998), also focus on screening agents of different types in an effort to explain high institutional trading activities.

Although there exist many models of delegated portfolio management, very few take transaction costs into account. Incorporating frictions in asset transactions may refute the underlying economic insights of these studies. The work by Ou-Yang (2003) uses a standard principal-agent model in which both the drift and the diffusion rates are affected by the agent's action. He finds that the optimal contract between the investor and the manager should be based on an active rather than passive benchmark. Since my model predicts that fund managers often trade too much, using an active index to evaluate fund performance could create serious problems. Total trading volume may explode, as each manager tries to match and beat the average performance of all actively-managed funds. In fact, it is an implication of my paper that benchmarks must be passive in the presence of trading costs in order to induce managers to trade economically.

My paper is only tangibly related to the literature on payment for order flow. The papers by Kandel and Marx (1999), Parlour and Rajan (2003), and Rhodes-Kropf (2005) all reach the same conclusion that payment for order flow could reduce investor welfare in more competitive environments. These studies focus on modeling how market makers offer price improvements to customers rather than solving portfolio delegation problems.

In the economic literature on contract theory, Diamond (1998) studies the optimal contract when outcomes depend on managers' choices as well as effort. He finds that the optimal contract converges to a linear payoff as the cost of effort shrinks relative to payoffs if the control space of the agent has full dimensionality. Interestingly, my model also yields a contract that is almost linear as such a contract offers the right balance between effort and investment choices. However, both the research topic and the economic lessons are drastically different between his paper and mine.

3 The Model

3.1 The market

There are two dates, 0 and 1. Two assets, safe and risky, are traded in the market at date 0. The safe asset incurs no trading costs and yields a riskless return of zero at date 1. All trades in the risky asset must go through a broker who charges a commission rate of c per dollar invested. At date 1, the risky security pays a stochastic liquidation dividend, which equals $H = 2$ in high state or $L = 0$ in low state with equal probability. Thus, there are totally three possible state realizations at date 1, high and low for the risky asset, and a medium state which occurs when no risky asset is purchased. Each dollar invested at date 0 generates $\{2(1-c),1,0\}$ at date 1 in high, medium, and low states, respectively. Since the net expected return for the risky asset is $-c \leq 0$, the general public invests in the safe asset only unless agents are risk seeking. Even that, commission rate cannot exceed $\frac{1}{2}$ if brokers want any business at all.

3.2 The fund

A profit-maximizing investor has an opportunity to hire a talented fund manager to manage his portfolio. The skills of potential fund managers are assumed to be observable. Moreover, I assume that managers have no resources of their own, are protected by limited liability, and are risk neutral.

If hired, the manager either remains inactive by keeping the fund in the safe asset, or actively trades the risky asset in the hope of realizing superior returns. Alternatively, we can interpret the investment in the safe asset as passive management by holding the existing benchmark portfolio, and trading the risky asset as actively managing this portfolio. The potential value of the manager comes from the private information that he can acquire about the risky asset. In particular, by exerting effort $e \in [0,1]$ at a quadratic cost $ke^2/2$, the fund manager obtains a private signal

$$\tilde{s} = \left\langle \begin{array}{ll} \tilde{v}, & \text{prob. } \tilde{\phi} \\ \tilde{\eta}, & \text{prob. } 1-\tilde{\phi}, \end{array} \right.$$

where $\tilde{\eta}$ has the same distribution as $\tilde{v}$ but is independent from it. Essentially, $\tilde{s}$ enables the fund manager to observe, in advance, the true liquidation value of the risky asset with probability $\tilde{\phi}$. Otherwise, he remains uninformed like everyone else. Obviously, the signal is more informative for larger values of $\tilde{\phi}$, which is a measure of signal precision. The distribution of $\tilde{\phi}$ depends on the effort the manager exerts and is given by

$$\tilde{\phi} = \left\langle \begin{array}{ll} \phi_H, & \text{prob. } e \\ \phi_L, & \text{prob. } 1-e, \end{array} \right.$$

where $0 \leq \phi_L < \phi_H \leq 1$. Thus, exerting more effort improves the quality of information and enhances the manager's chance of becoming perfectly informed. The manager determines how hard to work on information acquisition, and observes both $\tilde{s}$ and $\tilde{\phi}$, all of which are hidden information for the investor.

Notice that only the precision, not the signal itself, depends on effort. Moreover, expected signal quality is monotonic in effort, but precision itself is random. This captures the situation in which the manager works very hard but still fails to obtain a high quality signal. Thus, the investor is unable to design a contract that produces a pre-chosen signal precision, although any effort level can be implemented.

After signal realization, the manager decides whether or not to trade the risky asset: $i \in \{0, 1\}$, based on his conditional assessment of the state of risky payoff. Short sale, margin purchase, and partial investment are not allowed. The first two assumptions are not crucial and made for ease of exposition only. No partial investment follows from the manager's risk neutrality assumption. I rule out the possibility of a contract that specifies certain investment strategies, such as a percentage that must be kept in cash. Although the simplicity of this model enables the investor to write such contracts, it is very hard in practice, if not impossible, for investors to keep track and verify every position the manager takes. This is why I follow the same approach as in most of the papers in this literature[9] and assume that the investor does not write contracts that depend on the manager's investment strategy.

If the investor decides to hire the manager, he must design a contract to maximize the return on the portfolio net of all trading costs and expenses. The contract cannot condition directly on the manager's effort, investment, and private information, neither can it be contingent on commissions and perks since none is observable to the investor. Thus, the contract can only condition on realized portfolio return. Let us denote such contract by $W(\tilde{r})$ where $\tilde{r}$ is the net return of the portfolio. Since the manager's investment choice can take only two forms as in direct investment, the portfolio payoff space remains unchanged. Namely, net return $\tilde{r}$ equals $\{1 - 2c, 0, -1\}$ in high, medium, and low states, respectively.

The manager is assumed to receive zero remuneration when he chooses not to work for the investor. Because of limited liability and wealth constraint, he cannot be worse off working for the investor if offered, and participation constraint never binds. Everyone wants to become a fund manager, and all talented managers should be employed.

3.3 The broker

Profit-maximizing brokers make the market and incur no personal costs during asset transactions. They are modeled as Stackelberg leaders in setting commission rates $c \in [0, 1/2)$. In order to attract clients, each broker may choose to offer certain perquisites $q \in [0, c]$ to customers he deems important. I assume only fund managers, not individual investors, receive perks for trading. Of course, the manager gets q only if he decides (or commits ahead of time) to trade with the broker and pays c. This private benefit is lost if the manager holds the existing portfolio. Moreover, commissions and perquisites are determined in advance before investors commit to a contract. Neither quantity is contractually observable to investors.

Two market structures are considered: perfect competition in which multiple brokers compete

[9] One exception is Dybig, Farnsworth, and Carpenter (2004). They consider contracts that restrict the portfolio choice. Ding, Gervais, and Kyle (2006) study employee compensation inside a financial institution, where contracting on the size of the position each trader takes is possible.

for order flow, and monopoly in which there is only one broker for order execution. Broker monopoly can be interpreted as a market in which search and switching costs are so expensive that investors stick with their current brokers.

3.4 The timeline

Figure 1 depicts the event timeline of the model. I assume that the broker moves first before a portfolio delegation contract is agreed upon. Brokers make the equity market before the arrival of delegated portfolio management by professional money managers. Alternative settings with different timeline are briefly discussed in subsection 4.4.

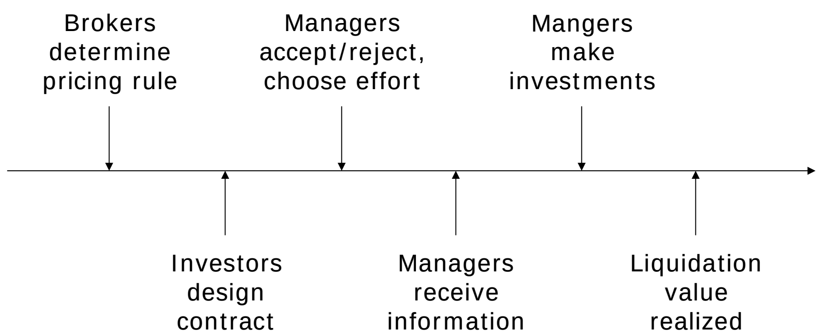

Figure 1: Sequence of events

4 Equilibrium analysis

An equilibrium of the model specifies (1) a decision for the broker on what commission rate c to charge and what perks q to offer the manager for trading; (2) for any cost-perquisite pair $\langle c, q\rangle$, a decision for the investor on whether to employ a fund manager, and if so, a contract $W(\tilde{r}|c, q)$ describing the manager's compensation; and (3) a decision for the fund manager on how much effort e to spend in information acquisition and a trading decision i conditional on his private information. The optimal contract must be incentive-compatible for the manager and maximizes the investor's net surplus, given any pricing scheme the broker chooses. The equilibrium pricing scheme should achieve profit-maximization for the broker.

Equilibria for both multiple competitive and monopolistic brokers are derived. To solve for the equilibrium, I start by finding the optimal contract between the investor and the manager for any given $\langle c, q\rangle$ pair. The optimal values of c and q are then determined by solving the broker's maximization problem.

4.1 Optimal portfolio delegation contract

I derive the optimal portfolio management contract assuming that the investor does decide to employ the fund manager. Since investors on their own only invest in the safe asset and earn zero profits, no hiring will occur if the contract yields a negative expected surplus for the investor.

The optimal contract must specify a payment for each state of the world. Without loss of generality, denote the manager's compensation by

$$W(\tilde{r}) = \begin{cases} \Delta_L + \Delta_M + \Delta_H & \text{if } \tilde{r} = 1 - 2c, \\ \Delta_L + \Delta_M & \text{if } \tilde{r} = 0, \\ \Delta_L & \text{if } \tilde{r} = -1. \end{cases}$$

Namely, Δ_M is the increment in compensation from the low to medium state, while Δ_H is the increment in compensation from the medium to high state. Due to limited liability, the lowest possible payment, Δ_L, is zero, which is also the manager's reservation wage. This contract can be interpreted as follows. The manager is let go with his reservation wage if his fund performs poorly relative to its passive counterpart; he gets a salary Δ_M if the fund performs similarly to passive management, and is rewarded an additional bonus Δ_H for superior performance.

The manager has two choice variables: effort and investment decision. The optimal contract must implement the optimal amount of effort from the manager. This is achieved by adjusting the bonus payment Δ_H, which is very much like a pay-performance sensitivity measure. The contract must also induce the desired investment given the manager's private information. The salary Δ_M is used to do that. It should be low enough to make risky investment appealing, and high enough to deter any gambling behavior.

The manager also enjoys perquisites from the broker if he trades with him. These personal benefits are lost if he keeps the fund in the safe asset. Consequently, the manager's total compensation is $\{q + \Delta_H + \Delta_M, \Delta_M, q\}$ in high, medium, and low states, respectively. Notice that the manager gets $q \geq 0$ when his fund performs poorly. This reduces the *actual* salary for inactivity or passive management to $\Delta_M - q$. The *actual* bonus for superior performance is $\Delta_H + q$, higher than what the contract really offers. Therefore, perquisites for trading strengthen the manager's incentive to invest in the risky asset, while encouraging him to work harder on information acquisition at the same time.

4.1.1 Some technicalities

I list several assumptions made for technical reasons. Altering them does not change the qualitative nature of the results, nor does it affect the underlying economic intuition of the model. They are made purely for the ease and convenience of analytical derivation.

From now on, assume $\phi_H > \frac{1}{2}$ and

$$\phi_L < \frac{\phi_H (2 - \phi_H)}{4 + \phi_H}. \tag{1}$$

Moreover, to guarantee an interior solution for equilibrium effort levels, (i.e., $e^* < 1$), I assume that[10]

$$\frac{\phi_H (\phi_H - \phi_L)}{(1 + \phi_H)} < 4k < (\phi_H - \phi_L)^2 . \tag{2}$$

4.1.2 Optimal investment decisions

Working backwards, I first discuss the optimal investment policy for a given signal realization, at which point any exerted effort is a sunk cost.

The manager's private information has four possible outcomes: high and precise; high and imprecise; low and precise; low and imprecise. Such information enables the fund manager to make better investment decisions. Specifically,

$$\begin{aligned} \Pr\left(\tilde{r} = H | \tilde{s} = H, \tilde{\phi} = \phi_j\right) &= \frac{1 + \phi_j}{2} \geq \frac{1}{2}, \text{ and} \\ \Pr\left(\tilde{r} = H | \tilde{s} = L, \tilde{\phi} = \phi_j\right) &= \frac{1 - \phi_j}{2} \leq \frac{1}{2}, \ j = \{H, L\}. \end{aligned}$$

Indeed, a favorable (high) signal indicates a better-than-average chance of beating passive management and getting the high-state return.

Expected portfolio return conditional on the manager's private information becomes

$$E\left(\tilde{r} | \tilde{s} = H, \tilde{\phi} = \phi_j\right) = \phi_j - (1 + \phi_j)\, c \tag{3}$$

which is positive when $c < \frac{\phi_j}{(1+\phi_j)}$, and

$$E\left(\tilde{r} | \tilde{s} = L, \tilde{\phi} = \phi_j\right) = -\phi_j - (1 - \phi_j)\, c \tag{4}$$

which is always negative.

Since expected net return is negative, trading with a low signal is never optimal for the investor regardless of its precision. However, a favorable signal does not necessarily imply positive returns due to the trading expenses. The investor has to consider three possibilities separately. If commissions are such that $c \geq \frac{\phi_H}{(1+\phi_H)}$, even a highly precise favorable signal cannot raise the expected payoff above trading expenses. The investor is therefore better off not hiring the manager because his private information is never valuable enough to generate net profits. At the other extreme,

[10] The proofs to later results will make the role of these specific assumptions more obvious.

when commissions are such that $c < \frac{\phi_L}{(1+\phi_L)}$, expected returns are positive for both precise and imprecise signals, as long as they are favorable. Hence, the best strategy is to trade whenever a favorable signal is received, and pay no attention to the precision of such signal. This is referred to as the "aggressive-trading" strategy. In fact, maximizing net return is equivalent to maximizing the chance of outperformance when trading expenses are low. Zero commissions obviously fall into this category.

The most interesting case is when commissions fall in the range $\frac{\phi_L}{(1+\phi_L)} \leq c < \frac{\phi_H}{(1+\phi_H)}$. Now, only a favorable *and* precise signal justifies trading. This is referred to as the "economic-trading" strategy, as it trades in the most economic way. It differs from the aggressive-trading strategy in its probability or frequency of trading. The aggressive-trading strategy trades half of the time; this frequency does not depend on effort since signal precision does not play a role in investment decisions. In contrast, the economic-trading strategy responds to trading fees by reducing the frequency of trade to $e/2$. It depends on managerial effort critically as the precision plays a decisive role in trading decisions. The more effort the manager puts in, the more likely he is to get a precise signal, and the higher the chance of making a trade. Yet, no matter how hard he works, the manager never trades more frequently than he would under zero/low commissions. From now on, all discussions are focused on this intermediate commission range.

Expected profits for each investment strategy are as follows:

	Economic-trading	Aggressive-trading
$E\pi(e)$:	$\frac{e}{2}[\phi_H - (1+\phi_H)c]$,	$\frac{1}{2}[\phi_L - (1+\phi_L)c + e(\phi_H - \phi_L)(1-c)]$.
$\frac{\partial E\pi(e)}{\partial e}$:	$\frac{1}{2}[\phi_H - (1+\phi_H)c]$,	$\frac{1}{2}(\phi_H - \phi_L)(1-c)$.

Economic trading maximizes portfolio returns and never generates expected losses for investors. Its marginal benefit of effort is proportional to the value created by superior information $\phi_H - (1+\phi_H)c$. On the other hand, the investor will sustain an expected loss $\phi_L - (1+\phi_L)c < 0$ when the manager trades on a favorable but imprecise signal due to excessive trading expenses. Indeed, expected profits under aggressive trading are positive on average if and only if the chance of making money by trading on a precise signal more than offsets the possible loss with an imprecise signal. Thus, the marginal benefit of effort is proportional to the difference in signal precision.

Commission rate c shows up in profits as proportional (to effort) costs under the economic-trading strategy. When the manager does not work, he always gets an imprecise signal. He will then remain inactive and make zero profits. However, using the aggressive-trading strategy, the manager still trades when the signal itself is favorable, even if it is very noisy. This imposes an expected loss on investors. Therefore, commissions show up as both fixed costs and proportional costs under the aggressive-trading strategy. As higher fees reduce the profitability of the portfolio for both strategies, profits decline faster with c under aggressive trading.

Clearly, implementing aggressive trading when commissions are far from trivial causes excessive trading. For any *given* effort level, investors earn more profits under the economic-trading strategy. However, implementing the most efficient trading *given* the manager's information does not necessarily make it optimal *before* signal realization. Indeed, the manager has to first determine how much effort to exert in information acquisition. Investors will not earn a lot of profits if the economic-trading strategy does not implement high effort in information acquisition. On the other hand, if the manager works very hard under the aggressive-trading strategy so that the chance of him getting an imprecise signal is very low, it could turn out making more profits for investors. Thus, implementing aggressive trading could be optimal ex-ante although inefficient ex-post. As a result, contracts that implement both strategies need to be solved and compared in order to find the optimal contract. But before doing so, the following proposition highlights the main insight of this section.

Proposition 4.1 *When commissions lie in the interval* $\left[\frac{\phi_L}{(1+\phi_L)}, \frac{\phi_H}{(1+\phi_H)}\right)$, *ignoring such fees in contract design causes the fund manager to trade excessively.*

Lastly, notice that q does not appear in the profit table. Perks only benefit the fund manager and do not directly affect portfolio payoffs. Indeed, perks play a role only indirectly through the equilibrium effort choice of the fund manager.

4.1.3 Incentive-compatible contracts

To implement either aggressive or economic trading, the contract must induce the desired investment choice for each possible signal realization. This specifies the relation between salary and bonus payments. Prior to obtaining the signal, the manager determines the effort spent in information acquisition, taking the investment rule as given. This yields a relation between effort and contract parameters. Combining the two, the incentive-compatible compensation package $\{\Delta_M, \Delta_H\}$ for each strategy is summarized below. For comparison purposes, the compensation derived under frictionless assumption ($c = q = 0$) is also listed.

Lemma 4.2 *For any effort e exerted, the fund manager gets paid according to the following menu:*

	Economic-trading	*Aggressive-trading*	*Frictionless*
Δ_M :	$2ke\frac{1+\phi_L}{\phi_H-\phi_L} + q$,	$2ke\frac{1-\phi_L}{\phi_H-\phi_L} + q$,	$2ke\frac{1-\phi_L}{\phi_H-\phi_L}$.
Δ_H :	$2ke\frac{1-\phi_L}{\phi_H-\phi_L} - q$,	$2ke\frac{1+\phi_L}{\phi_H-\phi_L} - q$,	$2ke\frac{1+\phi_L}{\phi_H-\phi_L}$.

The manager's total income is:

	Economic-trading	*Aggressive-trading*	*Frictionless*
Low state:	q,	q,	q.
Medium state:	$2ke\frac{1+\phi_L}{\phi_H-\phi_L}+q$,	$2ke\frac{1-\phi_L}{\phi_H-\phi_L}+q$,	$2ke\frac{1-\phi_L}{\phi_H-\phi_L}$.
High state:	$4ke\frac{1}{\phi_H-\phi_L}+q$,	$4ke\frac{1}{\phi_H-\phi_L}+q$,	$4ke\frac{1}{\phi_H-\phi_L}+q$.

The manager's compensation is contingent on realized portfolio payoffs. Since commissions do not alter the probability of each state occurring, they do not appear in the payment menu. Indeed, commissions affect the manager's compensation only through the equilibrium effort choice. Effort critically affects the amount of compensation the manager receives, because it is crucial in accurately predicting future payoffs through information acquisition.

As investors rationally predict the amount of perks the manager receives, compensation is adjusted accordingly to align investment incentives. The manager must be compensated for the loss in perks resulting from holding the portfolio, and less reward is needed to encourage risky investment. Hence, the salary increases while the bonus decreases with perks for both contracts. In fact, the manager's total income table indicates *fixed incremental compensation* from state to state. Variations in perks merely shifts the whole payment menu, but do not alter the manager's investment choices. Clearly, the contract derived under the frictionless assumption pays the manager too little salary and too much bonus. As a result, the manager not only trades on (precise or imprecise) favorable signals, he also trades when the signal indicates low state realization. This obviously reduces investor welfare.

More importantly, for any effort the manager exerts, the economic-trading contract always pays him a higher salary and a lower bonus than the aggressive-trading contract. This is necessary to suppress the manager's incentive to trade. Indeed, to reduce trading at a given effort level, the manager must be offered a higher salary with the other two state-payments intact. Given an imprecise signal, the aggressive-trading strategy implements inactivity if the signal is low, indicating less-than-average chance $\frac{1-\phi_L}{2}$ of high state occurring. The economic-trading strategy must induce inactivity even if the signal turns out to be favorable, indicating a better-than-average chance $\frac{1+\phi_L}{2}$ of outperformance. In order to do so, the investor must raise the salary by a fraction of $\frac{1+\phi_L}{1-\phi_L} > 1$. This increase in payment is the price investors must pay in exchange for more cost-effective trading.

Figure 2 illustrates some interesting features of these three contracts. Under the frictionless assumption, the agency problem remains due to limited liability, as the investor is unable to punish the manager should the low state occur. The optimal contract is therefore convex. In the presence of both trading expenses and perks, such a convex contract obviously cannot be optimal, as it causes the manager to trade too much and incur excessive expenses. In order to reduce the manager's incentive to trade, the investor is forced to raise the salary for inactivity, since he cannot

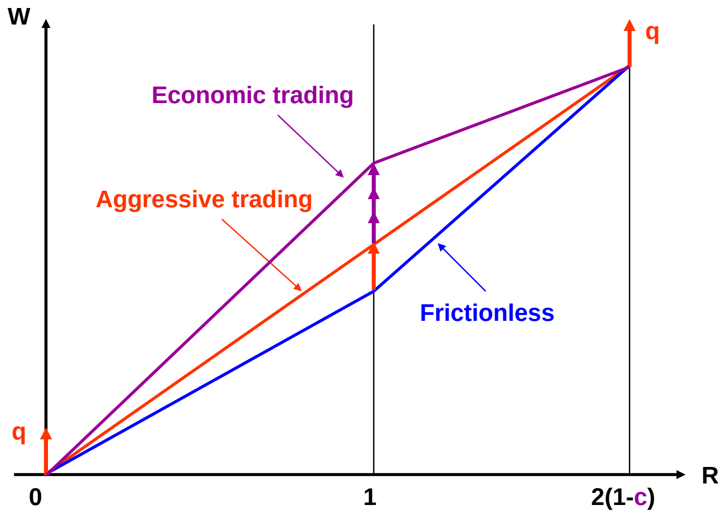

Figure 2: Three types of incentive-compatible contracts

punish the manager more for bad performance. As investors try to eliminate the distortion created by perquisite payments, a more linear compensation schedule emerges. This payment function prevents the manager from trading merely for claiming perks, but still results in the manager trading excessively to maximize his chance of getting a bonus. Since trading comes with commission fees, the investor is forced to bear these expenses. The economic-trading contract implements the most cost-efficient trading strategy by raising the salary even more and makes the compensation *concave*. It reduces the manager's trading frequency to the optimal level, but compromises the manager's incentive to gather information. Therefore, the fundamental tradeoff for efficient investment is the loss in information accuracy.

Eventually, the investor will optimally choose the equilibrium effort level he wants to implement. In order to do so, the investor must compare the marginal benefit with the marginal cost of effort. Thus, it is important to understand the effect of perks on the manager's *marginal* pay as effort varies. The manager gets perquisites only if he trades. Under aggressive trading, his effort does not alter the likelihood of trading, and therefore has no effect on the expected payment he receives. As a result, perquisites have no effect on his *marginal* payment for effort. With economic trading, higher effort increases the manager's trading frequency, thus improves his chance of getting a bonus. Since the investor reduces bonus payment as perks increase, the marginal payment of effort decreases in q.

4.1.4 The optimal contract

Depending on the relative importance of cost efficiency and information accuracy, both the aggressive- and economic-trading contracts are candidates for the optimal contract between the investor and the manager. After characterizing both candidates in the following two propositions, I discuss which is optimal for every admissible combination of costs and perks.

Proposition 4.3 *(Economic-trading) The optimal compensation package* $\left\{\Delta_M^E, \Delta_H^E\right\}$ *that implements economic-trading is given by*

$$\Delta_M^E = \frac{(1+\phi_L)\left[\lambda-(1+\phi_H)\,c+q\right]}{2\,(\phi_H-\phi_L)}+q, \tag{5}$$

$$\Delta_H^E = \frac{(1-\phi_L)\left[\lambda-(1+\phi_H)\,c+q\right]}{2\,(\phi_H-\phi_L)}-q, \tag{6}$$

where $\lambda \equiv \phi_H - 4k\frac{1+\phi_L}{\phi_H-\phi_L}$. *It induces an equilibrium effort level*

$$e^E = \frac{1}{4k}\left[\lambda-(1+\phi_H)\,c+q\right], \tag{7}$$

and the resulting investor surplus decreases in both c *and* q.

Proposition 4.4 *(Aggressive-trading) The optimal compensation package* $\left\{\Delta_M^A, \Delta_H^A\right\}$ *that implements aggressive-trading is given by*

$$\Delta_M^A = \frac{(1-\phi_L)\left[\kappa-(\phi_H-\phi_L)\,c\right]}{2\,(\phi_H-\phi_L)}+q, \tag{8}$$

$$\Delta_H^A = \frac{(1+\phi_L)\left[\kappa-(\phi_H-\phi_L)\,c\right]}{2\,(\phi_H-\phi_L)}-q, \tag{9}$$

where $\kappa \equiv (\phi_H-\phi_L) - \frac{4k}{(\phi_H-\phi_L)}$. *It induces an equilibrium effort level*

$$e^A = \frac{1}{4k}\left[\kappa-(\phi_H-\phi_L)\,c\right], \tag{10}$$

and the resulting investor surplus decreases in both c *and* q.

Because marginal profits are decreasing in commission fees, the investor optimally implements lower effort in order to reduce the compensation he has to pay. Similarly, as perks increase, the reduction in marginal payment raises the desired effort level under the economic-trading contract. For the aggressive-trading contract, the marginal payment does not depend on q, and nor does the equilibrium effort. Indeed, the aggressive-trading compensation depends on perks in a trivial way. It raises the salary and reduces the bonus so that the manager's *actual* incremental compensation between adjacent states $\{\Delta_M - q, \Delta_H + q\}$ stays constant in q, thus resulting in constant effort. On the other hand, perks increase the manager's (actual) incremental compensation under the economic-trading contract, which stimulates more effort exertion.

Overall, as perquisites increase, savings on bonus payment cannot cover the rise in salary, thereby making the investor worse off. Intuitively, perks strengthen the manager's incentive to both trade and acquire information. Since the manager is risk neutral and does not naturally shy away from risky investment, extra incentive to trade aggravates the agency conflicts between the investor and the manager. In fact, as long as the manager is not extremely risk averse, this detrimental effect on investor welfare will remain even after incorporating manager risk aversion.

The investor will hire a professional manager only if there are positive gains for doing so. The fact that investor surplus decreases in both c and q imposes bounds on fees and perks above which no hiring will take place. These bounds are derived next.

Lemma 4.5 *The investor hires the fund manager if and only if* $q < \bar{q}(c)$ *where*

$$\bar{q}^E(c) \equiv 4k\left(1 - \sqrt{1 - \frac{[\lambda - (1+\phi_H)c]}{4k}}\right)^2 \tag{11}$$

for the economic-trading contract and

$$\bar{q}^A(c) \equiv \frac{1}{8k}[\kappa - (\phi_H - \phi_L)c]^2 - [(1+\phi_L)c - \phi_L] \tag{12}$$

for the aggressive-trading contract.

Since the investor's expected profits decline with commissions, q must be small enough for his profits to remain positive. This makes the critical bound $\bar{q}(c)$ a decreasing function of c for both contracts. Moreover, aggressive trading incurs some fixed costs which are increasing with trading expenses. Given an imprecise but favorable signal, no trading will take place under economic trading. Fund profits remain at zero regardless of variations in trading fees. In contrast, the investor sustains more losses as commissions increase with aggressive trading. As a result, the bound $\bar{q}^A(c)$ for the aggressive-trading contract declines *faster* with commissions than $\bar{q}^E(c)$ for the economic-trading contract.

The fact that perks cannot go below zero imposes an implicit restriction on commissions. This critical bound for c can be found by setting $\bar{q}(c)$ to zero for each contract. Since $\bar{q}^A(c)$ declines faster than $\bar{q}^E(c)$ and both are monotonic in c, there is a high-fee region where only the economic-trading contract earns positive surplus for the investor. This is due to the fact that commissions increase both the fixed and proportional costs with aggressive trading. As a result, investor surplus under such contract declines faster with c compared to the surplus under economic trading.

When hiring takes place, the investor compares his expected profits net of all expenses under both contracts and determines which one to adopt. The following proposition summarizes the investor's optimal decision.

Proposition 4.6 *The difference in investor surplus between the economic- and aggressive-trading contract is increasing in commissions and decreasing in perquisites. The economic-trading contract dominates in the presence of high fees and low perks. Specifically,*

(i) When $c > \lambda / (1 + \phi_H)$ *: investors do not hire;*

(ii) When $\bar{c} < c \leq \lambda / (1 + \phi_H)$ *: economic-trading contract dominates for* $q < \bar{q}^E(c)$*, otherwise investors do not hire;*

(iii) When $\underline{c} < c \leq \bar{c}$ *: economic-trading contract dominates for* $q < \widehat{q}(c)$*; aggressive-trading contract dominates for* $\widehat{q}(c) \leq q < \bar{q}^A(c)$*, otherwise investors do not hire;*

(iv) When $c \leq \underline{c}$ *: aggressive-trading contract dominates for* $q < \bar{q}^A(c)$*, otherwise investors do not hire;*

where the expressions for $\underline{c}$*,* $\bar{c}$*, and* $\widehat{q}(c)$ *are given in the appendix, and* $\widehat{q}(c)$ *increases in* c*.*

Figure 3 illustrates the investor's optimal contract choice for given c and q. The economic-

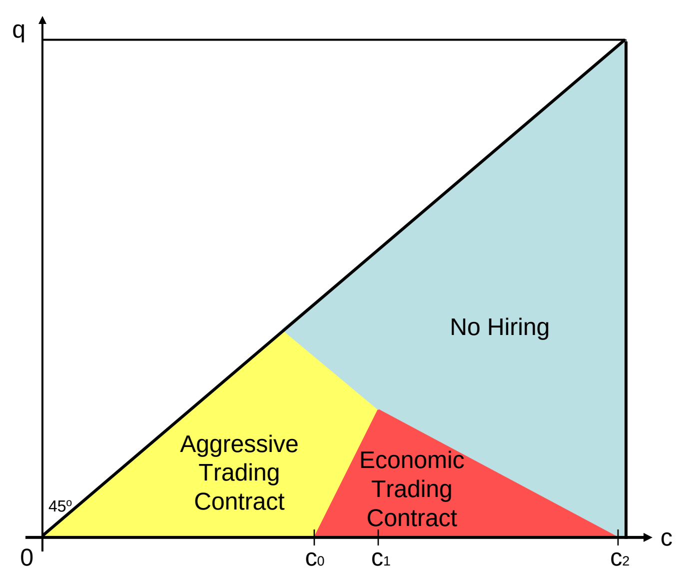

Figure 3: Optimal portfolio management contract

trading contract trades off trading costs with information gathering. It is best suited when commission fees are very high. When commissions are low, information acquisition is more important, so the aggressive-trading contract is optimal.

In the medium-fee region where there is no overwhelming dominance of one contract over the other, perquisites play a deciding role. Compared to the aggressive-trading contract, the economic-trading contract implements less frequent trading by compensating the manager more for inactivity. This increase in salary makes the economic-trading contract more expensive to implement, especially when perks are high. Thus, there is a critical level of perks $\widehat{q}(c)$ above which the aggressive-trading contract dominates. As trading fees increase, the economic-trading contract becomes more attractive, making the dividing line $\widehat{q}(c)$ an increasing function of c, which enlarges the area in which the economic-trading contract is optimal.

As expected, the investor does not hire the manager if perquisites exceed $\bar{q}(c)$. The gray area of the picture depicts this region of no hiring, which gets larger as commission costs increase. It is easy to verify that the effort level under the aggressive-trading contract is indeed higher in the region where the economic-trading contract is optimal. However, this increase in effort exertion, which improves the quality of the manager's information, is not large enough to compensate for the excessive trading costs incurred in the pursuit for exceptional performance.

4.2 Equilibrium pricing scheme

Now that the optimal contract for any possible combination of fees and perks has been derived, this section discusses how the broker endogenously determines c and q to maximize his own objective. To proceed, I first solve for the set of optimal $\langle c, q \rangle$ pair taking each contract as given. Then I check whether investors have incentives to deviate to the other contract given the resulting pricing menu.

4.2.1 Perfect competition

Since brokers incur no personal costs during the transaction, he generates a profit of $c - q$ for each trade. When there is perfect competition among brokers, the buy-side has all the bargaining power. In equilibrium, each broker must break even, or $c = q$. Moreover, in order to compete for business, all brokers should choose the level of perks that maximizes the fund manager's expected utility, subject to the investor hiring him in the first place.

Of course, the fund manager would like as much perks as possible, while the investor's expected profits decline. In equilibrium, the broker chooses a commission rate so that the investor becomes indifferent between hiring the manager and managing money himself. The broker then returns all the profits to the fund manager as perks. Both the broker and the investor break even, while the fund manager gets all the surplus from trade.

The economic-trading contract aims at maximizing net-cost return and is more sensitive to variations in fees and perks. It responds to high commissions by reducing the manager's frequency of trade. Therefore, the broker is forced to lower commissions under the economic-trading contract to improve his chance of making a deal. Analytically, it can be shown that the resulting $\langle c, q \rangle$ pair is indeed higher for the aggressive-trading contract. If the broker assumes economic-trading contract and sets his commissions accordingly, investors can always take this lower fee and deviate to the aggressive-trading contract to earn positive profits. On the contrary, if the broker assumes aggressive-trading contract, the resulting higher fees prevent investors from deviating to the economic-trading contract. Therefore, the investor offers the aggressive-trading contract in equilibrium, which is a proper balance between efficient trading and information gathering given the broker's pricing choice.

Proposition 4.7 *The equilibrium under perfect price competition is one in which all brokers charge*

$$c^{comp} = 1 - \frac{4\sqrt{k\left[k\phi_L\left(2+\phi_L\right)+\left(\phi_H-\phi_L\right)^2\right]}-4k\left(1+\phi_L\right)}{\left(\phi_H-\phi_L\right)^2} > 0 \tag{13}$$

and return the entire sum back to fund managers in the form of soft dollars and perks. Investors offer the aggressive-trading contract and just break even. Fund managers get all the surplus.

Remarkably, commissions are quite positive, not zero, with perfectly competitive brokers. However, brokers do not make any profits themselves. All the surplus that they gain by charging positive fees are returned to the managers through perks. In essence, brokers serve the role of transferring wealth from the fund holders to the fund managers through trading. As a result, investors, who start out with all the bargaining power in the market, end up merely breaking even in equilibrium.

4.2.2 Monopolistic broker

At the other extreme, a monopolistic broker has all the bargaining power in the market. He will maximize his expected revenue subject to the investor choosing to hire the manager in the first place. The broker's expected revenue contains two parts: the probability of a trade and the profits earned per trade. Specifically, it is given by:

$$\begin{aligned}\text{economic-trading contract} &: \frac{e^E\left(c,q\right)}{2}\left(c-q\right), \text{ and} \\ \text{aggressive-trading contract} &: \frac{1}{2}\left(c-q\right).\end{aligned}$$

Given the aggressive-trading contract, the fund manager will trade whenever the signal is favorable. The probability of a trade is constant at $1/2$, which is not affected by the pricing scheme the broker chooses. Assuming such contract will indeed be implemented, the broker chooses zero perks and the highest possible fees, up to the point where the investor becomes indifferent between hiring and not hiring. This however cannot be an equilibrium as the $\langle c, q \rangle$ pair falls into the high-fee region where the economic-trading contract is optimal.

On the other hand, the economic-trading contract induces trading only with a favorable and precise signal. This makes the trading probability a function of equilibrium effort, which depends on both c and q. Obviously, the commissions the broker charges will have to be above zero for him to make any profits. However, too high a charge would make the fund manager want to trade less with him. Perquisites, on the other hand, decrease the profits made per trade but increase the probability of a trade. Assuming such contract will indeed be implemented, the trading probability is strictly decreasing in c and increasing in q, while the opposite is true for the profits made per trade. The broker's revenue function is therefore globally concave, and so has exactly one maximum where both c and q are positive. However, this global maximum falls in the region where the investor is better off not hiring. The broker is thus forced to consider the second-best (constrained) maximum, which occurs at $q = 0$ and $c = \frac{\lambda}{2(1+\phi_H)}$. Still, this cannot be sustained as an equilibrium since the commission rate now gets so low that it falls in the region where the aggressive-trading contract is optimal. Indeed, the only possible candidates for equilibrium pricing are along the line $\widehat{q}(c)$, where the investor is indifferent between choosing either contract. Along this indifference line, the broker finds the point at which his expected revenue is maximized.

Proposition 4.8 *The equilibrium of a monopolistic market is one in which the broker charges* $c^{mono} > 0$ *where* c^{mono} *solves* $\widehat{q}(c^{mono}) = 0$*, and offers no perks for trading. The investor is indifferent between using the aggressive-trading or the economic-trading contract, and earns positive profits on average. The fund manager gets what the contract pays. Every party receives a share of the surplus.*

Equilibrium pricing menus in both markets are shown in Figure 4. A monopolistic broker sets higher commissions than multiple competitive brokers, but not much higher. He cannot extract all the surplus from the trade. Afraid of the investor switching to the economic-trading contract which reduces the chance of trade, the broker is forced to lower his fees which leaves the investor with some positive gains. In fact, the investor can do better if he can credibly commit to always offer the economic-trading contract.

Corollary 4.9 *Pre-committing to the economic-trading contract forces commissions down and makes investors better off with a monopolistic broker.*

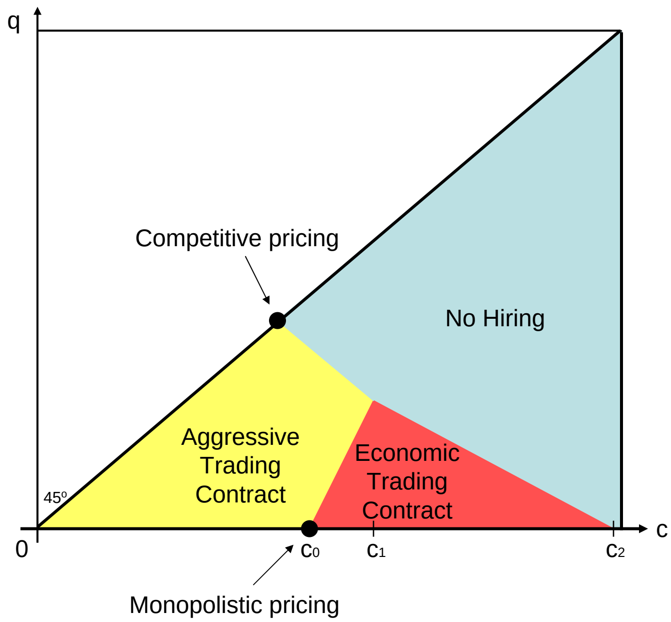

Figure 4: Market equilibrium pricing scheme

Ex-post, using the economic-trading contract when commissions are low is not optimal, as it causes the manager to shirk in searching for valuable information. Nonetheless, comparing to the profits made in equilibrium, the reduction in commission fees is sufficiently large to more than compensate for the loss in information gathering. The investor thus improves his expected wealth by committing to the economic-trading contract.

4.3 Contrast with the first best benchmark

The first best benchmark is the "no agency" scenario in which the fund manager's effort, signal, precision, and investment choice are all contractible. Alternatively, it can be interpreted as an economy in which the investor searches for information and manages his own portfolio. Either way, there is no conflict of interests between the fund holders and the fund managers. However, the contract still cannot condition on either commissions or perks.

Since the investor observes what the manager sees and does perfectly, the first best contract contains two parts. First, it specifies which investment strategy to take given the manager's private information. Second, it specifies how hard the manager should work in gathering such information. The resulting first best equilibrium is characterized below.

Proposition 4.10 *(First best solution) In absence of agency problems, equilibrium contract always implements economic trading. Equilibrium commission fees are* $\frac{\phi_H}{2(1+\phi_H)}$ *for both perfectly competitive and monopolistic brokers. Equilibrium perks are equal to the fees for the former and zero for* *the latter. The fund manager gets* $\frac{\left[\phi_H-(1+\phi_H)c^{FB}\right]^2}{8k}$ *if he exerts an effort* $\frac{\left[\phi_H-(1+\phi_H)c^{FB}\right]}{2k}$ *and trades only with a favorable and precise signal. Otherwise the fund manager gets zero. The investor makes* $\frac{\phi_H^2}{32k}$ *in either market.*

There are several distinct features in this first best equilibrium. First, the ex-post efficient economic trading is always optimal ex-ante, as there is no shirking problem in the information acquisition stage. Second, effort is directly contractible and is set at the point where marginal benefits equals marginal costs. It is therefore not a function of perks as they do not affect the investor's profits. Third, since there is no information rent sunk between the investor and the manager, equilibrium compensation exactly offsets the manager's costs of effort. Hence, the manager's surplus comes from perk payments only. Lastly, equilibrium commissions remain the same despite the nature of competition among brokers. Shifting the bargaining power between the sell- and buy-side merely shifts the trading gains between the broker and the fund manager. Investors are not affected by the degree of competition in the brokerage industry.

4.4 Alternative settings: reverse timeline

This section briefly discusses two alternatives in the order of movements by different players of the game. I illustrate qualitatively how surplus gets divided differently among three types of agents when their bargaining power in the market varies.

4.4.1 Investors are Stackelberg leaders of the game

Suppose the broker decides upon a pricing scheme after the investor commits to a contract. The investor then must take into consideration the broker's pricing strategy as a function of the contract form and choose the optimal contract that maximizes his net profits. As discussed before, the contract which implements economic trading from the manager forces the broker to set lower commissions, compared to the one that results in aggressive trading. With the investor being the first mover in this game, committing to an economic-trading contract makes him strictly better off with a monopolistic broker, while still breaking even with a competitive one. Therefore, we expect to see concave compensation schedules in portfolio payoffs between investors and managers, which implement less frequent trading and lower effort exertion by the money managers. These predictions are not very consistent with empirical observations.

4.4.2 Managers make take-it or leave-it offers to investors

Another alternative is to give the manager more power in which he makes an offer (a sales pitch) to investors. Since managerial talent is a scarce resource,[11] the manager will propose a contract that makes the investor just indifferent between accepting and rejecting. The investor always breaks even in this scenario. The relevant question is how surplus gets divided between the manager and the broker. Obviously, the manager still collects all the rents with competitive brokers. The more interesting case is with a monopolistic broker. Specifically, would an equilibrium arise in which the monopolistic broker agrees to pay the manager certain perks in exchange for his business, as the manager now has more power? I find that the resulting equilibrium when the manager makes offers to investors does not change qualitatively. The monopolistic broker still offers zero perks to the manager and sets commissions so that the manager becomes indifferent between trading aggressively and trading economically. As a result, the monopolistic broker is unable to extract all the gains from the trade, and leaves more profits for the manager. A formal analysis is omitted but is available upon request.

5 An extension: research service provided by the broker

Brokers often argue that they provide valuable research services at a discount rate when money managers purchase the whole bundle from them. So far, I only focus on the distortions created by the broker without explicitly modeling the research-related services that he may choose to provide in return for a higher commission rate. This section extends the baseline model to incorporate this feature.

Suppose now that the broker offers a service bundle which includes both order execution and research. As before, the broker executes the manager's order flow at no personal costs. On the research side, the broker chooses how much free effort e_0 to provide at a personal cost te_0, where $t \in [0,1]$. The total commission rate the broker charges is, of course, increasing in the value of the research services provided. Therefore, we can write $c = F(e_0)$ where $F(\cdot)$ is some increasing function in e_0. For simplicity, let $F(e_0) = e_0$. In addition to both types of services, the broker may choose to offer the manager perquisites q. The broker's net revenue per trade becomes

$$R(e_0, q) = F(e_0) - te_0 - q = (1-t)\, e_0 - q. \tag{14}$$

Equipped with the research services provided by the broker, the fund manager chooses how much effort e_f to add to e_0. The probability of getting a precise signal rises to $e_0 + e_f$. The following proposition summarizes the manager's equilibrium effort choice under each type of contracts.

[11] If not, we reach the trivial case in which investors claim all the surplus in contracting with competitive managers.

Proposition 5.1 *The optimal compensation package that implements economic trading by the manager is given by*

$$\Delta_M^E = \frac{2ke_f^E(1+\phi_L)}{(\phi_H-\phi_L)} + q,$$
$$\Delta_H^E = \frac{2ke_f^E(1-\phi_L)}{(\phi_H-\phi_L)} - q,$$

which induces an equilibrium effort level of

$$e_f^E = e^E - \frac{e_0}{2}. \tag{15}$$

The optimal compensation package that implements aggressive trading by the manager is

$$\Delta_M^A = \frac{2ke_f^A(1-\phi_L)}{(\phi_H-\phi_L)} + q,$$
$$\Delta_H^A = \frac{2ke_f^A(1+\phi_L)}{(\phi_H-\phi_L)} - q,$$

which induces an equilibrium effort level of

$$e_f^A = e^A - \frac{e_0}{2}. \tag{16}$$

Under both contracts, the investor's expected profits decrease in q monotonically. Profits decrease in c initially and then become increasing in commissions.

The equilibrium effort levels under both contracts shrink by $\frac{e_0}{2}$. This is the exact amount of the boost in the probability of obtaining a precise and favorable signal, under which positive profits are expected. The research services provided by the broker translate to an increase in expected profits, but at the same time the investor incurs higher expected payments in compensating the manager as the high outcome is more likely to occur. Because part of the effort is provided by the broker, the manager effectively receives a higher pay than what he really deserves. Anticipating this, the investor optimally implements a lower managerial effort level to reduce this waste in compensating the manager. Notice that since the manager's cost of effort is convex, the investor is able to implement a combined effort level higher than what he could without this additional effort provided by the broker.

As before, investor surplus declines in the amount of perk payment as it adds nothing but distortions to the manager's investment incentives. However, the investor gets valuable research services in return for more commissions. As a result, hiring the fund manager becomes less costly as the manager's private information is not as valuable and so he does not need to be motivated to work as hard. The investor essentially faces a tradeoff between paying commissions in exchange for research services from the broker and compensating the manager for his effort spent on information acquisition. Indeed, the investor's profits decrease in c initially up to a point above which profits start to increase in commissions. As the broker bundles more research services with higher commissions, the investor eventually becomes better off as the savings on payments more than compensate for higher fees.

This increasing relationship between investor surplus and commissions is sensitive to the linear relationship between commissions (c) and research services (e_0) specified in the model. The amount of free effort given away by the broker is linear in commissions, while the manager's cost of effort is convex. It is therefore cheaper for the investor to get research services from the broker rather than paying the manager to exert effort in information gathering. This result remains valid even with concave relations between c and e_0. Investors become better off with higher commissions as long as the marginal increase in research services provided by the broker rises with commissions fast enough to cover the marginal payment needed to induce managerial effort.

The optimal contract for given c and q is depicted in Figure 5. Since the broker is providing

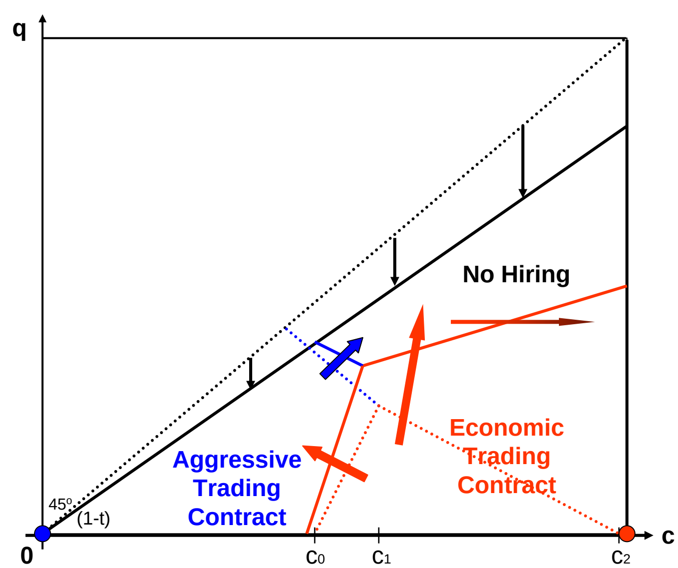

Figure 5: The optimal contract with free effort from the broker

useful services to the fund, the investor makes higher expected profits for the same amount of commissions paid. As a result, the no-hiring region shrinks. In the low-commission region where aggressive trading is implemented, investor surplus still decreases with c, but much slower. When commissions get high so that economic trading is optimal, the investor is better off with increasing commissions because of the valuable research services the broker provides. A manager who is unemployed will be hired as the broker charges higher fees and bundles more research services. This translates into a positively-sloped line dividing between the hiring and the no-hiring regions.

The contract that implements economic trading, which induces efficient investment but sacrifices the manager's incentive to gather information, is now more attractive. The manager's effort exertion on information acquisition is less important since a part of the research is provided by the broker. Indeed, the region in which the economic-trading contract is optimal gets quite a bit larger, and more so with higher commissions.

After finding the optimal contract, I now turn to the broker's problem and derive the equilibrium pricing scheme. Competitive brokers are considered first and the results are summarized below.

Proposition 5.2 *When the manager's cost of effort is high such that $k > \frac{(\phi_H - \phi_L)}{6}$, the pricing scheme for a competitive broker is as follows:*

(i) When $t \leq \underline{t}$: the broker sets the commission rate at $c^{\max}$ at which the investor just breaks even and return all surplus to the manager;

(ii) When $\underline{t} < t < \bar{t}$: the broker charges $c^* \in (0, c^{\max})$ and returns all profits to the fund manager as perks;

(iii) When $t \geq \bar{t}$: the broker sets $c = q = 0$ and the investor's surplus is maximized;

where the expressions for $\underline{t}$, $\bar{t}$, c^*, and $c^{\max}$ are given in the appendix.

Competitive brokers return all surplus to the fund manager as perks, or $q = (1-t)\,c$ in this case. A small t means the broker is able to provide research services very cheaply, leaving more surplus for possible perks. As we can see from equation (14), the equilibrium under this regime is qualitatively identical to that in the baseline model. The manager still prefers as much perk payment as possible and the broker sets his pricing scheme at the point where the investor just breaks even. Although valuable research services are obtained, the high levels of perks prevent the investor from generating any net profits.

On the other hand, if it is very costly for the broker to provide such research service (big t), the amount of available perks is very small, as the broker does not generate much surplus. The fund manager derives income from both the contract and the broker, which is increasing in both managerial effort and perks. High-cost research provided by the broker reduces the amount of effort the manager exerts, and at the same time leaves little surplus for perks. It is thus better for the manager to refuse such service, as the amount of perk payments cannot justify the reduction in his compensation due to declining effort. In other words, if it is very costly for the broker to provide research service relative to the manager's cost of effort, the manager would rather work himself and be compensated for his own effort.

In the intermediate t range, there is a tradeoff between higher perks and lower compensation as commissions increase. The manager's utility is concave in c where an interior solution emerges.

As a concrete example, when $\phi_H = 1$, $\phi_L = 0.1$, and $k = 0.18$, we obtain $\underline{t} \cong 0.27346$, $\bar{t} \cong 0.28125$, and the interior solution for $c^* \cong 3.57 - 12.7t$, bounded between 0 and $c^{\max} \cong 0.099$.

Turning to a monopolistic broker providing research services, the following proposition summarizes the results.

Proposition 5.3 *A monopolistic broker providing research services offers no perks and sets the commission rate at the point in which the investor is indifferent between two contracts.*

The economic intuitions for monopolistic brokers do not change qualitatively. As previous result indicates that the broker does not offer perks to attract business in the absence of the option to provide research services, he surely would not have any incentive to offer perks now when he is actually providing valuable services to the fund manager. As the broker now gains lower surplus by charging higher commissions due to his costs of providing more research, the equilibrium commission rate drops compared to the no-research case.

The equilibrium pricing menus with endogenous research services by the broker are shown in Figure 6.

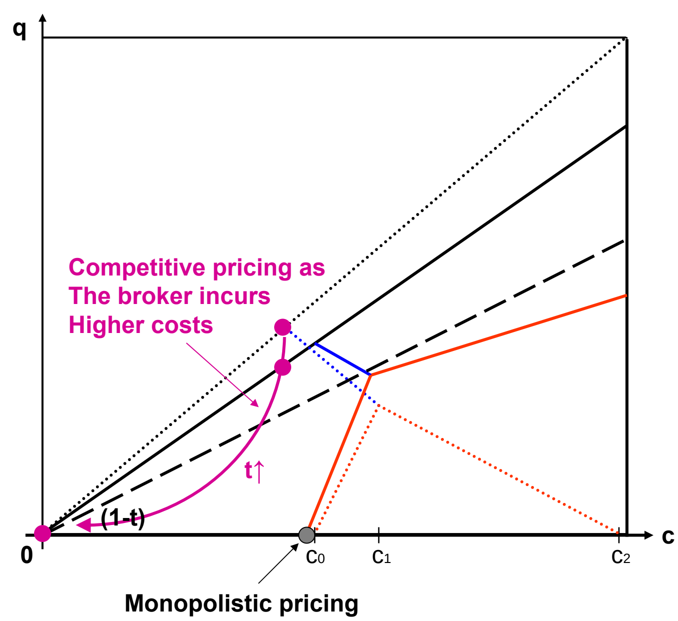

Figure 6: Market equilibrium with endogenous research services provided by the broker

6 Discussion and implications

The broker introduces two sources of friction during asset transactions. One is the commission fees he charges, and the other is a distortion in the manager's trading incentives. The investor's best response to these forces is to motivate the manager to reduce the trading frequency. In order to do so, the investor has to raise the salary he pays the manager for passive management. Clearly, both the fees and perks make investors worse off compared to a perfect, frictionless market without brokers. It is, therefore, important to ask whether the optimal contract derived under the frictionless assumption is still optimal in reality.

The answer is clearly "no" if investors ignore both commissions and perks. The resulting convex contract causes the manager to ignore substantial information indicating low state of return and still invest in order to obtain perks from the broker. However, I show that properly taking perks into account while ignoring commissions results in a roughly linear payment schedule that does *not* make investors worse off in equilibrium, although the fund manager still trades too much relative to the optimal level. This is due to the fact that trying to "correct" the fund manager's trading patterns comes at a price. In order to provide incentives for trading economically, more concave compensation must be given which reduces the manager's incentive to gather valuable information. Since the rational broker is fully aware of this tradeoff between cost minimization and information acquisition, he will push for an equilibrium in which investors are unable to completely undo the distortions he creates. As a result, offering a linear contract in portfolio payoffs is the investor's best response in balancing convexity to induce effort and concavity to motivate efficient trading.

The study by Wermers (2000) concludes that active mutual funds pick stocks well enough to cover their costs, which supports the fundamental tradeoff between cost and information derived from my model. Not only is the linear contract consistent with rewarding mutual fund managers a portion of assets under management observed in practice, it offers a possible explanation for high levels of trading activities by *rational* and *sophisticated* institutions. Moreover, the evidence that actively managed funds underperform passive benchmarks and good performance does not persist does not necessarily imply the lack of skills in mutual fund managers. The manager could be trading on unreliable or wrong information merely responding to the contract that has been offered to him. The manager's suboptimal trading decisions could simply reflect the investor's inability to correct the misalignments of interests created by brokers.

Somewhat counter-intuitively, I find that investors earn positive expected profits with a monopolistic broker, while merely breaking even with a competitive one. This surprising result remains valid even if the broker bundles useful research services in commissions, as long as the broker's costs for providing such services are small relative to the manager's cost of effort in information acquisition. Rather than lowering commission rates, competition bids up the amount of perks the broker offers. In order to finance these perks, brokers have to increase their fees, which come from the fund and reduce the investor's wealth.

I see three possible ways to alleviate this problem in order to increase investors' profits. First, having affiliated brokers who are either direct or indirect employees of the fund may help, as they behave more like monopolists who do not need to pay perks to attract clients. In fact, many funds, especially funds belonging to big mutual fund families, have pre-assigned brokers. On the other hand, in-house brokerage might introduce other agency problems as well. It is therefore an interesting empirical question as to whether funds that have affiliated brokers perform better than those who go to independent brokers for order execution. Naturally, outside brokers are more competitive in seeking for money managers' business, while inside brokers are monopolistic. Therefore, the following implication can be empirically tested.

Implication 1. *Funds that have their own in-house or affiliated brokers should perform better than those using outside brokers.*

Second, many funds contract to pay a pre-determined fee for up to a certain volume up front, and get soft-dollar research credits equal to some percentage of the commissions. This arrangement should result in less distortions in the manager's investment incentives, as fees and perks are paid in all states, regardless of whether a trade actually occurs or not.

Implication 2. *Funds that have pre-arrangements with brokers and pay commissions up front should perform better than those who pay at the time of the transaction.*

Both internal brokerage and contracting in advance may improve investor's surplus to some extent, but they do not completely solve the problem. The room for collusion still exists and brokers and managers will find ways to take advantage of it unless more structured audit and accountability disciplines are inserted regarding commission bundling practices. If all services purchased by commissions and their costs are perfectly disclosed to the public, investors can easily write a contract contingent on both commissions and perks. This would eliminate the broker's incentive to offer perquisite payments. Instead, competition among brokers will drive commissions towards zero or whatever other services included are really worth. On the other hand, under imperfect competition, brokers will still charge positive fees even with perfect disclosure on the commission usage. Therefore, an important policy implication of the model is that encouraging competition in the brokerage industry is beneficial to investors *only if* perks are fully disclosed to the public. The paper thus supports recent SEC proposals to impose more stringent disclosure rules on client commission usage. Commissions should be "unbundled" in the disclosure report, in the sense that each service included in commission payments and its costs should be listed separately and accounted for.

Implication 3. *Better performance and more performance persistence is expected with more transparent client commission usage required by law.*

My model also suggests an important role for the board of directors in mutual funds. Specifically, the board of directors are able to observe all the transactions between the fund managers and brokers. Thus, they may be able to oversee and prevent at least some of the inefficiencies in the trading process. One prediction is that boards play a more important role in actively managed funds, where the interaction between managers and brokers is more prominent. Indeed, the work by Chen, Goldstein, and Jiang (2006) finds that directors own more shares in actively managed funds, which suggests that directors are provided with more incentives in performing their monitoring role in actively managed funds.

Other testable predictions of the model are as follows.

Implication 4. *Funds that do more business with soft-dollar brokers should tend to trade more and exhibit less performance persistence.*

Implication 5. *Net returns for actively managed funds should not improve much responding to exogenous declines in execution costs (tick-size rule changes, electronic platforms, etc.).*

Implication 6. *Commission fees should not fall significantly and could even rise with increasing institutional trading demands.*

Implication 7. *Better order execution technology should not significantly decrease brokerage commissions or the number of brokers.*

Lastly, the tradeoff faced by the investor in motivating the manager to both gather information and reduce perks and transaction costs in trading is applicable to many other settings. This is, for instance, the exact tension in corporate finance in which shareholders want managers to explore new investment opportunities, while trying to minimize their empire building and other overinvestment incentives. Indeed, most CEOs and chief executives receive some combination of equity and stock options in their compensation packages, which is essentially a mixture of linear and convex payment schemes in the firm values.

7 Conclusion

The role played by the brokerage industry in delegated portfolio management is far from trivial. I show that in contracting with a money manager, neglecting the actions of the broker causes too much costly trading by the manager and reduces investor welfare. On the other hand, the contract that produces more cost-efficient trading compromises the manager's incentive to gather valuable information. The investor in equilibrium offers a linear contract in portfolio payoffs as a balance between information gathering and cost minimization. As a result, the manager trades excessively to maximize the chance of superior performance rather than maximizing expected returns. Strikingly, as long as the services included in bundled commissions remain invisible to the public, the broker can always pay money managers perks for trading with him, and investors are always better off when the brokerage industry is less competitive. More transparent disclosure rules regarding client commission practices can mitigate this problem.

An immediate extension of the model is to consider a multi-period contracting environment in which the manager is likely to get dismissed or the fund might cease to exist after certain failure. In particular, if the manager reinvests his own compensation in the fund, he may behave differently in terms of investment decisions because of his own stake in the fund. The fact that the manager now trades more sensibly enables the investor to offer a more convex contract, which implements higher effort and results in better information. This would capture realistic features of the hedge fund industry. Another direction in the modeling side is to introduce the hidden type problem, as managers can hide their incompetence in passive management. Further, this paper assumes constant proportional commission rates. Allowing such fees to vary with the size of the order is another possibility.

On the empirical front, several implications of the model can be tested. The best direction to proceed is to link commission fees and fund performance with exogenous changes in order execution technology. Using natural experiments around changes in tick size rules and the emergence of electronic executions provides a good starting point.

Appendix A: Official policies on client commission practices[12]

Before 1975, commission rates on national exchanges were fixed and brokers competed for business by providing clients brokerage functions and research related services. Effective May 1, 1975, the SEC adopted Rule 19b-3 under the Exchange Act, which ended fixed commission rates. Just one month later, Congress passed legislation unfixing commission rates as part of the Securities Acts Amendments of 1975. At that time, money managers and broker-dealers questioned how competition over commission rates would disrupt commission bundling practices which would be valuable for the investors. Congress thus included a safe harbor in the 1975 Amendments, codified as Section 28(e) of the Exchange Act. The safe harbor permits money managers to pay higher commissions than otherwise available on behalf of clients to obtain brokerage and research services if managers think the fees are reasonable. However, what constitutes "brokerage and research services" has drawn a great deal of attention and debate. Realizing the potential conflicts of interests between money managers and investors, the SEC has issued four interpretive releases under Section 28(e) and a report pursuant to Section 21(a) of the Exchange Act that addresses issues associated with Section 28(e).

For example, in 1976, the Commission issued an interpretive release excluding products and services such as office equipment, airline tickets, office furniture and business supplies. The 1986 release emphasized the importance of written disclosure of client commission arrangements. Moreover, the concept of "mixed use" were introduced to refer to product or service obtained using client commissions serving functions that are not related to the investment decision-making process. Investment managers should make a reasonable allocation of the cost of the product according to its use and should keep books and records concerning the allocations. The 1998 OCIE report finds that 28% of the money managers and 35% of the broker-dealers that were examined has entered into at least one client commission arrangement that was outside of the scope of the safe harbor. Examples of non-research items paid with client commissions included "CFA exam review courses, membership dues and professional licensing fees, office rent, utilities, phone, carpeting, marketing, entertainment, meals, copiers, office supplies, fax machines, couriers, backup generators, electronic proxy voting services, salaries, and legal and travel expenses."[13]

In 2004, the NASD Mutual Fund Task Force recommended to the SEC to narrow the interpretation of the scope of research services to the types that benefit the clients rather than financial advisors. On July 22, 2005, the United Kingdom Financial Services Authority (FSA) adopted final client commission rules describing "execution" and "research" services and products eligible to be paid for by commissions, as well as a number of non-permitted services. Around the same

[12] See U.S. Securities and Exchange Commission, 17 CFR Part 241, Release No. 34-52635; File No. S7-09-05 from www.sec.gov.

[13] 1998 OCIE Report, at 31-32. See www.sec.gov.

time, the SEC took the FSA's work into account and developed new interpretive guidance as to the meaning of the phrase "brokerage and research services" in Section 28(e). The new guidance attempted to clarify eligibility for permissible services as well as imposing more stringent disclosure rules. In summer 2006, there is considerable debate over whether execution and research-related services provided by brokerage firms must be "fully disclosed, accounted for, and separated from other brokerage services to facilitate the tests for compliance with Section 28(e) and the Interpretive Guidance."[14]

According to Ambachtsheer (1993), ERISA Technical Release #86-1 (since 1986) provides safe harbor to pension plan sponsors who choose to direct stock commissions to designated broker/dealers in order to purchase goods and services "for which the plan would otherwise have to pay." Canadian regulators have similar policies in place.

[14] See SEC S7-13-06 Public Comment 09/07/06 at www. sec.gov.

Appendix B: derivations and proofs

Proof of Proposition 4.1

This result follows from the text. ■

Proof of Lemma 4.2

The incentive-compatible contract must first implement the right investment decision from the manager. As explained in the text, there are four possible signal realizations. The economic-trading contract must induce the manager to trade with a favorable and precise signal only, while remain inactive in all three other cases. This yields an upper bound for Δ_M above which the manager always stays safe, as well as a lower bound below which the manager always trades the risky asset. This relation is given by

$$\text{economic-trading}: \frac{2q + (1+\phi_L)\,\Delta_H}{1-\phi_L} < \Delta_M < \frac{2q + (1+\phi_H)\,\Delta_H}{1-\phi_H}. \tag{17}$$

Similarly, there is an upper and lower bound for Δ_M for the aggressive-trading contract within which the manager trades whenever signal is favorable and remains inactive otherwise. It is given by

$$\text{aggressive-trading}: \frac{2q + (1-\phi_L)\,\Delta_H}{1+\phi_L} < \Delta_M < \frac{2q + (1+\phi_L)\,\Delta_H}{1-\phi_L}. \tag{18}$$

The incentive-compatible contract must also induce the manager to work. The manager's objective function for given investment rule is as follows:

$$\text{economic-trading} \;:\; \max_e U\,(riskless) + \Pr\,(s = H, \phi = \phi_H)\,[EU\,(risky) - U\,(riskless)] - \frac{ke^2}{2}, \text{ and}$$
$$\text{aggressive-trading} \;:\; \max_e U\,(riskless) + \Pr\,(s = H)\,[EU\,(risky) - U\,(riskless)] - \frac{ke^2}{2}.$$

Solving the manager's maximization problem yields a relationship between contract parameters and effort level:

$$\text{economic-trading} \;:\; \Delta_H = \frac{4ke - 2q + (1-\phi_H)\,\Delta_M}{(1+\phi_H)}, \text{ and} \tag{19}$$
$$\text{aggressive-trading} \;:\; \Delta_H = \frac{4ke}{(\phi_H - \phi_L)} - \Delta_M. \tag{20}$$

Combining with (17) and (18) yields the compensation menu as a function of the manager's effort. The manager's total income is then obtained after straightforward manipulations. ■

Proof of Proposition 4.3 and 4.4

Expected profits of the fund and the compensation menu as functions of managerial effort are both characterized in the text. It is straightforward to derive the expected compensation for the fund manager $Ew(e)$:

$$\text{economic-trading} \quad : \quad \left(1-\frac{e}{2}\right)q+\frac{2ke(1+\phi_L)}{(\phi_H-\phi_L)}+ke^2, \text{ and} \tag{21}$$

$$\text{aggressive-trading} \quad : \quad \frac{q}{2}+\frac{2ke}{(\phi_H-\phi_L)}+ke^2. \tag{22}$$

In the last step of contract design, the investor determines the desired effort level to implement in order to maximize his net profits

$$\max_e E\pi(e)-Ew(e)$$

for both types of contract. Taking the first order condition yields the solution for managerial effort. Plugging into the compensation menu gives the desired contract.

Finally, plugging the optimal effort level into the investor's objective function, we obtain the investor's net profits at optimum:

$$\text{economic-trading} \quad : \quad \frac{[\lambda-(1+\phi_H)c]^2}{16k}+\frac{[\lambda-(1+\phi_H)c-8k]}{8k}q+\frac{q^2}{16k}, \text{ and} \tag{23}$$

$$\text{aggressive-trading} \quad : \quad \frac{\phi_L-(1+\phi_L)c}{2}+\frac{1}{16k}[\kappa-(\phi_H-\phi_L)c]^2-\frac{q}{2}. \tag{24}$$

It is simple algebra to check that both functions are decreasing in c and q within the ranges specified in the text. This completes the proof. ■

Proof of Lemma 4.5

This is easily derived by setting (23) and (24) equal to zero. ■

Proof of Proposition 4.6

Assuming the investor earns positive expected profits under both contracts, I compare which one yields the highest profits for the investor. Denote the difference in profits between the economic-trading and the aggressive-trading contract by ΔEF, its expression is given by

$$\begin{aligned}\Delta EF(c,q) &= \frac{(2\phi_H-\phi_L+1)(1+\phi_L)}{16k}c^2+\left[\frac{4k\phi_L-\lambda(1+\phi_H)+(\phi_H-\phi_L)^2}{8k}\right]c \\ &\quad +\frac{\left[\lambda^2-(\phi_H-\phi_L)^2+8k(1-\phi_L)\right]}{16k}-\frac{k}{(\phi_H-\phi_L)^2}+\frac{[\lambda-(1+\phi_H)c-4k]}{8k}q+\frac{q^2}{16k}.\end{aligned} \tag{25}$$

Notice that ΔEF is quadratic and convex in both c and q.

Taking derivatives with respect to q, we have

$$\frac{\partial \Delta EF}{\partial q}=\frac{\lambda-(1+\phi_H)c+q-4k}{8k}<0, \tag{26}$$

since

$$\lambda - (1+\phi_H)\,c + q = 4ke^{CS} < 4k.$$

Taking derivatives with respect to c, we get

$$\frac{\partial \Delta EF}{\partial c} = \frac{(2\phi_H - \phi_L + 1)(1+\phi_L)}{8k}c + \frac{4k\phi_L - \lambda(1+\phi_H) + (\phi_H - \phi_L)^2}{8k} > 0, \tag{27}$$

which follows from the restriction that equilibrium effort is interior.

Since $\Delta EF(c,q)$ is convex and strictly decreasing in q, the smaller q root of ΔEF determines whether it is positive or negative, which in turn determines which contract is optimal. Therefore, the dividing line $\widehat{q}(c)$ is determined implicitly by solving $\Delta EF[c, \widehat{q}(c)] = 0$. Since ΔEF is well-defined and convex in q, its root $\widehat{q}(c)$ can be solved in closed form and shown that $\widehat{q}'(c) > 0$. Moreover, since perquisites are nonnegative, the lowest bound for c below which only the aggressive-trading contract is optimal is solved implicitly by $\widehat{q}(\underline{c}) = 0$.

The economic-trading contract is therefore bounded by $q < \widehat{q}(c)$, but q cannot exceed $\bar{q}^{CS}(c)$ above which the investor will not hire the manager. Since $\widehat{q}(c)$ is increasing while $\bar{q}^{CS}(c)$ decreasing in c, the region where the economic-trading contract is optimal is uniquely defined. The critical bounds for costs are therefore given by $\widehat{q}(c) = \bar{q}^{CS}(c)$ and $\bar{q}^{SC}(c) = 0$. Solving the former gives $\bar{c}$, and the latter gives $\frac{\lambda}{1+\phi_H}$. This completes the proof. ■

Proof of Proposition 4.7

A perfectly competitive broker charges $c = q$ such that the manager achieves the maximum in his utility. The manager's utility function under each contract is given by

$$\text{economic-trading} \ : \ \frac{[\lambda - (1+\phi_H)c][4\phi_H - 3\lambda - (1+\phi_H)c]}{32k} + \left[\frac{2\phi_H - \lambda - (1+\phi_H)c}{16k} + 1\right]q + \frac{q^2}{32k}, \text{ and} \tag{28}$$

$$\text{aggressive-trading} \ : \ q + \frac{(1-c)}{4} + \frac{(\phi_H - \phi_L)^2(1-c)^2}{32k} - \frac{3k}{2(\phi_H - \phi_L)^2}. \tag{29}$$

When $c = q$, it is straightforward algebra to show that both utility functions increase in $q\,(= c)$. Therefore, the value of $q\,(= c)$ is set at the point where investors just break even. Specifically, I obtain the value of $q\,(= c)$ at

$$\text{economic-trading} \ : \ \frac{(\lambda\phi_H + 8k) - 4\sqrt{k(\lambda\phi_H + 4k)}}{\phi_H^2}, \text{ and} \tag{30}$$

$$\text{aggressive-trading} \ : \ 1 - \frac{4\sqrt{k\left[k\phi_L(2+\phi_L) + (\phi_H - \phi_L)^2\right]} - 4k(1+\phi_L)}{(\phi_H - \phi_L)^2}. \tag{31}$$

As explained in the text, since the aggressive-trading contract results in a higher fee, it is the equilibrium choice. ■

Proof of Proposition 4.8 and 4.9

I first solve for the pricing scheme under the assumption of the aggressive-trading contact. The broker's objective function is given in the text. In this case, the broker sets $q = 0$ and c at which the investor just breaks even:

$$\text{aggressive-trading} : q = 0,\ \ c = 1 - \frac{\sqrt{8k\left[(\phi_H - \phi_L)^2 - 2k\left(1 - \phi_L^2\right)\right]} - 4k\phi_L}{(\phi_H - \phi_L)^2}. \tag{32}$$

Plugging these values into the investor's profit function under the economic-trading contract shows positive gains. Therefore, it can not be an equilibrium.

Assuming the economic-trading contract, maximizing the broker's objective function

$$\frac{1}{2}\frac{1}{4k}\left[\lambda - (1 + \phi_H)\, c + q\right](c - q)$$

yields a constrained maximum at

$$\text{economic-trading} : q = 0,\ \ c = \frac{\lambda}{2\,(1 + \phi_H)}. \tag{33}$$

At this pricing menu, the investor earns $\frac{\lambda^2}{64k} > 0$ with the economic-trading contract. However, switching to the aggressive-trading contract yields higher surplus. Thus, it is not an equilibrium either.

In order to obtain the equilibrium, the broker has to choose c and q to make the investor indifferent between choosing either contract, which is along the $\widehat{q}\,(c)$ indifference line. Along this line, the broker achieves profit-maximization at $q^* = 0$ and c^* where $\widehat{q}\,(c^*) = 0$, because giving perks back does not affect the manager's trading probability (as in the aggressive-trading contract).

Obviously, c^* is greater than $\frac{\lambda}{2(1+\phi_H)}$ which is the fee the broker would set if he assumes the economic-trading contract. Since investor surplus declines in c under the economic-trading contract, the investor is better off with lower fees. Therefore, pre-committing to use the economic-trading contract improves investor welfare. ■

Proof of Proposition 4.10

Under the first best scenario, the investor can directly implement the right investment choice by contracting on the manager's information. To determine optimal effort given the investment rule, the investor simply equals the marginal benefit with the marginal cost of effort. Therefore, for each investment strategy, the desired level of effort is given by

$$\text{economic-trading} \quad : \quad \frac{\left[\phi_H - (1 + \phi_H)\, c\right]}{2k}, \text{ and} \tag{34}$$

$$\text{aggressive-trading} \quad : \quad \frac{(\phi_H - \phi_L)(1 - c)}{2k}, \tag{35}$$

while the investor's surplus is

$$\text{economic-trading} \quad : \quad \frac{[\phi_H - (1+\phi_H)\,c]^2}{8k}, \text{ and} \tag{36}$$

$$\text{aggressive-trading} \quad : \quad \frac{1}{2}\left[\phi_L - (1+\phi_L)\,c + \frac{1}{4k}\,(\phi_H - \phi_L)^2\,(1-c)^2\right]. \tag{37}$$

After some algebraic manipulations, it can be shown that the economic-trading contract yields higher investor surplus in the range with interior solutions. Thus, the economic-trading contract is always optimal.

The manager's utility function is given by

$$EU^{FB} = \frac{[\phi_H - (1+\phi_H)\,c]}{4k} q. \tag{38}$$

With perfectly competitive brokers, setting $c = q$ yields $\frac{[\phi_H - (1+\phi_H)q]}{4k} q$, which is concave in q and have an interior solution at

$$\text{competitive}: c^{FB} = q^{FB} = \frac{\phi_H}{2\,(1+\phi_H)}. \tag{39}$$

The monopolist broker maximizes

$$\max_{c,q} \frac{1}{2} \frac{[\phi_H - (1+\phi_H)\,c]}{2k} (c-q),$$

which yields

$$\text{monopolistic}: c^{FB} = \frac{\phi_H}{2\,(1+\phi_H)}, \text{ and } q^{FB} = 0. \tag{40}$$

It is simple to check that $c^{FB} \in \left[\frac{\phi_L}{(1+\phi_L)}, \frac{\phi_H}{(1+\phi_H)}\right)$, which holds naturally given the conditions specified in the text.

Plugging the equilibrium effort $\frac{[\phi_H - (1+\phi_H)c^{FB}]}{2k}$ back into the investor's and the manager's profit functions completes the proof. ■

Proof of Proposition 5.1

Because of the free effort the broker provides, the probability of trading becomes

$$\text{economic-trading} \quad : \quad \frac{e_0 + e_f}{2}, \text{ and} \tag{41}$$

$$\text{aggressive-trading} \quad : \quad \frac{1}{2}. \tag{42}$$

It is straightforward to show that the incentive-compatible contract as a function of managerial effort e_f for each investment strategy takes the same form as before. The expected compensation for the fund manager $Ew(e_f)$ is as follows:

$$\text{economic-trading} \quad : \quad q + \frac{2ke_f(1+\phi_L)}{(\phi_H - \phi_L)} + \frac{(e_0 + e_f)}{2}(2ke_f - q), \text{ and} \tag{43}$$

$$\text{aggressive-trading} \quad : \quad \frac{q}{2} + ke_f\left[\frac{2}{(\phi_H - \phi_L)} + e_0 + e_f\right]. \tag{44}$$

The investor determines the desired effort level to implement in order to maximize his net profits

$$\text{economic-trading} \quad : \quad \frac{(e_0 + e_f)}{2}\left[\phi_H - (1+\phi_H)c\right] - Ew^E(e_f), \text{ and} \tag{45}$$

$$\text{aggressive-trading} \quad : \quad \frac{1}{2}\left[\phi_L - (1+\phi_L)c + (\phi_H - \phi_L)(1-c)(e_0 + e_f)\right] - Ew^A(e_f). \tag{46}$$

for both types of contract. Taking the first order condition yields the solution for managerial effort.

Finally, plugging desired level of effort into the investor's objective function, we obtain the investor's net profits at optimum:

$$\text{economic-trading} \quad : \quad \frac{e_0}{2}\left[\phi_H - (1+\phi_H)c + q\right] + k\left(e_f^E\right)^2 - q, \text{ and} \tag{47}$$

$$\text{aggressive-trading} \quad : \quad \frac{\phi_L - (1+\phi_L)c - q}{2} + \frac{(\phi_H - \phi_L)(1-c)c}{2} + k\left(e_f^A\right)^2. \tag{48}$$

It is simple algebra to verify that both functions are decreasing in q. Moreover, both functions are initially decreasing and then become increasing in c. ■

Proof of Proposition 5.2

A perfectly competitive broker always breaks even, thus $q = (1-t)c$. The manager's utility function under each contract is given by

$$\text{economic-trading} \quad : \quad q + \left[\frac{2k(1+\phi_L)}{(\phi_H - \phi_L)} + k\left(e_0 + \frac{e_f^E}{2}\right)\right]e_f^E, \text{ and} \tag{49}$$

$$\text{aggressive-trading} \quad : \quad q + \left[\frac{2k}{(\phi_H - \phi_L)} + k\left(e_0 + \frac{e_f^A}{2}\right)\right]e_f^A. \tag{50}$$

We already know that the aggressive-trading contract is the equilibrium choice with competitive brokers. Plugging $q = (1-t)c$ and $e_0 = c$ into equation (50), the manager's utility function at the optimum becomes

$$(1-t)c + k\left[\frac{(\phi_H - \phi_L)^2 - 4k}{4k(\phi_H - \phi_L)} - \frac{(\phi_H - \phi_L + 2k)}{4k}c\right]\left[\frac{(\phi_H - \phi_L)^2 + 12k}{8k(\phi_H - \phi_L)} + \frac{6k - (\phi_H - \phi_L)}{8k}c\right]. \tag{51}$$

Taking the first order condition w.r.t. c, we obtain

$$c^* = \frac{16k(1-t) - [(\phi_H - \phi_L) - 2k](\phi_H - \phi_L)}{(\phi_H - \phi_L + 2k)[6k - (\phi_H - \phi_L)]} - \frac{4k[6k + (\phi_H - \phi_L)]}{(\phi_H - \phi_L)(\phi_H - \phi_L + 2k)[6k - (\phi_H - \phi_L)]}. \tag{52}$$

To obtain an interior solution for c^*, t needs to be small enough to make sure that $c^* > 0$, i.e.,

$$t < \bar{t} \equiv \frac{3(\phi_H - \phi_L) - 6k}{4(\phi_H - \phi_L)} - \frac{[(\phi_H - \phi_L) - 2k](\phi_H - \phi_L)}{16k}. \tag{53}$$

Also, we need to make sure that $c^* < c^{\max}$ above which the investor does not hire, this yields a lower bound for t. This lower bound $\underline{t}$ can be found by setting $c^*(\underline{t}) = c^{\max}(\underline{t})$.

Finally, we need to check the second order condition to make sure that the utility function is globally concave in c. This second order condition is given by

$$SOC = -\frac{(\phi_H - \phi_L + 2k)}{2}\frac{6k - (\phi_H - \phi_L)}{8k}, \tag{54}$$

which is negative if and only if

$$k > \frac{(\phi_H - \phi_L)}{6}. \tag{55}$$

This completes the proof. ■

Proof of Proposition 5.3

The broker's objective function is given by

$$\text{economic-trading} \;:\; \frac{e_f^E(c,q)}{2}[(1-t)c - q], \text{ and} \tag{56}$$

$$\text{aggressive-trading} \;:\; \frac{1}{2}[(1-t)c - q]. \tag{57}$$

Repeating the same solution procedure as we did for the baseline model yields the result. ■

References

[1] Admati, A., and P. Pfleiderer (1997), "Does it all add up? Benchmarks and the compensation of active portfolio managers," *Journal of Business*, Vol. 70, No. 3, 323-350.

[2] Affleck-Graves, J., S. Hegde, and R. Miller (1994), "Trading mechanisms and the components of the bid-ask spread," *Journal of Finance*, Vol. 49, 1471-1488.

[3] Ambachtsheer, K. P. (1993), "The soft dollar question: What is the answer?" *Financial Analyst Journal*, January-February, 8-10.

[4] Baker, M., L. Litov, J. A. Wachter, and J. Wurgler (2004), "Can mutual fund managers pick stocks? Evidence from their trades prior to earnings announcements," working paper, Harvard Business School.

[5] Battalio, R. (1997), "Third market broker-dealers: Cost competitors or cream skimmers? An empirical analysis," *Journal of Finance*, Vol. 52, 341-352.

[6] Battalio, R., J. Greene, and R. Jennings (1997), "Do competing specialists and preferencing dealers affect market quality?" *Review of Financial Studies*, Vol. 10, No. 4, 969-993.

[7] Berk, J. B., and R. C. Green (2004), "Mutual fund flows and performance in rational markets," *Journal of Political Economy*, Vol. 112, No. 6, 1269-1295.

[8] Berkowitz, S. A., D. E. Logue, and E. A. Noser (1998), "The total cost of transactions on the NYSE," *Journal of Finance*, Vol. 43, No. 1, 97-112.

[9] Bernstein, P. L. (1998), "Where, oh where are the .400 hitters of yesteryear," *Financial Analysts Journal*, Vol. 54, Issue 6, 6-14.

[10] Brown, S. J., and W. N. Goetzmann (1995), "Performance persistence," *Journal of Finance*, Vol. 50, 679-698.

[11] Carhart, M. (1997), "On persistence in mutual fund performance," *Journal of Finance*, Vol. 52, 57-82.

[12] Carpenter, J. I. (2000), "Does option compensation increase managerial risk appetite?" *Journal of Finance*, Vol. 55, 2311-2331.

[13] Chan, H., N. Jegadeesh, and R. Wermers (2000), "The value of active mutual fund management: An examination of the stockholdings and trades of fund managers," *Journal of Financial and Quantitative Analysis*, Vol. 35, Issue 3, 343-368.

[14] Chan L. K. C., and J. Lakonishok (1995), "The behavior of stock prices around institutional trades," *Journal of Finance*, Vol. 50, No. 4, 1147-1174.

[15] Chen, Q., I. Goldstein, and W. Jiang (2006), "Directors' ownership in the U.S. mutual fund industry," working paper, Duke University.

[16] Chevalier, J., and G. Ellison (1997), "Risk taking by mutual funds as a response to incentives," *Journal of Political Economy*, Vol. 105, 1167-1200.

[17] Chordia, T., and A. Subrahmanyam (1995), "Market making, the tick size, and payment-for-order Flow: Theory and evidence," *Journal of Business*, Vol. 68, No. 4, 543-575.

[18] Christie, W., and R. Huang (1994), "Market structures and liquidity: A transactions data study of exchange listings," *Journal of Financial Intermediation*, Vol. 3, 300-326.

[19] Coles, J. L., J. Suay, and D. Woodbury (2000), "Fund advisor compensation in closed-end funds," *Journal of Finance*, Vol. 55, No. 3, 1385-1414.

[20] Conrad, J. S., K. M. Johnson, and S. Wahal (2001), "Institutional trading and soft dollars," *Journal of Finance*, Vol. 56, No. 1, 397-416.

[21] Cuoco, D., and R. Kaniel (2006), "Equilibrium prices in the presence of delegated portfolio management," working paper, Duke University.

[22] Das, S., and R. Sundaram (1998), "On the regulation of mutual fund fee structure," working paper, Harvard University and New York University.

[23] David, J., and L. Lightfoot (1994), "Fragmentation vs. Consolidation of securities trading: Evidence from the operation of rule 19c-3," working paper, Securities and Exchange Commission.

[24] Deli, D. N. (2002), "Mutual fund advisory contracts: an empirical investigation," *Journal of Finance*, Vol. 57, No. 1, 109-133.

[25] Diamond, P. (1998), "Managerial incentives: on the near linearity of optimal compensation," *Journal of Political Economy*, Vol. 106, No. 5, 931-957.

[26] Ding, F., S. Gervais, and A. S. Kyle (2006), "Institutional trading: decision making and employee compensation," working paper, Duke University.

[27] Dow, J., and G. Gorton (1997), "Noise trading, delegated portfolio management, and economic welfare," *Journal of Political Economy*, Vol. 105, No. 5, 1024-1050.

[28] Dybvig, P., H. K. Farnsworth, and J. N. Carpenter (2004), "Portfolio performance and agency," working paper, New York University.

[29] Ellis, C. D. (1998), *Winning the Loser's Game*, Third Edition (New York: McGraw Hill).

[30] Elton, E. J., M. J. Gruber, and C. R. Blake (2003), "Incentive fees and mutual funds," *Journal of Finance*, Vol. 58, No. 2, 779-804.

[31] Fant, L. F., and E. S. O'Neal (2000), "Temporal changes in the determinants of mutual fund flows," *Journal of Financial Research*, Vol. 23, Issue 3, 353-371.

[32] Goetzmann, W. N., and N. Peles (1997), "Cognitive dissonance and mutual fund investors," *Journal of Financial Research*, Vol. 20, Issue 2, 145-158.

[33] Goldstein, M., P. Irvine, E. Kandel, and Z. Wiener (2006), "Brokerage commissions and institutional trading patterns," working paper, University of Georgia and Hebrew University.

[34] Golec, J. H. (1992), "Empirical tests of a principal-agent model of the investment advisor relation," *Journal of Financial and Quantitative Analysis*, Vol. 27, 91-95.

[35] Grinblatt, M., and S. Titman (1989), "Mutual fund performance: An analysis of quarterly portfolio holdings," *Journal of Business*, Vol. 62, 394-415.

[36] Grinblatt, M., and S. Titman (1992), "The persistence of mutual fund performance," *Journal of Finance*, Vol. 47, 1977-1984.

[37] Grinblatt, M., and S. Titman (1993), "Performance measurement without benchmarks: An examination of mutual fund returns," *Journal of Business*, Vol. 66, 47-68.

[38] Gruber, M. J. (1996), "Another puzzle: The growth in actively managed mutual funds," *Journal of Finance*, Vol. 51, 783-810.

[39] Heinkel, R., and N. M. Stoughton (1994), "The dynamics of portfolio management contracts," *Review of Financial Studies*, Vol. 7, No. 2, 351-387.

[40] Kandel, E., and L. M. Marx (1999), "Payments for order flow on Nasdaq," *Journal of Finance*, Vol. 54, No. 1, 35-66.

[41] Keim, D.B., and A. Madhavan (1997), "Transactions costs and investment style: an inter-exchange analysis of institutional equity trades," *Journal of Financial Economics*, Vol. 46, 265-292.

[42] Keim, D. B., and A. Madhavan (1998), "The cost of institutional equity trades," *Financial Analysts Journal*, Vol. 54, Issue 4, 50-69.

[43] Lamoureux, C., and C. Schnitzlein (1995), "When it's not the only game in town (The effect of bilateral search on the quality of a dealer market)," working paper, University of Arizona.

[44] Lynch, A. W., and D. K. Musto (2003), "How investors interpret past fund returns," *Journal of Finance*, Vol. 58, No. 5, 2033-2058.

[45] Myners Report (2001), see http://www.treasury.gov.uk/docs/2001/myners_report0602.html.

[46] Neal, R., and D. Reiffen (1996), "The effect of integration between broker/dealers and specialists," in A. Lo (ed.), *Industrial Organization and Regulation of the Securities Industry*, University of Chicago Press, Chicago.

[47] Ou-yang, H. (2003), "Optimal contracts in a continuous-time delegated portfolio management problem," *Review of Financial Studies*, Vol. 16, No. 1, 173-208.

[48] Parlour, C. A., and U. Rajan (2003), "Payment for order flow," *Journal of Financial Economics*, Vol. 68, 379-411.

[49] Petersen, M., and D. Fialkowski (1994), "Posted versus effective spreads: Good prices or bad quotes?" *Journal of Financial Economics*, Vol. 35, 269-292.

[50] Rhodes-Kropf, M. (2005), "Price improvement in dealership markets," *Journal of Business*, Vol. 78, No. 4, 1-36.

[51] Scharfstein, D., and J. C. Stein (1990), "Herd behavior and investment,", *American Economic Review*, Vol. 80, No. 3, 465-479.

[52] Schwartz, R. A., and B. Steil (2002), "Controlling institutional trading costs," *Journal of Portfolio Management*, Vol. 28, Issue 3, 39-49.

[53] Sirri, E. R., and P. Tufano (1998), "Costly search and mutual fund flows," *Journal of Finance*, Vol. 53, No. 5, 1589-1622.

[54] Starks, L. T. (1987), "Performance incentive fees: An agency theoretic approach," *Journal of Financial and Quantitative Analysis*, Vol. 22, 17-32.

[55] Stoughton, N. M. (1993), "Moral hazard and the portfolio management problem," *Journal of Finance*, Vol. 48, No. 5, 2009-2028.

[56] Warner, J. B., and J. S. Wu (2006), "Why do mutual fund advisory contract change? Fund verses family influences," working paper, University of Rochester.

[57] Wermers, R. (2000), "Mutual fund performance: An empirical decomposition into stock-picking talent, style, transactions costs, and expenses," *Journal of Finance*, Vol. 55, No. 4, 1655-1695.