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INCENTIVE FEES - IMPACT ON PERFORMANCE MEASUREMENT OF HEDGE FUNDS

by

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APPROVAL

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Degree: **Master of Financial Risk Management**

Title of Project: **Incentive Fees - Impact on Performance Measurement of Hedge Funds**

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ABSTRACT

This paper estimates the incentive fees impact on hedge funds returns by estimating the factor model using gross return and net return respectively. We used the latest twelve year data, including the high volatile data of 2008 and 2009, to do the regression. As a result, we find that the beta is underestimated from the regression, implying that the incentive fees do have the impact on hedge fund performance. Additionally, we adopted a rolling-over regression technique to duplicate the performance of the hedge funds using ten hedge fund strategies. We find that some additional beta return can be captured by replicating through the gross returns. In summary, the incentive fees should be taken into consideration when we are measuring the performances and risk exposures of the hedge funds.

Keywords: Hedge funds; Incentive fees; Gross return; Rolling window regression; Underestimated beta; Hedge fund manager's skills

DEDICATION

We wish to dedicate this paper to our dearest parents for their continuous support and encouragement. With their unrequited love, we could keep on going without worry.

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1: Introduction

In the current capital market, hedge funds play an important role, appealing us to investigate on it. After some deep research, we find that because of the option-like nature of the incentive fees, it creates a non-linear payoff to the factors which should be eliminated by using gross returns. In order to demonstrate our hypothesis, we adopted the paper conducted by Brooks, Clare and Motoson (2007) as our reference paper and we wanted to confirm the two main conclusions in their paper by using the latest 12-year data.

For the first conclusion, they have pointed out that because of the existence of the incentive fees, the option-like nature of incentive fees creates a non-linear payoff to the factors which can be eliminated by using gross returns. Specifically, at first, they calculated the gross returns based on the data from 1994 to 2006 they have received from the TASS database. Then, they have performed a three-factor regression model to prove that the incentive fees have the impact on both alphas and betas with the major impact on alpha. The second conclusion was that some additional beta returns could be captured through the factor replication using the gross returns. They chose the specified factors for each hedge fund strategy and performed a 24-month rolling window regression repeatedly to demonstrate that the gross clones could capture the additional beta exposure.

For our paper, we aim to testify these two conclusions based on the latest

12-year data including 2008 and 2009 which had a high volatility and we are interested in whether the conclusions would change based on the latest data. We mainly adopted the procedures mentioned in Brooks, Clare and Motoson (2007) except that we created our own method to calculate the gross returns for hedge fund indices.

At last, we demonstrated that the two conclusions are the same to the precedent paper even under the volatile years of 2008 and 2009, even though some strategies such as dedicated short bias and global macro performed better in this period whereas others performed worse.

2: Literature Review

2.1 Hedge Funds Background

Hedge funds play an important role in the capital market, which appeals us to dig on this area. As we can see that the amount invested globally in hedge funds rose from approximately $50 billion in 1990 to approximately $1 trillion by the end of 2004. In addition, during 2004, trades by hedge funds often accounted for more than half of the total daily number of shares changing hands at NYSE. Moreover, even wealthy individual investors started to invest on hedge funds besides the large institutions.

A hedge fund is an investment fund open to a limited range of investors that undertakes a wider range of investment and trading activities in addition to traditional long-only investment funds, and that, in general, pays a performance fee to its investment manager. We then can see the economic function of hedge funds from this definition is that fund managers have the responsibility to guarantee that the invested capital obtained from investors could receive back and earn a healthy return.

Alfred W. Jones was generally considered as the pioneer to start the first hedge fund in 1949. Since then, especially since the turn of the century, the investments on hedge funds have exploded.

Compared to mutual funds, coexisted with hedge funds in the capital market, hedge fund managers typically have the rights to have short positions, to borrow, and to make extensive use of derivatives. Therefore, the hedge

funds return and diversification benefits depend on the skills of managers, to a large extent.

2.2 Methodology of Measuring Hedge Fund Returns

Classic performance measurements, including the Capital Asset Pricing Model (CAPM) and Fama–French four-factor model, are widely adopted for calculating hedge fund returns.

The most widely known performance measurement is the Sharpe ratio, which measures the relationship between the excess return and the standard deviation of the returns generated by a fund (Sharpe, 1966). However, Eling and Schuhmacher (2007) pointed out the drawbacks of the Sharpe ratio. Only if the hedge fund returns are normally distributed and the investors are willing to invest all their risky assets into just one fund, will the Sharpe Ratio be the accurate performance measurement.

In addition, under the situation that only a small portion of the investors' wealth is allocated to the hedge funds, Jensen (1968) first applied of a linear factor model to measure the managed portfolios performance. However, it was challenged by the subsequent empirical work about the ability of the CAPM to capture systematic variation in asset returns.

On the other hand, multifactor model is the most obvious method to estimate the hedge fund returns. Kristien and Jan (2006) introduced Dynamic Investment Strategies of Hedge Funds. Fung and Hsieh (2002), for example, adopted an asset-class multifactor model and Edwards and Caglayan (2001),

on the other hand, employed the Fama-French style risk factors.

2.3 Performance Attribution

Traditionally, hedge fund returns are just attributed to alpha and beta (A&B). However, hedge fund managers switch between asset classes, hold long as well as short positions, use leverage and derivatives resulting in highly non-linear payoff structures. Hence, Ibbotson and Chen (2006) decomposed hedge fund returns into their three components: the value added by hedge fund managers (alphas), the systematic market risks (betas), and the hedge fund fees (costs).

They constructed ten equally weighted indices of the hedge funds and chose three factors which represented traditional stock, bond and cash to perform the regression based on the model of Sharpeee (1992) for the analysis of mutual funds. The results indicated that the alphas were significantly positive and closed to the fees after the adjustment of the data biases, which meant that the investors and the hedge fund managers captured the approximately equivalent excess returns.

2.4 Impact of Incentive Fees

As was mentioned above, the factor models are the mainstream methods used to reach the results of the performance attribution of the hedge funds. However, Brooks, Clare and Motson (2007) found that use the net of the fee returns would underestimate the factor exposures (betas) due to the option-like nature of incentive fees. They used a large sample of hedge funds,

eleven factors and one month USD LIBOR to perform a three-factor model regression and a factor model replication. The results were that the return caused by beta would be underestimated by approximately 58 basis points per annum if the net of the fee returns were used to do the regression. They also demonstrated that replicating the hedge fund performance using the gross returns rather than the net returns can capture a part of the additional beta exposure. As a result, they suggested that using the gross returns of the hedge funds to perform the regression at first, which can eliminate the impact of the incentive fees, and then modeling the incentive fees independently to yield a more accurate relationship between the risks and returns for investors.

2.5 Hedge Fund Performance Replication

If the additional beta exposure can be captured by the replication on the gross returns, we will be interested in whether the hedge fund returns can be replicated. In this field, Hasanhodzic and Lo (2006) said that the performance of the hedge fund can be replicated using the liquid exchange-traded instruments to make up the portfolios with the similar risk exposures. Though the clones may be useless for some strategies like Event Driven and Emerging markets, most of the clones can track the corresponding hedge fund returns. They chose six factors to do the fixed-weight and the rolling-window clones respectively. As a result, they mentioned that the rolling window clones were better than the fixed-weight clones in that the fixed-weight clones were suffered by look-ahead bias due to the weights of the clones' portfolio as well

as the renormalization factors were constructed through the full-time data of fund and factor returns. The rolling window regression could address this problem and yield a higher R square to improve the results. In summary, they concluded that cloning the hedge fund returns is feasible though there are some differences of the performance of clones across hedge-fund strategies.

3: Data and Methodology

3.1 Data

The data used in this paper comes from three sources which are HedgeFund.net database, Bloomberg database and Morningstar database.

In order to find the impact of the incentive fees for hedge funds, we have chosen the monthly net returns of ten equally weighted hedge fund strategy indices from the HedgeFund.net database. The data used in our paper lasted from January 1998 to December 2009, which is the latest twelve year data, whereas the data adopted by the precedent paper was from 1994 to 2006. It should be mentioned that this DataStream including the data of 2008 and 2009, which had a high volatility.

The ten indices include 3,909 hedge funds which are all survived funds. We do not select the removed hedge funds because we are focus on the impact of the incentive fees which are more likely to be paid by the survived hedge funds. The survivorship bias will not seriously affect the results.

We have chosen eleven factors which is shown in Table 4 plus the one month USD LIBOR which is the leverage factor for the purpose of the performance attribution and the factor model replication. The eleven factors are shown in the Table 4. We have found the total return of the Finex-US Dollar index and GSCI Commodity Index from the Bloomberg. The total return of other nine factors plus the data of the one month USD LIBOR was found through the Morningstar database. We have used these twelve factors to

perform the regression with the net returns and gross returns of the hedge funds respectively to prove what we have hypothesized.

3.2 Methodology

3.2.1 Calculating the Net and Gross Hedge Fund Returns

In order to demonstrate the first conclusion in the precedent paper that eliminate the impact of the incentive fee by using the gross returns of hedge funds to perform the regression model, we need to obtain the net and gross hedge fund returns at first.

First of all, we have obtained the monthly net returns of the ten equally weighted hedge fund strategy indices. Then, we have estimated the gross returns of these ten indices by using the net returns, average level of the management fees and incentive fees. The management fees are calculated on a monthly basis.

The procedures we adopted here are as follows:

(1). We have set the initial NAV of the hedge fund index to be one. After that, it is easy to estimate the NAV for each month using the net returns and the initial NAV. According to the formula,

$$\mathbf{R_{NET_t}} = \frac{(\mathbf{NAV_t} - \mathbf{NAV_{t-1}})}{\mathbf{NAV_{t-1}}}$$

(2). If the NAV of the current month belows the highest NAV of the previous months, the gross return of the current month will simply be the net return of the current month plus the calculated monthly management fee.

(3). If the NAV of the current month is higher than the highest NAV of the

previous months, the gross return of the current month will be the sum of the net return of the current month, the monthly management fee and the incentive fee, which is simply the product of the average level of the incentive fees (i.e.20%) and the net return of that month.

3.2.2 Conducting Performance Attribution by Regression Model

After we got the net returns and gross returns, we moved to the critical part of performance attribution. In this part, we adopted the Brooks, Clare and Motson (2007)'s methodology. In order to analyze the performance attribution based on net and gross returns, we performed regressions on net and gross hedge fund returns respectively, using the S&P 500 index total returns, the Barclays Capital US Aggregate Bond Index total returns and the one month USD LIBOR as the stocks, bonds and cash benchmarks. The time series lasted from January 1998 to December 2009. The weights of the three factors should be constrained to sum to one with each style weights to be negative or positive in this regression model.

The model used here was a very simple regression model based on the framework of Sharpeee (1992) for mutual funds. The model was:

$$R_t = \alpha + \sum_{i=1}^{n} \beta_{i,t} F_{i,t} + \varepsilon_t$$

Where

α is the abnormal return

R_t represents the net or gross return of the hedge fund strategy for period *t*

$F_{i,t}$ represents the return of the factor F_i for period *t*

$\beta_{i,t}$ represents the hedge fund strategy's sensitivity to factor F_i at time *t*

After the alphas and betas were calculated, we then made a comparison between those of net returns and gross returns to see whether the betas are underestimated and the changes of the alphas. At last, we extracted the alphas from the net and gross returns to yield the returns from the betas. The fees component in the gross returns was simply the difference between the gross and net hedge fund returns for each strategy. However, the fees component in the net returns was estimated by using the median management and incentive fee levels. As a result, we decomposed the returns of the hedge funds into three components: alpha, beta and fees.

3.2.3 Duplicating Performance of Hedge Fund by Factor Model

There are three hedge fund replication methods, rule-based, factor-based, and distribution replicating approaches. In this part, we tried to testify the second conclusion mentioned in our precedent paper that use the gross returns and net returns to duplicate the performance of the hedge fund respectively by the method adopted by Hasanhodzica and Lo (2006), that is by the factor-based hedge fund replication method, which seeks to replicate hedge fund accessibility to alternative risk premium and control exposures to risk factors.

However, in the process of selecting the specified factors for each hedge fund strategy, we used the results which are shown in Table 5 yielded by Brooks, Clare and Motson (2007) rather than the procedures adopted by

Hasanhodzica and Lo.. Brooks, Clare and Motson ran regressions used the all possible combinations of the eleven factors to indentify the specific factors for each strategy. After determined the factors for each strategy, we then did the rolling window clones used the identified factors plus the one month USD LIBOR for each hedge fund index as well as the broad index. The one month USD LIBOR is a factor accounting for the shorting and leverage. The procedures are as follows:

(1) At first, we used net returns and gross returns of each hedge fund strategy as well as the broad hedge fund index to run a 24-month rolling window regression based on the data from January 1998 to December 2009. The equations were:

$$R_t = \alpha + \sum_{i=1}^{n} \beta_{i,t} F_{i,t} + \varepsilon_t \text{ And } \sum_{i=1}^{n} \beta_{i,t} = 1$$

Where

α is the abnormal return

R_t represents the net or gross return of the hedge fund strategy for period *t*

$F_{i,t}$ represents the return of the factor F_i for period *t*

$\beta_{i,t}$ represents the hedge fund strategy's sensitivity to factor F_i at time *t*

$\sum_{i=1}^{n} \beta_{i,t} = 1$ Can be achieved by using the 1 month USD LIBOR factor

(2) The regression coefficients $\beta_{i,t}$ were then used as the clone portfolio weights to calculate the rough clone returns R_{it}^{*} through the equation:

$$R_{it}^{*} = \sum_{i=1}^{n} \beta_{it}^{*} F_{i,t}$$

(3) A renormalization was needed here to match the volatility of the clone

returns and the hedge fund returns, thus, create a fair comparison. The renormalization factor γ_{it} were then calculated by the following equation:

$$\gamma_{it} = \frac{\sqrt{\frac{[\sum_{k=1}^{24}(R_{it-k} - \overline{R}_{it})]^2}{23}}}{\sqrt{\frac{[\sum_{k=1}^{24}(R^*_{it-k} - \overline{R}^*_{it})^2}{23}}}$$

(4) At last, we used this leverage factor and the previous calculated clone returns to calculate the final clone returns $\widehat{R}_{it}$ using the following equation:

$$\widehat{R}_{it} = (\gamma_{it} R^*_{it}) - (1 - \gamma_{it}) \mathrm{LIBOR}_t$$

We repeated this procedure for each rolling window, hedge fund strategy as well as the broad hedge fund index using both net and gross returns. As a result, we can obtain the clone returns for each strategy and the broad hedge fund index for 10 years from January 2000 to December 2009.

4: Results and Analysis

According to the procedures mentioned above (Chapter 3), we calculated the results and put it into Appendix in order to compare them to that of the precedent paper and then testify the points of the view.

4.1 Properties of Net and Gross Returns

As we can see from Table 1, it is obvious that the compound annual gross returns are higher than the net returns due to the fees charged by hedge funds. The average fee charged in our sample is 4.50% per annum.

Then, we also can see from Table 1 that there are some statistical properties of net and gross returns. And we used the value of three critical items to judge the ‘normal’ level of both net and gross returns.

The annualized standard deviation of the gross returns is higher than that of the net returns for all hedge fund strategies with an average level of 0.38%. When it comes to the skewness and kurtosis, the results in the Table 1 show that all the hedge fund indices as well as the broad index have the higher skewness of the gross returns, however, some strategies have the higher kurtosis and some strategies have the lower kurtosis. As a whole, there is an average increase of 0.29 for the skewness and an average reduction of 0.96 for the kurtosis of the gross returns compared with those of the net returns in our sample.

In summary, it seems that the distribution of the gross returns is more “normal” than that of the net returns. This result is almost as same as that of

Brooks, Clare and Motson (2007) except that almost all the strategies had lower net and gross returns compared with those of their paper. However, the dedicated short bias and global macro have higher returns. The reason is clearly the 2008 financial crisis which made the hedge funds have very bad performance. But the dedicated short bias obtained very high return in 2008, which is in line with our expectation.

4.2 Results of Performance Attribution

The results of the regression model in 3.2.2 were shown in Table 2 and Table 3. As we can see from the Table 2, the average increase of the alpha in our sample is 4.01%, which is much larger than the average level of the management fee (i.e.2%). Moreover, the alphas are significantly positive at the 5% significance level for all hedge fund strategies when we used the gross returns to perform the regression. In addition, we want to mention that the significance results of alphas are the same to that in the reference paper. Therefore, the hedge fund managers do add the returns to the hedge funds and the impact of the incentive fees are obviously on alphas.

When it refers to the beta, the magnitude of the systematic betas for all the ten hedge fund indices as well as the whole sample is greater if the gross returns are used to perform the regressions, which means that the hedge funds managers take more risk when the incentive fees are under consideration. Thus, using the gross returns to perform the regression may yield the more accurate results. The R-square value is volatile for all the hedge

fund strategies. Some strategies have relatively high R-square value such as dedicated short bias, emerging markets, event driven and long short equity. Others have a relatively low R-square value, which is in line with the results in Brooks, Clare and Motson (2007). The results in Table 2 are as same as the results in Brooks, Clare and Motson (2007).

According to Table 3, after we decomposed the hedge fund returns into three components, the returns attributable to the alpha and beta are both larger with an average level of 4.01% and 0.49% respectively. This result means that the beta will be underestimated if we use the net of the fee returns to perform the regression. Thus, the impact of the incentive fees is indeed on both alpha and beta with the major impact on the alpha.

The results in this table is almost as same as that of Brooks, Clare and Motson (2007) except that the gross returns which are grossed up through the estimated fees are lower than the gross returns for almost all the hedge fund strategies. However, in the precedent paper, some strategies have higher gross returns which are grossed up through the estimated fees with others do not have. It is the results of the decreased compound annual returns for almost all the strategies, which make the incentive fees component decreased as well.

In sum, we therefore testified the first conclusion in the precedent paper with the latest data.

4.3 Results of the Factor Model Replication

As was mentioned above, the beta will be underestimated if we use the net of fee returns for the performance attribution. Therefore, we used the gross returns to do the replication in order to capture the additional beta return and eliminate the impact of the incentive fees which create the non-linear payoff between the hedge fund returns and the factors.

As we can see in Table 6, the compound annual gross clone returns are greater in magnitude than the net clones for all indices as well as the broad hedge fund index. The average increase of the gross clones over the net clones is 0.38% though the standard deviation of the gross clone returns is also slightly higher. The performance is improved in the factor replication model for all the hedge fund strategy indices, which means that the result is better than that of the regression performed based on the three factors for all the hedge fund strategies.

We can find that for some strategies, the clone portfolios are able to replicate the actual returns, while for other strategies, the difference between the clone portfolio and the actual return is substantial. Specifically, the emerging market and long/short equity are improved obviously with the extreme high R-square values, however, some strategies such as convertible arbitrage and managed futures, which have the much lower R-square values, have a very limited improvement. And these results are the same to that in the precedent paper. In our opinions, combined with the further research, the mis-estimation of the current exposures to factors caused the failure to track

hedge fund returns. Moreover, there is not a prefect way to replicate hedge fund returns and we need to choose an appropriate one according to certain circumstances. But, as long as the returns of hedge funds are appealing, hedge fund clone products would still prove beneficial and useful. In addition, the correlation between the clone returns and the hedge fund indices returns are 80.42% and 81.75% for gross and net returns respectively, which implies the replication is successful.

In summary, the results in this table are almost as same as those of the precedent paper and we can capture the additional beta return through the gross return replication. Because of the improved the performance of the regression model, this factor replication model further confirms the result that the incentive fees do have the impact on the risk exposures of hedge funds.

5: Conclusions

In our paper, we want to demonstrate the two conclusions drawn in Brooks, Clare and Motson (2007). The first one is that the impact of the incentive fees makes the beta underestimated and therefore it cannot be ignored and the second one is that the duplication of performance of the hedge funds by the hedge funds gross returns can capture the additional beta returns.

At first, we calculated the gross returns for each hedge fund strategy as well as the broad index. We find that the distribution of the gross returns are more “normal” than that of the net of fee returns according to the critical indications, such as standard deviation, skewness and kurtosis. This result in our paper is the same to that in the precedent paper, with most strategies have lower compound annual returns because of the bad hedge funds performance in 2008.

Then, we used both gross returns and net returns to perform a three factor regression model respectively in order to analyze the performance attribution. We find that the use of the net returns would underestimate the return attributable to beta and the incentive fees do have the impact on the hedge funds, which are consistent to what we have expected as well as the precedent paper. In this part, the gross returns which were estimated based on the average level of management and incentive fees are lower for most strategies. This result is different from that of the precedent paper due to the

decreased compound annual returns for most of the hedge fund returns.

After demonstrating that the impact of the incentive fees is really on both alpha and beta, we carried out a factor model replication to see whether some additional beta returns could be captured and confirm the previous results further. We find that we could capture the additional beta returns using the factor model replication based on the gross returns and confirm our expectation further by the improved performance (higher R-square values) in the model. This result is also in line with that of the precedent paper.

We try to figure out the reason why the results are not changed and we think that even though the hedge funds had very bad performance in 2008, hedge funds had very good performance in 2009. Some hedge funds had much higher compound annual returns in 2009 than that of the 2008, which made the hedge funds suffered from the impact of the incentive fees in the latest twelve years as well as the these two high volatile years. Therefore, the impact of the incentive fees on the hedge fund performance measurement is very obvious and should be estimate independently.

Table 1

Statistical Properties of Net and Gross Returns

For the whole sample, compared to net returns, gross returns exhibit higher annualized standard deviation, higher skewness and lower kurtosis, suggesting a more 'normal' distribution of gross returns.

Net Return				
	Compound Annual Ret	**Annualized Std. Dev.**	**Skewness**	**Kurtosis**
Convertible Arb	8.35%	6.85%	-2.99	19.27
Dedicated Short Bias	3.20%	14.70%	0.63	1.55
Emerging MKTs	12.78%	14.97%	-1.22	4.41
Equity MKT Neutral	7.13%	2.88%	-0.19	3.06
Event Driven	9.04%	6.85%	-1.17	3.42
Fixed Income Arb	6.91%	4.50%	-3.79	22.74
Global Macro	10.83%	5.23%	0.797	1.55
Long Short Equity	12.35%	9.24%	0.21	2.63
Managed Futures	9.76%	8.39%	0.45	0.20
Multi Strategy	10.57%	6.50%	0.24	3.21
All Hedge Funds	9.39%	4.15%	-0.78	4.19

Gross Return				
	Compound Annual Ret	**Annualized Std. Dev.**	**Skewness**	**Kurtosis**
Convertible Arb	12.40%	7.12%	-2.77	16.96
Dedicated Short Bias	6.58%	15.50%	0.89	2.61
Emerging MKTS	18.50%	15.75%	-1.01	3.87
Equity MKT Neutral	10.92%	3.29%	0.15	2.41
Event Driven	13.34%	7.33%	-0.94	2.60
Fixed Income Arb	10.54%	4.67%	-3.55	20.69
Global Macro	15.61%	6.06%	1.01	1.85
Long Short Equity	17.66%	10.29%	0.59	3.14
Managed Futures	14.53%	9.42%	0.69	0.54
Multi Strategy	15.37%	7.30%	0.60	3.52
All Hedge Funds	13.89%	4.53%	-0.49	3.23

Table 2

Regression Results for Equally Weighted Hedge Fund Indices

For our sample, using gross returns, alphas are significant at the 5% significance level for all 10 strategies and the magnitude of betas for the risky assets (stocks and bonds) is also greater.

Regression Results: 1998-2009							
		Compound Annual Return	Annual Alpha	Betas (sum of Betas = 1)			
				Stocks	Bonds	Cash	RSQ
Convertible Arbitrage	**Net Return**	8.35%	3.62%	0.1906	0.3201	0.4893	23.56%
	Gross Return	12.40%	6.99%	0.1978	0.3225	0.4797	23.29%
Dedicated Short Bias	**Net Return**	3.20%	7.14%	-0.7437	0.0417	1.7020	69.68%
	Gross Return	6.58%	11.38%	-0.7879	0.0929	1.6950	70.48%
Emerging Markets	**Net Return**	12.78%	3.13%	0.5932	-0.0254	0.4322	42.72%
	Gross Return	18.50%	8.24%	0.6165	-0.0636	0.4471	41.78%
Equity Market Neutral	**Net Return**	7.13%	3.79%	0.0530	0.0912	0.8558	10.31%
	Gross Return	10.92%	6.95%	0.0584	0.0980	0.8436	9.54%
Event Driven	**Net Return**	9.04%	3.30%	0.2939	-0.0551	0.7611	50.38%
	Gross Return	13.34%	6.78%	0.3097	-0.0806	0.7709	48.84%
Fixed Income Arbitrage	**Net Return**	6.91%	3.61%	0.0706	0.1592	0.7702	8.18%
	Gross Return	10.54%	6.80%	0.0729	0.1671	0.7600	8.17%
Global Macro	**Net Return**	10.83%	3.45%	0.1189	0.2547	0.6264	16.85%
	Gross Return	15.61%	7.64%	0.1337	0.2684	0.5980	15.54%
Long/Short Equity	**Net Return**	12.35%	5.04%	0.3980	-0.0203	0.6223	50.51%
	Gross Return	17.66%	9.54%	0.4242	-0.0553	0.6311	46.39%
Managed Futures	**Net Return**	9.76%	3.04%	-0.0798	0.5104	0.5694	7.76%
	Gross Return	14.53%	7.48%	-0.0965	0.5684	0.5281	8.09%
Multi-Strategy	**Net Return**	10.57%	5.48%	0.2517	0.0967	0.6516	40.81%
	Gross Return	15.37%	9.74%	0.2735	0.0888	0.6377	38.17%
All Hedge Funds	**Net Return**	9.39%	3.23%	0.1146	0.1373	0.7480	21.93%
	Gross Return	13.89%	7.24%	0.1202	0.1406	0.7391	20.19%

Table 3

Performance Attribution for Equally Weighted Hedge Fund Indices

Systematic betas are underestimated based on the net returns compared to those of the gross returns and the average increase of the alpha in our sample is 4.01%, which is much larger than the average level of the management fee (2%)

Source of Return: Alpha, Beta and Cost 1998-2009						
		Pre-Fee Return	**Fees**	**Post-Fee Return**	**Alpha**	**Systematic Betas**
Convertible Arb	**Net Return**	12.44%	4.09%	8.35%	3.62%	4.73%
	Gross Return	12.40%	4.05%	8.35%	6.99%	5.41%
Dedicated Short Bias	**Net Return**	6.00%	2.8%	3.20%	7.14%	-3.94%
	Gross Return	6.58%	3.38%	3.20%	11.38%	-4.80%
Emerging MKTs	**Net Return**	17.98%	5.20%	12.78%	3.13%	9.65%
	Gross Return	18.50%	5.72%	12.78%	8.24%	10.26%
Equity MKT Neutral	**Net Return**	10.91%	3.78%	7.13%	3.79%	3.34%
	Gross Return	10.92%	3.79%	7.13%	6.95%	3.97%
Event Driven	**Net Return**	13.30%	4.26%	9.04%	3.30%	5.74%
	Gross Return	13.34%	4.30%	9.04%	6.78%	6.56%
Fixed Income Arb	**Net Return**	10.64%	3.73%	6.91%	3.61%	3.30%
	Gross Return	10.54%	3.63%	6.91%	6.80%	3.74%
Global Macro	**Net Return**	15.54%	4.71%	10.83%	3.45%	7.38%
	Gross Return	15.61%	4.78%	10.83%	7.64%	7.97%
Long/Short Equity	**Net Return**	17.44%	5.09%	12.35%	5.04%	7.31%
	Gross Return	17.66%	5.31%	12.35%	9.54%	8.12%
Managed Futures	**Net Return**	14.20%	4.44%	9.76%	3.04%	6.72%
	Gross Return	14.53%	4.77%	9.76%	7.48%	7.05%
Multi-Strategy	**Net Return**	15.21%	4.64%	10.57%	5.48%	5.09%
	Gross Return	15.37%	4.80%	10.57%	9.74%	5.63%
All Hedge Funds	**Net Return**	13.74%	4.35%	9.39%	3.23%	6.16%
	Gross Return	13.89%	4.50%	9.39%	7.24%	6.65%

Table 4

Selected Factors for Replication

There are 11 candidate factors which provide a broad cross section of risk exposures. These factors are sorted into two groups: those that require investment and those that are cash neutral.

Factors Requiring Investment		
Name	**Description**	**Data Stream Mnemonic**
MKT	S&P 500	WILEQTY
CMDITY	GSCI Commodity Total Return	GSCITOT
BOND	Barclay Capital Aggregate Total Return	LHAGGBD
EMERGING	MSCI Emerging Markets Index Total Return	MSEMKFL
GLOBAL STOCKS	JP Morgan Global Broad Excluding U.S. Total Return	JPMBXUS
GLOBAL BONDS	MSCI World Excluding U.S. Total Return	MSWFXU
DVIX	Change In CBOE VIX Index	CBOEVIX

Cash Neutral Factors		
Name	**Description**	**Data Stream Mnemonic**
SMB	S&P 500 Small Cap Minus S&P 500 Large Cap (Both Total Return)	WILEQTY&WILDJLC
USD	Finex-US Dollar Index Return	NDXCS00
CREDIT	Barclay Capital Credit Intermediate Bond Index Minus Barclay Capital Government Intermediate (Both Total Return)	LHCRPIN&LHGOVIN
SLOPE	Barclay Capital Treasury: 20+ Year Index Minus Barclay Capital Short Treasury Index (Both Total Return)	LHTR20Y&LHSHORT

Table 5

Results of Factor Selection

This table shows the specified factors for each hedge fund index. The result was quoted from Brooks, Clare and Motson (2007).

	MKT	SMB	USD	CMDTY	BOND	CREDIT	SLOPE	EMERGING	GLOBAL-STOCKS	GLOBAL-BONDS	DVIX
Convertible Arb				-0.1676		4.7782					0.3358
Dedicated Short Bias	-0.4704										
Emerging MKT	0.1741					1.7949		0.1918			
Equity MKT neutral	0.9976	0.2139		0.0903							0.0219
Event Driven	0.1432		0.0979		0.2597	1.3747		0.0589			0.0373
Fixed Income Arb			0.3530	-0.1130		1.5706				0.5375	-0.0704
Global Macro		-0.2030				2.4284		0.0731	-0.1027	0.3253	
Long Short Equity	0.2698	0.1895	0.1387	0.0800			0.0890	0.0771	-0.0388	0.1854	
Managed Futures			0.4379					0.0000	-0.1298	0.6477	
Multi-strategy			0.3873	0.1302	0.7322	-3.6661		0.1485			

Table 6

Results of the Factor Model Replication

In all cases, the returns of the gross clones are greater in magnitude than those of the net clones, demonstrating that the additional beta returns could be captured by gross returns rather than net returns.

Regression Results: 1998-2009							
		Index		**Clone**			
		Compound Annual Return	**Annual Standard Deviation**	**Compound Annual Return**	**Annual Standard Deviation**	**Mean R2 of Regression**	**Correlation Between Clone & Index**
Convertible Arb	NR	7.57%	7.27%	4.98%	11.13%	35.30%	47.72%
	GR	11.45%	7.53%	5.74%	12.21%	34.56%	46.18%
Dedicated Short Bias	NR	3.18%	13.98%	-0.58%	22.23%	77.80%	83.29%
	GR	6.30%	14.44%	-1.73%	22.63%	78.49%	83.87%
Emerging MKTs	NR	13.97%	12.88%	7.78%	14.04%	92.64%	85.88%
	GR	19.95%	13.62%	12.56%	15.42%	91.97%	80.72%
Equity MKT Neutral	NR	5.67%	2.60%	5.28%	3.40%	45.79%	40.62%
	GR	9.10%	2.92%	8.88%	3.68%	45.65%	42.87%
Event Driven	NR	8.41%	6.51%	5.04%	7.67%	86.51%	77.72%
	GR	12.57%	6.96%	5.89%	8.18%	85.10%	76.36%
Fixed Income Arb	NR	6.87%	3.64%	5.70%	4.49%	48.67%	38.02%
	GR	10.53%	3.83%	5.82%	4.54%	48.54%	37.45%
Global Macro	NR	9.11%	4.64%	9.18%	7.52%	71.07%	48.73%
	GR	13.50%	5.32%	10.86%	8.75%	70.91%	45.77%
Long/Short Equity	NR	8.34%	8.12%	1.59%	9.86%	95.32%	87.67%
	GR	12.67%	8.85%	1.77%	11.14%	94.24%	85.80%
Managed Futures	NR	8.94%	8.44%	9.35%	9.78%	34.52%	40.45%
	GR	13.55%	9.42%	10.46%	11.20%	33.75%	40.66%
Multi Strategy	NR	8.61%	5.89%	5.28%	6.35%	77.69%	66.29%
	GR	12.97%	6.51%	5.81%	6.93%	77.19%	62.97%
All Hedge Funds	NR	8.31%	3.98%	4.46%	4.33%	90.31%	81.75%
	GR	12.53%	4.30%	4.94%	4.99%	89.49%	80.42%

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