The Performance of Hedge Funds: Risk, Return, and Incentives

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ABSTRACT

Hedge funds display several interesting characteristics that may influence performance, including: flexible investment strategies, strong managerial incentives, substantial managerial investment, sophisticated investors, and limited government oversight. Using a large sample of hedge fund data from 1988–1995, we find that hedge funds consistently outperform mutual funds, but not standard market indices. Hedge funds, however, are more volatile than both mutual funds and market indices. Incentive fees explain some of the higher performance, but not the increased total risk. The impact of six data-conditioning biases is explored. We find evidence that positive and negative survival-related biases offset each other.

HEDGE FUNDS HAVE BEEN IN EXISTENCE for almost 50 years. However, their recent growth has increased their prominence in the financial markets and the business press. Since the late 1980s, the number of hedge funds has risen by more than 25 percent per year. The rate of growth in hedge fund assets has been even more rapid. In 1997, there were more than 1200 hedge funds managing a total of more than $200 billion. Though the number and size of hedge funds are small relative to mutual funds, their growth reflects the importance of this alternative investment vehicle for institutional investors and wealthy individual investors.[1]

As the name implies, hedge funds began as investment partnerships that could take long and short positions. They have evolved into a multifaceted organizational structure that defies simple definition. There are, however, a

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[1] Statistics on hedge fund growth appear in Hennessee Hedge Fund Review, June 1998; "A hitchhiker's guide to hedge funds," Economist, June 13, 1998; "Gaining an edge with hedge funds," Business Week, July 29, 1996; and in Lederman and Klein (1995).

number of features that characterize hedge funds. These features include a largely unregulated organizational structure, flexible investment strategies, relatively sophisticated investors, substantial managerial investment, and strong managerial incentives. Hedge funds may therefore yield insights into the impact of regulation, alternative investment practices, and incentive alignment on performance.

Domestic hedge funds are largely unregulated because they are typically limited partnerships with fewer than 100 investors, which exempts them from the Investment Company Act of 1940.[2] Offshore hedge funds are non-U.S. corporations and are not subject to SEC regulation. This limited regulation allows hedge funds to be extremely flexible in their investment options. Hedge funds can use short selling, leverage, derivatives, and highly concentrated investment positions to enhance returns or reduce systematic risk. They can also attempt to time the market by moving quickly across diverse asset categories. Hedge funds attract mainly institutions and wealthy individual investors, with minimum investments typically ranging from $250,000 to $1 million. Additionally, hedge funds often limit an investor's liquidity with lock-up periods of one year for initial investors and subsequent restrictions on withdrawals to quarterly intervals. One cost of this flexibility is that hedge funds face strong advertising restrictions.

Hedge funds are also characterized by strong performance incentives. On average, hedge fund managers receive a 1 percent annual management fee and 14 percent of the annual profits. For most funds this bonus incentive fee is paid only if the returns surpass some hurdle rate or "high-water mark"—meaning there is no incentive fee until the fund has recovered past losses. Although incentive fees and high-water marks could lead to excess risk taking under some conditions, there are countervailing forces that may dampen risk. Hedge fund managers often invest a substantial amount of their own money in the fund. Furthermore, the managers of U.S. hedge funds are general partners, so they may incur substantial liability if the fund goes bankrupt.[3]

These structural aspects of hedge funds are in sharp contrast to the organizational structure of the more common pooled investment mechanism, mutual funds. Mutual funds are regulated by the SEC. The regulations, together with mutual fund prospectus disclosure requirements, are designed to carefully inform the investor and limit some potentially risky activities. These regulations and disclosure requirements generally limit the usage of

[2] In June 1997, the 100 investor limit was lifted for hedge funds that impose a $5 million investor net worth requirement. However, for the sample period used in this paper, the 100 investor limit was in effect.

[3] In some ways, the structure of hedge funds closely resembles that of venture capital funds. Venture capital funds tend to be limited partnerships with strong incentive fees. However, there seems to be less variation in incentive fees for venture capital funds. Gompers and Lerner (1999) document that 81 percent of the venture capital funds in their sample have incentive fees of 20 to 21 percent.

short selling, leverage, concentrated investments, and derivatives.[4] Small minimum investments and daily withdrawals are also common for mutual funds, and incentive fees for managers are extremely rare.[5] Mutual fund fees are largely based on fund size; however, indirect performance incentives exist if size and performance are strongly linked. Mutual funds have an advantage in creating this link because they can advertise performance.

Marked differences also exist in the extent of academic research into mutual funds and hedge funds. There is a substantial mutual fund literature, but academic research into hedge funds is just emerging. Two recent hedge fund papers reflect this trend. Using monthly data from TASS Management and Paradigm LDC, Fung and Hsieh (1997) show that time-series and cross-sectional differences in leverage and long and short positions make analyzing hedge fund strategies more complex. The static buy-and-hold strategies that Sharpe (1992) found to work for mutual funds must be adapted to include five new investment styles for hedge funds. Using annual data from *The U.S. Offshore Funds Directory*, Brown, Goetzmann, and Ibbotson (1999) investigate the performance and survival of offshore hedge funds. They find that these hedge funds display positive systematic risk-adjusted returns. The superior performance does not appear to stem from managerial skill, for they find no evidence of performance persistence. However, some of the positive hedge fund returns may result from survival-related conditioning biases. Several practitioner papers using a large sample of hedge funds also find evidence of superior hedge fund performance (see Hennessee (1994) and Oberuc (1994)).

This paper expands this emerging hedge fund literature in four directions. First, we analyze hedge fund performance using a larger sample that includes both U.S. and offshore funds, monthly instead of annual return data,

[4] The Investment Company Act of 1940 allows mutual funds to participate in these activities only if they are spelled out in their prospectuses. Many mutual funds do place these investment options in their prospectuses but they rarely use such options. For example, mutual funds are allowed leverage up to 50 percent of their net assets. Yet only 236 out of the 6,997 mutual funds in the Morningstar database had a negative cash balance at the end of 1995 and only 12 had a negative cash balance greater than −25 percent. Thus, rarely do mutual funds approach the allowed limit of leverage. The conservative investment strategies of mutual funds might stem from the nature of mutual fund investors, notification requirements for using certain investment options, larger cash fluctuations due to limited withdrawal restrictions, or additional regulatory restrictions. For instance, mutual funds must borrow from a bank when buying securities on margin, and diversified mutual funds get preferential tax treatment (CDA/Wiesenberger).

[5] The dearth of incentive fees for mutual funds can be directly tied to regulation. A 1972 SEC study shows that performance fee arrangements were becoming common before 1970. In 1968 and 1969, approximately 40 percent of all new investment companies proposed performance-related fees. In 1970, Congress amended The Investment Company Act of 1940, requiring that all performance fees be symmetrical—that is, managers had to pay a fee if fund performance fell short of performance goals equal to the amount they received if fund performance exceeded the goals. By 1972, performance fee plans were employed in only 10 percent of funds. By 1995, only 117 of the 6,997 mutual funds in the Morningstar database employed incentive fees.

and a broader set of metrics than Brown et al. (1999). Second, we perform several new data-conditioning bias analyses including following defunct funds through liquidation, exploring a multiperiod sampling bias, and documenting a regulatory-related, self-selection bias that offsets survival-related biases, especially for U.S. hedge funds. Third, we provide a potential explanation for the superior performance of hedge funds by linking one of the key hedge fund characteristics—incentive fee—to performance. Fourth, we show that hedge funds are significantly riskier than their mutual fund counterparts and we explore the determinants of this increased volatility.

The structure of this article is as follows. Section I explores the link between hedge fund characteristics and performance using a principal-agent framework. A description of the hedge fund database, variables, and hypotheses is given in Section II. Section III presents the main empirical results concerning the risk and return performance of hedge funds relative to standard indices and mutual funds. This section also demonstrates the strong link between incentive fees and hedge fund performance. The impact of numerous data-conditioning biases is assessed in Section IV. Section V concludes the paper with a summary and discussion of caveats that reveal future research opportunities.

I. Hedge Fund Structure and Performance

The relationship between investors and fund managers can be characterized by principal-agent models (Ross (1973), Holmstrom (1979)).[6] The ideal fund structure aligns investors' goals with fund managers' incentives. Otherwise, managers may consume perks, reduce effort, or incur risks that lower returns to investors. Four basic mechanisms mitigate principal-agent problems: incentive contracts, ownership structure, market forces, and government regulation. Hedge funds generally emphasize the first two solutions. In contrast, mutual funds tend to rely more heavily on the latter two.

Using a principal-agent model, Starks (1987) analyzes the impact of incentive contracts on portfolio managers' investment decisions. Her model allows managers to choose the portfolio risk level and the level of resources allocated to improving portfolio returns. She compares two types of incentive contracts, symmetric and bonus plans. Both plans pay managers a fee if they exceed some benchmark return. Symmetric plans also penalize managers if they fall short of that benchmark. Starks finds that symmetric contracts align risk preferences of investors and fund managers, but they lead

[6] Jensen and Meckling (1976) employ the principal-agent model to explain the relationship between shareholders and corporate managers. Their article has spawned a vast literature on the relationship between senior management compensation, ownership, and corporate performance. Our paper focuses on similar issues, but in the context of the investor-fund manager relationship.

to a less than optimal investment in resources. Bonus plans are inferior to symmetric plans because managers select more risk and less resource investment than is optimal for investors.[7]

Hedge fund incentive plans are primarily bonus plans. Thus, we cannot directly test Starks' hypothesized difference between symmetric and bonus plans. Starks' model does imply that bonus plans enhance managerial effort relative to no incentives. This increased effort should translate into higher performance for funds with bonus incentive plans, but possibly with the trade-off of inducing greater risk. More recently, Carpenter (1998) explores the link between risk and bonus incentive fees using a general utility function and benchmark portfolio model. Her model shows that increases in incentive fees decrease managerial risk taking. Thus, evaluating the impact of incentive plans on investors' wealth requires an evaluation of both risk and return.

A second solution to the principal-agent problem links agents and principals through joint ownership. For investment funds, joint ownership requires managers to invest a significant amount of their own wealth in the fund. Starks (1987) notes that the findings of her model might change when the manager's undiversifiable capital is considered. Intuitively, managerial investment should increase effort, but it may make managers risk averse relative to investors' preferred risk level. Thus, the combination of managerial investment and incentive bonus plans may move managerial effort closer to the optimal level, counteracting the nonoptimal risk taking of these approaches taken individually. Hedge funds are noted for combining considerable managerial investment with strong incentive bonus fees.

Market forces provide a third potential solution to the principal-agent problem. If investors are well informed and willing to act on that information, then investors will exit funds in which managerial effort is too low or risk taking too high in favor of funds with more optimal efforts and risks. Ippolito (1992) and Sirri and Tufano (1998) both find some support for the importance of this mechanism in the mutual fund industry. These papers find that exceptionally high fund performance leads to a significant inflow of new money. They reach different conclusions for exceptionally poorly performing funds. In particular, Sirri and Tufano (1998) find that poorly performing mutual funds are not penalized in terms of a significant loss of investor dollars. A different market mechanism may come into play for poor performers. Khorana (1996) shows that up to two years of below average performance significantly increases the probability that a mutual fund manager will be replaced. These market mechanisms may also be at work in the hedge fund industry, although their impact may be weaker. Information on

[7] Golec (1992) also applies a principal-agent model to fund management. His model specifies managerial effort as information production. Incentive contracts impact both return and risk through this information production. His empirical analysis of 27 mutual funds with incentive fees offers some support for his model. However, his model focuses more on determining incentive fee parameters than on how incentives affect risk and return.

mutual fund performance is much more prevalent, given the advertising restrictions on hedge funds. The managerial ownership stake in hedge funds may also lessen managerial replacement.

A fourth mechanism for resolving principal-agent problems is regulation. Regulation can restrict the agent's ability to take advantage of the principal. However, these restrictions may constrain profit-maximizing opportunities. For example, in 1970 Congress required incentive plans to be symmetrical, to prevent potential risk-taking abuses from bonus incentive plans. This regulation has had potentially negative consequences. Mutual fund managers appear to prefer no incentive plan to symmetric incentive plans. Consequently, symmetric incentive fees are very rare in the mutual fund industry, and bonus incentive fees are common in the hedge fund industry where the incentive plan regulations do not apply.

A similar regulatory trade-off may exist for mutual fund restrictions on lockup periods, leverage, short selling, concentrated investments, and derivatives. These restrictions are in place to prevent managers from taking on what are perceived to be inappropriate risks, but they may also limit some appropriate applications of these tools. In particular, these may be important techniques for laying off systematic risk. Similar regulatory restrictions are placed on pension funds. Since mutual funds and pension funds comprise a substantial portion of investment assets, these regulatory restrictions may allow hedge funds to earn excess risk-adjusted returns by focusing on arbitrage opportunities through the use of less commonly employed investment strategies. Ackermann and Ravenscraft (1998) demonstrate that these regulatory restrictions lead to dramatic differences between hedge funds and mutual funds with respect to the use of lockup periods, illiquid securities, short selling, derivatives, leverage, and concentration. These investment differences also appear to handicap mutual fund performance relative to hedge funds.

II. Data, Variables, and Hypotheses

Reporting of data on hedge funds is voluntary, therefore no one source is comprehensive. To develop a large database on both existing and defunct hedge funds, we combine two of the leading publicly available hedge fund databases. The two databases are Managed Account Reports, Inc. (MAR), which is distributed through LaPorte Asset Allocation System, and Hedge Fund Research, Inc. (HFR). At the end of 1995, the combined data sets contain 1272 funds with at least one monthly net return observation. However, the number of unique funds is 923 because 349 funds are reported in both data sources.[8] The sample is further reduced to 906 by the elimination of 5

[8] It is reassuring to find that data from the duplicate funds are identical in almost all cases. In those few instances where a significant disagreement exists, we reconcile these differences by calling the fund, referring to additional sources (Nelson's Directory of Investment Managers and The US Offshore Funds Directory) or consulting with the data suppliers. Similar research is employed to fill in missing auxiliary data items for 22 funds.

Natural Resource funds, 11 funds that combine multiple funds, and 1 potential performance outlier.[9] The combined data contain the largest collection of complete, cross-checked, monthly hedge fund returns currently available. Both databases perform a number of due diligence checks to verify the accuracy of the data.

Returns are defined as the change in net asset value during the month (assuming the reinvestment of any distributions on the reinvestment date used by the fund) divided by the net asset value at the beginning of the month. Returns are net of management fees, incentive fees, and other fund expenses. As in the case of U.S. open-end mutual funds, this is the basis for actual returns received by investors. In practice, actual investor returns differ from reported returns due to factors such as sales and redemption fees, and differences between bid and ask prices offered by the fund. The vast majority of funds report returns in U.S. dollars. We convert the few foreign currency returns to U.S. dollars using appropriate spot exchange rates available in the International Monetary Fund's *International Financial Statistics*.[10]

The use of monthly data has some strong advantages over annual returns used by Brown et al. (1999). Monthly returns greatly enhance the accuracy of our standard deviation measure of risk. For our two- to eight-year samples, our standard deviation estimates are based on 24 to 96 observations, rather than 2 to 8 for annual data. Annual returns also smooth large variations in returns caused by external market forces and dynamic hedge fund strategies. Given the importance of risk-adjusted returns and our direct analysis of hedge fund risks, this accuracy is critical. Monthly data are also critical for some aspects of survival bias analyses. With monthly data we can study funds that survive less than one year and we can track our defunct funds through the month of liquidation.

The disadvantages of monthly data are twofold. First, *The U.S. Offshore Funds Directory* contains a historical list of funds that can be used to directly analyze backfilling. Using these data, Brown et al. (1999) shows the potential importance of backfilling bias. The trade-off is they use annual data on offshore funds only. We find some weak evidence that U.S. funds outperform offshore funds and some strong evidence that U.S. and offshore funds exhibit different levels of risk and are subject to different conditioning biases.

A second problem with monthly returns stems from estimating returns net of incentive fees. Incentive fees are typically based on performance over a

[9] The Natural Resource funds category is a relatively new one and does not have sufficient time series to be consistently reported in this study. We cannot identify a closely related category into which the data can be combined. Including these five observations in the total sample has no effect. The potential outlier is a fund with almost no performance variance over a 2-year period. This fund transforms a below-average 7.7 percent annual return into a very large Sharpe ratio (Sharpe (1966)).

[10] Additionally, a very small number of funds trade on overseas exchanges. In these cases, the actual return received by the investor depends directly on the market price of the fund, rather than on its net asset value. These funds still report net asset value returns.

quarter or year. Net monthly returns can only be estimated after the incentive period is over and even then the allocation to the months within the incentive fee period is somewhat arbitrary. However, net monthly return is a calculation hedge funds and their investors take seriously. The audited reports that hedge funds send to investors generally include monthly returns and these are the same returns the funds supply to the databases. Subscription and redemption opportunities typically do not correspond to the incentive fee period. Many incentive fee periods are annual, whereas more than 85 percent of the hedge funds allow multiple redemption opportunities each year. The incentive fee is prorated to these entering and exiting investors using a variety of allocation mechanisms. Hedge funds handle monthly reporting in a similar manner. Monthly returns are estimated during the incentive fee period, then within several months after the period is over, hedge funds (who report net monthly returns) send corrected monthly net return data to the data vendors. These updated data allocate the ex post incentive fee across months, again using a variety of allocation methods. Therefore, in doing hedge fund research with monthly data it is important to wait until midyear to obtain data for the prior year so that the corrected data can be entered.[11]

Ex post data, however, are still inaccurate. The correct value of the net return can be obtained by viewing the incentive fee from an option perspective. For a fund with a 20 percent incentive fee, the investor's position is comparable to having a portfolio of assets and being short 20 percent of a call with a strike price at the high-water mark. The option value of the call is a measure of the incentive fee that the investor expects to pay at the end of the period. With this perspective, any biases in the reported ex post net returns could be assessed through simulation. Using a mean return of 13.5 percent and a standard deviation of 20 percent, we compare an ex post allocation rule of equally distributing the actual end-of-year incentive fee across all 12 months, with the option perspective incentive fee allocation. The equal distribution rule would result in an ex post reported Sharpe ratio below the option-based mean and a variance that is higher than the option-based variance. This would bias monthly return hedge fund studies against finding a positive relationship between incentive fee and Sharpe ratio and toward finding a positive relationship between incentive fee and risk.[12] Unfortunately, hedge funds use many different methods to allocate incentive fees across

[11] This description of the monthly return calculation is based on discussions with the data sources, industry experts, hedge fund accounting firms, and hedge fund managers. The incentive fee issue is made more complicated by high-water marks and hurdle rates. If high-water marks are the same for all investors, then high-water marks accentuate the measurement problem, making ex post adjustments even more important. If new investors have different high-water marks, then returns are not the same for all investors in the fund. This problem exists for both monthly and annual data. Typically, hedge funds report the returns for the initial investor, although sometimes it is for the average investor.

[12] We thank Stephen Brown and an anonymous referee for suggesting this option perspective. The anonymous referee provided the simulation results discussed above using a lognormal distribution and 20,000 simulations of 5-year returns. Dick Rendleman helped us confirm these findings using the same parameters and a binomial distribution.

months. Existing data do not even fully identify the set of methods used, let alone their frequency. Therefore the equal distribution rule illustrates the potential for a bias, but it cannot be used to accurately assess the direction and magnitude of the potential mismeasurement. Given the importance of this issue, additional research to identify these methods and their impact on monthly return estimates is needed. These fundamental trade-offs between annual and monthly data suggest that performance studies using both data frequencies are warranted to capture the strengths and weaknesses of each approach.

To ensure a sufficient number of observations for measuring risk and risk-adjusted returns, we restrict our sample to funds with a minimum of 24 months of current data. The combined data set contains 547 funds with monthly returns from January 1, 1994 through December 31, 1995 (the most recent year available at the start of this study). In addition to the two-year sample, we report findings on 4-, 6-, and 8-year periods, all ending December 31, 1995. The number of hedge funds with data covering these periods is 272, 150, and 79, respectively. The decision to overlap the sample periods works against hedge funds. As the results will show, 1994–1995 is the worst period for hedge fund returns.

As with almost any database, our hedge fund data may contain various forms of conditioning bias. For mutual funds, Brown and Goetzmann (1995), Elton, Gruber, and Blake (1996), and Malkiel (1995) estimate that the inclusion of discontinued funds reduces the average annual mutual fund return by between 0.2 and 1.4 percentage points. Brown et al. (1999) find that the survivorship bias is about 3 percentage points per year for offshore hedge funds.

In December 1992, HFR began keeping data on funds that stop reporting. MAR began this practice in December 1993. In the combined data set, 146 unique funds cease reporting during the 1993 through 1995 period. Five of these funds are dropped because they report for three months or less. These five funds have above average return performance, but extreme Sharpe values. The database also notes the reason that reporting ends: discontinuation and self-selection. Only 37 of the 141 funds report that they are discontinued (liquidate, restructure, or merge into another fund). The remaining 104 funds stop reporting because of self-selection. Specifically, they simply stop voluntary reporting.[13] In Section IV, we analyze a variety of survival-related biases that could affect the performance findings.

[13] We cannot verify that funds which stop voluntary reporting continue to operate. Thus, some of these funds may belong in the terminated category. Several factors influence the decision to voluntarily report. Generally, funds find it advantageous to join the databases because of the exposure they receive. The decision to list, however, has an important potential drawback because activities associated with reporting may be interpreted as illegal advertising by the SEC. In February 1995, Barron's published a list of individual hedge fund statistics from the MAR database (Barron's, July 10, 1995, p. 15). The SEC investigated and warned that further such releases of information might lead to regulation of participating funds. A number of funds terminated reporting to the MAR database after this warning, specifically citing this threat. This climate suggests that withdrawing funds consist of underperformers that do not wish to publicize their performance, plus larger, successful funds that do not wish to (or need to) chance SEC intervention.

The databases provide auxiliary data on a number of hedge fund characteristics that can be used to test some of the theories discussed in Section I. The broad type of investment style used by the hedge fund is specified. MAR describes the investment style through a classification system in which hedge funds are assigned to one of seven categories. These categories include event driven, global, global macro, market neutral, short sales, U.S. opportunistic, and fund of funds. The MAR definition of each of these categories is given in Figure 1. HFR contains a detailed description of the investment strategy that allows us to place their funds into the MAR system. If there is some trade-off between return and systematic risk, then market neutral and short selling funds should earn lower raw returns.

Both databases report management and incentive fees. The incentive fee is the percentage of annual profits (over some benchmark or high-water mark) captured by fund management. Table I shows basic descriptive statistics for management fee, incentive fee and several other hedge fund characteristics. The mean and median values for incentive fee are 14 and 20 percent, respectively. Hedge funds give managers strong incentives, and, consistent with the diversity of hedge funds, this incentive varies substantially across funds with a range of zero to 50 percent. However, much of the distribution is concentrated at two points, zero and 20 percent. As discussed in the preceding section, principal-agent theory predicts that incentive fees—which align investor and fund manager interests—should improve returns. If global stock, currency, and bond markets are strongly efficient, however, hedge funds will not be able to recover their fees, which could lead to an inferior net return. Incentive fees may also impact the risk, although incentive fee models yield different predictions regarding the direction of this impact.

In addition to the incentive fee, most hedge funds charge an annual management fee. According to Table I, the mean and median annual management fees are approximately 1 percent of assets with a range between zero and 6 percent. We expect that management fees either only recover their costs if the hedge fund market is competitive (Grossman and Stiglitz (1980), Ippolito (1989)) or may result in losses if agency problems exist (Jensen (1968), Elton et al. (1993)).

We define the age of a fund as the number of months since its inception. Given that age is truncated at 24 months, the mean and median ages are 63 and 49 months. A positive coefficient on age may indicate that experience helps fund managers identify and exploit mispriced assets. Alternatively, age may reflect a potential survival bias. Because the databases we use backfill much of the older data, the older funds may contain a disproportionate number of surviving funds.

The databases classify hedge funds into two domiciles, U.S. and offshore: U.S. hedge funds are generally limited partnerships with (until very recently) fewer than 100 investors and offshore hedge funds are typically corporations. The main advantage of offshore hedge funds is that the number or net worth of investors is not limited. Thus, offshore funds tend to be larger. Offshore funds can accept U.S. investors, but there are limitations on how

Event Driven:
Distressed Securities - Manager focuses on securities of companies in reorganization and bankruptcy, ranging from senior secured debt to the common stock of the company.

Risk Arbitrage - Manager simultaneously buys stock in a company being acquired and sells stock in its acquirers.

Global:
International - Manager pays attention to economic change around the world (except the United States) but more bottom-up oriented in that managers tend to be stock-pickers in markets they like. Uses index derivatives to a much lesser extent than macro managers.

Emerging - Manager invests in less mature financial markets of the world, e.g. Hong Kong, Singapore, Pakistan, India. Because shorting is not permitted in many emerging markets, managers must go to cash or other markets when valuations make being long unattractive.

Regional - Manager focuses on specific regions of the world, e.g. Latin America, Asia, Europe.

Global Macro:
Opportunistic trading manager that profits from changes in global economies, typically based on major interest rate shifts. Uses leverage and derivatives.

Market Neutral:
Long/short stocks - Half long/half short. Manager attempts to lock-out or neutralize market risk. In theory, market risk is greatly reduced but it is very difficult to make a profit on a large diversified portfolio so stock picking is critical.

Convertible arbitrage - Manager goes long convertible securities and short the underlying equities.

Stock index arbitrage - Manager buys a basket of stocks and sells short stock index futures, or the reverse.

Fixed income arbitrage - Manager buys T-bonds and sells short other T-bonds that replicate the bond purchased in terms of rate and maturity.

Short Sales:
Manager takes a position that stock prices will go down. Used as a hedge for long-only portfolios and by those who feel market is approaching a bearish trend.

U.S. Opportunistic:
Value - Manager focuses on assets, cash flow, book value, out-of-favor stocks.

Growth - Manager invests in growth stocks; revenues, earnings, and growth potential are key.

Short term - Manager holds positions for a short time frame.

Fund of Funds:
Capital is allocated among a number of hedge funds, providing investors with access to managers they might not be able to discover or evaluate on their own. Usually has a lower minimum than a hedge fund.

Figure 1. Definitions of Managed Account Reports (MAR) categories. MAR definitions of hedge fund types and subtypes are listed above. The MAR database classifies funds at the type level.

Table I

Hedge Fund Features Descriptive Statistics

This table presents summary statistics on five features of hedge funds. The sample consists of 547 hedge funds in the combined MAR and HFR sample that have at least 24 consecutive months of performance data ending December 31, 1995. Annual management fee is the percentage of the fund's net assets under management that is paid annually to fund management for administering the fund. Incentive fee is the percentage of profits (sometimes over a hurdle rate or high-water mark) that is given to fund management in reward for positive performance. Size is the amount of the fund's net assets under management as of December 31, 1995. Age is the number of months the fund has been in operation between its inception and December 31, 1995. U.S. vs. offshore is a dummy variable with a value of one for U.S.-domiciled funds and zero for offshore funds.

Feature	Mean	Median	Std. Dev.	Minimum	Maximum
Annual management fee (%)	1.25	1	0.65	0	6
Incentive fee (%)	13.87	20	9.16	0	50
Size ($ millions)	108.04	27	320.45	0.1	4270
Age (months)	62.72	49	42.69	24	338
U.S. vs. offshore	0.52	1	0.50	0	1

they can solicit U.S. investors, and the number and wealth of U.S. investors is still restricted. Table I shows that these two types are almost equally represented in our sample. U.S. funds might be expected to have somewhat higher risk-adjusted returns because their managers take on added liability as general partners.[14]

The correlation matrix of hedge fund characteristics, shown in Table II, reveals several statistically significant differences between fund features.[15] Incentive fees tend to be significantly higher in the United States, and in event driven, global macro, and market neutral categories. Incentives are significantly lower in the fund of funds and global categories. Global macro and event driven funds are significantly larger than average, while short sales, U.S. opportunistic, and U.S. hedge funds tend to be significantly smaller than average. The only significant correlations among the noncategorical

[14] Another control variable that is commonly used in many finance studies is size. Funds may exhibit economies or diseconomies of scale. The diseconomies could arise from difficulty in replicating strategies for a large fund, especially if the strategy involves profiting from small arbitrage opportunities. The sample contains an impressive range in fund size from $100 thousand to $4.3 billion, with mean and median fund sizes of $108 million and $27 million, respectively. Unfortunately, estimating size in our regression framework suffers from a serious causation problem. This problem is made worse by the fact that we do not have a complete time series on size. All funds report the dollar value of assets at the end of our sample period (1995). As we move back in time, the number of size observations drops. Using end-of-period size creates a problem if fund growth is tied to superior fund performance. End-of-period size is positively and generally significantly correlated with fund performance. However, given the causation problem, we omit size from the analysis. The regression results presented in Tables VIII and IX are very similar to those with size included in the regression equation.

[15] Unless otherwise specified, statistical significance in this paper is defined at the 5 percent level for a two-tailed test.

Table II

Estimated Correlations of Hedge Fund Features

This table presents Pearson correlations for five features of hedge funds and seven investment style classifications of hedge funds. The sample consists of 547 hedge funds in the combined MAR and HFR sample that have at least 24 consecutive months of performance data ending December 31, 1995. Annual management fee (MGT) is the percentage of the fund's net assets under management that is paid annually to fund management for administering the fund. Incentive fee (INCENT) is the percentage of profits (sometimes over a hurdle rate or high-water mark) that is given to fund management in reward for positive performance. SIZE is the natural logarithm of the amount of the fund's net assets under management (in millions) as of December 31, 1995. AGE is the number of months the fund has been in operation between its inception and December 31, 1995. U.S. vs. offshore (US) is a dummy variable with a value of one for U.S.-domiciled funds and zero for offshore funds. EVENT, FOF, GLOBAL, GLMAC, NEUT, SHORT, and USOP are abbreviations for Event Driven, Fund of Funds, Global, Global Macro, Market Neutral, Short Sales, and U.S. Opportunistic, respectively. These are dummy variables that have a value of one if a fund is in the specified category and zero otherwise. *p*-values are given in parentheses.

Feature	MGT	INCENT	SIZE	AGE	US	EVENT	FOF	GLOBAL	GLMAC	NEUT	SHORT	USOP
MGT	1.00											
	(0.00)											
INCENT	−0.06	1.00										
	(0.18)	(0.00)										
SIZE	−0.02	0.08	1.00									
	(0.71)	(0.08)	(0.00)									
AGE	−0.02	−0.12	0.33	1.00								
	(0.64)	(0.00)	(0.00)	(0.00)								
US	−0.19	0.09	−0.09	−0.05	1.00							
	(0.00)	(0.03)	(0.04)	(0.28)	(0.00)							
EVENT	0.05	0.24	0.09	0.09	0.09	1.00						
	(0.29)	(0.00)	(0.05)	(0.04)	(0.03)	(0.00)						
FOF	0.07	−0.34	−0.07	−0.08	−0.03	−0.18	1.00					
	(0.09)	(0.00)	(0.11)	(0.07)	(0.44)	(0.00)	(0.00)					
GLOBAL	−0.00	−0.11	0.04	−0.06	−0.18	−0.16	−0.25	1.00				
	(0.96)	(0.01)	(0.33)	(0.15)	(0.00)	(0.00)	(0.00)	(0.00)				
GLMAC	0.05	0.14	0.16	0.07	−0.09	−0.12	−0.19	−0.17	1.00			
	(0.20)	(0.00)	(0.00)	(0.12)	(0.03)	(0.01)	(0.00)	(0.00)	(0.00)			
NEUT	−0.00	0.12	−0.01	−0.05	0.04	−0.13	−0.20	−0.19	−0.14	1.00		
	(1.00)	(0.00)	(0.79)	(0.22)	(0.40)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		
SHORT	−0.07	0.05	−0.09	−0.01	0.01	−0.04	−0.06	−0.06	−0.04	−0.04	1.00	
	(0.12)	(0.25)	(0.03)	(0.76)	(0.79)	(0.37)	(0.16)	(0.20)	(0.35)	(0.30)	(0.00)	
USOP	−0.12	0.05	−0.12	0.07	0.17	−0.19	−0.29	−0.27	−0.20	−0.22	−0.06	1.00
	(0.00)	(0.29)	(0.00)	(0.13)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.14)	(0.00)

variables are the expected positive relationship between age and size and a negative relation between age and incentive fee. Newer hedge funds seem to be imposing higher incentive fees. These simple correlations demonstrate the need to evaluate hedge fund categories and hedge fund characteristics in a multiple regression framework. However, none of the simple correlations are so large that they raise serious multicollinearity concerns.

In the next section, we compare hedge fund performance to a number of general market indices and to similarly classified mutual funds. The mutual fund return data and classifications are obtained from Morningstar. Frank Russell Company provided data on the Russell 2000 index. All other indices are obtained from MAR. Index and mutual fund returns are also total return figures in U.S. dollars.

III. Results

Table III reports mean and median annualized total returns for the seven MAR categories.[16] Returns are net of fees and expenses, but in this table they are not adjusted for risk nor compared to any general index. As with all the tables, we report findings for the 2-, 4-, 6-, and 8-year sample periods ending December 31, 1995. Except for the short sales category, we have a minimum of 56 observations for each category in the 2-year sample. That minimum drops to six observations for the 8-year sample. The 2- and 4-year short sales findings should be interpreted with caution because we only have seven and five observations. Results for the 6- and 8-year short sales sample are not reported because we only have one observation.

On average, hedge funds earn a mean annualized return of between 9.2 and 16.1 percent over the 8-year observation period. There is, however, substantial variation across fund classifications. In the more recent periods, event driven and U.S. opportunistic funds earn superior returns. In the longer period samples, global and global macro funds excel. Market neutral, short sales, and funds of funds tend to earn returns below the sample average; however, these funds are designed to reduce risk and they do consistently display the smallest standard deviations in individual fund returns. Global, global macro, and U.S. opportunistic tend to display some of the highest variation in returns (as measured by both the standard deviation and range). The only category that shows above-average returns and below-average variance is event driven. With this one exception, the risk and return profile of the hedge fund categories is consistent with the standard risk-return trade-off and the general definitions of the fund classifications.

A. Absolute Returns Relative to Standard Indices

The first formal statistical tests are presented in Table IV where we begin to address the general question of whether the structural advantages of hedge funds are sufficient to generate superior returns. Our first effort at mea-

[16] The performance measures used in this paper assume an annual holding period.

Table III

Hedge Fund Annual Returns

This table gives descriptive statistics for the hedge funds' annualized total returns. The combined MAR and HFR hedge fund sample is divided into seven MAR hedge fund investment style categories and four sample periods. The sample periods contain MAR and HFR hedge funds that have at least two, four, six, or eight consecutive years of performance data ending December 31, 1995. The n/a notation for short sales indicates that for the 6- and 8-year sample periods there was only one observation in this category. *N* represents the number of hedge funds in the sample or subsample.

MAR Category	Sample Period (in years) Ending December 31, 1995	*N*	Mean	Median	Std. Dev.	Minimum	Maximum
Total	2	547	9.2%	8.9%	11.9%	−38.4%	69.3%
	4	272	14.7%	13.9%	9.2%	−16.3%	58.1%
	6	150	14.6%	13.4%	7.8%	−1.1%	47.4%
	8	79	16.1%	15.0%	8.7%	−1.9%	39.8%
Event driven	2	56	11.1%	11.6%	7.2%	−16.2%	35.4%
	4	34	15.8%	16.3%	4.7%	7.3%	26.2%
	6	27	14.7%	13.2%	7.7%	3.9%	43.6%
	8	11	17.9%	15.0%	7.8%	11.5%	39.8%
Fund of funds	2	118	3.2%	3.6%	7.9%	−14.7%	33.7%
	4	57	10.2%	10.2%	8.2%	−13.4%	27.0%
	6	22	12.6%	10.1%	6.5%	5.0%	32.3%
	8	6	11.4%	10.1%	3.2%	9.3%	18.4%
Global	2	104	5.7%	5.9%	13.1%	−32.5%	68.3%
	4	44	17.1%	15.7%	10.1%	0.7%	44.5%
	6	27	15.3%	15.1%	7.5%	−1.1%	28.0%
	8	16	19.3%	17.4%	9.6%	7.0%	39.5%
Global macro	2	61	9.8%	9.1%	14.6%	−38.4%	69.3%
	4	35	14.9%	16.7%	8.7%	−16.3%	37.0%
	6	23	18.0%	15.8%	8.7%	2.8%	43.0%
	8	14	20.5%	19.5%	7.1%	6.9%	35.4%
Market neutral	2	72	9.9%	8.9%	9.3%	−10.1%	44.7%
	4	27	9.8%	9.6%	4.4%	3.4%	24.0%
	6	19	10.4%	9.9%	2.9%	5.7%	16.1%
	8	9	8.0%	7.8%	2.9%	3.2%	12.4%
Short sales	2	7	5.6%	3.6%	9.3%	−4.9%	23.9%
	4	5	2.8%	3.6%	5.5%	−4.0%	9.1%
	6	n/a	n/a	n/a	n/a	n/a	n/a
	8	n/a	n/a	n/a	n/a	n/a	n/a
U.S. opportunistic	2	129	16.0%	14.3%	11.5%	−16.6%	67.3%
	4	70	19.2%	18.2%	9.6%	−4.5%	58.1%
	6	32	15.3%	14.6%	8.7%	−0.4%	47.4%
	8	23	14.9%	16.5%	8.7%	−1.9%	38.5%

suring superior returns compares hedge fund performance to general indices. In Table IV, we begin with two common equity indices, the S&P 500 and the Morgan Stanley Capital International (MSCI) EAFE Total Return indices. The MSCI EAFE Total Return index is a value-weighted index for Europe, Australia, New Zealand, and the Far East. During our four time periods, the S&P 500 outperforms the EAFE index by 400–1000 basis points. We

Table IV

Hedge Fund Annual Returns in Excess of Standard Equity Total Return Benchmarks

This table gives the hedge fund annual returns relative to the S&P 500 Total Return and the MSCI EAFE Total Return indices. The combined MAR and HFR hedge fund sample is divided into seven MAR hedge fund investment style categories and four sample periods. The sample periods contain MAR and HFR hedge funds that have at least two, four, six, or eight consecutive years of performance data ending December 31, 1995. The n/a notation for short sales indicates that for the 6- and 8-year sample periods there was only one observation in this category. *N* represents the number of hedge funds in the sample or subsample. *p*-values for mean and median differences from zero are provided.

MAR Category	Sample Period (in years) ending December 31, 1995	*N*	Hedge Fund Annual Returns Relative to the S&P 500 Total Return Index					Hedge Fund Annual Returns Relative to the MSCI EAFE Total Return Index				
			Mean	*p*-Value	Median	*p*-Value	SD	Mean	*p*-Value	Median	*p*-Value	SD
Total	2	547	−10.3%	0.00	−10.5%	0.00	11.9%	−0.6%	0.21	−0.9%	0.01	11.9%
	4	272	0.6%	0.28	−0.3%	0.54	9.2%	4.6%	0.00	3.7%	0.00	9.2%
	6	150	0.6%	0.37	−0.7%	0.62	7.8%	9.6%	0.00	8.4%	0.00	7.8%
	8	79	−0.4%	0.68	−1.5%	0.31	8.7%	7.5%	0.00	6.3%	0.00	8.7%
Event driven	2	56	−8.3%	0.00	−7.8%	0.00	7.2%	1.3%	0.19	1.8%	0.07	7.2%
	4	34	1.6%	0.05	2.1%	0.09	4.7%	5.6%	0.00	6.1%	0.00	4.7%
	6	27	0.7%	0.66	−0.8%	0.62	7.7%	9.7%	0.00	8.2%	0.00	7.7%
	8	11	1.4%	0.59	−1.6%	0.76	7.8%	9.2%	0.00	6.3%	0.00	7.8%
Fund of funds	2	118	−16.3%	0.00	−15.8%	0.00	7.9%	−6.6%	0.00	−6.2%	0.00	7.9%
	4	57	−3.9%	0.00	−3.9%	0.00	8.2%	0.0%	0.98	0.1%	0.80	8.2%
	6	22	−1.4%	0.34	−3.9%	0.15	6.5%	7.6%	0.00	5.1%	0.00	6.5%
	8	6	−5.1%	0.02	−6.4%	0.06	3.2%	2.8%	0.11	1.5%	0.03	3.2%

Global	2	104	−13.7%	0.00	−13.5%	0.00	13.1%	−4.1%	0.00	−3.9%	0.00	13.1%
	4	44	2.9%	0.06	1.6%	0.14	10.1%	6.9%	0.00	5.6%	0.00	10.1%
	6	27	1.3%	0.40	1.1%	0.45	7.5%	10.3%	0.00	10.1%	0.00	7.5%
	8	16	2.7%	0.29	0.8%	0.29	9.6%	10.6%	0.00	8.7%	0.00	9.6%
Global macro	2	61	−9.6%	0.00	−10.3%	0.00	14.6%	0.0%	0.99	−0.7%	0.95	14.6%
	4	35	0.7%	0.62	2.5%	0.23	8.7%	4.7%	0.00	6.5%	0.00	8.7%
	6	23	4.0%	0.04	1.8%	0.03	8.7%	13.0%	0.00	10.9%	0.00	8.7%
	8	14	4.0%	0.06	2.9%	0.06	7.1%	11.8%	0.00	10.8%	0.00	7.1%
Market neutral	2	72	−9.6%	0.00	−10.5%	0.00	9.3%	0.1%	0.96	−0.9%	0.56	9.3%
	4	27	−4.4%	0.00	−4.6%	0.00	4.4%	−0.4%	0.65	−0.6%	0.36	4.4%
	6	19	−3.6%	0.00	−4.2%	0.00	2.9%	5.5%	0.00	4.9%	0.00	2.9%
	8	9	−8.6%	0.00	−8.7%	0.00	2.9%	−0.7%	0.52	−0.8%	0.57	2.9%
Short sales	2	7	−13.8%	0.01	−15.8%	0.03	9.3%	−4.2%	0.31	−6.2%	0.30	9.3%
	4	5	−11.3%	0.01	−10.5%	0.06	5.5%	−7.3%	0.06	−6.5%	0.06	5.5%
	6	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
U.S. opportunistic	2	129	−3.4%	0.00	−5.1%	0.00	11.5%	6.3%	0.00	4.5%	0.00	11.5%
	4	70	5.0%	0.00	4.0%	0.00	9.6%	9.0%	0.00	8.0%	0.00	9.6%
	6	32	1.3%	0.42	0.6%	0.60	8.7%	10.3%	0.00	9.6%	0.00	8.7%
	8	23	−1.7%	0.38	0.0%	0.42	8.7%	6.2%	0.00	7.8%	0.00	8.7%

focus on equity indices because there are few pure bond hedge funds. For the 391 hedge funds that provide regional composition information, 27 percent hold primarily international assets and 34 percent hold a balance of U.S. and international assets. The EAFE index is used instead of the MSCI World index, because the World index gives heavy weight to the S&P and would therefore yield results between the EAFE and the S&P.[17]

If we look at the full hedge fund sample versus both indices, the results suggest a draw. Of the 16 mean and median values in the full sample section of Table IV, eight are positive and eight are negative. In three cases the hedge fund returns are significantly below the index and in six cases the hedge funds significantly outperform the index.

Hedge funds' ability to outperform the market clearly depends on the time period, the market index, and the hedge fund category. Hedge funds tend to underperform the market in 1994 and 1995. During this period, 21 of the 32 values for individual hedge fund categories in Table IV are significantly negative and only two are significantly positive. Because the S&P 500 index outperforms the EAFE index in all sample periods, hedge funds look much better relative to EAFE. Using the EAFE index, 37 of the 60 means and medians are significantly positive, and only five are significantly negative. Using the S&P 500 index, only five are significantly positive and 26 are significantly negative. However, 16 of these 26 occur in the 1994–1995 period and all of the remainder occur in the three categories designed to reduce risk: fund of funds, market neutral, and short sales. In fact, the market-adjusted returns in these three categories are always negative. If there is any form of risk return trade-off, then it is not surprising that these categories underperform the market. Excluding the 1994–1995 sample, the four remaining categories display returns above the S&P 500 index in 21 of the 24 cases considered in Table IV.

B. Risk and Return

The preceding analysis ignores differences in risk between hedge funds and the various indices. Hedge funds may be enhancing returns by taking on extra risk. Alternatively, some hedge funds are designed to reduce risk.

[17] During our four time periods, most of the other common indices (Wilshire 5000, Russell 2000, Lehman Government/Corporate Bond, Lehman Aggregate Bond, and Balanced (60 percent S&P and 40 percent Lehman Aggregate Bond)) also display annual returns between the S&P and the EAFE. The exceptions on the negative side are the two bond indices, which are roughly 200 basis points below the EAFE index during 1994–1995 and 1992–1995. An exception on the positive side is the Russell 2000 index, which is 100 to 200 basis points above the S&P during the 1992–1995 and the 1990–1995 periods. Excess returns based on the S&P 500 might be biased upward, to the extent that hedge funds hold small firm stocks. Unfortunately, we do not have detailed information on the percentage of small stock holdings for most hedge funds. For the 2-, 4-, 6-, and 8-year periods, twenty-two, nine, four, and three hedge funds state that they primarily invest in U.S. small stocks. Their mean annual excess returns relative to the Russell 2000 (with p-values in parentheses) are 8.4 percent (0.00), 7.1 percent (0.03), 9.7 percent (0.02), and 5.9 percent (0.09). The median excess returns are similar.

In Table V we account for total risk using the traditional Sharpe ratio, $(R_h - R_f)/\sigma_h$, where R_h is the hedge fund return, R_f is the riskless rate of return (90-day T-bills), and σ_h is the standard deviation of the individual hedge fund return over the period considered (Sharpe (1966)). In this table, we use only the full sample hedge fund category so that hedge funds can be compared to eight standard indices.

Overall, the conclusions are similar to those in Table IV. Hedge funds do not consistently outperform market aggregates. In fact, on a total risk-adjusted basis, the market has a slight edge with 35 of the 64 mean and median comparisons in favor of the market indices. The 1994–1995 sample period is again the worst for hedge funds. During this period, the only index the hedge funds beat is EAFE. However, over the 6-year period from 1990 through 1995, hedge funds significantly outperform all but the bond-based indices. Although hedge funds do not consistently beat the market, they do appear to be earning enough of a superior return to cover their costs given that the hedge fund returns in Tables IV and V are net of fees and expenses.

Portfolio theory offers an alternative approach to viewing the value of hedge funds. Elton, Gruber, and Rentzler (1987) develop a methodology for assessing the contribution of an alternative investment portfolio to an existing portfolio. For a new asset group to be a valuable addition to the portfolio, the Sharpe ratio of the new asset group must exceed the product of the Sharpe ratio of the existing portfolio and the correlation of the asset group and the current portfolio.[18] The correlations between the hedge fund returns and the eight indices for our four time periods range from 0.136 to 0.323. Applying even the maximum correlation to the Sharpe ratios in Table V reveals that hedge funds augment all of these indices for all of our time periods.

Many hedge funds use tools designed to reduce systematic rather than total risk. Though this is obviously true for short sellers and market neutral funds, techniques such as short sales are employed by most hedge funds. If there is a trade-off between systematic risk and return, the above results do not fully capture a potentially important hedge fund advantage. We do find that hedge funds have small β's with a mean and median value of 0.28 and 0.23 for the S&P 500. Market neutral and short sales funds have the expected zero and negative values for β. Furthermore, Jensen's α (Jensen (1968)) is significantly positive for hedge funds in all samples except the 2-year period and typically ranges from 6 to 8 percent. This fundamental finding of low β's and positive α's holds for the other indices used in Table V. Brown et al. (1999) find similar α's and β's for their 1989–1995 sample period despite dramatic differences with regard to sample frequency and composition. Unfortunately, empirically verifying the low systematic risk claims of hedge funds is problematic. Fung and Hsieh (1997) reveal some of the difficulties in measuring hedge fund performance, especially these simple measures of systematic risk.

[18] Edwards and Park (1996) and Irwin, Krukemyer, and Zulauf (1993) use this approach to evaluate managed futures and public commodity pools.

Table V

Sharpe Ratio Comparisons of Hedge Funds with Standard Market Indices

This table presents the mean and median Sharpe ratio for the hedge funds in each of four sample periods. The samples contain MAR and HFR hedge funds that have at least two, four, six, or eight consecutive years of performance data ending December 31, 1995. The Sharpe ratio of eight standard market indices is also given for each time period. A test of the difference between the index Sharpe ratio and the mean or median hedge fund sample value is presented. The mean and median superiority column gives the *p*-value from this test and lists index or hedge fund depending on which Sharpe ratio is higher. The figures represent total return performance in U.S. dollars. The Balanced index is a combination of 60 percent S&P 500 and 40 percent Lehman Aggregate Bond.

	Hedge Fund Sharpe Ratios			Index Sharpe	Mean Superiority (*p*-value)		Median Superiority (*p*-value)	
Sample Period	Mean	Median	Index	Ratio				
1/94–12/95	0.145	0.121	S&P 500	0.415	Index	(0.00)	Index	(0.00)
			MSCI EAFE	0.107	Hedge Funds	(0.01)	Hedge Funds	(0.13)
			MSCI World	0.229	Index	(0.00)	Index	(0.00)
			Wilshire 5000	0.387	Index	(0.00)	Index	(0.00)
			Russell 2000	0.211	Index	(0.00)	Index	(0.00)
			Balanced	0.372	Index	(0.00)	Index	(0.00)
			Lehman Aggregate Bond	0.164	Index	(0.18)	Index	(0.01)
			Lehman Gov't/Corp. Bond	0.159	Index	(0.31)	Index	(0.01)

1/92–12/95	0.297	0.291	S&P 500	0.334	Index	(0.01)	Index	(0.00)
			MSCI EAFE	0.111	Hedge Funds	(0.00)	Hedge Funds	(0.00)
			MSCI World	0.190	Hedge Funds	(0.00)	Hedge Funds	(0.00)
			Wilshire 5000	0.334	Index	(0.01)	Index	(0.00)
			Russell 2000	0.277	Hedge Funds	(0.14)	Hedge Funds	(0.31)
			Balanced	0.346	Index	(0.00)	Index	(0.00)
			Lehman Aggregate Bond	0.267	Hedge Funds	(0.03)	Hedge Funds	(0.08)
			Lehman Gov't/Corp. Bond	0.263	Hedge Funds	(0.02)	Hedge Funds	(0.04)
1/90–12/95	0.241	0.220	S&P 500	0.204	Hedge Funds	(0.01)	Hedge Funds	(0.09)
			MSCI EAFE	0.000	Hedge Funds	(0.00)	Hedge Funds	(0.00)
			MSCI World	0.058	Hedge Funds	(0.00)	Hedge Funds	(0.00)
			Wilshire 5000	0.202	Hedge Funds	(0.01)	Hedge Funds	(0.06)
			Russell 2000	0.169	Hedge Funds	(0.00)	Hedge Funds	(0.00)
			Balanced	0.239	Hedge Funds	(0.91)	Index	(0.31)
			Lehman Aggregate Bond	0.304	Index	(0.00)	Index	(0.00)
			Lehman Gov't/Corp. Bond	0.288	Index	(0.00)	Index	(0.00)
1/88–12/95	0.231	0.235	S&P 500	0.246	Index	(0.41)	Index	(0.37)
			MSCI EAFE	0.045	Hedge Funds	(0.00)	Hedge Funds	(0.00)
			MSCI World	0.108	Hedge Funds	(0.00)	Hedge Funds	(0.00)
			Wilshire 5000	0.245	Index	(0.44)	Index	(0.40)
			Russell 2000	0.191	Hedge Funds	(0.03)	Hedge Funds	(0.03)
			Balanced	0.272	Index	(0.03)	Index	(0.02)
			Lehman Aggregate Bond	0.272	Index	(0.03)	Index	(0.02)
			Lehman Gov't/Corp. Bond	0.260	Index	(0.12)	Index	(0.10)

C. Hedge Funds versus Mutual Funds

An alternative approach to assessing hedge fund performance is to compare hedge funds to mutual funds. This comparison offers several advantages over indices. As discussed in the introduction, mutual funds and hedge funds are closely related managed funds that differ on a number of potentially important characteristics. Performance differences between these two groups may reflect the advantages and disadvantages of these characteristics. For many investors, mutual funds are one of the most common forms of alternative investment mechanisms to hedge funds. Furthermore, hedge funds and mutual funds can often be matched more carefully, avoiding problems of selecting the right indices.

Since some MAR categories (market neutral, short sales) do not have mutual fund equivalents, new category definitions are required. We define two sets of mutually exclusive categories. The first set is stock, bond, or balanced. Funds are assigned to the stock or bond category if the fund primarily invests in one of these two types of assets. Funds with significant holdings of both stocks and bonds are assigned to the balanced category. The second set is United States, international, and global. Funds with primarily non-U.S. investments are labeled as international. Funds with a balance of U.S. and foreign investments are classified as global.[19] To further sharpen comparisons, we also report results for the four subcategories for which we have sufficient data, U.S. stock, U.S. balanced, global stock, and global balanced. Mutual funds are assigned to these classifications based on Morningstar category descriptions.[20] For hedge funds, the data sources generally state whether the fund contains stocks or bonds and the regional focus of the fund.

The results of the hedge fund and mutual fund Sharpe ratio comparison are given in Table VI. The first category contains the full sample of hedge funds and mutual funds with returns for the 2-, 4-, 6-, and 8-year periods. For the full sample, hedge funds always outperform mutual funds except for the median return in the 2-year period. In the 4-, 6-, and 8-year periods, either the mean or median difference is statistically significant.

The individual category results show that this hedge fund advantage is fairly pervasive across categories, although the statistical significance of the 8-year sample often wanes because of the sharply reduced sample size. The mean or median hedge fund return is significantly greater than the corresponding mutual fund value in 36 of the 80 individual category comparisons. The reverse is true in only three cases. These three cases are for the 2-year sample of stock and balanced funds. Hedge funds hold substantially more international assets in these categories. As Table VI shows, international

[19] These definitions of international and global are common in the mutual fund industry, and are adopted here. Although MAR classifies international as a subcategory of global, MAR provides investment region information that permits a distinction between international and global funds.

[20] We exclude municipal bond funds from the mutual fund sample because we expect a fundamental difference between the Sharpe ratios of municipal and taxable bonds. There are no municipal bond hedge funds in our sample.

assets performed poorly in 1994 and 1995. The mutual fund advantage becomes insignificant or disappears when only U.S. stock or U.S. balanced funds are considered. Furthermore, hedge funds tend to dominate mutual funds in every region—United States, international, and global—for all time periods.

This evidence suggests that hedge funds outperform mutual funds even on a risk-adjusted basis. However, the Sharpe ratio assumes a specific risk-return trade-off that may not reflect the preferences of the typical mutual fund investor. We compare the volatility of hedge funds and mutual funds in Table VII. Hedge funds are clearly more volatile. In 78 of the 88 mean and median comparisons in Table VII, the standard deviation of returns is higher for hedge funds than mutual funds. In 53 of these cases hedge fund volatility is significantly higher. The only category in which mutual funds appear slightly more risky than hedge funds is global stocks. In no case, however, is the mutual fund standard deviation significantly greater.

D. Hedge Fund Characteristics and Performance

In Tables VIII and IX, we attempt to isolate hedge fund characteristics that might explain the performance and volatility of hedge funds. We regress risk-adjusted performance and volatility on four characteristics of hedge funds and six dummy variables for hedge fund categories. The global macro dummy variable is omitted from these series of regressions. The coefficients on the six remaining hedge fund category variables therefore represent the risk-adjusted performance and volatility of these categories relative to the global macro category. We adjust for total risk in Table VIII by using the Sharpe ratio. In Table IX, the dependent variable is the natural log of the standard deviation of the hedge fund total monthly returns over the 2-, 4-, 6-, and 8-year time periods. We use the natural log because it yields a more normally distributed dependent variable and improved explanatory power. The results are comparable without logs.

One hedge fund characteristic consistently explains risk-adjusted performance—incentive fee. This variable is significant in all four time periods for the Sharpe ratio regressions. The effect of incentives on performance is quite powerful. Moving from a fund with no incentive fee to a fund with the median incentive fee (20 percent) increases the Sharpe ratio by an average of 0.15 (or 66 percent of the average Sharpe ratio).[21] The standard deviation regressions in Table IX reveal that this improved risk-adjusted performance

[21] Although there is a large range of incentive fees from zero to 50, most of the distribution is concentrated in two points, zero and 20. Depending on the sample period, between 25 and 42 percent of the hedge funds do not have an incentive fee and between 35 and 50 percent of the hedge funds have a 20 percent incentive fee. We perform several sensitivity tests on the incentive fee variable to assess the impact of this distribution. Adding a squared incentive fee term to the regressions does not yield a consistently significant nonlinear pattern. Replacing the continuous incentive fee variable with a dummy variable that equals one if the incentive fee is positive weakens the t value and R^2. Even if we eliminate the zero incentive fee values, the incentive fee coefficient remains about the same. Given the drastically reduced variation in incentive fees, however, the t value drops to between 1.23 and 3.99.

Table VI

Hedge Fund versus Mutual Fund Sharpe Ratio Comparison

This table presents the mean and median Sharpe ratios for comparably classified hedge funds and mutual funds and *p*-values from tests for differences in hedge fund and mutual fund mean and median values. The difference in means tests assume unequal variances because the hedge fund and mutual fund Sharpe ratio variances are significantly different in virtually all of this table's comparisons. The combined MAR and HFR hedge fund sample and the Morningstar mutual fund sample are divided into 10 standard asset type and regional categories and subcategories. The mean, median, and standard deviation (SD) are also given for four sample periods. The sample periods contain hedge funds and mutual funds that have at least two, four, six, or eight consecutive years of performance data ending December 31, 1995. *N* represents the number of funds in the sample or subsample. The regional categories U.S., International, and Global, as well as the asset categories stock, bond, and balanced, are mutually exclusive but do not sum to the total because portfolio composition information is not available for every hedge fund. U.S. stock, U.S. balanced, global stock and global balanced are the only subcategories in which we have sufficient hedge fund observations to confidently compare means and medians.

Type	Sample Period (years) Ending December 1995	Hedge Fund Sharpe Ratios				Mutual Fund Sharpe Ratios				*p*-Value for Mean Difference	*p*-Value for Median Difference
		Mean	Median	SD	*N*	Mean	Median	SD	*N*		
All	2	0.145	0.121	0.330	547	0.144	0.148	0.180	3384	1.00	0.06
	4	0.297	0.291	0.226	272	0.223	0.221	0.133	1892	0.00	0.00
	6	0.241	0.220	0.178	150	0.183	0.192	0.094	1429	0.00	0.04
	8	0.231	0.235	0.164	79	0.192	0.205	0.080	1144	0.04	0.13
U.S.	2	0.259	0.242	0.242	154	0.175	0.179	0.170	2823	0.00	0.00
	4	0.362	0.328	0.228	82	0.237	0.235	0.130	1610	0.00	0.00
	6	0.245	0.218	0.204	37	0.195	0.198	0.086	1260	0.15	0.07
	8	0.200	0.231	0.163	25	0.202	0.209	0.073	1033	0.96	0.31
International	2	0.002	−0.015	0.348	105	−0.045	−0.017	0.130	261	0.18	0.91
	4	0.192	0.197	0.117	41	0.135	0.132	0.074	128	0.01	0.01
	6	0.160	0.158	0.109	26	0.037	0.038	0.066	73	0.00	0.00
	8	0.169	0.155	0.105	12	0.082	0.081	0.064	52	0.02	0.06
Global	2	0.080	0.060	0.346	132	0.025	0.046	0.159	300	0.03	0.83
	4	0.270	0.242	0.225	70	0.151	0.171	0.153	154	0.00	0.01
	6	0.251	0.230	0.178	41	0.143	0.137	0.110	96	0.00	0.01
	8	0.287	0.271	0.168	29	0.121	0.128	0.099	59	0.00	0.00

Stock	2	0.160	0.144	0.357	216	0.193	0.226	0.176	1892	0.18	0.00
	4	0.280	0.266	0.230	104	0.228	0.234	0.117	1092	0.00	0.22
	6	0.218	0.218	0.169	54	0.153	0.170	0.083	838	0.00	0.02
	8	0.235	0.269	0.182	27	0.185	0.201	0.080	701	0.17	0.08
Bond	2	0.322	0.238	0.348	41	0.046	0.076	0.154	1154	0.00	0.00
	4	0.368	0.360	0.277	16	0.199	0.198	0.158	621	0.03	0.13
	6	0.255	0.209	0.202	12	0.233	0.245	0.094	450	0.73	1.00
	8	0.233	0.104	0.234	7	0.201	0.211	0.076	343	0.75	0.25
Balanced	2	0.133	0.121	0.301	237	0.212	0.229	0.132	338	0.00	0.00
	4	0.330	0.322	0.207	127	0.281	0.293	0.117	179	0.02	0.08
	6	0.262	0.243	0.190	71	0.201	0.208	0.084	141	0.01	0.11
	8	0.223	0.252	0.143	39	0.213	0.229	0.083	100	0.71	0.54
U.S. stock	2	0.245	0.227	0.242	96	0.242	0.263	0.147	1529	0.91	0.30
	4	0.323	0.322	0.236	47	0.244	0.250	0.116	915	0.03	0.02
	6	0.162	0.201	0.143	19	0.168	0.176	0.075	735	0.87	0.49
	8	0.144	0.203	0.175	14	0.196	0.206	0.075	625	0.31	1.00
U.S. balanced	2	0.268	0.250	0.223	48	0.232	0.242	0.112	300	0.28	0.76
	4	0.395	0.337	0.202	32	0.286	0.294	0.108	158	0.01	0.01
	6	0.319	0.243	0.232	15	0.211	0.212	0.069	123	0.10	0.17
	8	0.251	0.257	0.083	9	0.225	0.233	0.067	90	0.41	0.28
Global stock	2	0.092	0.018	0.382	34	0.059	0.048	0.106	102	0.62	0.43
	4	0.288	0.285	0.152	16	0.180	0.196	0.090	49	0.02	0.02
	6	0.299	0.269	0.175	10	0.091	0.086	0.058	30	0.01	0.03
	8	0.355	0.317	0.145	8	0.128	0.117	0.054	24	0.00	0.00
Global balanced	2	0.091	0.075	0.335	78	0.059	0.100	0.171	38	0.49	0.69
	4	0.291	0.288	0.217	42	0.238	0.270	0.160	21	0.28	0.48
	6	0.242	0.274	0.169	23	0.136	0.126	0.134	18	0.03	0.27
	8	0.276	0.285	0.143	16	0.109	0.072	0.131	10	0.01	0.11

Table VII

Hedge Fund versus Mutual Fund Volatility Comparison

This table presents the mean and median volatility (measured as the standard deviation of monthly total returns) for comparably classified hedge funds and mutual funds. *p*-values from tests for differences in hedge fund and mutual fund mean and median values are also given. The nonparametric Wilcoxon-Mann-Whitney mean test is used since the distributions of the standard deviations are bounded by zero. t-test results are very similar. The combined MAR and HFR hedge fund sample and the Morningstar mutual fund sample are divided into 10 standard asset type and regional categories and subcategories. The mean, median and standard deviation (SD) is also given for four sample periods. The sample periods contain hedge funds and mutual funds that have at least two, four, six or eight consecutive years of performance data ending December 31, 1995. *N* represents the number of funds in the sample or subsample. The regional categories U.S., International and Global, as well as the asset categories Stock, Bond and Balanced, are mutually exclusive but do not sum to the total because portfolio composition information is not available for every hedge fund. U.S. Stock, U.S. Balanced, Global Stock and Global Balanced are the only subcategories in which we have sufficient hedge fund observations to confidently compare means and medians.

Type	Sample Period (years) Ending December 1995	Standard Deviation of Monthly Total Returns								*p*-Value for Mean Difference	*p*-Value for Median Difference
		Hedge Funds				Mutual Funds					
		Mean	Median	SD	*N*	Mean	Median	SD	*N*		
All	2	0.034	0.027	0.027	547	0.025	0.025	0.013	3384	0.00	0.00
	4	0.034	0.029	0.022	272	0.024	0.023	0.013	1892	0.00	0.00
	6	0.035	0.032	0.020	150	0.031	0.031	0.016	1429	0.01	0.86
	8	0.037	0.036	0.018	79	0.031	0.032	0.015	1144	0.00	0.05
U.S.	2	0.035	0.030	0.019	154	0.024	0.024	0.012	2823	0.00	0.00
	4	0.037	0.032	0.020	82	0.023	0.022	0.013	1610	0.00	0.00
	6	0.038	0.037	0.017	37	0.030	0.031	0.016	1260	0.01	0.01
	8	0.036	0.036	0.012	25	0.030	0.031	0.015	1033	0.02	0.01
International	2	0.045	0.037	0.024	105	0.040	0.035	0.013	261	0.25	0.20
	4	0.054	0.045	0.027	41	0.041	0.037	0.010	128	0.04	0.10
	6	0.054	0.047	0.023	26	0.045	0.043	0.010	73	0.38	0.61
	8	0.056	0.051	0.023	12	0.044	0.043	0.009	52	0.04	0.06
Global	2	0.036	0.028	0.041	132	0.023	0.022	0.011	300	0.00	0.00
	4	0.034	0.029	0.019	70	0.022	0.019	0.010	154	0.00	0.00
	6	0.034	0.029	0.017	41	0.027	0.022	0.012	96	0.01	0.00
	8	0.036	0.036	0.016	29	0.028	0.024	0.012	59	0.01	0.11

Stock	2	0.036	0.031	0.021	216	0.033	0.030	0.011	1892	0.62	0.47
	4	0.038	0.034	0.022	104	0.032	0.029	0.012	1092	0.11	0.15
	6	0.039	0.038	0.021	54	0.041	0.038	0.012	838	0.10	1.00
	8	0.041	0.037	0.019	27	0.040	0.038	0.011	701	0.89	0.84
Bond	2	0.026	0.017	0.021	41	0.013	0.013	0.007	1154	0.00	0.01
	4	0.033	0.028	0.022	16	0.013	0.012	0.006	621	0.00	0.01
	6	0.037	0.029	0.025	12	0.014	0.013	0.007	450	0.00	0.02
	8	0.032	0.026	0.020	7	0.014	0.013	0.006	343	0.04	0.25
Balanced	2	0.033	0.026	0.032	237	0.021	0.021	0.004	338	0.00	0.00
	4	0.032	0.027	0.020	127	0.019	0.018	0.005	179	0.00	0.00
	6	0.033	0.030	0.017	71	0.024	0.023	0.006	141	0.00	0.00
	8	0.039	0.037	0.017	39	0.023	0.023	0.006	100	0.00	0.00
U.S. stock	2	0.038	0.034	0.020	96	0.032	0.029	0.010	1529	0.00	0.06
	4	0.040	0.035	0.019	47	0.031	0.027	0.012	915	0.00	0.00
	6	0.045	0.042	0.017	19	0.040	0.037	0.012	735	0.16	0.25
	8	0.040	0.038	0.012	14	0.040	0.037	0.011	625	0.68	0.59
U.S. balanced	2	0.033	0.027	0.017	48	0.021	0.020	0.004	300	0.00	0.00
	4	0.034	0.027	0.020	32	0.018	0.018	0.004	158	0.00	0.00
	6	0.032	0.033	0.011	15	0.024	0.023	0.006	123	0.00	0.01
	8	0.035	0.035	0.006	9	0.023	0.022	0.006	90	0.00	0.01
Global stock	2	0.030	0.028	0.014	34	0.031	0.030	0.005	102	0.25	0.43
	4	0.031	0.028	0.012	16	0.032	0.031	0.006	49	0.36	0.28
	6	0.033	0.029	0.010	10	0.040	0.040	0.008	30	0.12	0.47
	8	0.039	0.041	0.011	8	0.039	0.039	0.007	24	0.90	1.00
Global balanced	2	0.035	0.026	0.049	78	0.023	0.021	0.007	38	0.06	0.02
	4	0.031	0.027	0.017	42	0.021	0.018	0.009	21	0.01	0.00
	6	0.030	0.028	0.016	23	0.023	0.022	0.008	18	0.08	0.08
	8	0.033	0.027	0.017	16	0.025	0.023	0.009	10	0.17	0.11

Table VIII

Regression of Hedge Fund Sharpe Ratio Performance on Hedge Fund Characteristics

This table reports the regression estimates of risk-adjusted performance on four key hedge fund characteristics and six hedge fund investment style categories. The samples comprise MAR and HFR hedge funds that have at least two, four, six, or eight consecutive years of performance data ending December 31, 1995. *N* represents the number of hedge funds in the sample. The regression model is a linear specification of the following equation:

$$\textit{Sharpe ratio} = f(\text{Management fee, Incentive fee, Age, U.S. vs. offshore, Fund categories}).$$

Annual management fee (MGT) is the percentage of the fund's net assets under management that is paid annually to fund management for administering the fund. Incentive fee (INCENT) is the percentage of profits (sometimes over a hurdle rate or high-water mark) that is given to fund management in reward for positive performance. AGE is the number of months the fund has been in operation between its inception and December 31, 1995. U.S. vs. offshore (US) is a dummy variable with a value of one for U.S.-domiciled funds and zero for offshore funds. EVENT, FOF, GLOBAL, NEUT, SHORT, and USOP are abbreviations for event driven, fund of funds, global, market neutral, short sales, and U.S. opportunistic, respectively. These are dummy variables that have a value of one if a fund is in the specified category and zero otherwise. Global macro is the omitted fund category. *p*-values are given in parentheses.

Variable	2 Years	4 Years	6 Years	8 Years
Intercept	−0.031 (0.62)	0.131 (0.03)	0.210 (0.00)	0.027 (0.72)
MGT	−0.017 (0.41)	−0.009 (0.62)	−0.051 (0.01)	−0.001 (0.96)
INCENT	0.007 (0.00)	0.005 (0.00)	0.007 (0.00)	0.011 (0.00)
AGE	0.000 (0.44)	0.000 (0.29)	−0.000 (0.91)	0.000 (0.15)
US	0.039 (0.15)	0.049 (0.06)	0.003 (0.92)	0.019 (0.59)
EVENT	0.222 (0.00)	0.260 (0.00)	0.047 (0.31)	0.017 (0.76)
FOF	−0.062 (0.22)	0.038 (0.41)	0.043 (0.40)	0.155 (0.03)
GLOBAL	0.003 (0.95)	0.018 (0.70)	−0.003 (0.95)	0.078 (0.15)
NEUT	0.178 (0.00)	0.067 (0.19)	−0.020 (0.70)	−0.083 (0.15)
SHORT	−0.064 (0.60)	−0.248 (0.01)		
USOP	0.160 (0.00)	0.083 (0.05)	−0.031 (0.51)	−0.008 (0.87)
N	547	272	150	79
Adjusted R^2	0.177	0.245	0.205	0.373

results from higher returns without higher total risk. Incentive fees have a negligible impact on the volatility of returns. Thus, the fear that incentive fees encourage managers to take on too much risk seems unfounded.[22]

[22] A potential complication is that most incentive contracts include some form of high-water mark. Under certain conditions, high-water marks may cause managers to further incur risks (Goetzmann, Ingersoll, and Ross (1998)). We have high-water mark information for a large subsample of funds. We include a high-water mark dummy variable in the standard deviation regressions. High-water marks and incentive fee are insignificant and display inconsistent signs even when they are interacted with each other. The problem is that the relationship between high-water marks, incentive fees, and volatility is complicated. The relationship should depend on where the fund is relative to its high-water mark. This is further complicated by the fact that new investors may have different high-water marks than original investors.

Table IX

Regression of Hedge Fund Risk on Hedge Fund Characteristics

This table reports the regression estimates of hedge fund return volatility on four key hedge fund characteristics and six hedge fund investment style categories. The samples comprise MAR and HFR hedge funds that have at least two, four, six, or eight consecutive years of performance data ending December 31, 1995. *N* represents the number of hedge funds in the sample. The regression model is a linear specification of the following equation:

Return volatility = *f*(Management fee, Incentive fee, Age, U.S. vs. offshore, Fund categories).

Return volatility is measured as the natural logarithm of the standard deviation of total monthly returns. Annual management fee (MGT) is the percentage of the fund's assets under management that is paid annually to fund management for administering the fund. Incentive fee (INCENT) is the percentage of profits (sometimes over a hurdle rate or high-water mark) that is given to fund management in reward for positive performance. AGE is the number of months the fund has been in operation between its inception and December 31, 1995. U.S. vs. offshore (US) is a dummy variable with a value of one for U.S.-domiciled funds and zero for offshore funds. EVENT, FOF, GLOBAL, NEUT, SHORT, and USOP are abbreviations for event driven, fund of funds, global, market neutral, short sales and U.S. opportunistic, respectively. These are dummy variables that have a value of one if a fund is in the specified category and zero otherwise. Global macro is the omitted fund category. *p*-values are given in parentheses.

Variable	2 Years	4 Years	6 Years	8 Years
Intercept	−3.478 (0.00)	−3.309 (0.00)	−3.545 (0.00)	−3.201 (0.00)
MGT	0.115 (0.00)	0.080 (0.11)	0.141 (0.03)	0.064 (0.43)
INCENT	0.002 (0.57)	0.001 (0.76)	0.002 (0.73)	−0.006 (0.37)
AGE	−0.001 (0.31)	−0.001 (0.33)	0.001 (0.48)	0.001 (0.63)
US	−0.079 (0.13)	−0.185 (0.01)	−0.190 (0.04)	−0.201 (0.12)
EVENT	−0.737 (0.00)	−0.712 (0.00)	−0.452 (0.00)	−0.327 (0.09)
FOF	−0.382 (0.00)	−0.452 (0.00)	−0.454 (0.01)	−1.048 (0.00)
GLOBAL	0.115 (0.22)	0.182 (0.14)	0.195 (0.22)	−0.005 (0.98)
NEUT	−0.644 (0.00)	−0.595 (0.00)	−0.403 (0.01)	−0.475 (0.02)
SHORT	0.333 (0.15)	0.347 (0.16)		
USOP	−0.001 (0.99)	0.025 (0.82)	0.122 (0.40)	−0.149 (0.39)
N	547	272	150	79
Adjusted R^2	0.234	0.310	0.274	0.285

According to the principal-agent framework discussed in Section I, the strong positive impact of incentive fee on performance confirms the importance of aligning investor and manager interests. There are several possible alternative explanations for this finding. Industry consultants suggest that higher incentive fees may attract superior managerial talent.[23] We cannot eliminate this hypothesis because we do not have data on managers' past

[23] For example, " 'Star' Managers Cultivate Hedge Funds," The Wall Street Journal, April 21, 1997, p. A17, argues that a growing number of mutual fund managers are leaving for the rich rewards of hedge fund management. Interestingly, the subtitle for this article is "Successes in Mutual Sector Aren't Always Repeated."

employment and performance. This alternative explanation, however, does suggest that managerial talent explains hedge fund returns. Brown et al. (1999) test and reject the managerial talent hypothesis.

It is also possible that the causation is from performance to incentive fee. Superior performance may allow a manager to negotiate a higher incentive fee. We can clearly reject this causation explanation because incentive fees rarely change. Incentive fees are fixed in the offer documents; they can be changed by a vote of interested parties but this almost never occurs. As evidence, we examine every case in which MAR or *Nelson's Directory of Investment Managers* reports incentive fee for two or more years during the period 1994–1996. We perform a similar exercise on the HFR data for 1996 and 1997. Out of 1651 consecutive year comparisons, only 11 changes in incentive fees were found. The data vendors contacted six of these 11 funds and in all six cases the change was a correction of inaccurate data, not an actual change in incentive fees. As an added check, HFR agreed to call 25 randomly selected funds with at least four years of performance data. None of these funds had changed their incentive fee during their existence.

With respect to the other three hedge fund characteristics, there is some weak evidence that management fees reduce risk-adjusted returns and U.S. funds outperform offshore funds. In Table VIII, the coefficient on management fee is always negative, but it is significant in only one of the four regressions. The U.S. hedge fund dummy is always positive, but is only significant in one regression and only at the 10 percent level. As we show in the next section, the U.S. hedge fund dummy understates the true difference between U.S. and offshore funds because offshore funds suffer from a stronger survival bias. The coefficient on hedge fund age is never significant.

The volatility regressions in Table IX give added insight into the potential source of the management fee and U.S. fund risk-adjusted performance findings. U.S. funds gain a risk-adjusted performance advantage by lowering risk. The coefficient on the U.S. dummy in Table IX is always negative and significant in two of the four regressions. This reduced risk may stem from the additional liabilities that U.S. managers incur from organizing as a limited partnership. Management fees increase the volatility of hedge funds. The coefficient on management fee is always positive and significantly so in half the regressions in Table IX. This is consistent with research that finds management fees create an agency problem.

Table VIII reveals that no one hedge fund category dominates. Event driven funds come the closest with all positive and two significant coefficients. Short sales appear to display the worst performance, but we can only measure the impact of short sales for the 2- and 4-year samples. All of the other categories display inconsistent signs across the four samples. In general, success in hedge funds is more complicated than simply picking the right category.

It is clear that hedge fund categories display dramatically different total risk profiles. In Table IX, the event driven, fund of funds, and market neutral categories display significantly lower return variances than the omitted category of global macro funds. Thus, one of the sources of the risk-adjusted

return advantage for event driven funds is their lower risk. The added diversification of fund of funds does work to lower volatility. Market neutral funds not only reduce systematic risk, but also total risk. In contrast, short sellers' drive for negative systematic risk increases the standard deviation of fund returns.[24]

Ex post variance measures may fail to capture the likelihood of extreme draws on the distribution that can cause serious problems for a highly leveraged hedge fund with illiquid securities. These problems are illustrated by the dramatic collapse of Long-Term Capital Management L.P. in 1998. Though our sample period (1988–1995) covers a complete business cycle and several global crises, the magnitude of these events do not match the depth of 1998 global crises. Therefore, some of the Sharpe ratio advantage for hedge funds may reflect compensation for the risk of these extreme events. However, several factors limit these risks for our sample. First, Long-Term Capital had leverage ratios as high as 100 to 1. The maximum leverage ratio reported in our sample is 20 to 1 for a disappearing fund and 12 to 1 for an extant fund. Only six other funds report leverage ratios of 5 to 1 or more.[25] Second, Long-Term Capital and the other defunct hedge funds mentioned in the press during 1998 were global or global macro funds.[26] The global categories are more likely to experience dramatic changes in their environment. This is true even during the 1988–1995 period. Of the 688 funds in our sample (both extant and disappearing), 38 have a monthly return greater than 25 percent in absolute value. Two-thirds of these are global or global macro funds. The hedge fund category performance results given in many of the tables demonstrate that our findings are not driven by the global categories. Third, hedge funds may be the 1990s equivalent of leveraged buyouts. Using agency theory based arguments, numerous academic studies find leveraged buyouts generated above-average returns (e.g., Kaplan (1989)). In the late 1980s, however, the combination of dramatic increases in competition, excesses in the debt markets, and a weakening economy demonstrated that there are limits to the level of debt. Similarly, the combination of dramatic growth in the size and number of hedge funds, lack of controls in the debt market, and a severe global crisis reveals limits to the leverage of hedge funds.

IV. Data-Conditioning Biases

The above findings are based on funds that report performance data for at least 24 consecutive months ending December 31, 1995. Performance studies of existing funds with a required return history may be artificially inflated

[24] The regressions reported in Tables VIII and IX are also subjected to standard outlier and heteroskedasticity tests without much effect on the results.

[25] Leverage is defined as the average leverage for the life of the fund. Leverage is reported for approximately half of the funds in our sample.

[26] We could find reference to extreme losses for Niederhoffer Funds, High Risk Opportunities Funds, Russia Value Fund, McGinnis Funds, and Croesus-UFG Russia Fund. All these funds are in the global categories.

if poorly performing funds are systematically omitted from the database. Mutual fund research confirms the existence of various forms of survivorship bias. A similar analysis of hedge funds is especially important because hedge fund performance displays greater variance than mutual fund performance. Volatility has been shown to be positively related to fund disappearance (Brown et al. (1992)).

We investigate the impact of six forms of related data-conditioning biases: survivor, termination, self-selection, liquidation, backfilling, and multiperiod sampling. Many of these biases have been identified in the mutual fund literature (e.g., Carhart (1997)). Survivor bias is the effect of considering only the performance of funds that are alive and present in the database at the end of the sample period. It occurs because some databases only keep a current list of funds or researchers start with a list of funds that exist at the end of their sample period. Termination and self-selection biases are two subsets of survivor bias. Some funds drop out of the hedge fund database because they cease to exist and others voluntarily stop reporting. Even studies that address the termination bias by studying the returns of discontinued funds may suffer from a liquidation bias. This bias occurs because disappearing funds may not report the final periods leading up to and including their liquidation. When a new fund is added, the database providers typically request the full performance history for that fund. This may result in a backfilling bias because only funds that survived the backlisting period are included. Researchers often sample only funds that exist for a certain period of time. This multiperiod sampling bias excludes not only funds that failed to survive for the whole period, but also funds that entered the sample during that period.[27]

A. Survivor Bias—Termination and Self-Selection

Survivor bias has received considerable attention in the mutual fund literature. To study survivor bias, we organize our tests in a manner that may be most likely to expose a difference between the performance of surviving and disappearing funds. In Table X, the performance of each disappearing fund during its entire available 1988–1995 return history is compared to the set of extant funds whose returns span the same interval. We perform this comparison over the exact time period for which we have a return series for the disappearing fund.[28] For this test, we include in the extant fund group all funds that report at the end of our sample period (December 1995) even

[27] The multiperiod sampling bias is closely related to Carhart's (1997) look-ahead bias. Both consider the impact of requiring funds to survive a minimum period of time. However, examining look-ahead bias requires a list of funds that can be tracked forward. Because of backfilling in the database, such a list is not available.

[28] Because our performance data are monthly, this methodology no longer allows use of an annual holding period, since we no longer measure returns over an integer number of years. We therefore use a holding period equal to the return history of the disappearing fund (an average of 31 months), or the reduced time period under study. Further tests demonstrate that our results are not sensitive to reasonable choices of the investor holding period.

Table X

Performance and Volatility Comparisons of Disappearing and Extant Funds

This table presents monthly total return, Sharpe ratio, and standard deviation of monthly total return statistics for funds that drop out of the databases versus funds that exist and are present in the databases at the end of 1995. The performance and volatility of each disappearing fund during its entire available 1988–1995 return history is compared to the set of currently extant funds whose returns span the same interval. The comparison is over the exact return history of the disappearing fund. The weighted average statistics weight each disappearing and relevant extant fund return by the number of months of the disappearing fund's return history.

	Disappearing Funds	Extant Funds	*p*-Value for Difference
Panel A: Performance Comparison for All Disappearing Funds (N = 141)			
Average monthly return	0.88%	0.79%	0.60
Weighted average monthly return	0.96%	0.97%	0.92
Median monthly return	0.81%	0.93%	0.12
Average Sharpe ratio	0.176	0.180	0.94
Weighted average Sharpe ratio	0.202	0.215	0.69
Median Sharpe ratio	0.152	0.202	0.12
Panel B: Volatility Comparison for All Disappearing Funds (N = 141)			
Average standard deviation of monthly returns	0.038	0.034	0.76
Weighted average standard deviation of monthly returns	0.039	0.035	0.12
Median standard deviation of monthly returns	0.034	0.029	0.06
Panel C: Performance Comparison for Disappearing Funds That Terminate (N = 37)			
Average monthly return	0.86%	0.84%	0.95
Weighted average monthly return	0.80%	1.00%	0.18
Median monthly return	0.60%	0.95%	0.00
Average Sharpe ratio	0.138	0.183	0.67
Weighted average Sharpe ratio	0.109	0.220	0.03
Median Sharpe ratio	0.088	0.204	0.00
Panel D: Performance Comparison for Disappearing Funds That Stop Reporting (N = 104)			
Average monthly return	0.88%	0.78%	0.55
Weighted average monthly return	1.03%	0.96%	0.50
Median monthly return	0.89%	0.93%	0.89
Average Sharpe ratio	0.190	0.179	0.85
Weighted average Sharpe ratio	0.241	0.212	0.45
Median Sharpe ratio	0.201	0.197	0.78
Panel E: Performance Comparison for U.S. Disappearing Funds (N = 87)			
Average monthly return	1.01%	0.87%	0.45
Weighted average monthly return	1.08%	1.00%	0.44
Median monthly return	1.02%	0.96%	0.65
Average Sharpe ratio	0.257	0.209	0.40
Weighted average Sharpe ratio	0.257	0.223	0.35
Median Sharpe ratio	0.206	0.206	0.88
Panel F: Performance Comparison for Offshore Disappearing Funds (N = 52)			
Average monthly return	0.65%	0.66%	0.98
Weighted average monthly return	0.73%	0.91%	0.24
Median monthly return	0.54%	0.88%	0.05
Average Sharpe ratio	0.033	0.127	0.33
Weighted average Sharpe ratio	0.086	0.200	0.04
Median Sharpe ratio	0.052	0.183	0.02

if they do not report for a full two years. This inclusion allows us to separate survivor bias from the multiperiod sampling bias that is explored in Section D. By neither truncating the returns of disappearing funds on either end by calendar year, nor assuming their investors buy into the average fund for the remainder of the calendar year in the year of disappearance, we may be best positioned to detect a performance differential between groups. We test for differences in the mean and median absolute returns and Sharpe ratios of disappearing and extant funds. We also weight each fund's return by the number of months of the disappearing fund's return history. This attempts to correct for the possibility that funds with the shortest return histories, which are most likely to produce performance outliers, have the largest impact on the results.

Panel A in Table X suggests that disappearing funds tend to be subpar performers. However, this below-average performance is generally small and it is never statistically significant. The underperformance of disappearing funds is larger for the Sharpe ratio than the monthly total return, which suggests that disappearing funds are more volatile. Panel B confirms that variance and disappearance are positively correlated, but again the findings are not statistically significant. These findings are weaker than other research in mutual funds and Brown et al.'s (1999) findings for hedge funds. As the next panels show, voluntary reporting by hedge funds explains our weaker findings. Survival bias analysis in hedge funds is complicated by the interaction of two distinct biases: a termination bias and a self-selection bias. SEC regulation causes strong U.S. and offshore differences in the importance of these two biases.

The performance of terminating funds is shown in Panel C. Consistent with prior literature, there is evidence that terminating funds are poor performers. Terminating funds underperform the comparable set of extant funds in five of six comparisons, and three of these cases are statistically significant. On average, the performance of terminating funds is approximately two-thirds the extant funds' performance.

Panel D presents identical tests for funds that stop reporting. These funds outperform the relevant set of extant funds in five of six cases, but the difference is never significant. This neutral result is consistent with the idea that both superior and inferior funds voluntarily end reporting.

If a self-selection bias is indeed balancing a terminating-fund bias, we might expect to observe a larger variance of individual fund performance figures for disappearing than extant funds, as revealed by an F-test. For each disappearing fund, we randomly select 100 funds, with replacement, from the comparison group of extant funds. We perform distinct randomized comparisons for both the raw return and Sharpe ratio, generating a total of 200 comparisons. There is strong evidence that the variance in performance is larger for disappearing funds. In 197 of 200 comparisons the variance of disappearing funds is larger, and in 182 of these 197 cases the difference is statistically significant. The performance of disappearing funds is clearly

more extreme, which is also consistent with the interpretation that a self-selection bias is balancing a terminating-fund bias.

United States and offshore funds provide further evidence into the balance between self-selecting and terminating funds. Superior U.S. funds have two reasons to withdraw from the databases: they are within arm's length of potential SEC regulation and they may no longer desire exposure if they have reached the 100 investor limit. We therefore expect a larger percentage of U.S. funds to self-select. The information in Panels E and F of Table X is consistent with this hypothesis. Though U.S. and offshore funds are roughly equally represented in our overall sample, 87 disappearing funds are U.S. funds. Only 52 disappearing funds are offshore funds. Of the 87 U.S. funds that drop out, only 14 give termination as their reason for departure. Twenty-three of the 52 disappearing offshore funds confirm that they terminate.

Panel E in Table X reveals that disappearing U.S. funds outperform the control group of extant funds in all six tests, though the difference is never statistically significant. Offshore funds always underperform the control group, and three of the tests are significant. This latter finding is consistent with the Brown et al. (1999) survival analysis of offshore hedge funds.

In sum, survivor analysis of U.S. and offshore hedge funds must recognize two counteracting biases, termination and self-selection. For our sample, the net impact of these two effects is small. One rough way to measure the impact of net survivor bias is to average the performance differences between disappearing and extant funds in Panel A of Table X. Across the three raw return measures, this average is 0.013 percent. Excluding disappearing funds has virtually no impact on our assessment of overall performance. This self-selection bias has two interesting implications for hedge fund research. First, some hedge funds may not actively seek new money, because there may be diminishing returns to their arbitrage strategies. Second, some of the best hedge fund managers may be opting out of the databases.

B. Liquidation Bias

For some of the terminated funds additional return activity may follow the final monthly performance figure recorded in the database. While the database providers make painstaking efforts (including multiple follow-up phone calls and faxes for approximately one year after disappearance) to minimize this effect, it is conceivable that funds lose substantial value in the period subsequent to reporting. Investors in terminating funds may experience discounts in value due to liquidation of underlying fund holdings, and a delay in redemption of proceeds.

At our request, HFR agreed to poll each of their terminating funds to examine whether the information recorded in their database reflects the timing and the amount of money returned to investors. HFR was able to recover all returns through the instant of redemption for all of their terminating funds. It turns out that they already track a majority of terminating

Table XI

Evidence on the Impact of Backfilling

This table compares hedge fund performance with and without each fund's first two years of monthly return data eliminated. After this truncation, the performance of the fund over each sample period is compared with its performance during the sample period that begins two years earlier and includes the fund's first two years of return data. The samples comprise MAR and HFR hedge funds that retain at least two, four, six, and eight years of consecutive monthly return data ending December 31, 1995 after the fund's first two years of monthly return data are eliminated. *N* represents the number of hedge funds in the given comparison. *p*-values are not reported because none of the differences are statistically significant.

Sample Period (in years) Ending December 31, 1995	*N*	Annual Returns with (without) Each Fund's First 24 Months of Performance Data Eliminated		Sharpe Ratio with (without) Each Fund's First 24 Months of Performance Data Eliminated	
		Mean	Median	Mean	Median
2	272	9.3% (9.2%)	9.2% (8.9%)	0.145 (0.145)	0.134 (0.121)
4	150	14.3% (14.7%)	13.5% (13.9%)	0.313 (0.297)	0.276 (0.291)
6	79	14.3% (14.6%)	13.0% (13.4%)	0.215 (0.241)	0.189 (0.220)
8	40	16.8% (16.1%)	15.8% (15.0%)	0.238 (0.231)	0.250 (0.235)

funds through redemption. For these funds, redemption does not necessarily occur at the end of the final month of reporting, so the final month's return is already slightly disadvantaged. The remainder of the funds show short additional return histories and minimal delays in redemption. Overall, the average loss in fund value beyond the information contained in the database is only 0.7 percent, and the average delay between the final return reported in the database and actual redemption is 18 days. Post-reporting returns appear to have a negligible impact on our results.

C. Backfilling Bias

Because we do not know when funds were added to the database, we cannot determine the exact amount of backfilling. An indirect approach to addressing backfilling, commonly employed in equity market papers using COMPUSTAT data (e.g., Fama and French (1993)), is to eliminate the first two years of reported data. These years should contain the most backfilled data. Given that hedge fund time-series data are limited, eliminating two years a priori is too costly. Instead, we compare the results for each of our time periods with and without the first two years of each fund's returns eliminated. If eliminating these two years does not affect the results, backfilling is less likely to be a concern.

With and without each fund's first two years of performance data, the raw return and Sharpe ratio statistics in Table XI closely track one another. Nine of the 16 performance statistics are actually larger when the first two years of data are discarded. None of the differences are significantly different. Averaging across the sample periods, we find that eliminating the first two

Table XII
Performance Comparison of Funds with and without Full 1994–1995 Return History

This table compares the monthly total return and Sharpe ratio statistics for funds with and without 24 consecutive months of return data ending December 1995. The performance of each combined MAR and HFR hedge fund without a complete 1994–1995 return history is compared to the set of MAR and HFR hedge funds with full performance history during this period. The comparison is over the exact 1994–1995 return history of the fund without complete 1994–1995 performance data. Funds with three or fewer months of return history are excluded because they may produce extreme Sharpe ratios.

	Funds without Full 1994–1995 Return History (N = 452)	Funds with Full 1994–1995 Return History (N = 547)	p-Value for Difference
Average monthly return	0.98%	0.79%	0.05
Weighted average monthly return	0.86%	0.74%	0.10
Median monthly return	0.81%	0.86%	0.84
Average Sharpe ratio	0.255	0.247	0.79
Weighted average Sharpe ratio	0.225	0.208	0.50
Median Sharpe ratio	0.206	0.199	0.89

years of each fund's return data increases the raw return by 0.05 percent per year and decreases the Sharpe ratio by 0.003. Both of these figures change the full sample values by 1 percent or less. This finding is part of a consistent pattern indicating that nonreporting or disappearing hedge funds contain more winners than is typical of other databases where reporting is more mandatory or universal.

D. Multi-Period Sampling Bias

The main performance tests in this paper require a fund to have multiple, consecutive years of return data ending December 31, 1995. Conditioning on survival over multiple years may impart an upward performance bias. In Table XII we compare funds with less than full performance history during 1994–1995 to funds with complete performance history during this period. Funds with less than full history during 1994–1995 include funds that both disappear or begin during this interval. We examine this bias during 1994–1995 because both HFR and MAR kept track of disappearing funds during this time.

Averaging across the three raw return measures, funds with a less than complete 1994–1995 return history actually outperform funds with a complete history by 12 basis points per month. Since these funds represent one-third of the total return activity during 1994–1995, their inclusion would raise our performance measures by three basis points per month. There is no evidence that conditioning on a fund existing for multiple years biases performance upward.

In sum, we find that basing our performance results on extant funds with a required return history does not introduce a systematic bias. Consistent with the mutual fund literature, we find direct evidence that hedge funds that cease to exist perform poorly. However, this terminating fund bias is countered by a self-selection bias, which has no clear counterpart in mutual funds. Superior performing funds may voluntarily withdraw from the databases because they are able to raise sufficient funds on their own, and therefore derive little benefit from the exposure provided by the database. Economically and statistically, these terminating fund and self-selection biases appear to offset. We also do not find evidence that other conditioning biases influence our conclusions from using only extant funds.[29] Because the conditioning biases for hedge funds are weaker than those found in mutual funds, our comparisons with mutual funds in Table VI are biased against hedge funds.

V. Conclusion

Hedge funds display many attractive organizational features that should help align the interests of hedge fund managers and investors. Hedge fund managers tend to invest heavily in their own fund; most receive a substantial portion of their pay in the form of incentive fees; and many are general partners with liability for extreme losses. Hedge fund managers also have a substantial amount of latitude and flexibility with respect to investment strategies because they are largely unregulated and because they attract larger, more sophisticated investors. By contrast, most mutual fund managers do not receive incentive-based compensation and they are much more conservative in employing investment options such as leverage, derivatives, concentrated investments, and short selling.

This combination of incentive alignment and investment flexibility gives hedge funds a clear performance advantage over mutual funds. Using 2-, 4-, 6-, and 8-year samples all ending in December 1995 with 547, 272, 150, and 79 hedge fund observations, we find that the average (median) hedge fund Sharpe ratio is 21 (11) percent higher than comparable mutual fund Sharpe ratios, and this performance advantage increases when we match funds by region (United States, international, and global). Hedge funds achieve this

[29] Another common indirect approach to assessing potential data-conditioning biases is the appraisal ratio (Treynor and Black (1972)). This ratio is defined as Jensen's α divided by the residual standard deviation. The appraisal ratio lowers the value of Jensen's α for funds that are riskier and therefore less likely to survive. Like our Jensen's α results, the appraisal ratio is positive and significant for all time periods, except the 2-year sample. A related approach is to take the weighted average of Jensen's α, using the residual standard deviations as weights. This measure is directly comparable to Jensen's α. The weighted average is 16 percent lower than the unweighted average, but very close to the median Jensen's α. These findings suggest that fund risk does play some role in explaining high hedge fund returns, but this role is a minor one.

Sharpe ratio superiority despite their higher total risk. The average (median) total risk is 27 (12) percent higher for hedge funds. Thus, some of the characteristics that enhance hedge fund performance may not be appropriate for mutual funds that attract undiversified, risk-averse clients.

Despite their advantage over mutual funds, hedge funds are unable to consistently beat the market when absolute or total risk-adjusted returns are used. We compare hedge funds to eight standard market indices with mixed results. The winner in this comparison depends on the time period, the index, and the hedge fund category. This overall neutral result does suggest that hedge funds are able to outperform the market on a gross return basis. On average, their ability to earn superior gross returns is about equal to the incentive and administrative fee. This is consistent with an efficient market for researching and exploiting information on mispriced securities. Hedge funds may play an important role in improving market efficiency, especially given their ability to use concentrated investments, take an active role in corporate governance, and invest in illiquid securities. Because mutual funds are often limited in their ability to employ similar strategies, they may not be able to earn back their fees. This conclusion is more consistent with the literature that finds mutual funds earn subpar net returns (e.g., Jensen (1968) and Elton et al. (1993)) than those papers that find they recover their fees (e.g., Ippolito (1989)).

Although our results suggest that hedge funds offer little advantage over indexing, the low beta values on hedge funds make them a potentially valuable addition to many investors' portfolios. An Elton et al. (1987) test indicates that hedge funds always enhance a portfolio containing any of the eight indices considered.

We have some success in linking these superior returns to the organizational features of hedge funds. Incentive fees are the most important and significant determinants of risk-adjusted return. An increase in the incentive fee from zero to the median value of 20 percent leads to an average increase in the Sharpe ratio of 66 percent. Incentives are effective at aligning manager and investor interests or attracting top managers. Contrary to theoretical arguments, a higher incentive fee does not increase managers' proclivity to take on risks. The coefficient on incentive fee in a total risk regression is always insignificant and does not even display a consistent sign. We also find some potentially interesting differences between U.S. and offshore hedge funds. United States hedge funds display consistently significantly lower total risk than offshore funds, even after controlling for differences in hedge fund categories. This lower risk consistently translates into a Sharpe ratio advantage for U.S. hedge funds, but this advantage is only marginally significant in one of four regressions. These findings may reflect the additional liability that U.S. managers face because U.S. funds tend to be limited partnerships instead of corporations. Management fees consistently raise total risk and reduce Sharpe ratios, although the risk effects are statistically more powerful. Fund age never significantly influences risk or

return in our sample. Finally, we find some significant differences in the total risk profiles of specific hedge fund categories, but these risk differences do not translate into consistently significant risk-adjusted performance advantages.

We investigate six related data-conditioning biases. Of these, the termination and self-selection biases are most powerful. Funds that terminate have significantly lower median (but not mean) performance measures than extant funds. However, funds that cease voluntary reporting contain a mix of over- and underperformers with a slight edge to the overperformers. This self-selection problem arises mainly from U.S. regulations on advertising and limits on the number of investors.[30] The survivor bias is a combination of the termination and self-selection biases. For the whole sample and the U.S. hedge fund subset, the self-selection bias dominates, leading to no significant difference between extant and disappearing funds. For offshore funds the termination bias dominates. Following terminating funds through liquidation (liquidation bias) does exacerbate the termination bias, but the impact is minimal. Our indirect tests for backfilling and multiyear sampling biases suggest that these effects are generally small.

These hedge fund conclusions warrant several caveats. First, we have only a limited time period to evaluate hedge funds, and many findings in finance have been sensitive to the time period studied. Second, the diverse and flexible investment options employed by hedge funds make it difficult to classify hedge funds, identify the correct benchmark, and thus measure relative performance. We attempt to compensate for this potential problem by using numerous market indices, by using the Sharpe ratio that does not rely on index benchmarks, and by comparing carefully matched hedge funds and mutual funds. However, none of these solutions allow us to estimate systematic risk with any confidence. Thus, we are unable to account for one of the potential advantages of hedge funds, low systematic risk. On the other hand, our standard deviation of return measure of total risk may not fully capture the complex risk taking from hedge funds' dynamic, highly leveraged strategies. Though our time period of 1988 through 1995 covers almost a complete macroeconomic cycle, there are states of nature that have not occurred over this period that might expose some unique hedge fund risks. The substantial losses for several hedge funds in reaction to the global crises of 1998 demonstrate the impact of these extreme events. The most dramatic negative returns have occurred in highly leveraged global hedge fund categories. Global and global macro hedge funds demonstrate the most extreme observations even during our sample period. Eliminating these categories from our analysis would not change our hedge fund performance conclusions. Further, the extent of leverage observed in the most prominent 1998 hedge fund collapse is five times the maximum observed in our 1988–1995 sample. Still, the apparent superiority of hedge funds over mutual funds may reflect an

[30] Since the limit on the number of investors was eased in 1996 and 1997, the self-selection bias may become less pronounced in post-1997 data.

underestimation of true hedge fund risk. Fourth, varying policies on high-water marks, fee allocation mechanisms, the treatment of new and existing investors, and hurdle rates complicate the incentive fee analysis. Our measure of incentive fees does not control for these complications. Monthly incentive fees, therefore, contain an unknown reporting bias that may be as important as depreciation rates, common cost allocation, and transfer pricing issues in accounting profits. Additionally, we have no data on other important incentive alignment features such as the amount of money that managers invest in their own fund. Fifth, some of our data-conditioning bias conclusions, especially backfilling, depend on indirect tests. Unfortunately, our data sources do not have any information on when a fund entered the database to directly address the backfilling bias. Such a list exists for offshore funds, but as we show the conditioning biases may be different for U.S. and offshore funds. These caveats pose opportunities for future research. These opportunities combined with the wealth of other fund-related issues should make hedge funds a fruitful area for extensive research.

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