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Optimal Hedge Fund Performance Fees

Minli Lian and Peter Klein[1]

Existing literature claims that performance fees induce excessive risk-taking behavior from hedge fund managers because higher risk increases the value of the performance fee option. In this paper it is argued that the relationship between investors and hedge fund managers is similar to the relationship between shareholders and corporate managers. Principal-agent theory is applied to this issue which shows that the performance of hedge funds and the payoff of the performance fee contract are endogenously determined by the fund manager's effort. The excess returns are shared between the investor and the manager and there is a natural upper bound to risk. The empirical results indicate that performance fees are positively associated with risk adjusted returns which is consistent with the theory.

JEL Codes: G10 and G29

1. Introduction

Hedge funds provide investors the opportunity to benefit from unconventional trading and arbitrage opportunities. Compensation to the manager for successfully finding and implementing such opportunities usually consists of both a management fee and a performance fee. Typically, the management fee ranges from one to two percent of assets under management, while the performance fee ranges from ten to twenty-five percent of the fund's returns in excess of some benchmark, such as the yield on short term treasury bills. Since these performance fees can represent a significant percent of the fund's profits it is important to examine whether they are warranted by the risk adjusted returns that hedge funds can provide.

The potential incentive effects of a performance fee on the level of effort that the hedge fund manager chooses to exert are the topic of this paper. It models the relationship between an investor and a hedge fund manager as a principal-agent problem with hidden action where the unobservable action is the manager's level of effort. This relationship is analogous to that between shareholders and corporate managers where employee stock options are awarded to motivate the corporate managers. The performance fee motivates hedge fund managers to pursue unconventional strategies that are riskier, but which also have higher returns. The principal argument is that investors will offer a performance fee if they believe that the additional managerial effort it will induce will lead to higher risk adjusted returns.

The question of why performance fees are not the prevalent form of compensation for traditional long-only investment managers is also considered. This paper finds that the change in the distribution of returns for traditional managers that is likely to be produced by higher effort implies that optimal compensation contracts for traditional managers are likely to consist of management fees only.

[1]Lian is at Kwantlen Polytechnic University and Klein is at Simon Fraser University. E-mails: minli.lian@kpu.ca and pklein@sfu.ca.

These hypotheses are tested empirically by considering the relationship between performance fees and Sharpe and Sortino ratios. These tests find that performance fees are positively related to risk adjusted returns in terms of both Sharpe and Sortino ratios.

The rest of this paper is organized as follows. Section two provides a brief review of the relevant literature. Section three presents the theoretical framework and discusses its implications. Section four presents the empirical tests of this theory and section five provides a brief summary and conclusion.

2. Literature Review

Most of the existing literature on hedge fund manager compensation applies an option approach to evaluate the performance fee provision (see Carpenter (2000), Richter and Brorsen (2000), Anson (2001), Elton, Gruber and Blake (2003), Goetzman, Ingersoll and Ross (2003), Hodder and Jackwerth (2007), Clare and Motson (2009), Panageas and Westerfield (2009), Guasoni and Oblój (2013) and Buraschi, Kosowski and Sritrakul (2014)). Many of these papers argue that the optionality of the performance fee leads to unbounded risk shifting, as higher risk increases the value of the performance fee option. In contrast, Brown, Goetzman and Park (2001) and Ross (2004) find there can be limits to such risk shifting based on the risk aversion of the hedge fund manager. Kouwenberg and Ziemba (2007) developed a model based on prospect theory to justify performance fees and also did an empirical study that supports their theory.

The effect of managerial effort on investment performance has been analyzed in the context of traditional portfolio management (see Stoughton (1993), Admati and Pfleiderer (1997), Starks (1997) and Li and Tiwari (2009)). These papers are based on the more general framework outlined in Holmstrom (1979) which shows that optimal risk sharing depends on the distribution of returns conditional on the level of managerial effort. This approach has not been extended to the study of optimal hedge fund fees.

3. Theoretical Framework

3.1 Modelling Managerial Effort

In the principal-agent literature, the principal is usually assumed to be risk neutral and the contract design problem is set up as a two-stage maximization problem. At stage one the principal characterizes the performance fee for each level of effort that the manager can choose, while at stage two the principal induces the desired effort level from the manager. When the action is observable, the best solution is achieved where the principal specifies the desired effort level, and the agent exerts the effort and is compensated accordingly. When the action is unobservable and the agent is risk neutral, the best solution is still achievable where the principal receives a fixed rent and the agent acts as the residual claimant. The risk is entirely shifted from the principal to the agent. However, if the agent is risk averse, the principal needs to balance the trade-off between providing insurance to the agent and providing motivation for the agent to exert the desired effort level. The optimal solution requires risk sharing between the principal and the agent.

The investor's optimization problem can be written as follows:

$$\max \int u\big(\pi * NAV - w(\pi)\big) * f(\pi|e_h)\, d\pi$$

s.t.

$$\text{i)} \int v\big(w(\pi)\big) f(\pi|e_h) d\pi - g(e_h) \geq \bar{u}$$

$$\text{ii)} \int v\big(w(\pi)\big) f(\pi|e_h) d\pi - g(e_h) \geq \int v\big(w(\pi)\big) f(\pi|e_l) d\pi - g(e_l)$$

Where u represents the investor's utility function and v the fund manager's utility function, π is the outcome and $w(\pi)$ is the wage of the agent. Two effort levels are assumed which are represented by: e_h for the high effort level and e_l for the low effort level. $g(e)$ is the disutility function of the fund manager which is strictly convex in the amount of effort provided. NAV is the net asset value at the beginning of the period under consideration. Risk aversion requires that both u and v are concave, i.e., $u' > 0$, $u'' < 0$, $v' > 0$, and $v'' < 0$. $w(\pi)$ is the compensation to be received by the manager.

Condition (i) is the participation constraint for the manager. It ensures the manager enjoys an expected level of utility that is above some minimum level $\bar{u}$.

Condition (ii) is the incentive constraint and applies only when the investor wants to induce the higher level of effort. It can be reorganized as:

$$\int v\big(w(\pi)\big) f(\pi|e_h) d\pi - \int v\big(w(\pi)\big) f(\pi|e_l) d\pi \geq g(e_h) - g(e_l)$$

As in Holmstron (1997) the optimal choice of w can be determined by pointwise optimization of the Lagrangian. Assuming that γ and μ are the Kuhn-Tucker multipliers for (i) and (ii) respectively, the first order condition at each level of $\pi, \pi \in [\underline{\pi}, \overline{\pi}]$, yields

$$\frac{u'\big(\pi * NAV_{t-1} - w(\pi)\big)}{v'\big(w(\pi)\big)} = \gamma + \mu\Big(1 - \frac{f(\pi|e_l)}{f(\pi|e_h)}\Big)$$

If the low level of effort is being induced the incentive constraint does not bind. Thus $\mu = 0$ and the first order condition can be written as

$$\frac{u'\big(\pi * NAV_{t-1} - w(\pi)\big)}{v'\big(w(\pi)\big)} = \gamma$$

It is clear that $\gamma > 0$ since the left hand side of this equation can never be zero. This implies the participation constraint binds and the manager must earn the minimum level of utility $\bar{u}$.

Next, the case when the investor wishes to implement the higher level of effort is considered. It is assumed that there is a set of return levels such that $f(\pi|e_l) > f(\pi|e_h)$ for each level of return π within this set. This would entail from the usual assumption that the distribution of the return conditioning on the high effort level first order stochastically dominates the distribution conditioning on the lower effort level. Because the investor and fund manager are risk averse, γ must be strictly positive, i.e., the participation constraint always binds.

The last term on the right hand side of the first order condition is the likelihood ratio. In order to understand how this ratio varies, consider a fixed compensation level w_f where

$$\frac{u\prime(\pi * NAV_{t-1} - w_f)}{v\prime(w_f)} = \gamma$$

The first order condition implies $w(\pi)$ should be greater than w_f if the likelihood ratio is less than one and that $w(\pi)$ should be less than w_f when the likelihood ratio is greater than one. In other words, the manager should be paid less when the likelihood of realizing a given level of profit is higher when the low level of effort is exerted, and paid more when the likelihood of realizing a given level of profit is higher when the high level of effort is exerted. If, for example, it is assumed that the likelihood ratio is monotonic decreasing then the compensation schedule will be monotonic increasing, as outlined in Milgrom (1981).

3.2 Optimal Compensation for Hedge Fund Managers

So far it has been shown that optimal compensation schedule should depend on the ratio of the likelihoods conditional on low and high levels of managerial effort. Next, an analysis is conducted of how this likelihood ratio will vary over the range of possible returns when the agent is a hedge fund manager pursuing unconventional trading and arbitrage opportunities. This will provide insight to the design of the optimal compensation contract.

This analysis is based on a consideration of the risk and return objectives to which most hedge funds are managed. Hedge funds are often said to follow absolute return strategies. This is because hedge fund managers spend their time identifying arbitrage and near arbitrage opportunities where the direct impact of equity and bond market movements is fairly small. They sit on the sidelines with their investors' capital in a liquid low risk asset, such as treasury bills until they identify a profitable trade at which point an allocation to that trade will be made.

A classic example of hedge fund activity is a stock index arbitrage trade where the hedge fund manager is attempting to profit through small differences in the price of a stock index futures contract and the cash price of the stocks underlying the index. The manager will keep the investors' capital in a low risk liquid security such as treasury bills until an arbitrage opportunity arises, at which point the leg of the trade which is overvalued is sold short and the leg which is undervalued is purchased. One would expect that a hardworking hedge fund manager would be able to identify and act on such opportunities more quickly than a manager who does not exert as much effort. Thus the hardworking manager should have a more positive risk/reward ratio and the risk-adjusted returns produced should be higher. This high level of effort is precisely what an optimal compensation contract should be able to induce.

This discussion provides some context for describing the likelihood ratios of the probability density functions of hedge fund managers when they provide differing levels of effort. In the low effort case, the return distribution will have some similarities to that of money market investments because the manager is too lazy to research and implement profitable trading opportunities and will tend to keep the investors' capital on the sidelines in a money market investment. The manager may be able to identify some profitable trading opportunities but these will tend to be fairly modest where the profits are above the rate of return on money market but not substantially so. Figure 1 depicts a probability density function for a low level of effort that is consistent with these characteristics. This figure assumes returns in the range from 0 to 5% are obtained when the manager sits on the sidelines and invests in money market. In this example it is assumed this occurs 60% of the time. Even for a lazy manager there is some probability of higher returns because some profitable trading opportunities are able to be identified at the low level of effort. These opportunities provide returns which are somewhat in excess of the return on money market and represent the remaining 40% of the probability mass. The probability assigned to very high levels of returns (beyond 12% in the figure) is very small because the manager exercises insufficient effort to identify such profitable opportunities.

An example probability density function for a high effort manager is also shown in Figure 1. In this case there is once again some probability on earning only money market returns because even hardworking hedge fund managers may not be fully allocated at all points in time. In this example it is assumed this occurs only 40% of the time. At all levels of the support in this region this probability is lower than in the previous example because the return distribution from investing in money market is the same although the amount of time invested in money market is less. The diligent hedge fund manager exerts sufficient effort to identify a number of profitable trading opportunities at varying levels of return in excess of the return on treasury bills. The probability of finding fairly high return opportunities is greater than for the lazy hedge fund manager.

The likelihood ratio of these two probability density functions is also shown in Figure 1. In the region of money market returns this ratio is fixed because it depends solely on the differences in the amount of time the lazy and diligent hedge fund managers are sitting on the sidelines. For return levels in excess of money market the ratio is monotonic decreasing because the high effort manager is able to find more high profit trades as compared to the lazy manager.

Figure 1: Likelihood Ratios for High and Low Effort Hedge Fund Managers

This figure presents an example of the probability density functions for hedge fund returns provided by high and low effort managers which are indicated by pdf h and pdf l respectively. LR refers to the ratio of these likelihoods and 1 – LR corresponds to the term on the right hand side of the first order condition.

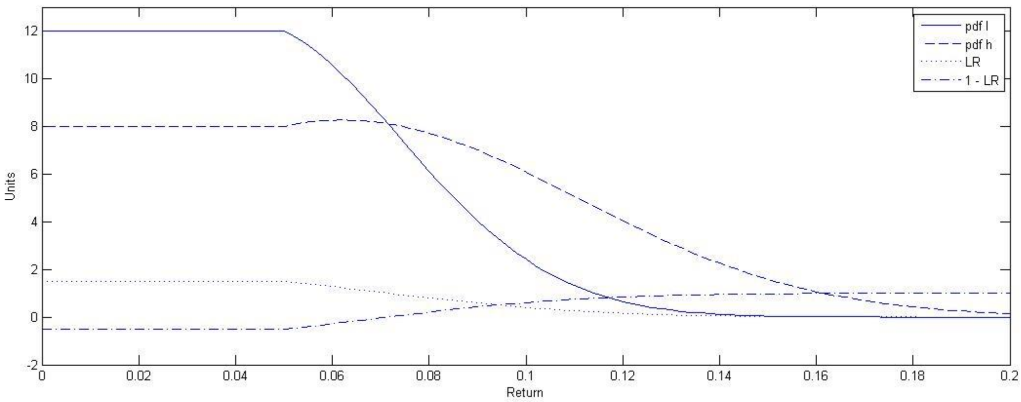


Figure 1 also depicts one minus the likelihood ratio, which is the term in the first order condition upon which the optimal compensation structure depends. It varies from -.5 to +1.0 with a turning point at 5% which is the assumed upper limit of the region of money market returns. This pattern implies compensation should be fixed over the region of money market returns but that it is increasing in returns thereafter. This is similar to the payoff on a call option where the underlying asset is the return on investors' capital and the strike price is the return on money market investments. It is important to note this optimal compensation schedule does not precisely correspond to the payoff on such a call option because the manner in which the likelihood ratio decreases is not precisely linear. For example, the likelihood ratio depicted in this figure starts to flatten as returns become very high. As implied by the first order condition the compensation schedule also depends on the ratio of the marginal utilities of the investor and the manager. The general shape of the likelihood ratio does, however, suggest that optimal compensation should have option-like characteristics, at least over the most relevant range of returns.

3.3 Optimal Compensation for Traditional Managers

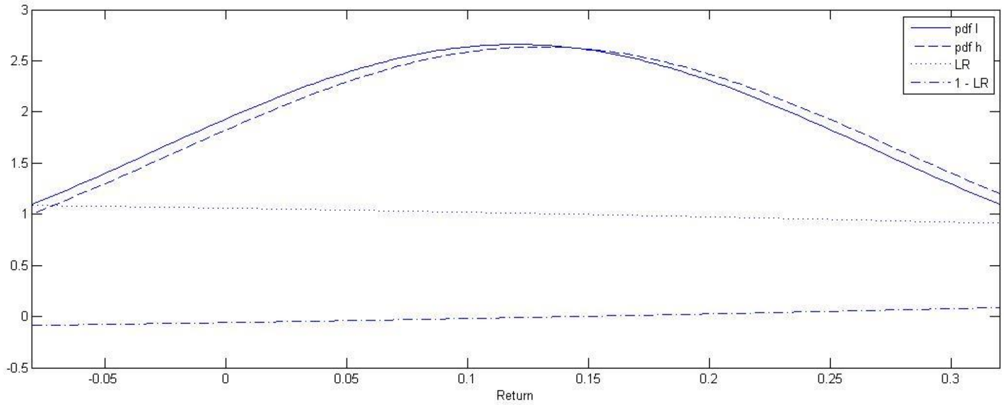
This sub-section extends this analysis to traditional long-only asset managers which, in general, target a benchmark. This implies they are fully allocated in assets similar to their benchmark at all times. When they identify an investment opportunity they will tilt their holdings away from the benchmark to some extent by overweighting stocks they believe to be undervalued and by underweighting stocks they believe to be expensive. They are typically bound by their investment mandate not to incur too much tracking error by straying too far from their benchmark.

This discussion implies that for traditional investment managers the return distributions conditional on different levels of effort should be fairly close to the risk on the benchmark to which they manage. A lazy manager will tend to simply mirror the index and can easily do so by investing in securities in weights similar to those in the index. A hardworking manager will vary weights to some extent as discussed above but will still target risk which is similar to that on the benchmark. The key difference because of the different levels of effort is the location of the two distributions. A hardworking manager, if successful, should be able to create returns in excess of those on the benchmark without significantly changing the risk. In sum, the risk should not change significantly because of a high level of effort but the location of the distribution should move to the right.

An example of the effect on the likelihood ratio of managing to an equity benchmark is depicted in Figure 2. This example is based on the assumption the lazy manager keeps investors' capital in the passive benchmark which is assumed to have an expected return of 12% and standard deviation of 15%. The high effort manager is assumed to be able of offer an information ratio of .5 which is generally considered to indicate the manager is in the top quartile of managers. Assuming outperformance of 1% implies a tracking error of 2% which results in a standard deviation of returns on the portfolio which is slightly higher than the benchmark at 15.13%. As depicted in Figure 2 these two distributions are very similar but the high effort distribution is slightly more disperse and is shifted to the right. The likelihood ratio is also shown in Figure 2. In contrast with that for the two hedge fund managers it is very flat, having a value of -.14 at the lower limit of the returns considered and an upper value of .13 at the extreme right hand side. The reason the likelihood ratio does not change much is because the conditional densities do not greatly differ at any level in the support of the distribution of returns. Figure 2 also depicts one minus the likelihood ratio which is directly linked to optimal compensation as discussed above.

Figure 2: Likelihood Ratios for High and Low Effort Traditional Managers

This figure presents an example of the probability density functions for returns provided by high and low effort traditional long-only investment managers which are indicated by pdf h and pdf l respectively. LR refers to the ratio of these likelihoods and 1 – LR corresponds to the term on the right hand side of the first order condition.



This finding is consistent with the literature on optimal compensation for traditional investment managers, such as Stoughton (1993), Admati and Pfleiderer (1997), Starks (1997) and Li and Tiwari (2009). It is important to note, however, that the overall flatness of the line in Figure 2 implies that only a small part of a traditional investment manager's compensation should be performance based. Further, there is no obvious turning point or kink in the optimal compensation schedule as there was in the compensation schedule for hedge fund managers, which implies the form of risk sharing does not need to be option based.

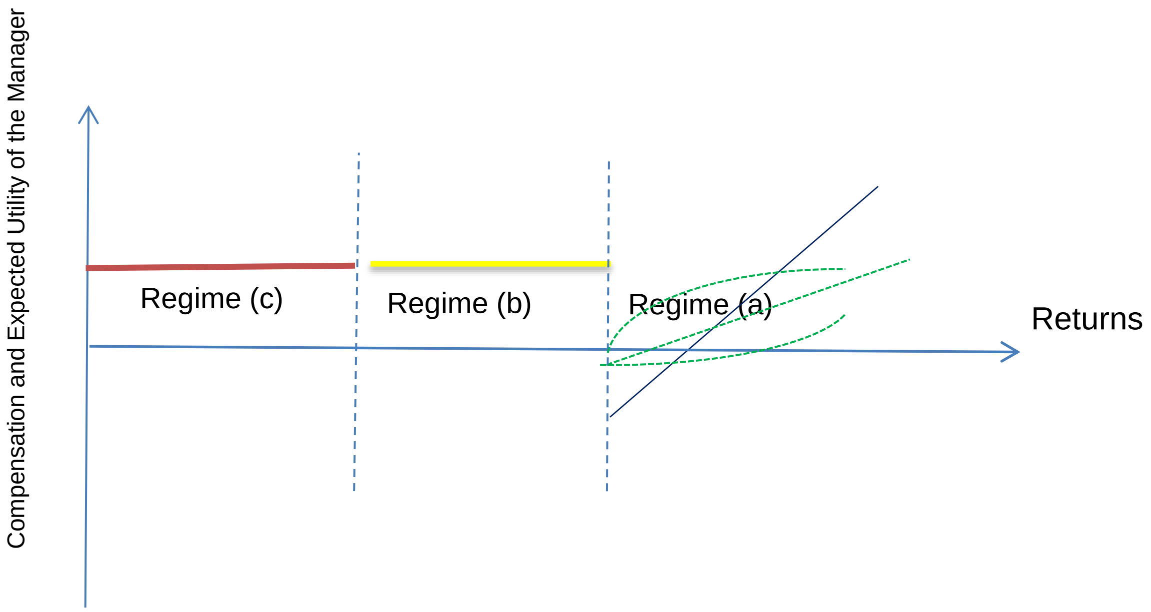
3.4 Excessive Risk Taking by the Manager

Ross (2004) showed that performance fees can be risk inducing or risk reducing depending on the interaction of the convexity effect, translation effect and magnification effect. This paper proposes that two further effects need to be added to Ross (2004). The first is the disutility of effort. As effort increases, the marginal disutility of effort increases at an accelerating rate. The second is the knockout effect. This effect refers to the fact that when the return of the fund is far below the benchmark, there is a possibility that investors might withdraw their funds. As a consequence, managers may lose future management fees and their reputations might be damaged. This induces the manager not to take on too much risk.

As outlined in Ross (2004) the payoff/expected utility function of the fund manager can be divided into three regimes with different risk-taking implications as captured in Figure 3. In Regime (a), the performance fee is in the money. The translation effect and magnification effect dominate the other effects. Whether the performance fee is risk inducing or risk reducing depends on the risk attitude of the manager, as well as the marginal disutility of effort. Managers with increasing risk aversion will display totally different risk strategies from those with decreasing risk aversion or constant risk aversion. In Regime (b), the performance fee is at the money or slightly out of the money and the convexity effect dominates all other effects. Regardless of the managers' risk attitude, they opt to increase the volatility of the investment and the value of the performance fee contract. Regime (c) refers to the implicit floor on the performance fee, which occurs when the fund experiences a huge loss and the investor exercises his right to withdraw assets. When the fund hits the implicit floor, it is very detrimental to fund managers. Their performance fees for the current period are gone, future management fees are gone, and their reputations may be damaged. Therefore, managers are motivated to adopt more conservative risk approaches and to limit how much risk they will take when faced with the threat of losing the base of assets under management, and the threat of damaging their reputation which could curtail their future careers.

Figure 3: Utility and Risk Attitude of the Manager

This figure displays the compensation of a fund manager and the corresponding expected utility based on an option-like performance fee. The dotted lines indicate the expected utilities and the solid line represents the total compensation. In Regime (a), the performance fee is in the money, and the utility and risk appetite of the manager depends on the utility function. In Regime (b), the performance fee is out of the money and the investor still keeps its investment in the fund. The manager receives a flat management fee. In Regime (c), the investor withdraws its investment from the fund and the manager's future compensation is zero.



3.5 Choice of Hurdle Rate

The hurdle rate is another distinct feature of hedge fund performance fees. Admati and Pfleiderer (1997) note that the benchmark is an irrelevant and distorting factor unless the benchmark itself is a conditional optimal portfolio. In contrast, the rate of return on treasury bills is a natural choice of hurdle rate in the model developed in this paper.

4. Empirical Analyses

In this section, the risk-adjusted returns of hedge fund managers who are paid varying levels of performance fees are analyzed. A positive relationship is found between hedge fund performance fees and risk-adjusted performance which supports the theory in this paper.

The risk adjusted returns are measured in terms of Sharpe and Sortino ratios. The Sharpe ratio is the most popular measure for assessing risk adjusted returns. However, it penalizes both upside and downside risk despite the fact that upside variation is usually desirable. In contrast, the Sortino ratio only penalizes returns below the benchmark. Therefore, the Sortino ratio appears to be a better measure between the two for the purpose of this study.

The empirical tests follow Kouwenberg and Ziemba (2007) and adopt both the Ordinary Least Squares (OLS) and Maximum Likelihood Estimate (MLE) approaches. The MLE estimates are based on the skewed student's t-distribution and can accommodate the non-normality of the Sharpe and Sortino ratios.

The data is provided by www.hedgefundresearch.net (HFR), which is one of the biggest providers of hedge fund data in North America. Over 7,000 funds are included in the database between January 1991 and December 2008. This data is more extensive than the Zurich Hedge Fund Universe data used in Kouwenberg and Ziemba (2007) which ended in November 2000. Our study includes funds with more than 12 months of data. The risk-free rate of interest is downloaded from the Fama French data library.

Table 1 summarizes the demographics of funds in the HFR database. The average monthly return of hedge funds is 0.35%, with mean live funds yielding 0.47%. The average Sharpe ratio for the entire hedge fund universe is 0.08 and 0.12 for live funds. The average Sortino ratio for the entire hedge fund universe is 0.18.

Charging a performance fee is the norm in the hedge fund industry. Out of 7,349 funds in our study, only 14% do not charge performance fees. Among them, 12% of the live funds have no performance fee provision. In general, 52% of funds in the study follow the industry standard and charge a 20% performance fee. The average performance fee among all funds is 14.5%. The average management fee for the entire hedge fund universe is 1.44% per year.

Table 1: Hedge Funds – Summary Statistics

This table presents summary statistics on seven features of hedge funds between January 1991 and December 2008. Features include: mean monthly returns, volatilities, Sharpe ratio, performance and management fees, and Sortino ratio. Results for live funds and dead funds are also reported.

		Live	Dead	Overall
Mean Monthly Return	Mean	0.469	0.209	0.353
	Stdev	1.188	1.045	1.134
Volatility	Mean	3.983	3.295	3.677
	Stdev	2.998	2.571	2.838
Sharpe Ratio	Mean	0.115	0.045	0.084
	Stdev	0.389	0.451	0.419
Sortino Ratio	Mean	0.176	0.177	0.177
	Stdev	0.934	0.916	0.926
Performance fee	Mean	15.877	12.805	14.512
	Stdev	7.372	7.793	7.714
Management Fee	Mean	1.461	1.413	1.439
	Stdev	0.666	0.691	0.691
Funds with Performance Fees of:	=0	483	549	1032
	<20%	854	1344	2198
	=20%	2589	1262	3851
	>20%	158	110	268
	Total	4084	3265	7349
	=0	12%	17%	14%
	<20%	21%	41%	30%
	=20%	63%	39%	52%
	>20%	4%	3%	4%
	Total	100%	100%	100%

Table 2 compares the performance of hedge funds with and without performance fees. It also examines the difference in performance for hedge funds that charge below or above the median performance fees of 20%. In general, hedge funds with a performance fee provision display higher average returns and risk adjusted returns. The average Sharpe ratio for the hedge funds with performance fee provisions is three times higher than the average Sharpe ratio for those without. The average Sortino ratio is also higher for the hedge funds with the performance fee provision. The differences are all statistically significant.

Table 2: Performance Comparison of Hedge Funds with Different Performance Fees

This table compares the returns, Sharpe ratios and Sortino ratios of hedge funds with and without performance fees, and hedge funds that charged below 20% performance fees with those charged above 20% performance fees.

	With	Without	t	Below 20%	Above 20%	t
Return	0.41	0.02	9.90	0.11	0.85	-9.08
Sharpe Ratio	0.09	0.03	3.88	-0.02	0.23	-6.16
Sortino Ratio	0.20	0.03	7.59	0.00	0.32	-4.41

Table 3 reports the regression results for returns before adjusting for risk. The table includes the entire hedge fund universe, the live funds and the graveyard funds. The results show that performance fees are positively related to the returns with coefficient estimates ranging between 0.02 and 0.04 in all three tables.

Tables 4 reports the test results for risk adjusted returns based on OLS and MLE for the whole hedge fund universe, live funds and graveyard funds. As expected, both the OLS and the MLE estimates show that performance fees are positively related to the Sharpe and Sortino ratios and that the effect is statistically significant in all analyses. Results for both the live funds and dead funds are similar to the results based on the hedge fund universe and are very robust. Both the Sharpe ratio and Sortino ratio are positively related to the performance fee rates. In other words, performance fees appear to be able to motivate fund managers to pursue better risk-return investment opportunities.

Table 3: Regression Results for Returns

This table presents the estimation results of the cross-sectional regression for the hedge fund universe, live funds and graveyard funds. Each set of regressions comprises four rows. The results for the multiple linear regressions are reported in the first and second row of each measure, where the first row provides the estimates and the second row presents the t-statistics. The MLE estimates based on skewed student's t-distribution are presented in the third and fourth row, where the third row reports the estimates and the fourth row reports the t-statistics. LR is the likelihood ratio and DoF is the estimated degree of freedom. The cross-sectional model is as follows:

$$\text{Return} = \alpha + \beta_1 * \text{Age} + \beta_2 * \text{Performance fee} + \beta_3 * \text{Management fee} + \varepsilon.$$

Intercept	Age	Incentive Fee	Management Fee	R Squared	LR	DoF
			Hedge Fund Universe			
(0.678)***	0.007***	0.031***	0.051***	0.13		
(16.93)	27.39	18.98	2.76			
(0.338)***	0.005***	0.022***	0.080***		(8273.84)	1.74
(12.74)	35.93	26.45	6.76			
(0.616)***	0.007***	0.032***		0.13		
(18.64)	27.25	20.07				
(0.240)***	0.005***	0.023***			(8296.71)	1.75
(10.87)	35.87	28.55				
			Live Funds			
(0.720)***	0.007***	0.036***	0.086***	0.12		
(11.93)	19.19	14.62	3.15			
(0.277)***	0.005***	0.021***	0.096***		(4881.84)	1.73
(7.23)***	24.70	17.46	5.96			
(0.619)***	0.007***	0.038***		0.12		
(12.12)	18.95	15.94				
(0.167)***	0.004***	0.023***			(4900.64)	1.73
(5.03)	24.74	19.79				
			Graveyard Funds			
(0.619)***	0.008***	0.023***	0.010	0.13		
(11.66)	19.66	10.14	0.28			
(0.312)***	0.005***	0.018***	0.058***		(3314.18)	1.73
(8.36)	24.32	15.83	3.24			
(0.610)***	0.008***	0.023***		0.13		
(14.07)	19.68	10.35				
(0.240)***	0.005***	0.019***			(3319.14)	1.75
(8.01)	24.10	16.75				

Table 4: Regression Results for Risk Adjusted Returns

This table presents the estimation results of the cross-sectional regression for the entire hedge fund universe, the live funds and the graveyard funds. The results for the multiple linear regression are reported in the first and second row of each block where the first row provides the estimates and the second row presents the t-statistics. The skewed student –t MLE estimates are presented in the third and fourth row where the third row reports the estimates and the fourth row reports the t-statistics. LR is the likelihood ratio and DoF is the estimated degree of freedom. The cross-sectional models are as follows:

$\text{Sharpe ratio} = \alpha + \beta_1 * \text{Age} + \beta_2 * \text{Performance fee} + \beta_3 * \text{Management fee} + \varepsilon$; $\text{Sortino ratio} = \alpha + \beta_1 * \text{Age} + \beta_2 * \text{Performance fee} + \beta_3 * \text{Management fee} + \varepsilon$.

	Intercept	Age	Performance Fee	Management Fee	R Squared	LR	DoF
			Hedge Fund Universe				
Sharpe Ratio	(0.134)***	0.001***	0.010***	(0.003)	0.04		
	(8.61)	11.69	14.92	(0.38)			
	(0.295)***	0.002***	0.006***	0.014***		297.52	2.50
	(28.16)	39.47	19.65	3.20			
Sortino Ratio	(0.157)***	0.001***	0.017***	0.009	0.02		
	(4.51)	4.51	11.91	0.58			
	(0.400)***	0.003***	0.006***	0.016***		(1932.41)	1.85
	(37.23)	48.74	17.04	2.96			
			Live Funds				
Sharpe Ratio	(0.107)***	0.001***	0.008***	0.011	0.04		
	(5.15)	8.11	9.98	1.22			
	(0.229)***	0.002***	0.005***	0.018***		148.09	2.53
	(15.29)	23.51	12.64	3.40			
Sortino Ratio	(0.161)***	0.001***	0.018***	0.000	0.02		
	(3.47)	4.04	9.08	0.01			
	(3.920)***	0.003***	0.006***	0.011		(1230.53)	1.81
	(26.51)	35.69	13.20	1.52			
			Graveyard Funds				
Sharpe Ratio	(0.0153)***	0.002***	0.010***	(0.017)	0.04		
	(6.40)	8.22	9.54	(1.58)			
	(0.334)***	0.002***	0.005***	0.004		236.99	2.43
	(22.89)	31.33	11.68	0.56			
Sortino Ratio	(0.154)***	0.001***	0.017***	0.023	0.02		
	(2.90)	2.12	7.76	0.94			
	(4.120)***	0.003***	0.005***	0.021***		(694.29)	1.92
	(26.56)	33.47	10.63	2.75			

5. Conclusion

This paper provides a new theoretical framework for justifying hedge fund performance fees. In contrast with existing literature it shows that performance fees can be optimal for investors in order to compensate hedge fund managers for their effort. The results from the empirical tests are consistent with the theory.

Given the large size of the hedge fund industry and the ongoing debate about the merits and demerits of performance fees, these findings represent an original and timely advance in research on optimal compensation for hedge fund and traditional investment managers. They make a contribution by furthering the understanding and knowledge of the reasons why compensation for hedge fund managers differs from compensation for traditional investment managers. The implications of this research provide support for the prevalence of support these different compensation models in the real world.

The results in this paper are limited by the strict assumptions of the theoretical model. They are also limited by the empirical methods employed and by the data with which this theory has been tested.

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