Performance Characteristics of Hedge Funds and Commodity Funds: Natural Versus Spurious Biases

by

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Abstract

It is well known that the pro forma performance of a sample of investment funds contains biases. These biases are documented in Brown, Goetzmann, Ibbotson and Ross (1992) using mutual funds as subjects. The organization structure of hedge funds, being private and often offshore vehicles, makes data collection a much more onerous task. This amplifies the impact of performance measurement biases. This paper reviews these biases in hedge funds. We also propose using funds-of-hedge funds to measure aggregate hedge fund performance, based on the idea that the investment experience of hedge fund investors can be used to estimate the performance of hedge funds.

I. Introduction

Hedge funds and commodity funds are interesting for investors and academics, because they present very different return profiles than mutual funds. In this emerging research effort, much attention has focused on documenting the general characteristics of fund performance. One set of results, first reported in Fung and Hsieh (1997a), is that the returns of hedge funds typically have low correlation to standard asset indices. This is documented more extensively in Schneeweiss and Spurgin (1998) and confirmed in all subsequent studies. A second set of results, reported in Fung and Hsieh (1997a) and confirmed in Brown, Goetzmann, and Ibbotson (1999) and Brown, Goetzmann, and Park (1997), showed quantitatively that there are many hedge fund styles, each exhibiting different return characteristics. In addition, Fung and Hsieh (1997a, 1997b) presented evidence that some of these styles can generate option-like returns. These are the types of interesting performance that make hedge funds and commodity funds valuable as "alternative investments" to the standard asset classes.

These two sets of results have important implication for the construction and risk management of portfolios of hedge funds. On the whole, hedge funds are "zero-beta like"

investments.[1] It is well known that, although zero-beta securities have no systematic risk, there is absolute risk. For example, there have been cases of hedge fund failures in a manner that is consistent with having "event risk" in their trading styles. A case in point is Long-Term Capital Management (LTCM). From inception until mid-1998, LTCM's returns had low correlation with any of the major asset markets and had a standard deviation comparable to that of the S&P 500 index. While LTCM had low systematic and absolute risk as measured by conventional methods, it nonetheless had significant risk that was evident in the second half of 1998.

The zero-beta and event risk performance characteristics meant that simple linear statistical measures such as standard deviations, Sharpe ratios, and correlations with standard asset indices can be misleading measures of hedge fund risk. These caveats were clearly noted in Fung and Hsieh (1997a). Therefore to understand risk and return of hedge funds, one must model their dynamic trading strategies. For example, Fung and Hsieh (1999b) applied option strategies to model trend following strategies.

Against this background, there are two approaches to further our understanding of hedge fund investing.[2] One approach

asks the question: "As an investment category, what kind or risk return characteristics does the hedge fund industry offer as a whole?" The other, more detailed question, is: "How does one go about constructing hedge fund portfolios and manage the ongoing risk?" These are two distinct approaches for the following reasons.

We refer to the first question as the performance measurement question. Its answer should communicate to investors whether the general performance profile of the hedge fund industry is attractive. Once convinced that the general performance characteristics of the industry add value, investors can directly access these returns by employing fund-of-hedge funds managers. In essence, the due diligence, portfolio construction, and risk management process associated with the investment are externalized to outside agents, and the investors need not be concerned with the second question directly. We therefore refer to this second question as the portfolio management question.

If an investor wishes to directly manage an investment in hedge funds, then answers to the portfolio management question are essential. This of course will entail the development of an analytical framework to assess the many trading styles offered

by hedge fund managers, extensive due diligence efforts, and tools to assist in the construction and ongoing management of the portfolio. These two approaches are not mutually exclusive. Indeed, institutional investors have pursued them in parallel as part of an overall management strategy.

There are some basic impediments to delivering succinct answers to these two questions. Information on hedge funds are not easily available. In the US, hedge funds are generally offered by way of private placements, which are exempt from the registration and disclosure requirements that govern the issuance and trading of public securities. Hedge funds domiciled in a number of offshore financial centers generally operate with less restrictions, disclosure requirements and regulatory supervision. The lack of disclosure requirement makes it difficult to obtain information on hedge funds, particularly so in the US because the Securities Exchange Commission explicitly limits the ability of offshore hedge funds to disseminate information about their activities. There is no industry association for hedge funds, like the Investment Company Institute, that provides general information with attested accuracy for mutual funds. Well known database suppliers of mutual fund data such as Morningstar do not offer a

comparable service for hedge funds. Investors and academics have relied on information collected by database vendors from hedge fund managers who would cooperate. Recent published work[3] have used data supplied by TASS Investment Research, MAR/Hedge, and Hedge Fund Research (HFR).

This paper focuses on the performance measurement question. At a basic level, investors and academics want to measure the performance of a typical investment in hedge funds. We use the concept of the 'market portfolio' of hedge funds to denote the value-weighted portfolio of all hedge funds. The return to the market portfolio of hedge funds provides the aggregate investment experience in hedge funds, analogous to the concept of market portfolio in the Capital Asset Pricing Model, such as the CRSP (Center for Research in Security Prices) value-weighted portfolio in all stocks.

The return of the market portfolio of hedge funds can be easily calculated if one had access to the complete record of performance data and assets under management of all hedge funds, including those that have ceased operation. Unfortunately, no such record exists. As private investment vehicles, hedge funds are simply not required to disclose their performance to the

public. Thus, the market portfolio of hedge funds is not observable.

Typically, the market portfolio is proxied by an equally weighted portfolio of the hedge funds in a database collected by database vendors. We call this the 'observable portfolio.' A comprehensive tabulation of the basic performance statistics using this approach was reported in Schneeweis and Spurgin (1998). More recently, similar results were reported in Brown, Goetzmann, and Ibbotson (1999), and Ackerman, McNally, and Ravenscraft (1999).

Two potential biases can arise when using the portfolio of hedge funds in a database to proxy the market portfolio. A 'selection' bias occurs if the hedge funds in the observable portfolio are not representative of the universe of hedge funds. An 'instant history' bias occurs if database vendors backfill a hedge fund's performance when they add a new fund into their database. The returns of the observable portfolio can be used to proxy those of the market portfolio if we can adjust for selection bias and instant history bias. Leaving aside issues on data collection methods, selection bias is a natural consequence of the way the hedge fund industry is organized,

whereas instant history bias is synthetically generated by database collection methods.

The calculation of the return of the 'observable portfolio' of a given database requires an accurate record of funds entering and leaving that database. A crude and biased method is to use the performance of only 'surviving' funds, i.e., those hedge funds in a database that are still in operation. We call this the return of the 'surviving portfolio'. This procedure can lead to 'survivorship bias,' if funds dropped out of a database because of performance reasons.[4] The returns of the surviving portfolio can be used to proxy that of the market portfolio if we can first adjust for survivorship bias, and then selection as well as instant history biases. Like selection bias, survivorship bias is also a natural bias in the sense that it arises naturally from the birth, growth and death process of hedge funds.

These biases are recognized by most database vendors and academics. See, for example, Brown, Goetzmann, and Ibbotson (1999), Brown, Goetzmann, and Park (1997), Fung and Hsieh (1997b), and Ackerman, McNally, and Ravenscraft (1999). Once the biases have been identified and estimated, researchers can

obtain a more accurate estimate of the return of the market portfolio of hedge funds.

The purpose of the present paper is to provide an overview of these data issues and new results using the TASS database as of September 1999. We also propose a simple alternative for measuring the returns of the market portfolio that is founded on practicality and not on statistical techniques.

II. Survivorship Bias

Typically, hedge fund data sold by database vendors contain only information for funds that are still in operation. The same is true of Morningstar's mutual fund database. The rationale appears to be based on the assumption that "subscribers to these data services are only interested in funds with whom they can invest their capital."

Databases containing information only on existing funds are known to contain potential biases. To explain these biases, it is common practice to distinguish between 'surviving' funds and 'defunct' funds. 'Surviving' funds refer to those funds that are still in operation and are reporting information to the database vendor at the end of the data sample. 'Defunct' funds refer to those funds that have left the database for any number

of reasons, including bankruptcies, liquidations, mergers, name changes, and voluntary stoppage of information reporting. If funds become defunct primarily because of poor performance, then the historical performance of surviving funds is an upward-biased measure of the experience of a typical hedge fund investor, who would have invested in both surviving and defunct funds. This bias is known as 'survivorship' bias, and has been well documented in the mutual fund literature. See, for example, Grinblatt and Titman (1989), Brown, Goetzmann, Ibbotson, and Ross (1992), and Malkiel (1995).

II.A. Survivorship Bias Is the Difference in Performance Between the Observable and the Surviving Portfolios

Following Malkiel (1995), we measure survivorship bias as the difference in the performance of two portfolios. One portfolio is the 'observable portfolio'. It invests equal amounts in each fund in the database each month starting from the beginning of the data sample. When new funds are added to the database, the portfolio is rebalanced to maintain equal investment in each fund. Similarly, returned capital from defunct funds is reinvested in the remaining funds. This portfolio represents a simple strategy of investing in all funds

in a database each month. If there is no selection bias (i.e. if the database contains a representative sample of the universe of hedge funds), the return of this portfolio measures the performance of the entire industry, progressing naturally through the birth, growth, and death process of individual funds.

The other portfolio is the 'surviving portfolio.' It invests equal amounts in all funds that are still in the database as the end of the sample. The treatment of new funds is as in the observable portfolio, but by construction there are no defunct funds in the surviving portfolio. The return of the surviving portfolio is often referred to as the "pro forma" returns of a given set (or portfolio) of funds. Specifically, the surviving portfolio represents the experience of an investor who avoids all defunct funds. On the one hand, this investor escapes from the poor performance of funds that goes out of business, but will not benefit from having good performing funds that no longer accept capital and stop reporting to database vendors.[5]

Calculating the performance of the observable portfolio of hedge funds represents quite a challenge. In the absence of a central repository for hedge fund information, it is nearly

impossible to find complete and accurate information on funds after they have ceased operation or have limited the release of performance information to investors. Database vendors can only offer information on funds that have dropped out of their own databases. Since many vendors started collecting hedge fund data in the early 1990s, at best they can only have incomplete records of defunct funds in the 1980s.

Before proceeding, we remark here that the equally weighted portfolios are not meant to represent actual investment experience, since it is not possible to reallocate across hedge funds on a monthly basis. A value weighted construct is a more natural gauge of investment experience. However, assets under management are frequently incomplete or simply not available in hedge fund databases, so the equally weighted construct is the only proxy that can be calculated from individual hedge funds.

II.B. The Survivorship Bias in Commodity Funds

We start our review of survivorship bias in commodity funds. Commodity funds are funds managed by commodity trading advisors (CTAs), who trade primarily futures contracts.

For individual commodity funds[6], estimates of survivorship bias can be found in Schneeweiss, Spurgin, and McCarthy (1996),

Fung and Hsieh (1997b), and Diz (1999). Using data provided by TASS, Fung and Hsieh (1997b) examined surviving and defunct funds operated by commodity trading advisors (CTAs) from 1989 to 1995. They found that a commodity fund drops out of the database with a probability of 19% per year, which is high compared to the 5% drop out rate in mutual funds.[7] The survivorship bias, i.e., the performance difference between the surviving portfolio and the observable portfolio, averaged 3.4% per year. In contrast, the survivorship bias in mutual funds was estimated to be in the range of 0.5% to 1.5% per year.

In this paper, we updated the results of Fung and Hsieh (1997b) by adding two more years of data. Between 1989 and 1997, the observable portfolio returned, on average, 15.5% per year, while the surviving portfolio returned 19.1%. The survivorship bias in commodity funds is therefore 3.6% per year. This is higher than the 1.4% estimate implied by the information in Schneeweis, Spurgin, and McCarthy (1996), but the conclusions are similar.

II.C. The Survivorship Bias in Hedge Funds

In the arena of hedge funds, estimates of survivorship bias can be found in Brown, Goetzmann, and Ibbotson (1999), and

Brown, Goetzmann, and Park (1997). Brown, Goetzmann, and Ibbotson (1999; hereafter referred to as BGI) studied annual returns of offshore hedge funds listed in the 1989 through 1995 issues of the *US Offshore Funds Directory*. Offshore hedge funds differ from onshore hedge funds as follows. An onshore hedge fund accepts US domiciled investors and operates under the regulatory environment described in the previous section of the paper. In particular, an onshore hedge fund cannot have more than 100 investors.[8] An offshore hedge fund operates outside the US, accepting primarily non-US persons. Typically, many hedge fund managers operate simultaneously onshore and offshore vehicles employing almost identical strategies.[9] Thus BGI argued that their offshore hedge fund sample is reasonably representative of hedge funds.

As noted by BGI, their sample was largely free of survivorship bias, with one exception. The *US Offshore Funds Directory* contained funds that were in operation at the end of each year. Missing were funds that were operating at the end of the previous year but dropped out of the sample in the subsequent year. While this might introduce a small bias in the returns of hedge funds, the magnitude of this bias should be a fraction of the normal survivorship bias.

BGI found that offshore funds have a 20% drop out rate, and their returns averaged 13.3% per year. They estimated the survivorship bias to be 3% per year. In other words, the surviving portfolio of offshore funds operating at the end of 1995 had an average historical return of 16.3% per year.

Brown, Goetzmann, and Park (1997; hereafter referred to as BGP) used the TASS hedge fund and commodity fund database. Table 1 in BGP indicated that TASS began keeping track of defunct funds as of 1994. There were 244 defunct funds from 1994 to 1996. BGP found that, during the period 1993-1996, hedge funds had a drop out rate of 15%, and the observable portfolio returned on average 12.2% per year with a standard deviation of 4.8%. These results are similar to those for offshore funds in BGI.

While BGP did not provide a direct estimate of the survivorship bias, we analyzed the TASS hedge fund database as of September 1999. This database contained 1,120 surviving and 602 defunct hedge funds. The estimates of survivorship bias are summarized in Table 1. The surviving portfolio had an average return of 13.2% from 1994 to 1998, while the observable portfolio had an average return of 10.2% during this time. From

this we can infer that the survivorship bias is 3.0% per year for hedge funds.

In summary, the survivorship bias in commodity funds is 1.4-3.6% per year, while it is roughly 3% per year in hedge funds.

II.D. The Performance of Different Types of Defunct Funds

The TASS hedge fund database provides some explanations for why 602 funds become defunct: 60% were liquidated, 4% were merged into another fund, 28% were removed because the manager stopped reporting return information; no explanation were available on the remaining 8%. Table 1 provides the average returns for three types of defunct funds. It shows that defunct funds (regardless of their reason for becoming defunct) typically have lower returns than surviving funds. Funds that liquidated, however, performed substantially worse than funds that became defunct for other reasons. During 1994-98, the portfolio of liquidated funds averaged –0.4% per annum, while the portfolio of merged funds and the portfolio of funds that stopped reporting returns averaged 7-8% per annum.

These results, along with those of BGI and BGP, are different from a recent study by Ackerman, McNally, and

Ravenscraft (1999; hereafter referred to as AMR), who found that the average returns of defunct funds were not lower than the returns of surviving funds. It is possible, as suggested by AMR, that differences in the data can account for the divergent findings. AMR merged the HFR and MAR databases, while BGI, BGP, and our papers used the TASS data set. In addition, AMR included funds-of-hedge funds in their analysis, while the other papers did not.[10]

III. "Instant History" Bias

So far we have shown how to adjust the returns of the surviving portfolio to obtain a proxy of the returns of the observable portfolio (which is more difficult to calculate). Next, we discuss how to adjust the returns of the observable portfolio to obtain a proxy of the returns of the market portfolio without instant history bias.

When a vendor adds a new fund into a database, historical returns are often "back filled." In the words of Park (1995), funds come into a database with "instant histories." This happens because it is much easier for fund managers to market themselves if they had "good" track records. New hedge funds typically undergo an "incubation" period, trading on money from

the manager's friends and relatives. After compiling "good" performance, these funds then market themselves to database vendors and hedge fund consultants. When vendors put these funds into their databases, they "back fill" the earlier returns during the incubation period.

Park (1995) estimated the incubation period to be 27 months in the MAR CTA database. BGP found the incubation period in the TASS CTA database to be 27 months as well, but 15 months in the TASS hedge fund database.

Here, we update the BGP results for commodity funds. We do this using two portfolios. The first is the (aforementioned) observable portfolio, which naively invests in all of the existing funds each month. The second portfolio (called the adjusted observable portfolio) invests in all of the existing commodity funds each month after deleting the first 27 months of returns. For the period 1989-1997, the adjusted observable portfolio's return averaged 11.9% per year, while that of the observable portfolio was 15.5%. This gives an estimate of 3.6% per year for the instant history bias.

For hedge funds, TASS actually provides direct information on the incubation period, i.e., the lag between the inception date of a fund and the date it entered the TASS database. Table

2 provides the distribution of the incubation period for the hedge funds in the TASS database. The median was 343 days or roughly 1 year. This is very close to the estimate of 15 months in BGP. We therefore calculated the adjusted observable portfolio by dropping the first 12 monthly returns from each hedge fund. This portfolio returned an average of 8.9% during 1994-98. Previously, we found that the observable portfolio's return averaged 10.3%. Thus, the instant history bias for hedge funds is therefore 1.4% per year.

Note that BGI's data did not have any instant history bias. They found that, when a fund was first listed in the US Offshore Funds Directory, it typically had more than one year of return history. BGI found the average return of offshore hedge funds to be 13.3% per year, very similar to the 12.7% estimated from the TASS hedge funds.

Once again, a contrary conclusion was reached in AMR, who found that there is no instant history bias in their data. This difference might be a result of the difference in datasets (mentioned earlier). In addition, AMR measured instant history bias differently than Park (1995), BGP, and the present study.

IV. Selection Bias

A hedge fund consultant needs the consent of a hedge fund manager before information can be released to a third party. This creates the possibility of selection bias. Presumably, only funds with good performance want to be included in a database, which means that the returns of funds in the database are higher than the returns of all existing funds.[11] This means that a vendor's database may not provide a true picture of the achievable performance of all funds available for investment.[12]

While there are no estimates of the size of the selection bias in hedge funds, Fung and Hsieh (1997a) found anecdotal evidence suggesting that the selection bias could be limited. Managers with superior performance did not necessarily participate in vendors' databases, particularly when the managers were not interested in attracting more capital. For example, George Soros's Quantum Fund has been closed to new investments since 1992 even though Quantum has a legendary performance record. In fact, Quantum has regularly returned capital to investors to keep the fund's assets under management around $5 billion. However, database vendors have been able to obtain Quantum's returns through other public sources. In contrast, Long-Term Capital Management successfully kept its performance from database vendors and from the general public

since its inception.[13] This anecdotal evidence indicates that there are offsetting factors at work. While some hedge fund managers are eager to include their "good" performance in vendors' databases, other managers have deliberately kept their "good" performance away from them. This limits the magnitude of the selection bias.

It would certainly be interesting to study the selection bias in hedge fund and commodity fund databases. However, to do this accurately, we need the input from the investors of funds that do not generally disclose their performance data to database vendors. This task is not likely to be achieved by academics alone. In the next section, we propose a less onerous alternative that could provide empirical clues to measuring the selection bias.

V. Funds-of-Hedge Funds As A Proxy of the Market Portfolio of Hedge Funds

We now introduce a third proxy for the market portfolio of hedge funds using an equally weighted portfolio of funds-of-hedge funds. The idea is quite simple. If we want to estimate the investment experience of hedge funds, it is natural to look at the experience of hedge fund investors themselves. In this

context, funds-of-hedge funds represent typical investors in portfolios of hedge funds with generally available performance history.

Unlike mutual funds, where the concept of funds-of-mutual funds has not gained popularity, the structure of the hedge funds market has led to the demand for and the existence of funds-of-hedge funds. There are many reasons why the "market portfolio of hedge funds" is not a practical investment proposition. For instance, the minimum investment in a single hedge fund runs anywhere from US$100,000 to well over US$1,000,000. With more than 1,000 hedge funds on offer, it will take a very substantial investment to create a portfolio that proxies the market in the literal sense.[14] This is not to mention the daunting task of administering such a large portfolio of essentially private investment vehicles. Therefore, in contrast to mutual funds where passive diversification leads investors to "low cost" indexed funds, the reverse is true of hedge fund investing. For these reasons, investors use funds-of-hedge funds as a way of accessing a diversified portfolio of hedge funds.

V.A. The Track Records of Funds-of-Hedge Funds Avoids Many Biases in Samples of Individual Hedge Funds

The investment experience of funds-of-hedge funds avoids many of the inherent biases that are idiosyncratic to using individual hedge fund returns from databases to measure industry performance. As portfolio managers generally do not directly engage in trading, an important element of the services offered by a fund-of-hedge funds manager is to provide accurate performance information on a timely basis to investors. The majority of the funds-of-hedge funds track record can be reconciled and audited to match the underlying funds' performance records. These track records retain the investment experience in hedge funds that have gone out of business due to poor performance, as well as hedge funds that have stopped reporting to database vendors because of good performance. Thus, the individual track records of funds-of-hedge funds do not contain survivorship bias that the pro forma returns of the underlying portfolio of hedge funds would. Similarly, the question of selection bias does not arise. In addition, when a fund-of-hedge funds adds a hedge fund to its portfolio, the portfolio's past investment records are unaffected, so there is no instant history bias.

As the track records of funds-of-hedge funds contain an accurate picture of the experience of a group of hedge fund investors, the aggregate experience of all funds-of-hedge funds, weighted by their assets under management, should provide a good approximation of the aggregate investment experience in hedge funds. The problem is, again, that no one has a complete record on the universe of funds-of-hedge funds. The best we can do is to use the equally weighted average of the returns of funds-of-hedge funds in a database.

V.B. Samples of Funds-of-Hedge Funds Contain Less Return Measurement Biases Than Samples of Individual Hedge Funds

In using a sample of funds-of-hedge funds to estimate the experience of the universe of funds-of-hedge funds, we need to consider potential biases that may arise when analyzing samples of funds-of-hedge funds. We base our results on the TASS hedge fund database as of September 1999, where there were 262 surviving and 60 defunct funds-of-hedge. Of the 60 defunct funds-of-hedge funds, 42 were liquidated, 2 were merged, and 15 were removed due to the lack of return information.

Table 1 shows that the surviving portfolio of funds-of-hedge funds averaged 7.7% per year during 1994-98. The observed

portfolio averaged 6.3%. Thus, the survivorship bias for funds-of-hedge funds is only 1.4% per year, less than half of that of individual hedge funds. Note that the 1994-98 period included two years (1994 and 1998) with poor hedge fund performance, and three years (1995-97) with good hedge fund performance.

There is, in fact, one line of argument that could justify the use of surviving funds-of-hedge funds to measure the aggregate investment experience in hedge funds. As the hedge fund industry in aggregate did not go out of business, funds-of-hedge funds that did are poor proxies for the universe of hedge funds.[15] In the same way, the returns of surviving funds-of-hedge funds are good proxies for the performance of the universe of hedge funds because they reflect the same set of investor demands that shapes the hedge fund industry. In addition, their track records are more continuous than individual hedge funds. These are important advantages in working from the demand side for hedge funds rather than with databases of hedge funds themselves.

We next turn to the issue of instant history bias. We do this in two steps. In the first step, we estimate the incubation period in funds-of-hedge funds. Table 2 shows that the median incubation period for funds-of-hedge funds is 484

days or roughly 16 months. In the second step, we measure the instant history bias in funds-of-hedge funds, by comparing the average return of the equally weighted portfolio with and without the first 16 monthly returns of each funds-of-hedge funds. This yields an estimate of the instant history bias of 0.7%, half of that of individual hedge funds.

Lastly, we deal with the issue of selection bias. Funds-of-hedge funds typically invest in a diversified portfolio of hedge fund styles and are less prone to capacity constraints. Consequently they are more amenable to disclose their track records in order to attract more capital, so there is little selection bias in large samples of funds-of-hedge funds.

V.C. Funds-of-Hedge Funds As A Proxy For the Market Portfolio of Hedge Funds

The previous subsection shows that our sample of funds-of-hedge funds contains less survivorship bias and instant history bias than our sample of individual hedge funds. We also argue that our sample of funds-of-hedge funds is likely to have less selection bias for theoretical reasons. In this subsection, we discuss how to use the performance of funds-of-hedge funds to estimate the performance of the market portfolio of hedge funds.

While a single fund-of-hedge funds may represent a non-random sample of individual hedge funds available for investments, the aggregate experience of all funds-of-hedge funds should be a fairly representative sample of hedge funds that are open for investments. It is closer to a "bias free" proxy of the market portfolio of hedge funds than averages derived from databases of individual hedge funds.

Over the sample period 1994-98, the equally weighted portfolio of funds-of-hedge funds in the TASS database returned 6.3% per annum. This is similar to the HFR fund-of-hedge fund index which returned 6.4%. If we adjust for instant history bias, the return would be 5.6.

In order to relate the returns of funds-of-hedge funds to the returns of individual hedge funds, it is helpful to discuss two factors that cause these two returns to diverge from each other. The first factor is the operating expenses and management fees charged by a funds-of-hedge.[16] Typically, database vendors report the returns of funds-of-hedge funds net of all fees and expenses to reflect the investment experience of investors in fund-of-hedge funds. Here, we must distinguish between fees and expenses charged by the underlying hedge funds that funds-of-hedge funds invest in, and the fees and expenses

charged by the funds-of-hedge funds themselves. Let us refer to the former as hedge fund fees and expenses and the latter as portfolio fees and expenses. The average portfolio fees and expenses provide an indirect answer to the "portfolio management question" we posed at the beginning of the paper. Although it does not directly tell us how to manage a hedge fund portfolio, it does tell us how much it costs on average to manage a portfolio that performs in line with the hedge fund market. These portfolio fees and expenses should be added back to the net returns of funds-of-hedge funds to provide an estimate of the performance of the market portfolio of hedge funds in the conventional way where the portfolio manage costs are excluded. Before doing so, we need to consider one more factor that could cause the net return of funds-of-hedge funds to systematically diverge from the market portfolio of hedge funds.

This second factor concerns the cash held by funds-of-hedge funds. As a rule, funds-of-hedge funds regularly hold cash to deal with potential redemptions, but report returns on total assets managed inclusive of cash. Therefore, the reported funds-of-hedge funds returns are downward biased estimates of the investment experience of the underlying hedge fund portfolios. The question arises as to whether any cash balance

is needed for individual investors holding a portfolio of hedge funds where outside investor withdrawals are not relevant. We contend that most hedge fund portfolios carry an unavoidable cash balance. It is a consequence of the cumbersome contribution and withdrawal process of individual hedge funds.[17] The performance drag of cash balances in funds-of-hedge funds is not likely to be different from that in hedge fund portfolios of individual investors. Nonetheless, the performance drag of cash balances should be removed from the net return of funds-of-hedge funds to arrive at a more accurate proxy of the market portfolio of hedge funds.

Unfortunately, funds-of-hedge funds data collected by consultants do not contain sufficient information to facilitate direct estimates of the portfolio management costs. Operating expenses must be extracted from the annual reports of each funds-of-hedge funds, and their intertemporal cash positions are almost impossible to ascertain with any degree of accuracy. Fortunately the more significant part of the portfolio management cost, namely the fixed fees and incentive fees of funds-of-hedge funds are obtainable from their offering documents. The distribution of the fixed fees and incentive fees for the funds-of-hedge funds in the TASS database are in

Table 3. For fixed fees, the mode is 1-2%, and the median is 1.5%. For incentive fees, the mode is 0%, and the median is 10%.

Accounting for the effect of fixed fees is a fairly straight forward exercise. We need only to add them back to the returns of the funds-of-hedge funds.

Accounting for the effect of incentive fees is more problematic. It is customary to pay incentive fees on performance in excess of a hurdle rate, but the TASS database did not have complete information on hurdle rates. Out of the 322 funds-of-hedge funds, only 67 had information. Seven had no hurdle rates, 33 had an absolute hurdle rate ranging from 5% to 20%, and 27 used a benchmark interest rate for hurdle rates. So it is not clear exactly how much incentive fees should be added back in.[18] In addition, there are quite a variety of incentive fee arrangements among funds-of-hedge funds. A proper analysis should also include the different hedge fund styles that funds-of-hedge funds adopt as their portfolio emphasis.

Accounting for the effect of cash balances is also problematic, as there is no information on the cash balances of funds-of-hedge funds in the TASS database.

To estimate the performance of the hedge funds in the funds-of-hedge funds, we consider two extreme cases. At one extreme, we add back only fixed fees and ignore incentive fees and cash balances. This implies that, during 1994-98, funds-of-hedge funds earned 7.8% per year from their hedge funds investment. At the other extreme, we assume a 5% cash balance and a Treasury bill rate of 5%, a fixed fee of 1.5%, an incentive fee of 10% on performance in excess of the Treasury bill rate. Using these parameters, the underlying hedge fund investments of funds-of-hedge funds had to return 8.1% to result in a net return of 6.3%. This is consistent with our earlier estimate for the market portfolio for the same period of 8.9% based on the individual hedge funds in the TASS database.

Table 4 contains year-by-year estimates. The returns of the adjusted observable portfolio of individual hedge funds are in the second column. The returns of the observable portfolio of funds-of-hedge funds (net of fees and expenses) are in the third column. The implied returns of the hedge fund portfolios in funds-of-hedge funds are in the fourth column. The fifth column is an estimate of the portfolio management cost. Its range is 1.5-3% per year.

What we have achieved here is to establish a readily observable, "almost bias free" measure of the "after costs" returns of the hedge fund market's performance – the funds-of-hedge fund index performance provided by database vendors. In terms of the portfolio management costs of a typical hedge fund portfolio, our data suggest a figure of approximately 1.5-1.8% per annum. Undoubtedly, more accurate estimates of the portfolio management costs can be obtained with more research effort. The advantage of working from the demand side of hedge funds allows us to narrow the problem down to well-defined, readily observable parameters and avoids having to deal with spurious biases that arose from database collection procedures.

V.D. We Exclude Public Commodity Pools Due to Their High Fees

Next we turn to the issue of funds-of-funds that invest in commodity funds known as 'commodity pools' in the CTA industry. Elton, Gruber, and Rentzler (1990) found publicly offered commodity pools returned only an average of 4.4% per year during 1980-1988. Irwin, Krukemyer, and Zulauf (1993) found the average return of 9.4% per year during 1986-1990. They attributed the large discrepancy between the returns of publicly offered commodity pools and individual commodity funds to the

high cost and fees of commodity pools. For publicly offered commodity pools, Table VI in Irwin, Krukemyer, and Zulauf (1993) showed that commissions were 9.3% of equity, fixed fees 5.0% of equity, and incentive fees were 20.0% of gross trading profits. These fees are consistent with the findings in Edwards and Ma (1988), and are substantially higher than those charged by funds-of-hedge funds. Gross of all costs, Table VII in Irwin, Krukemyer, and Zulauf (1993) found the returns to commodity pools to be 21.2%. [19] With these high costs, it is perhaps not surprising that commodity pools have not gained popularity over the years. Since some funds-of-hedge funds do include CTAs in their portfolios as part of their diversification, we prefer to exclude commodity pools in our estimates of the hedge fund industry's performance.

VI. Multi-Period Sampling Bias

The last bias we consider has nothing to do with how hedge fund and commodity fund data are collected by database vendors. Instead, it deals with the sampling requirement that a fund must have sufficient history before it is included in a study. The bias from this procedure is called 'multi-period sampling bias.'[20] For example, Fung and Hsieh (1997a) required 36 months

of return history before a fund was included in their study, to ensure sufficient degrees of freedom in their regressions. AMR required funds to have 24 months of return history for inclusion in their study.

The requirement of sufficient history may or may not be problematic, depending on the context in which the information is used. For example, if an investor would not invest in funds that had less than 36 months of return history, then a study imposing those restrictions would not create incorrect inference (assuming no other biases were present).

Nonetheless, it is of interest to know whether it makes a difference in average returns by requiring funds to have a minimum return history. To answer this, we create a fifth portfolio, which is the same as the adjusted observable portfolio, with one additional restriction. Every fund in the portfolio must have at least 36 months of return history.

For the period 1989-1997, the fifth portfolio's average return for commodity funds was 12.0% per year, 0.1% higher than that for the adjusted observable portfolio. For the period 1994-1998, the fifth portfolio's return for hedge funds was 9.5% per year, 0.6% higher than that for the adjusted portfolio.

Thus, the multi-period sampling bias, if it existed, was very small.

VII. Conclusion

Hedge funds and commodity funds are interesting investment vehicles for investors and academics. Their return profiles are quite different from those of mutual funds and standard asset indices. This represents diversification opportunities for investors. They also provide a new data source for testing asset pricing theories and the efficiency of markets.

The structure of the hedge fund and commodity fund industry is such that complete and accurate information on the universe of funds and their histories are almost unobtainable. Understandably, database vendors have their own idiosyncratic ways of "coping" with incomplete information. Consequently, attempts to estimate industry-wide performance statistics have to deal with a litany of biases. Some of these are natural to the birth, growth, and death process of hedge funds while others are spuriously generated through the application of statistical techniques to circumvent data deficiencies. In this paper we analyzed these problems.

In addition, we propose a simple alternative of using funds-of-hedge funds to estimate the performance of the hedge fund market. This is founded on the idea that, if we want to measure performance experience of a set of assets, the natural starting point is to observe the experience of investors in those assets. Funds-of-hedge funds invest in hedge funds. Their track records are almost free of the many biases contained in databases of individual funds. A sufficiently broad array of funds-of-hedge funds in aggregate should be a good proxy for the market's demand for hedge fund strategies. The average return of funds-of-hedge funds could therefore serve as a good proxy of the market portfolio of all hedge funds. Fortuitously, several database vendors report indices of funds-of-hedge funds.

Although the funds-of-hedge funds alterative is simple and readily available, there are two caveats to consider. The returns of funds-of-hedge funds is a measure of the return on hedge funds net of all costs, including those incurred in managing a portfolio of hedge funds. Alternatively, we can remove the effects of the cash holdings in funds-of-hedge funds as well as the fees and expenses charged by funds-of-hedge funds to obtain the net return on hedge funds, before incurring the portfolio management cost. By making reasonable assumptions, we

found that estimates of the industry's performance statistics after adjusting for various measurement biases are consistent with the performance statistics of funds-of-hedge funds. The convergence of performance estimates based on data from the supply side of hedge funds, the individual funds performance records, and the demand side of hedge funds, the funds-of-hedge funds performance records, adds credence to existing empirical conclusions on the aggregate performance of the hedge fund industry. Further research and careful documentation of the structural parameters of funds-of-hedge funds such as fees, expenses, and cash balances is likely to provide more accurate estimates of the hedge fund industry's performance characteristics.

Beyond measuring the performance of the entire hedge fund industry, our method can be adapted to individual hedge fund styles. This will help to refine answers to the performance measurement and the portfolio management questions adjusting to the many, and varied, individual trading styles of hedge funds.

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Table 1
Summary of Estimates of Hedge Fund Performance

Article (Data Source)	Period	Portfolio	Average Annual Return	Survivor-ship Bias	Instant History Bias
Panel A: Individual Hedge Funds					
BGI (Offshore Hedge Fund)	1989-95	Surviving	16.3%	Yes	No
		Observed	13.3%	No	No
BGP (TASS)	1993-96	Adj. Observed	12.2%	No	No
Latest (TASS)	1994-98	Surviving	13.2%	Yes	Yes
		Observed	10.2%	No	Yes
		Adj. Observed	8.9%	No	No
		Liquidated	-0.4%	-	Yes
		Merged	7.2%	-	Yes
		Return Stoppage	8.0%	-	Yes
Panel B: Funds-of-Hedge Funds					
Latest (TASS)	1994-1998	Surviving	7.6%	Yes	Yes
		Observed	6.3%	No	Yes
		Adj. Observed	5.6%	No	No

Table 2
Distribution of Hedge Fund Incubation Period
(Number of Days from Inception to Entry into TASS Database)

Percent	Individual Hedge Fund	Fund-of-Hedge Funds
Min	0	0
1%	0	28
5%	40	51
10%	61	71
25%	128	178
50%	343	484
75%	829	1,111
90%	1,913	2,018
95%	2,660	2,418
99%	4,734	4,944
Max	9,983	9,693

Table 3
Distribution of Fixed Fees and Incentive Fees
In Funds-of-Hedge Funds

Panel A: Distribution of Fixed Fees

Fixed Fee	Number of Funds-of-Hedge Funds *Total*	*Live*	*Defunct*
Nil	7	4	3
0-1%	77	69	8
1-2	186	154	32
2-3	37	23	14
3-4	12	10	2
4-5	0	0	0
5-6	3	2	1

Panel B: Distribution of Incentive Fees

Fixed Fee	Number of Funds-of-Hedge Funds *Total*	*Live*	*Defunct*
Nil	111	99	12
0- 5%	19	17	2
5-10	72	62	10
10-15	24	19	5
15-20	72	51	21
20-25	24	14	10

Table 4
Annual Returns of Hedge Funds

Year	Individual Hedge Funds[a]	Funds-of Hedge Funds[b]	Implied Hedge Fund Returns[c]	Implied Portfolio Cost[d]
1994	0.5%	-2.7%	-1.5%	1.3%
1995	15.4%	10.6%	12.8%	2.2%
1996	15.8%	12.9%	15.8%	2.9%
1997	15.1%	10.3%	12.7%	2.4%
1998	4.4%	0.0%	1.3%	1.3%

Note:

[a] The adjusted observable portfolio return of the individual hedge funds in the TASS hedge fund database.

[b] The observable portfolio return of the funds-of-hedge funds in the TASS hedge fund database.

[c] Estimated using on the following assumptions: 5% cash balance, 1.5% fixed fee, 10% incentive fee, hurdle rate set to be the 1-year Treasury bill rate.

[d] The difference between the implied hedge fund returns in the fourth column and the funds-of-hedge funds returns in the third column.

Footnotes:

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1. There are some exceptions. Fung and Hsieh (1997a) found that the "value" style had strong positive exposure to equities, while BGI showed that "short sellers" had strong negative exposure to equities.

2. From this point on, the term 'hedge fund' when used collectively includes commodity funds.

3. See Fung and Hsieh (1997a), Eichengreen et al (1998), Schneeweiss and Spurgin (1998), Brown, Goetzmann and Ibbotson (1999), and Ackerman, McNally and Ravenscraft (1999).

4. We can also apply these three concepts of performance to a subset of hedge funds.

5. The problems from using only surviving funds are well known in the hedge fund industry. The surviving portfolio is widely recognized to have an upward bias in performance because "bad funds" (i.e. poorly performing funds that have ceased operation) are excluded. What is less well known is the existence of an offsetting bias from the exclusion of "good funds" that ceased reporting their returns. Note that the standard conception of survivorship bias, as applied to mutual funds, refers only to the bias caused by deleting "bad funds" that have ceased operating due to poor performance. The issue of deleting "good funds" that have ceased voluntary reporting never arises, because all mutual funds are required to publicly disclose their returns. For our purpose, we choose to include the deletion of "good funds" as a survivorship bias, because this is a natural consequence of the way the hedge fund industry is organized. Some authors, such as Ackerman, McNally, and Ravenscraft (1999), refer to the deletion of "good funds" as "selection" bias. We reserve "selection" bias for a different phenomenon, namely, that funds may choose not to be included in a vendor's database at all.

6. We distinguish between individual commodity funds and commodity pools. See Irwin et al (1993) for a detailed description.

7. A fund drops out of the database for one of many reasons. The

manager may stop reporting performance information to the database vendor. The fund may have merged with another fund. The database vendor may remove the fund from the database if the manager provided return information deemed unreliable. Lastly, the fund may have gone bankrupt.

8. This restriction has been increased to 500 investors recently, but it did not apply to the sample studied this paper.

9. Note that Fung and Hsieh (1997a) did not distinguish between onshore versus offshore hedge funds. Both are included. If a manager operated identical onshore and offshore funds, we used only the one with the longer history in our sample.

10. Up to the time of the writing of this paper, correspondence with the authors of the AMR study did not completely resolve some of these issues. The precise details are not directly relevant to this paper. Suffice to say that the AMR study noted differences in the performance characteristics of offshore versus onshore hedge funds. There is a tax bias in favor of hedge fund managers using offshore vehicles to attract investors. Until the US tax code changes, this trend in the hedge fund industry is likely to persist. It is unclear whether the conclusions reached in AMR sufficiently heeded this difference. Note that, in line with industry trend, the earlier studies by BGI, BGP, and to an extent Fung and Hsieh (1997a) are predominantly based on offshore hedge funds. The results in Liang (1999) confirm that there is a difference in the attrition rates and survivorship biases between the HFR database (which has more onshore funds) and the TASS database (which has more offshore funds).

11. As noted earlier, we use the term "selection bias" differently than the way AMR used it. By selection bias, we mean that hedge funds refuse to participate in a vendor's database. AMR used the term to mean funds that dropped out of a database when the manager stopped reporting information to a vendor.

12. Note that selection bias does not exist in mutual fund databases, because mutual funds must publicly disclose their performance.

13. Note that LTCM was one of the 940 funds in the Fung and Hsieh (1997a) universe. But it did not have the requisite 36 months of returns at the end of 1995 to be included in the final sample of

409 funds used in the study.

14. One of the values of a fund-of-hedge funds is to overcome the investment size constraint that limits individual investors' ability to diversify.

15. Perhaps an analogy is useful. If we are unable to observe the returns of the S&P 500 index, we could use the aggregate return of all domestic US mutual funds as a proxy. We would be justified to exclude mutual funds that went out of business. Presumably, funds that went out of business had disappointing performance. Either they underperformed the market or barely matched the index whilst promising above index returns to their investors. Either way, their exclusion have no material impact to that approximation.

16. We are indebted to Howard Wohl and an anonymous referee for these points.

17. Most hedge funds require a notification period from investors to add and redeem capital. Redemption dates and frequency also vary from fund to fund. This makes it almost impossible to operate a hedge fund portfolio without any cash balance.

18. Often the Treasury bill rate is used as a proxy for the risk free return to capital.

19. Private communication with the authors of Edwards and Liew (1999) also show that public commodity pools continue to charge high fees in the 1990s.

20. Our use of the term 'multi-period bias' is different from that of AMR.