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**THE IMPACT OF PERFORMANCE BASED FEES ON
PENSION FUND MANAGEMENT**

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THE IMPACT OF PERFORMANCE-BASED FEES ON PENSION FUND MANAGEMENT

by

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Introduction

Recently, the Department of Labor and the Securities and Exchange Commission gave their approval to performance-based fee arrangements for managers of pension funds. The change in attitude of these government agencies is widely viewed as an enlightened decision. As a recent Institutional Investor (Hawthorne (1986)) article states, "Pension officers are turning to performance-based systems because they are fed up with shelling out millions of dollars in fees year after year for money management strategies that can't even seem to keep up with the market." It is also widely believed that performance-based fees may create greater incentives for portfolio managers to use their talents for the benefit of the pension fund.

In fact, as we will show, these contracts could lead to the opposite result. Many performance contracts, particularly those that are being developed currently, can create incentives for the portfolio manager to game the contract at the expense of the pension fund. For example, the archetypical performance contract provides an incentive to the portfolio manager to increase the unsystematic volatility of the portfolio and/or target a portfolio beta that substantially deviates from one. Such contracts offer the portfolio manager a riskless arbitrage opportunity that is easy to implement. However, by appropriately altering the contracts with a cap on the maximum performance fee and instituting a penalty for negative performance, the adverse incentives problem can be corrected.

1. Performance-Based Contracts and Options

The simplest performance contract has two features: a base fee and a bonus based on the degree to which the managed portfolio's return exceeds the return of some benchmark, typically the Standard and Poor's 500 index

portfolio. The article in Institutional Investor, for instance, states that Chicago Corp. will get ten percent of the difference between the performance of its managed portfolio and that of the S&P 500.

It should be noted that the Chicago Corp. contract has many of the features of a call option. Diagram 1 illustrates the performance-based contract's percentage reward to the manager as a function of the return of his portfolio in excess of the return of the S&P 500. The flat portion of the diagram, the base fee, corresponds to the value of an option when it is out-of-the-money and the positively sloped portion corresponds to the value of an in-the-money option. The bonus trigger point of the Chicago Corp. contract is at zero, implying that the kink in the graph is at its intersection with the vertical axis.

 Diagram 1 about here

More general performance fee contracts could have positive or negative bonus trigger points, which would shift the graph to the right or to the left. They could have caps on the fee and/or several trigger points at which the bonus rate increases. They might also be represented as a series of escalating steps. Although it is impossible to analyze all of the contracts that are currently being considered, most of these can be approximated by a few representative contracts. As a result, the insights gained from examining a few representative contracts generalize to most situations.

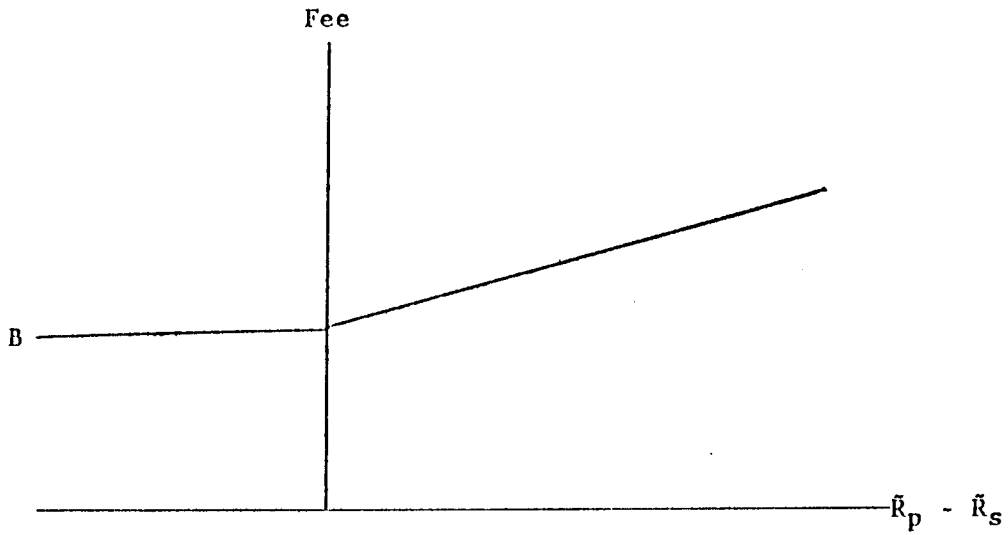
Consider a manager who holds the equity securities in the S&P 500 (properly proportioned) as his portfolio. In this case, his reward will be the vertical intercept of the performance graph, which will normally be the base fee. On the other hand suppose that a manager holds a leveraged

DIAGRAM 1

MANAGEMENT FEE AS A FUNCTION OF THE RETURN OF THE PORTFOLIO IN EXCESS OF
THE RETURN OF THE STANDARD AND POOR'S 500 PORTFOLIO

Panel A: Simple Fee Structure

Fee



position in the S&P 500. To make the example simple, suppose he borrows one million dollars at a rate of 9% and invests two million dollars in the S&P 500. We can plot the return of his levered S&P 500 position in excess of the S&P 500 return as a function of the S&P 500 return. This is done in Diagram 2. The S&P 500 portfolio (i.e. the unlevered position) lies on the horizontal axis in this diagram. The levered position in the S&P 500 described above is a 45 degree line. In general, the slope of this line increases and the intercept decreases as the leverage increases.

 Diagram 2 about here

2. Algebraic Analysis of the Value of Performance-Based Fees

Diagram 2 allows us to plot the performance fee of a levered position in the S&P 500 as a function of the S&P 500 return. For simplicity, we assume that the fee structure is of the Chicago Corp. type,

$$F = \max[B, B + Vm(\tilde{R}_p - \tilde{R}_s)] \quad (1)$$

$$= B + Vm [\max(0, \tilde{R}_p - \tilde{R}_s)], \text{ where}$$

B = base fee

V = net asset value of the fund at the beginning of the evaluation period.

m = fraction of the return of the fund in excess of the S&P return awarded to the manager as a bonus for good performance.

\tilde{R}_p = return of the managed portfolio

\tilde{R}_s = return of the S&P 500 portfolio.

In the case described above, we assumed

$\tilde{R}_p = 2\tilde{R}_s - .09$ and $V = 1,000,000$. If we also assume that $m = .10$, as is true for Chicago Corp., we can write the fee in equation (1) as

$$F = B + 100,000 \max(0, \tilde{R}_s - .09) \quad (2)$$

DIAGRAM 2

RETURN IN EXCESS THE S&P 500 RETURN OF A 50% LEVERED PORTFOLIO
AS A FUNCTION OF THE RETURN OF THE STANDARD AND POOR'S 500 PORTFOLIO

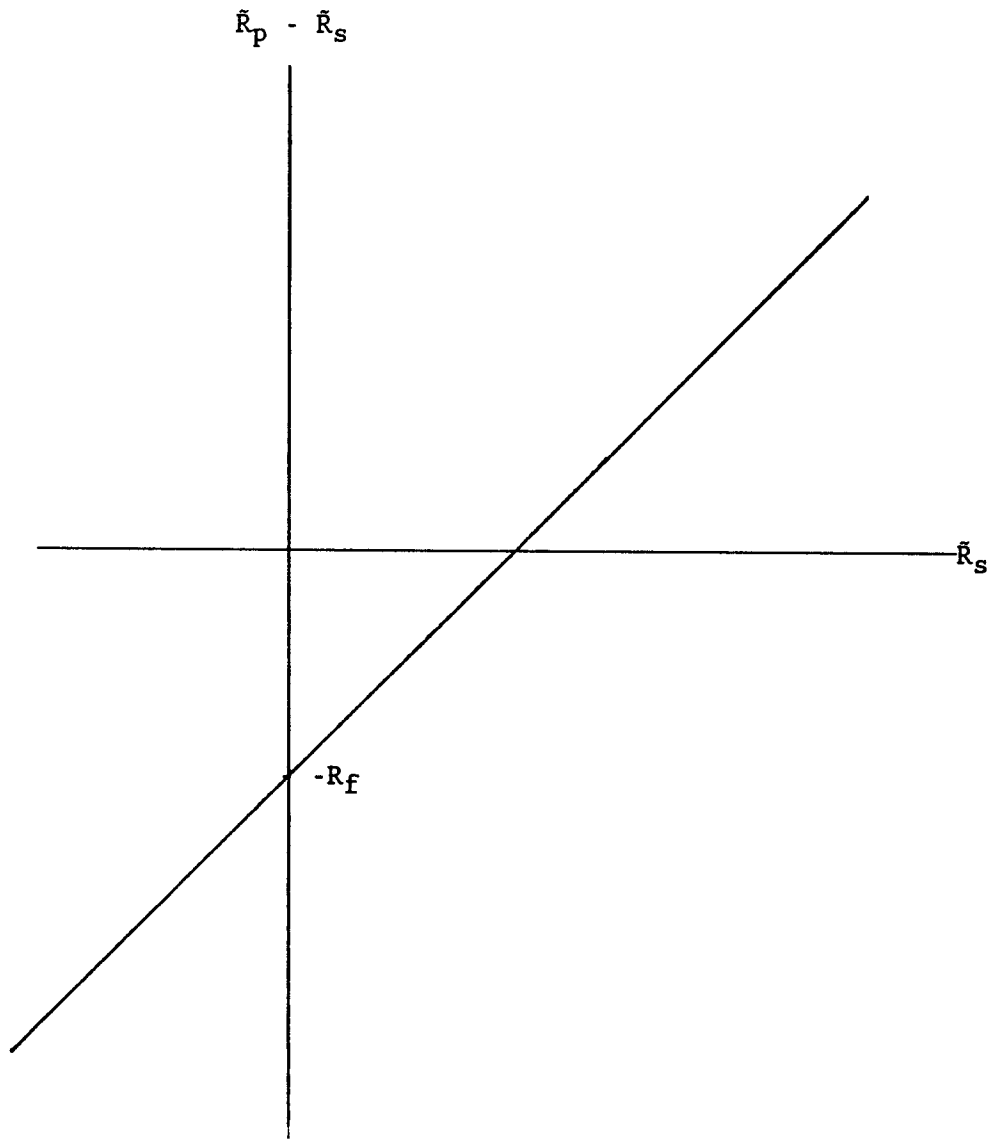


Diagram 3 plots this equation, which represents the fee as a function of the return of the S&P 500. This still has the shape of a call option payoff.

Note, however, what happens if the leverage of the position changes. If the fraction f of V , with $f > 1$, is invested in the S&P 500, and $V(f - 1)$ is borrowed to finance this purchase, equation (2) becomes

$$F = B + 100,000 (f - 1) \max(0, \tilde{R}_S - .09), \quad (3)$$

and for $f < 1$, (i.e. the fund is long in the risk-free asset), it becomes

$$F = B + 100,000 (1 - f) \max(0, .09 - \tilde{R}_S). \quad (4)$$

 Diagram 3 about here

Equations (3) and (4) are plotted in Diagram 4 for various values of f . As Diagram 4 Panel A illustrates, as f increases above one (i.e. more leverage), the slope of the payoff changes--it becomes steeper to the right of the kink. Alternatively, as can be easily seen from equation (3), increasing the leverage of the position implies that the fee structure has more call options implicit in the payoff. Since call options always have positive value, as the manager levers up his portfolio, he increases the present (and expected) value of his fee contract. Similarly, as can be seen in Panel B, decreases in f below one, (i.e. placing a portion of the portfolio in a risk-free asset), make the slope of the payoff steeper to the left of the kink. This represents an increase in the number of put options awarded to the manager. Note that any increase in fees due to leverage changes is offset by a decrease in the expected return of the fund since leverage changes per se cannot benefit the fund.

 Diagram 4 about here

DIAGRAM 3

MANAGEMENT FEE FOR A 50 % LEVERED PORTFOLIO AS A FUNCTION OF
THE RETURN OF THE STANDARD AND POOR'S 500 PORTFOLIO

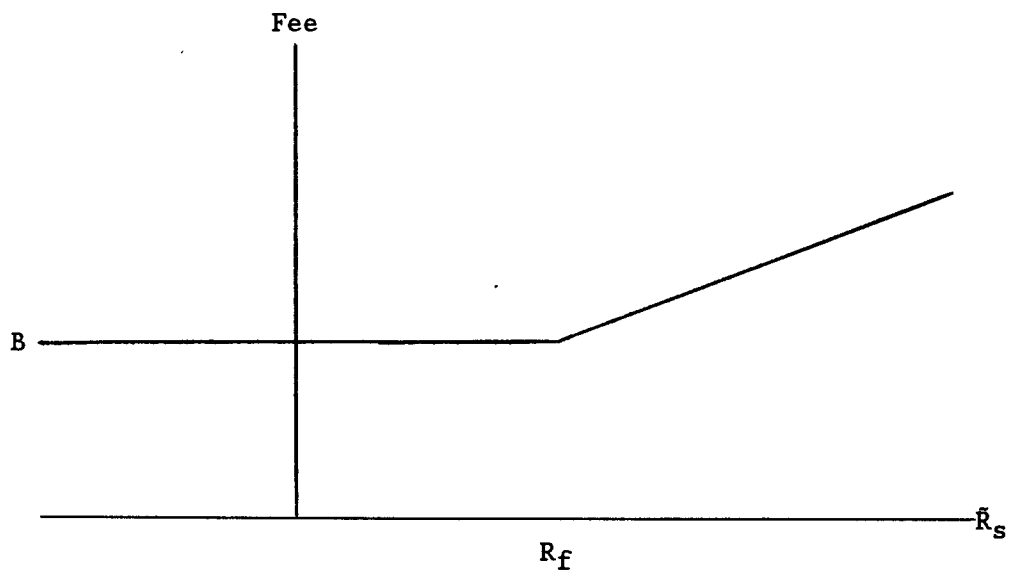
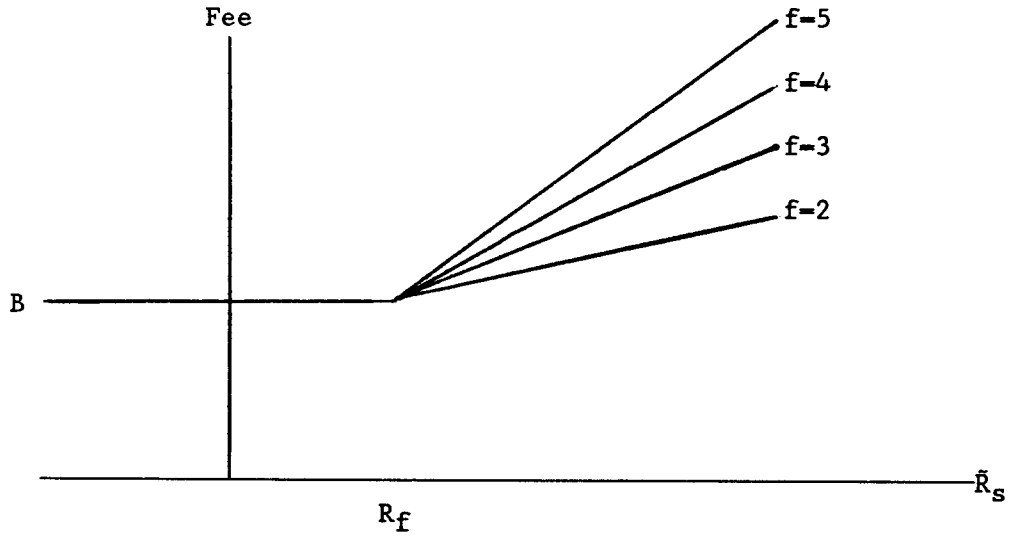


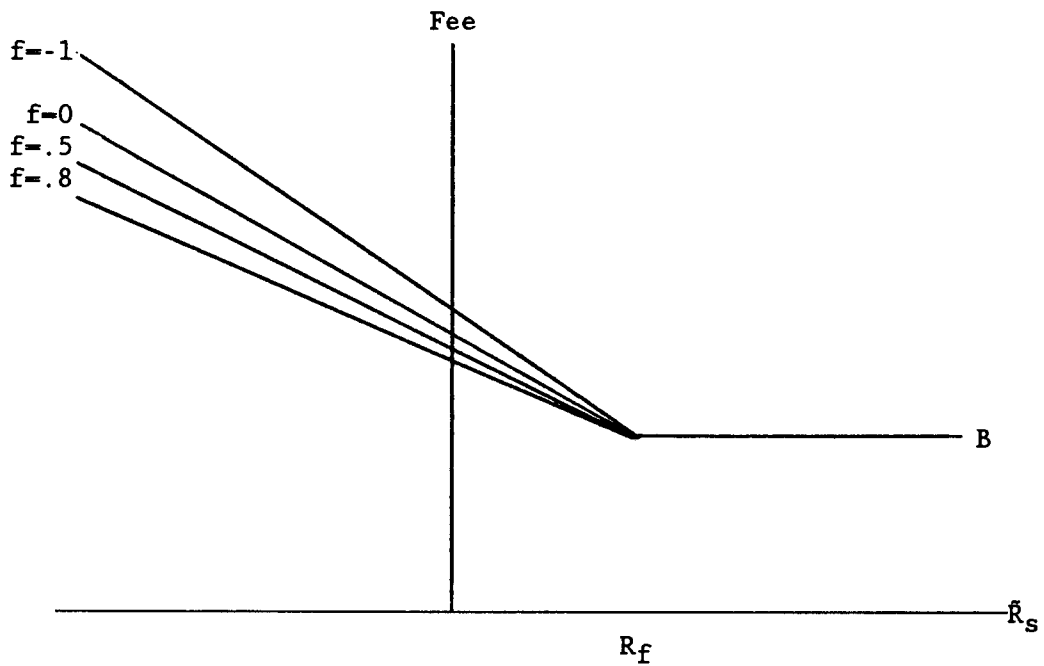
DIAGRAM 4

MANAGEMENT FEE FOR VARIOUS PORTFOLIOS OF THE
RISK-FREE ASSET AND THE S&P 500
AS A FUNCTION OF THE RETURN OF THE STANDARD AND POOR'S 500

Panel A: Leverage Positions in the S&P 500



Panel B: Portfolios with Long Positions in the Risk-Free Asset



If he desires, the portfolio manager can capture the present value of these fees risklessly. For a levered portfolio, he merely needs to write call options on a one dollar investment in the S&P 500 in his personal portfolio with striking prices equal to one plus the risk-free rate. In years where the S&P 500 does poorly, he will be compensated by the decline in the value of the options he had shorted for his personal portfolio. In years where the S&P 500 does well, he will be compensated through his management fee for the liability incurred by the option short positions. In either event, his profit is equal to the sum of his base fee and the proceeds from the sale of the options in his personal portfolio. The number of options he writes is the product of V , m , and $f - 1$.

To hedge the fees for a portfolio with a positive net position in the risk-free asset (i.e. $f < 1$), the manager merely needs to write comparable put options. The number of options he writes is the product of V , m , and $1 - f$. It is important to note that this hedging need never be known to the pension fund officers.

More general fee contracts might impose caps on the fee structure, (e.g. 2% of net asset value) or have many trigger points. These fee structures, as currently implemented, generally provide incentives to employ risk-free borrowing or lending to create a risk position that substantially differs from the risk of the S&P 500 portfolio alone. The fee, in this case, can be hedged with portfolios of call (or put) options. The striking prices of the options depend on the trigger points, the proportion of the managed portfolio invested in the risk-free asset, and the cap. For example, the contract with a cap and a single trigger point for a manager who follows a buy-and-hold strategy in the S&P 500 and a risk-free asset can be hedged by (i)

purchasing options on the S&P 500 with striking prices that are related to the trigger point for the bonus, and (ii) writing options with striking prices that are related to the cap. The striking prices of these options also vary as the amount of leverage in the portfolio varies. (The technical analysis of many of these more general contracts is found in Grinblatt and Titman (1987).)

3. A Numerical Example of Contract Valuation

As a simple exercise, we used the Black-Scholes model to calculate the value of the performance-based fee for various portfolios of the S&P 500's equities and a risk-free asset. Under the assumption that the manager is compensated annually, we estimated the value of the one-year European calls on the S&P 500 required to perfectly hedge the fee contract arranged for Chicago Corp. The numbers are expressed as a percentage of net asset value. In this example, $m = .1$ and the volatility of the S&P portfolio is assumed to be $.20$, which yields a call option value equal to 7.97% of the value of the underlying asset.¹ Because of the parameters of the option contract, the relevant put option has an identical value. For risk-free investments, short or long, amounting to 10% of the net asset value of the managed fund, and hence portfolio betas (relative to the benchmark) of 1.1 and $.9$ respectively, this performance-based fee can, without risk, be guaranteed to offer 79.7 basis points of net asset value per year in excess of the base fee. For betas of $.8$ or 1.2 , the bonus fee is equivalent to paying the manager an additional 159.4 basis points per year.

¹The borrowing rate of interest does not effect the calculation of the call and put option values because the present value of the striking price is not affected by the interest rate.

It should be noted that even though the European option valued above is not traded, performance-based fees can still be almost perfectly hedged with publicly traded American index options. Alternatively, one could hedge with dynamic trading strategies that mimic options--employing futures contracts, index funds, or individual securities. The hedge ratios for these trading strategies are somewhat more complicated to calculate and they change over time. Despite this, the European option values still represents the market value of the performance-based contract that should be used for comparisons with standard fixed management fees. The above example indicates that for a leveraged portfolio or a portfolio with a beta (relative to the benchmark) that is substantially less than one, the Chicago Corp. performance contract is significantly more lucrative than most standard fixed management fees.

4. Designing Contracts without Adverse Risk Incentives

In the previous section, we demonstrated that managers with performance-based contracts can increase the value of their fees by increasing leverage or investing in a risk-free asset. This tendency to alter the risk of the managed portfolio is similar to the incentives equity holders have to expropriate wealth from existing bondholders by increasing their leverage, choosing riskier projects, paying dividends, etc. Bondholders, aware of the adverse incentives of value-maximizing equity holders, write covenants into their bonds that limit these forms of expropriation. Pension funds could similarly restrict the behavior of their performance-compensated portfolio managers. For instance, it is possible to contractually prohibit the manager from borrowing or holding short or long positions in a risk-free asset or equivalent positions in futures or option contracts. The manager

could, however, still achieve higher fees by choosing to hold securities with either very high betas or very low betas. One could try to counter this behavior by basing the fee on a measure of performance that is adjusted for beta,² but there is a vast literature in finance on classes of securities that outperform beta-based benchmarks as traditionally computed. Moreover, in this case, the manager can gain by choosing stocks with large amounts of unsystematic risk. This could be even worse from the pension fund's perspective, since it might increase the fund's riskiness without increasing its expected return. It should also be noted that contractual limitations on the manager could be counterproductive if it limits his flexibility, and hence, his ability to achieve abnormal returns.

A pension fund officer could also try to eliminate the incentive to increase risk by changing the performance contract. In the absence of a cap, a manager who is penalized by losses as much as he benefits from gains earns a fee that is perfectly correlated with pension fund performance. However, it is probably impossible to penalize the portfolio manager an unlimited amount.

A cap on the fee does not eliminate the incentive to increase or decrease risk if the bonus is triggered when the return of the portfolio is greater than that of the S&P 500, as in Diagram 5a. However, if the bonus is triggered for portfolio returns that are less than the S&P return, as in Diagram 5b, the contract may eliminate the incentive. One can think of such contracts as providing a reward for performance above that of the S&P, a penalty for performance below that of the S&P 500, and caps on both rewards and penalties. If the maximum gain in compensation that the manager can

²See Grinblatt (1986/1987) for a review of these techniques.

achieve from beating the S&P (above what he would achieve by matching the S&P) is no greater than the maximum loss in compensation from doing worse than the S&P, the adverse risk-incentive is eliminated for certain portfolio managers. These are managers who follow strategies that allow only small changes in the risk of the portfolio over time, (such as buy-and-hold and many rebalancing strategies).

Diagram 5 about here

Contracts with penalties that exceed rewards may not preclude gaming if the portfolio manager can aggressively alter the portfolio's risk within the evaluation period. Some strategies, for instance, can virtually guarantee that the manager will receive the maximum fee, irrespective of the severity of the penalty. These strategies, described in Grinblatt and Titman (1987), dramatically alter the risk of the managed portfolio over time in response to past movements in stock prices. Although the changes in risk required to guarantee the maximum fee are too drastic to be realistic, in that they generate large transaction costs and can be easily detected, the incentive to aggressively alter risk still exists. Evidence of this was found in a recent Wall Street Journal article, (Dorfman (1986)), which recalled "a couple of managers who stated their objectives as investing in blue-chip stocks with market capitalizations over \$500 million. But when the managers' performance numbers sagged, they began to 'stretch for performance by going for takeover candidates and high-flying over-the-counter stocks.'" "

We believe that contracts should have maximum penalties for poor performance that exceed the maximum reward for good performance (relative to purchasing the S&P). However, penalties that are too severe are not

desirable. Such penalties will not only eliminate the manager's incentive to alter risk, but will reduce the incentives of the manager to use his investment talents to improve the true performance of the fund as well. This is because superior stock selection requires non-zero unsystematic risk in the portfolio, which reduces the present values of contracts with sufficiently large penalties relative to the rewards. For this reason, careful design of the performance-based contract is important.

5. Long Term Reputation Considerations

The model described above oversimplifies the rewards and penalties faced by actual portfolio managers. Most importantly, it assumes a one period horizon for managers. In reality, these managers may be more concerned about the renewal of lucrative contracts and about their long term reputations than about the additional amounts they can earn by altering risk in the manner outlined above.

If the risk of the portfolio is easily observed by the pension fund officers, we expect these reputation considerations to mitigate the adverse incentive effects discussed here. However, since the risk of an actively managed portfolio is difficult to measure, our simple model may capture incentive problems that are present in more complicated settings.³ Moreover, there is reason to suspect that reputation considerations may reinforce our arguments about adverse risk incentives.

³The pension fund officer expects the returns of an actively managed portfolio to differ from the return of the S&P 500. For such an actively managed portfolio, volatility is measured imprecisely, except in very long time series. For this and other theoretical reasons, it would be impossible to determine on the basis of a few observed ex-post returns whether a difference between the two returns is due to a deliberate attempt to game the contract or to active management based on superior investment talent.

Regardless of the type of compensation contract, there is a maximum amount that the portfolio manager can lose by performing very poorly. He cannot do worse than lose all of his present and future business. However, the upside potential associated with significantly outperforming the benchmark is considerable, particularly if the manager is a newcomer to the profession who is managing small amounts of money. This suggests that, even for a manager with a fixed percentage fee contract, the long run payout may be similar to a contract with a very generous cap. To offset the increased adverse risk incentives created by these reputational issues, it may be necessary to increase the penalties or decrease the cap on the performance contract from the levels specified in the previous section.

On the other hand, an established manager with an illustrious track record may already be managing a great deal of money. For such a manager, the potential loss from performing poorly may outweigh the gains from performing well. In this case, reputational considerations may imply that the fee appears to have a very tight cap, and it may be necessary to decrease the penalties or increase the cap from the levels specified in the previous section.

6. Conclusion

In this paper, we have shown that pension fund officers could inadvertently agree to performance-based fees that are substantially more lucrative than standard fixed-management fees. The fee structure might also encourage the fund's portfolio manager to assume unnecessary unsystematic risk and select a target beta that substantially differs from one. Although this is shown in a single period model, we argue that reputation considerations do

not fundamentally alter these conclusions.

Our analysis also demonstrated that these adverse incentives can be mitigated with appropriately designed contracts. Caps on fees, as well as sizable penalties for poor performance, can eliminate the incentives to alter the risk of the fund.

Numerical estimates of the value of these contracts suggest that the issues raised here are not trivial. For instance, with a contract that lacks a cap, a portfolio manager can substantially increase his fees, on average, by small additions of unsystematic risk or by inducing small deviations in the portfolio's beta from one.

The analysis here has assumed that the appropriate benchmark is the return of the S&P 500. It is, of course, trivial to extend this to other benchmarks. A pension fund that requires a more conservative investment strategy should select a less risky benchmark, such as a weighted average of the S&P 500 return and that of treasury bills, (with positive weights that sum to one). With an appropriate cap and base fee, contracts with such a benchmark would induce a target beta that is approximately equal to the weight on the S&P 500. Alternatively, funds desiring riskier strategies might consider leveraged positions in the S&P 500 or a riskier portfolio (such as an equally-weighted portfolio of all NYSE stocks) as a benchmark.

There are a number of issues that were not discussed in the paper that may affect the risk incentives of the portfolio manager. These include the optimal length of the evaluation period, restrictions on the portfolio manager's personal portfolio, the extent to which the investment choices of the portfolio manager are monitored, and the choice between using inside portfolio managers vs. hiring outsiders. For example, inside managers might

be less tempted to alter the risk of the portfolio to game the fee. This is because the rewards for successful performance relative to the penalties for poor performance are probably smaller for inside managers than for outside managers, especially when issues like job security and public exposure are considered. Future research that examines these issues may provide additional insights that are relevant to the design of performance-based contracts.

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