Working Paper

The ABCs of Hedge Funds:
Alphas, Betas, & Costs

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ABSTRACT

Despite the retrenchment of the hedge fund industry in 2008, hedge fund assets under management are currently over one and a half trillion dollars. We analyze the potential biases in reported hedge fund returns, in particular survivorship bias and backfill bias. We then decompose the returns into three components: the systematic market exposure (beta), the value added by hedge funds (alpha), and the hedge fund fees (costs). We analyze the performance of a universe of about 8,400 hedge funds from the TASS database from January 1995 through December 2009. Our results indicate that both survivorship and backfill biases are potentially serious problems. Adjusting for these biases brings the net return from 14.26% to 7.63% for the equally weighted sample. Over the entire period, this return is slightly lower than the S&P 500 return of 8.04%, but includes a statistically significant positive alpha. We estimate a pre-fee return of 11.42%, which we split into a fee (3.78%), an alpha (3.01%), and a beta return (4.62%). The positive alpha is quite remarkable, since the mutual fund industry in aggregate does not produce alpha net of fees. The year by year results also show that alphas from hedge funds were positive during every year of the last decade, even through the recent financial crisis of 2008 and 2009.

1. Introduction

Hedge funds had negative returns and net withdrawals during 2008. The year interrupted a two decade stream of almost continuous positive aggregate performance and asset growth. However, by splitting the aggregate and year by year returns into alpha, beta, and costs, we show that the net alphas have been positive in every year after 1998, even through the recent financial crisis. This is because hedge funds have substantial beta as well as alpha, so that much of the return, both in positive and negative years, can be attributed to the beta or systematic risk.

In 1990 there were only about 530 hedge funds managing about $50 billion. By the end of 2009, there were more than 8,000 hedge funds managing $1.6 trillion[1]. The strategy mix of the hedge fund industry has also changed. In 1990 the industry was dominated by funds following a global macro strategy, while in 2008 the largest number of funds belonged to equity-based strategies like long-short equity and event driven. Hedge funds have gained increasing acceptance among both institutional and individual investors.

This paper updates the Brown, Goetzmann, and Ibbotson (1999) paper that one of the authors participated in originally, which found that statistically significant alphas were earned in the hedge fund industry. But that paper covered the 1989–1995 period, before much hedge fund data was available.[2] By starting in 1995 and analyzing the period through December 2009, we are now able to analyze a relatively complete fifteen year data set that corrects for survivorship bias by including dead funds, and corrects for backfill bias by excluding backfilled data. Many other researchers have also studied hedge funds. These include Fung and Hsieh (1997, 2000, and 2004); Asness, Krail, and Liew (2001); and Liang (2000).

[1] HFR press release, January 20, 2010.
[2] Brown, Goetzmann, and Ibbotson (1999) attempted to estimate the impact of survivorship, although they did not have a complete sample of dead funds. They also recognized the potential selectivity biases in their database. Table A1 in the appendix shows the number of funds in the TASS database each year.

Despite the growing mainstream use of hedge funds, the industry is largely unregulated because they are usually either limited partnerships or off-shore corporations. This gives hedge fund managers tremendous flexibility, but makes accurate measurement of performance difficult. Since hedge funds are not required to report their returns, most hedge fund returns are reported to data collectors on a voluntary basis. There are several data vendors that collect and measure hedge fund returns,[3] but most of the data published are subject to two main biases. The first is survivorship bias. When a fund fails, it is often removed from a database along with its performance history. Its elimination creates a survivorship bias because the database only includes successful funds. The second common bias is backfill. Hedge funds tend to start reporting performance after a period of good performance, and that previous good performance history (or backfill) may be incorporated into the data base.[4]

Hedge funds also have a different fee structure than traditional long-only managers; they not only have a management fee, but also an incentive fee. The typical hedge fund fee structure is 1.5% plus a 20% incentive fee.[5] Although the typical management fee of mutual funds may be in the same range as that of hedge funds, incentive fees are very rare in the mutual fund industry. Incentive fees are usually associated with high watermarks, meaning that they are only earned after past losses have been recovered.

It is important to distinguish between the returns that come from alpha and beta. The alpha component is value added, and does not appear to be present in the mutual fund industry in aggregate. On the other hand, the return from the beta can readily be produced by investing in

[3] For example, Morningstar, Hedge Fund Research, Inc., TASS/Tremont, Managed Accounts Reports, and Zurich Capital Markets.
[4] Another bias often cited in hedge fund data is selection bias, which refers to not having a representative sample of funds. In this paper, we concentrate our effort on the survivorship and backfill bias.
[5] Median fee structure, according to TASS Data.

mutual funds, or by just directly investing in a diversified portfolio of stocks and bonds without any special skill of the investment manager. Presumably, it is the high alphas the hedge fund industry has earned, along with their low correlations with other asset classes, which have led to the great interest in this industry with the corresponding high cash inflows. The results of this paper confirm the significant positive alphas, but also show that a substantial part of the return can be explained by simple stock, bond, and cash betas.

2. Hedge Fund Return Measures

To effectively determine the sources of hedge fund returns, we first attempt to measure historical hedge fund returns accurately and without bias. Hedge fund returns tend to suffer from many biases, because reporting of returns is voluntary.

2.1 Data

We use monthly hedge fund return data from the TASS database from January 1995 through December 2009. The TASS database is an excellent data base to use because the dead funds are included and backfilled data is so marked.

We first combine the live funds and dead funds. There are 13,383 funds in the database, 4,962 of which are categorized as fund of funds. We eliminate fund of funds from this analysis. Out of the remaining 8,421 funds, 3,408 funds were still alive and 5,013 funds were dead at the end of December 2009. Table 1 presents the detailed breakdowns. For each fund, the after-fee monthly return data were collected.[6] With the live, dead, and backfill measures, we construct six

[6] The analysis in this paper is conducted using after-fee return data. We estimate the gross-fee total return on hedge fund portfolio by applying the typical fee structure in section 3.

subsamples of the returns data listed in the Appendix. We usually focus on the equally weighted returns, but we also measure value weighted returns.[7]

For survivorship bias, we compare the returns between portfolios with and without the dead funds. For backfill bias, we compare the returns between the subsamples with and without the backfilled return data. We then analyze the survivorship bias and backfill bias in hedge fund return data by comparing returns on the above three portfolios across the six subsamples of funds.[8]

2.2 Survivorship Bias

When a fund fails, it is often removed from a database along with its performance history. Its elimination creates a survivorship bias because the database then only tracks the successful funds. Survivorship bias typically occurs when a dying fund stops reporting performance. The performance of a dying fund tends to be much lower compared to the other live funds, thus creating an upward bias in a fund database with only live funds.

It is well known that the sample of live only funds contains survivorship bias. When Brown, Goetzmann and Ibbotson (1999) analyzed survivorship bias on returns using off-shore hedge funds, they reported an attrition rate of about 14% per year over 1989–1995. Their estimate of the survivorship bias was around a 3% unrealizable return per year. This result is consistent with the 3% estimate provided by Fung and Hsieh (2000) on the TASS database from 1994–1998. However, only a 0.2% return survivorship bias is estimated in Ackermann, McEnally and Ravenscraft (1999). Liang (2000) showed that differences in these estimates may be explained by

[7] Many funds do not report AUM and are left out of the value weighted sample. For comparison purposes, we also calculate equally weighted returns for the sample of funds which report AUM.
[8] Table A1 in the appendix gives the number of funds in each of the six subsamples year-by-year.Table A3 in the appendix provides detailed summary return statistics for each of the three portfolios across the six subsample databases.

compositional differences in the databases and different timeframes. More specifically, the lower estimate by Ackermann et. al. can be explained in terms of the lower proportion of dead funds retained in the combined HFR/MAR database, the inclusion of fund of funds (less susceptible to overall failure), and the pre-1994 start date, since the leading databases only retain returns on dead funds that died after this date. Barry (2003) also studied the characteristics of dead funds using the TASS data from 1994 to 2001. His estimate of the survivorship bias of 3.8% is higher than the Fung and Hsieh (2000) estimate, due to three extra years of return data.

Table 2 presents our estimates of the survivorship bias from January 1995 to December 2009 using the equally weighted portfolio. In the database with backfilled return data, the equally weighted portfolio with live only funds returned 14.26% per year, compared to 11.14% with both live and dead funds. Therefore, with backfilled data the survivorship bias is estimated to be 3.12% (14.26%–11.14%) per year. When we exclude the backfilled data, the live only funds returned 12.84% per year, compared to 7.63% for the equally weighted portfolio with dead and live funds. This indicates a more accurate estimate of survivorship bias of 5.21% (12.84%–7.63%) per year. By excluding the backfilled data, our survivorship estimate is substantially higher than others have estimated. Aggarwal and Jorion (2010) estimate a similarly high survivorship bias. They showed that survivorship in the TASS database may be underestimated because of the addition of Tremont database (with survivorship problems) funds between April 1999 and November 2001, as described in more detail in our Appendix.

2.3 Backfill Bias

Backfill bias occurs because many hedge funds include prior unreported performances to data collectors when they first start reporting their returns. These backfilled returns tend to provide an upward bias to the overall return data, since typically only favorable early returns are reported (not the unfavorable ones). A few studies have attempted to estimate this instant history bias.

Fung and Hseih (2000) study the distribution across funds of the lag between each fund's inception date and the date at which it enters the database. They find a median lag of 343 days and delete the first 12 months of all funds' reported returns, finding an instant history bias of 1.4% per year. Malkiel and Saha (2005) also studied the impacts of various reporting biases in the hedge fund data. They estimate that the backfill bias is over 500 basis points higher than the contemporaneously reported returns from 1994 to 2003. Posthuma and van der Sluis (2003) report that more than 50% of all returns in the TASS database are backfilled returns.[9] They estimate a backfill bias over the period 1996–2001 of about 400 basis points.

Table 2 also presents our estimates of the backfill bias from January 1995 to December 2009 using the equally weighted portfolio. In the database with backfilled return data, the equally weighted portfolio with live only funds returned 14.26% per year, compared to 12.84% without the backfilled data. Therefore, the backfill bias is estimated to be 1.42% (14.26%–12.84%) per year for the live funds. When we included the dead fund data, the equally weighted portfolio with backfilled data returned 11.14% per year, compared to 7.63% for the equally weighted portfolio over without the backfilled data. This indicates that backfill bias is 3.51% per year over the live plus dead sample. Thus the backfill bias can be substantial, especially when using the complete sample of live plus dead funds. However, Aggarwal and Jorion (2010) show that although survivorship and backfill bias may both be high, the merged Tremont sample includes some survivorship bias that we may be counting as backfill bias. This is because TASS marks the date of a fund entry into its database (including the Tremont data fund addition date), and we count any data before that date as backfill bias, when it may instead include survivorship bias.

[9] We include more detailed information on the amount of backfilled data in each hedge fund category in the TASS data base in the appendix Table A1 and A2.

Another interesting finding is that the backfill bias is measured to be much smaller using the value-weighted portfolios than the equally weighted portfolios. Table 3 presents the average returns calculated using both the equally weighted portfolio and the value-weighted portfolio, constructed with only funds that have reported their assets under management. For the equally weighted portfolio, the backfill bias is estimated to be 2.63% (10.94%–8.31%). For the value-weighted portfolio, the backfill bias is estimated to be only 0.17% (11.09%–10.92%). This seems to indicate that bigger funds are less likely to have backfilled data in the database. We will take a more detailed look at fund size and performance in the next section. Table 3 also suggests that bigger funds outperform smaller funds. After correcting for backfill biases, the value weighted index outperforms the equally weighted index 10.92% vs. 8.31%.

2.4 Is a Bigger Hedge Fund Better?

As we have seen, larger funds tend to have less backfill bias. To further study the impact of fund size on returns, we construct a series of portfolios ranked according to the reported AUM for each fund. We rank funds based on the previous month's AUM (thus eliminating look-back bias), then we group them into various categories based on the ranking. We then calculate the returns of an equally weighted portfolio for each category. Table 4 presents the results. On average, the largest 1% of the funds returned 10.10% after fees, outperforming all the other categories. Funds in the largest 1% category outperformed the average by over 2 percentage points per year. However, the standard deviations are also correspondingly higher; the extra returns achieved by the larger funds are associated with higher average risk.

It is widely speculated that hedge funds with larger AUM are more likely to underperform, because the bigger size makes it difficult for managers to find enough investment opportunities to generate superior returns, or that transactions costs increase with size. Although this might be true for a fund over its own life-cycle, our cross-sectional results indicate that larger funds outperform smaller funds on average. This result might have three possible explanations. First, the larger funds may have more access to leverage or be willing to take on extra risk, which is consistent with the higher standard deviations. Second, managers of larger funds may have greater skill than the average fund manager, so that even with a bigger fund they are still able to deliver better than average returns. Third, larger AUM managers have more resources and maybe able to focus more on managing the funds instead of managing their business. Even if the second and third explanations are valid, the extra risk seems to mitigate any return advantage the bigger funds might enjoy.

2.5 The Bias Issue and Indexes

The above results show that survivorship bias and backfill bias can be quite large for individual hedge fund return data in the TASS hedge fund data base. Analysis that does not correct for these biases can lead to overstated results. Value-weighted indexes are likely to have less severe biases, since larger funds are more likely to survive. Also, because larger funds have usually been around longer, proportionally they are less likely to have backfill data during our sample period. We compare returns from two popular hedge fund overall indexes with our equally weighted portfolios. The HFRI index is an equally weighted index, while the CSFB index is a value-weighted index. The two indexes returned roughly 10% per year over the same time period. Although their returns are still higher than the 7.63% equally weighted portfolio return on the live and dead with no-backfilled sample, they are more reasonable than the biased 14.26% on the live only with backfilled data. Also, since most of the hedge fund indexes (such as HFRI and CSFB/Trement) are created on the fly, we believe their return biases are much smaller than the biases in historical datasets. The biases in indexes are more likely, however, to occur in their older data.

3. Sources of Hedge Fund Returns

After controlling the survivorship and backfill bias in the returns, we investigate the sources of hedge fund returns. Hedge funds are often characterized as investment vehicles that are not that correlated with the traditional stock and bond markets, because so much of their returns are generated through manager skill. In other words, compared to traditional investment vehicles (e.g., mutual funds), a portion of the return of hedge funds comes partially from a positive net alpha component.

In this paper, we focus on determining what portion of hedge returns is derived from traditional long beta exposures (i.e., stocks, bonds, and cash) and what portion is from hedge fund alpha. Asness (2004a and 2004b) further proposed breaking hedge fund alpha into: 1) beta exposure to other hedge funds, and 2) manager skill alpha. Fung and Hsieh (2004) analyzed hedge fund returns with traditional betas and non-traditional betas, which include trend following exposure (or momentum) and several derivative-based factors. They found that adding the non-traditional beta factors can explain up to 80% of the monthly return variation in hedge fund indexes. Jaeger and Wagner (2005) also increased their R-squares by adding in other hedge fund factors and conclude that hedge funds "generate returns primarily through risk premia and only secondarily through imperfect markets." We also conduct a separate analysis that includes non-traditional betas. We use the 7 factor model proposed by Fung and Hsieh (2004). The results are reported in section 3.2 as well.

We agree that a portion of the hedge fund returns can be explained by non-traditional betas (or hedge fund betas). However, these non-traditional beta exposures are not well specified or agreed upon, and are not readily available to individual or institutional investors. A substantial portion of alpha can always be thought of as betas waiting to be discovered or implemented. Nevertheless, since hedge funds are the primary way to gain exposure to these non-traditional betas, these non-traditional betas should be viewed as part of the value-added that hedge funds provide compared to traditional long-only managers.

Therefore, our analysis concentrates on separating the hedge fund returns using only the traditional stock, bond, and cash beta exposures that are easily assessable for investors without hedge funds. We calculate the average amount of hedge fund returns that come from long-term beta exposures versus the hedge fund value-added alpha. We also compare the fees hedge funds are charging relative to the amount of alpha that hedge funds add.

3.1 Data and Model

We analyze the performance of a universe of about 8,421 hedge funds in the TASS database from January 1995 through December 2009. We focus on the live plus dead fund sample that excludes the backfilled data. This corrects for both the survivorship and the backfill biases, including the problems with the TASS databases noted by Aggarwal and Jorion (2010), because TASS notes the entry date into their databases including the merged Tremont funds. The corrected overall compound return for this equally weighted sample is 7.63% compared to 8.04% on S&P500 stocks over the same period.[10]

We use the equally weighted index using the live and dead funds without backfilled data constructed above as the hedge fund return series for this analysis, because it has the least amount of survivorship and backfill bias. We also construct indexes for each of nine hedge fund subcategories in the TASS data base using the same methodology. The nine subcategories are convertible arbitrage, emerging market, equity market neutral, event driven, fixed income arbitrage, global macro, long/short equity, managed futures, and dedicated short.

[10] From appendix Table A3, we can see that the compound return of stocks, bonds, and cash were 8.04%, 6.43%, and 3.54% respectively.

3.2 Aggregate Alpha, Beta, and Cost Results

The attribution is based upon the return-based style analysis model developed by Sharpe (1992) on mutual funds. We maintain the constraint that all style weights sum to one. We allow individual style weights to be negative or above one to account for shorting and leverage. We also include lagged betas as well as contemporaneous betas to control for the stale pricing impact on hedge fund returns.[11] The benchmarks used in the return-based analysis are the S&P 500 total returns (including both concurrent and with one-month lag), U.S. Intermediate-term Government Bond returns (including one-month lag), and cash (U.S. Treasury Bills).[12] Again, in this analysis we choose to include only the traditional stocks, bonds, and cash as the beta exposures, because we are mostly interested in the value-added by hedge funds to investors that hold portfolios allocated to only traditional stocks, bonds and cash.

Table 5 presents the equally-weighted compound annual return of each of the nine categories, and the equally weighted index of all the funds. The overall annual compound return of the equally weighted index was 7.63% over the period with an annualized alpha of 3.01%. Note that all nine subcategories had positive alphas over entire 15 year period, with three of them having an alpha that is statistically significant at the 5% level. The overall alpha estimate of 3.01% is also

[11] Asness, Krail, and Liew (2001) point out that many hedge funds hold, to various degrees, hard to price illiquid securities. For the purposes of monthly reporting, hedge funds often price these securities using either last available traded prices or estimates of current market prices. These practices can lead to reported monthly hedge fund returns that are not perfectly synchronous with monthly S&P 500® returns, due to the presence of either stale or managed prices. Non-synchronous return data can lead to understated estimates of actual market exposure.

[12] We also ran the analysis with other benchmarks (small cap, growth, value, high-yield, etc.), and the results were similar. We use the data from Ibbtoson® *SBBI® 2010 Classic Yearbook, Market Results for 1926-2009,* Morningstar, Inc.

statistically significant at 5% level.[13] Our results confirm that hedge funds added alpha over the period, and also provided excellent diversification benefits to stock, bond, and cash portfolios.

In Table 6 we subtract out the 3.01% alpha return leaving 4.62% of the return that can be explained by the stock, bond, and cash betas. Estimating fees based upon the median fee level of the funds (usually a 1.5% management fee and 20% of the return as an incentive fee) gives us an overall fee estimate of 3.78%, which when added to the reported post-fee return, gives us an estimated pre-fee return for the index of 11.42%.[14] The pre-fee return of 11.24% for the overall sample can now be separated into the fees 3.78% and the post-fee return 7.63%, which can in turn be separated into the alpha 3.01% and the systematic beta return 4.62%. Note that both the systematic return and the fees exceed the alpha (post fees), but nevertheless the alpha is significantly positive. Figure 1 illustrates the breakdown between fees, systematic beta returns, and alphas for each of the nine subcategories of funds and the overall equally weighted sample.

We also conduct a separate analysis that includes non-traditional betas. We use the 7 factor model proposed by Fung and Hsieh (2004) with the equally weighted overall index. The results are reported in table 7. Both the R-square and the annual alpha is higher than that of the model only including stocks, bonds, and cash. The 7 factor alpha of 5.17% is statistically significant and may be so high because hedge fund managers are able to time the factors rather than passively investing in the factors as risk premiums. The alpha estimate is similar to the ones reported in Fung and Hsieh (2004), albeit with much longer data history. This indicates that even accounting for the non-traditional betas, hedge funds added significant alpha over this period.

[13] The betas for stocks and bonds are the sums of their betas plus their lagged betas. We also calculate an alpha for the overall equally weighted index (live+dead and no backfill) with the constraint that the sum of betas to one is relaxed. The alpha is also positive and statistically significant at 5% level.

[14] The funds in the TASS database are reported net of fees. Median fund fees are used to estimate fees. It is not possible to perfectly measure fees for many of the funds, since many fees are privately negotiated and not reported.

3.3 Year-by-Year Results

We examine the year-by-year return results in Table 8 and in Figure 2. The aggregate hedge fund returns were positive in all years except 1998 and 2008, although in the years 2000-2002 the returns were below 2% a year.

We conduct a year by year analysis to estimate the annual hedge fund beta and alpha return using an out of sample 3-year rolling window analysis. The year by year alpha and systematic beta results are also shown in Table 8, with the decomposition illustrated year in Figure 3. These results are even more favorable for hedge funds because the hedge fund alpha is positive for every year except 1998. Even in 2008, when the overall equally weighted hedge fund return is a negative 16.08%, the alpha is estimated to be a positive 6.65%. This consistent high alpha is quite remarkable, given the variety of market conditions over the period: the 1990s bubbles, the 2000-2002 bear market, the 2003-2007 bull market, and the recent financial crisis. The annual results confirm that over the period, hedge funds have added a significant amount of alpha to stock, bond, and cash portfolios. The results show that hedge funds exhibit tactical asset allocation skills, especially by reducing beta exposures to the market in bear markets. For example, the estimated stock beta exposure was lowest during 2000-2002 bear market period. Hedge Funds did not avoid the beta exposure in 2008 nor fully participate in the 2009 market, but nevertheless kept their positive alpha throughout the financial crisis of 2008 and 2009.

The positive hedge fund aggregate alphas for the last eleven years in succession suggest that hedge funds really do produce value. The substantial stock market beta associated with hedge funds also indicates that they are not really fully “absolute return.” In fact, hedge funds vary year-by-year with the market.

4. Conclusions

We wish to measure the sources of hedge fund returns. In particular we estimate what portion of the returns comes from alphas, betas, and costs. The portion that comes from alpha is most relevant to us, because this is the part that investors would have difficulty in achieving with stock, bond, and cash portfolios.

In order to measure returns, it is first important to select data that is as free as possible from biases. We study a period (January 1995–December 2009) in which it was possible to delineate the backfilled data and include the dead funds. We include both live and dead funds so that we can correct for survivorship bias. We exclude backfilled data that managers submitted when they joined the database. Our results indicate that both survivorship bias and backfill bias are potentially serious problems. The equally weighted sample of funds that existed at the end of the sample period had a compound return of 14.26% net of fees. Including dead funds reduced this return to 11.14%. Excluding the backfilled data further reduced the return to 7.63% net of fees.

Both biases were much smaller for the value-weighted index of hedge funds. Larger funds had much lower attrition rates, and many joined the database before the sample period started in 1995. Even when backfill data existed, it was likely given a low weight. After both biases were removed, the largest funds outperformed smaller funds. The largest 1% of funds had a return of 10.10%, the largest 20% of funds had a return of 8.85%, while the smallest 50% of funds had a return of 7.45%. However, the larger funds also had commensurately higher risk.

We estimated a pre-fee return from the equally weighted index of hedge funds to be 11.42%, which consisted of fees of 3.78%, an alpha of 3.01%, and returns from the betas of 4.62%. The alpha estimate is statistically significant at 5% level. All nine subcategories of types of funds had positive alphas, and the three of the subcategories were statistically significant.

Not only is the alpha during the entire period significantly positive, we also find that hedge fund alphas stayed positive from year to year. The alpha is positive for all years except 1998. This indicates that the average hedge fund manager added value in both bear and bull markets. Further examination of the stock beta estimates shows that hedge fund managers on average under-weighted equities in their portfolios during the technology bubble collapse. However, hedge funds did not substantially reduce their beta in 2008, earning a negative return for the year. Nevertheless, hedge funds continued to produce positive alpha in both 2008 and 2009, continuing an eleven year of unbroken string of positive alphas.

The results presented here are only a reflection of historical returns. Hedge funds are relatively young investment options and very dynamic. We expect them to continue to evolve going forward. A significant amount of money has flowed into hedge funds in the past several years. Therefore we cannot be assured that the high past alphas we measure are a good prediction of the future alpha in the hedge fund industry.

Table 1. Number of Hedge Funds in the TASS data base excluding fund of funds

(Jan. 1995 ~ Dec. 2009)	Total	Fund of Funds	Total Excluding FOF
Live	5970	2562	3408
Dead	7413	2400	5013
Live + Dead	13383	4962	8421

Table 2. Measuring Hedge Fund Returns: Survivorship Bias and Backfill Bias

	Compounded Annual Return	STD
With Backfill*		
–Live Only	14.26%	6.49%
–Live + Dead	11.14%	6.18%
Without Backfill*		
–Live Only	12.84%	6.74%
–Live + Dead	7.63%	6.55%
HFRI Weighted Composite **	10.02%	7.50%
CSFB/Tremont	10.35%	7.80%

* Equally weighted post fee returns from the TASS database (Jan 1995–Dec 2009)
** The data for HFRI is from Jan 1995 to Jul 2009.

Table 3. Measuring Hedge Fund Returns: Equal- vs. Value-Weighted*

Jan. 1995 ~ Dec. 2009, Live + Dead	Compound Annual Return	STD
With Backfill		
– Equally Weighted	10.94%	6.20%
– Value Weighted	11.09%	4.89%
Without Backfill		
– Equally Weighted	8.31%	6.60%
– Value Weighted	10.92%	5.29%

*Only funds that have reported their assets under management are included in this table.

Table 4. Is Bigger Better?

Jan. 1995 ~ Dec. 2009	Equally WTD, Live + Dead, No Backfill		End of Sample Category Min. AUM ($M)*
	Compound Annual Return	Average Fund STD	
Largest 1%	10.10%	11.56%	103,696
Largest 5%	8.60%	9.02%	6,524
Largest 10%	8.70%	8.98%	3,009
Largest 20%	8.85%	8.16%	1,612
Largest 50%	8.03%	6.39%	196
Smallest 50%	7.45%	6.90%	1

*Categories were formed at the beginning of each period, with the returns measured afterward (out of sample); AUM amounts are as of December 2009.

Table 5. Regression Results: (Jan. 1995 – Dec. 2009) *

	Compound Annual Return (%)	Annual Alpha (%)	Betas (Sum of Betas = 1)			RSQ
			Stocks	Bonds	Cash	
CV Arb	7.31	2.76	0.34	-0.22	0.89	0.35
Emerging	9.09	5.00	0.65	-0.69	1.04	0.39
Equity Mkt Neutral	6.54	2.38**	0.09	0.02	0.89	0.19
Event Driven	8.10	3.73**	0.31	-0.29	0.99	0.52
Fixed Inc Arb	6.16	2.39***	0.12	-0.13	1.01	0.12
Global Macro	7.08	2.10	0.15	0.22	0.62	0.10
L/S Equity	10.29	5.16**	0.46	-0.28	0.82	0.53
Managed Futures	5.56	1.17	-0.04	0.52	0.52	0.10
Short	-0.45	1.74	-0.89	0.34	1.55	0.56
Overall Equally Weighted	7.63	3.01**	0.32	-0.21	0.89	0.47

* Equally Weighted Indexes (Live + Dead, No Backfill, Post Fee Returns. The betas for stocks and bonds in the table are the sums of their betas plus their lagged betas.
**Significant at 5% confidence level
***Significant at 10% confidence level

Table 6. Sources of Returns: Alphas, Betas, and Costs (Jan. 1995 – Dec. 2009)*

	Pre-Fee Return*	Fees*	Post-Fee Return	Alpha	Systematic Beta Return	Alpha/Fee Ratio	Info Ratio	Sharpe Ratio
CV Arb	11.01	3.70	7.31	2.76	4.55	0.74	0.44	0.97
Emerging	13.23	4.15	9.09	5.00	4.09	1.21	0.41	0.65
Equity Mkt Neutral	10.05	3.51	6.54	2.38	4.15	0.68	0.86	2.10
Event Driven	12.00	3.90	8.10	3.73	4.37	0.96	0.91	1.38
Fixed Inc Arb	9.57	3.41	6.16	2.39	3.77	0.70	0.52	1.27
Global Macro	10.72	3.64	7.08	2.10	4.97	0.58	0.35	1.13
L/S Equity	14.73	4.45	10.29	5.16	5.12	1.16	0.79	1.10
Managed Futures	8.83	3.27	5.56	1.17	4.40	0.36	0.13	0.61
Short	1.32	1.76	-0.45	1.74	-2.19	0.99	0.13	0.07
Overall Equally Weighted	11.42	3.78	7.63	3.01	4.62	0.80	0.63	1.16

* Equally weighted indexes, Live + Dead, No Backfill, post fee returns and alphas from Table 5, with systematic beta return being the difference between them. Fees are based upon median fees, usually 1.5% and 20%. Pre-fee returns are post-fee returns plus fees.

Table 7 Hedge Fund Results using Fung and Hsieh's 7-factor model (Jan. 1995 – June. 2009)*

Factors	Proxies	Beta
Bond Trend-Following Factor	Return of PTFS Bond lookback straddle	-0.008
Currency Trend-Following Factor	Return of PTFS Currency Lookback Straddle	0.010
Commodity Trend-Following Factor	Return of PTFS Commodity Lookback Straddle	0.014
Equity Market Factor	The Standard & Poors 500 index monthly total return	0.257
The Size Spread Factor	Wilshire Small Cap 1750 - Wilshire Large Cap 750 monthly return	0.192
The Bond Market Factor	The monthly change in the 10-year treasury constant maturity yield	-2.257
The Credit Spread Factor	The monthly change in the Moody's Baa yield less 10-year treasury constant maturity yield	-28.962
Annual Alpha (%)		**5.17%****
R-Square		**0.63**

*Equally weighted indexes, Live + Dead, No Backfill, post fee returns. The three trend-following factors are downloaded from the following web site, http://faculty.fuqua.duke.edu/~dah7/HFRFData.htm. Since the factors are produced with 6-month lag, we can only run the analysis from Jan 1995 to June 2009.
**Alpha is statistically significant at 5% confidence level.

Table 8. Year-by-Year Post-Fee Returns, Alphas, Systematic Beta Returns, and Betas*

Year	Post-Fee Return	Alpha	Systematic Beta Return	Betas Stocks	Betas Bonds	Betas Tbill
1998	-2.38	-14.07	13.31	0.55	-0.63	1.08
1999	25.19	7.20	16.96	0.47	-0.70	1.23
2000	1.90	6.89	-4.81	0.51	-0.92	1.41
2001	1.95	10.27	-7.97	0.33	-1.23	1.90
2002	1.17	10.08	-8.30	0.30	-0.41	1.10
2003	17.62	12.06	4.95	0.19	-0.27	1.09
2004	7.77	3.06	4.62	0.31	0.19	0.50
2005	8.96	5.14	3.67	0.33	0.30	0.37
2006	11.75	2.65	8.89	0.42	0.32	0.26
2007	10.02	3.38	6.34	0.64	0.17	0.19
2008	-16.08	6.65	-21.75	0.53	-0.11	0.58
2009	16.38	5.93	9.63	0.37	-0.15	0.78

* Overall Equally Weighted Index, Live+Dead and No Backfill with out of sample Sum of Betas Equal to 1. The betas for stocks and bonds in the table are the sums of their betas plus their lagged betas.

Figure 1. Source of Hedge Fund Returns by Hedge Fund Category: Alphas, Betas, & Costs (January 1995 – December 2009)

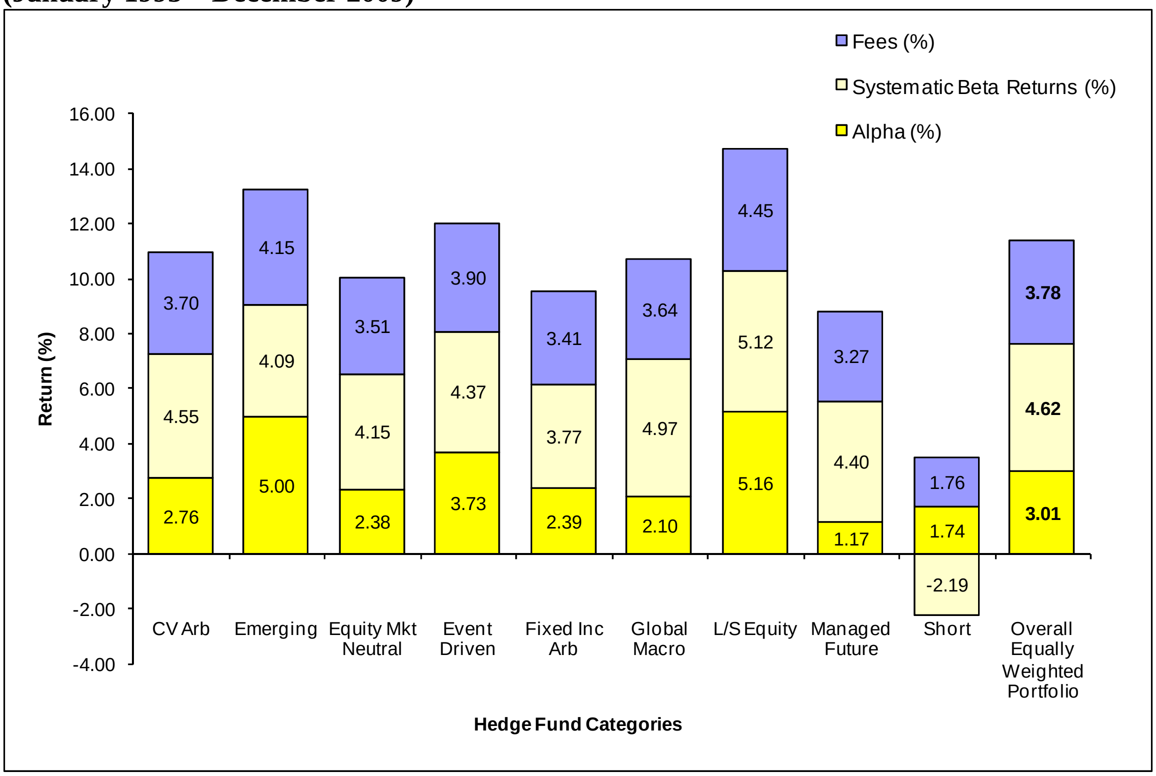


Figure 2. Year-by-Year After-Fee Hedge Fund Returns

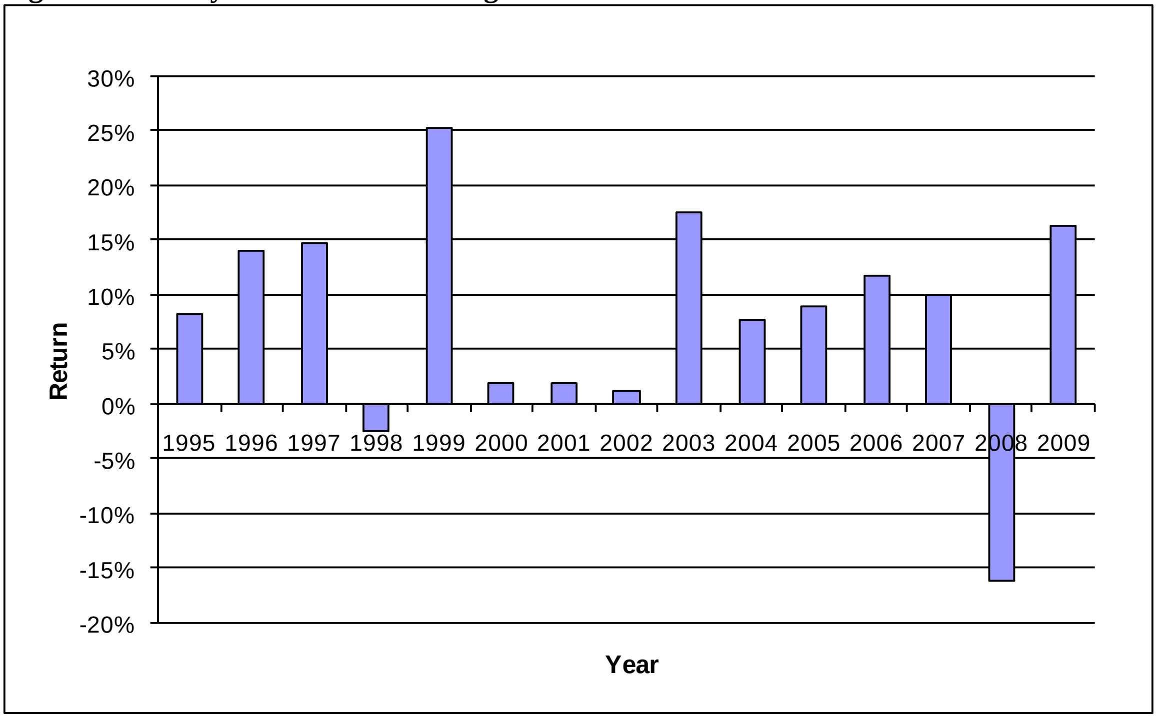
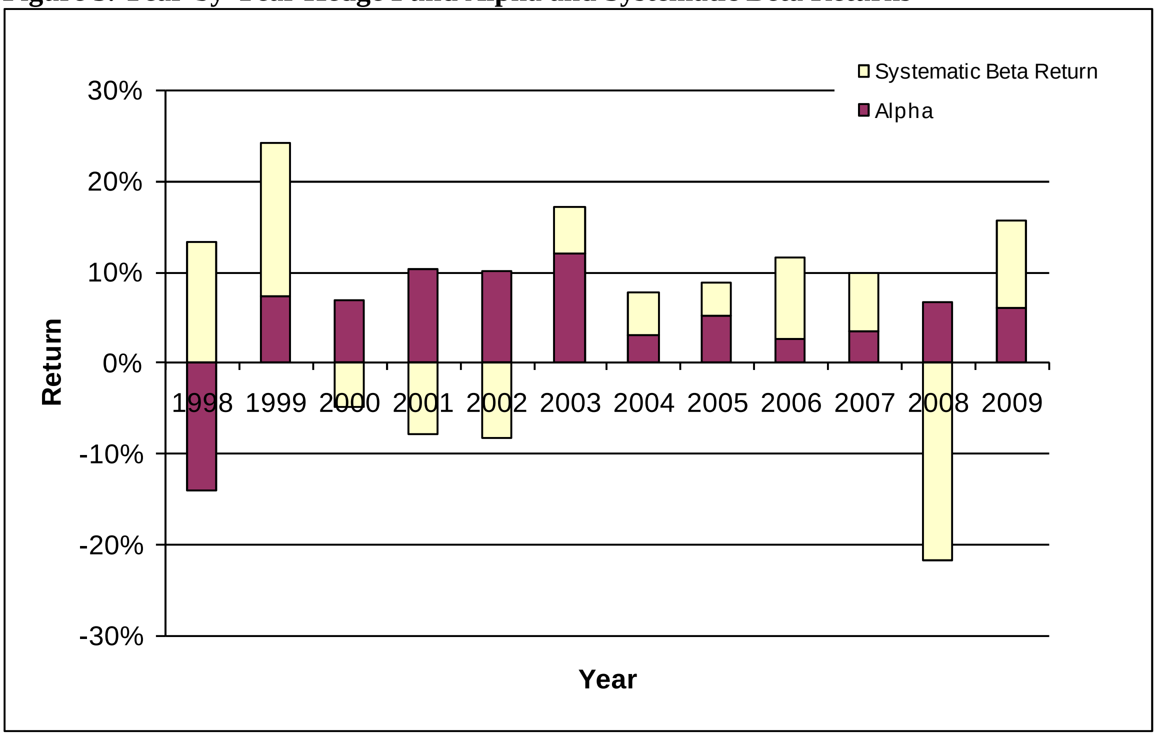


Figure 3. Year-by-Year Hedge Fund Alpha and Systematic Beta Returns –



Appendix

We separate the funds into the following six subsamples:

- Live funds only with backfill data
- Live funds only without backfill data
- Live and dead funds with backfill data
- Live and dead funds without backfill data
- Dead funds only with backfill data
- Dead funds only without backfill data

Table A1. Number of Funds in the Six Subsamples (Jan. 1995 – Jan. 2009)*

Date	Live & Dead no Backfill	Live no Backfill	Dead no Backfill	Live & Dead with Backfill	Live with Backfill	Dead with Backfill
Jan-95	52	12	40	850	161	689
Jan-96	237	29	208	1045	207	838
Jan-97	408	59	349	1245	268	977
Jan-98	564	88	476	1490	343	1147
Jan-99	718	139	579	1707	435	1272
Jan-00	788	176	612	1949	531	1418
Jan-01	1011	249	762	2167	644	1523
Jan-02	1465	432	1033	2542	850	1692
Jan-03	1708	571	1137	2885	1024	1861
Jan-04	1985	722	1263	3383	1274	2109
Jan-05	2413	962	1451	3978	1620	2358
Jan-06	2967	1286	1681	4410	2048	2362
Jan-07	3245	1643	1602	4763	2489	2274
Jan-08	3727	2380	1347	4653	2932	1721
Jan-09	3912	3276	636	3912	3276	636

*Funds in the fund of funds category are excluded. Funds are listed as dead if they died at any time during the sample period from Jan. 1995 ~ Dec. 2009. For example, the 15 funds listed in December 1994 were living at the beginning of 1995.

Aggarwal and Jorion (2010) noted that in March 1999, Tremont Capital Management purchased the TASS database. They merged the Tremont data into the TASS data from April 1999 through November 2001. TASS counts the data entry date as the initial date, with all prior data considered backfill data. Thus Table A1 shows a high proportion of backfilled data in the early years. This Tremont merged data can contain survivorship bias and may not be backfill from the fund manager's perspective, since the funds may have entered the Tremont database earlier. However, we classify it has backfill data since we cannot tell when the funds entered the Tremont database. In any event, our results focus on the first column in Table A1, which can be a relatively small sample, but is corrected for both biases. The percentage of backfill data by each fund category are listed in Table A2.

Table A2. Percentage of History Backfilled (Jan. 1995 ~ Dec. 2009)

Primary Category	**Percentage of History Backfilled**
CV Arb	40%
Emerging	38%
Equity Mkt Neutral	37%
Event Driven	41%
Fixed Inc Arb	46%
Global Macro	41%
L/S Equity	41%
Managed Futures	52%
Short	52%
Overall Equally Weighted	**43%**

For each subsample, we compiled three portfolios and calculated the monthly returns for each:

- An equally weighted portfolio
- A value-weighted (using previous month's assets under management) portfolio. Many funds only report asset under management once a quarter. We impute the AUM amount using the return figures, if the AUM was not reported that month. Funds with no AUM data are excluded from the value-weighted portfolio.
- An equally weighted portfolio using only the subsample of funds that have reported assets under management (AUM) amount. This portfolio is referred to as "equally weighted portfolio with AUM" to differentiate it from the full-sample equally weighted portfolio.

Table A3. Returns from Subsamples (Jan. 1995 – Dec. 2009)

Equal Weighted	Geometric Mean (%)	Arithmetic Mean (%)	Standard Deviation (%)
Live + Dead, No Backfill*	7.63%	7.86%	6.55%
Live + Dead, With Backfill	11.14%	11.35%	6.18%
Live, No Backfill	12.84%	13.09%	6.74%
Live, With Backfill	14.26%	14.49%	6.49%
Dead, No Backfill	3.83%	4.08%	6.93%
Dead, with Backfill	7.58%	7.81%	6.55%
Equal Weighted with AUM			
Live + Dead, No Backfill*	8.31%	8.54%	6.60%
Live + Dead, With Backfill	10.94%	11.15%	6.20%
Live, No Backfill	12.76%	13.02%	6.77%
Live, With Backfill	14.18%	14.42%	6.54%
Dead, No Backfill	4.55%	4.82%	7.22%
Dead, with Backfill	7.30%	7.53%	6.57%
Value Weighted			
Live + Dead, No Backfill*	10.92%	11.07%	5.29%
Live + Dead, With Backfill	11.09%	11.22%	4.89%
Live, No Backfill	11.14%	11.30%	5.37%
Live, With Backfill	11.82%	11.93%	4.46%
Dead, No Backfill	8.70%	8.96%	6.96%
Dead, with Backfill	8.15%	8.38%	6.62%
Benchmarks			
Stocks	8.04%	9.41%	15.81%
Bonds	6.43%	6.54%	4.60%
Cash	3.54%	3.54%	0.55%

* Unbiased

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