

Hedge Fund Alpha, Cycle or Sunset?

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Abstract

The hedge fund industry has grown from \$200 billion in assets under management around the turn of the millennium to now over \$3 trillion. Many reports criticize hedge funds for destroying investor capital particularly since the 2008 global financial crisis (GFC). In this paper, I investigate this assertion and further seek to demystify hedge fund strategies by evaluating fund performance that can be attributed to the market as well as other well-known systematic factors over the past 25 years to include outcomes prior to and following the 2008 GFC. When adjusted for market risk the evidence shows that, after fees and costs, hedge fund managers as a group have shown a marked decline in risk-adjusted return and appraisal ratios since the GFC. Although performance has not been great in recent years, I show why it is perhaps not quite as terrible as the headlines often suggest. I further investigate hedge fund returns against a suite of well-known systematic risk/return factors documented in the literature beyond the market factor and find that hedge funds have meaningful exposures to many of these factors which have importantly influenced their returns over the past 25 years. Armed with this information, investors are better positioned to make more informed decisions in deciding manager allocations.

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Hedge Fund Alpha, Sunset or Cycle?

The hedge fund industry has grown quite rapidly from its nascent early years at the turn of the millennium with around \$200 billion in assets under management to now over \$3 trillion in assets under management.¹ With that growth has come increased scrutiny with many reports criticizing hedge funds for destroying investor capital particularly since the 2008 global financial crisis (GFC). I review the empirical evidence for performance and risk exposures of hedge fund managers over the past 25 years, with a particular emphasis on comparing outcomes prior to and following the 2008 global financial crisis (GFC), adjusting for market risk and additional well-known risk factors documented in the literature. I review hedge funds as a group overall as well as fund managers focused on equities.

Hedge funds have drawn much attention in recent years. Critics often point to how hedge funds managers as a group have underperformed the stock market especially since the GFC. Much of this criticism of hedge fund performance however compares them incorrectly against an all-equity benchmark. As we know, any measure of the value of active management of hedge funds must account for risk or factor exposure. That is, hedge funds create value when they deliver a return greater than a passive benchmark of similar risk. So criticisms of hedge fund performance that use an incorrect benchmark (most often assuming 100 percent equity exposure as the benchmark) lack merit (see for e.g., Asness, Krail and Liew, 2001). In this paper, I will examine how hedge funds have performed over the past 25 years for which we have available data. In particular, I investigate hedge fund market risk-adjusted performance, or alpha, over the full 25-year period and to what extent the level of alpha has changed, especially in the 10-years since the GFC. I will then turn attention to explore to what extent hedge fund returns are influenced by other systematic factors that have been shown in the literature to influence returns of active managers. Equipped with an understanding of the risk factors and alpha driving hedge fund returns, investors are better able to consider whether or not there are positive expected returns associated with these factors, and the possible time horizon for reaping any associated positive risk premium.

Hedge Fund Performance and Market Risk

To adjust for hedge fund market risk, I'll start with a simple regression that measures hedge fund alpha and market beta over the full 25 year sample period beginning in 1994, when data for hedge funds has been deemed more reliable, and ending June 2019. This can be seen by estimating Equation 1, shown below, which adjusts for the market using the S&P 500 and follows the approach of Dimson (1979) and Asness, Krail, and Liew (2000). For hedge fund returns, I create a hedge fund composite using the monthly after-fee returns of the overall Credit Suisse Hedge Fund Index and the HFRI Fund Weighted Composite Index (weighted 50/50).

¹ Source, BarclayHedge website <https://www.barclayhedge.com/solutions/assets-under-management/hedge-fund-assets-under-management/hedge-fund-industry/>

Equation 1

$$R_t = \alpha_1 + \beta_1 \text{S\&P500}_t + \beta_2 \text{S\&P500}_{t-1} + \varepsilon_t$$

2.2%	0.30	0.07
(2.47)**	(17.42)***	(3.83)***

$$R^2 = 0.52$$

Where

R_t is the monthly total net return of the hedge fund composite, net of fees, in month t

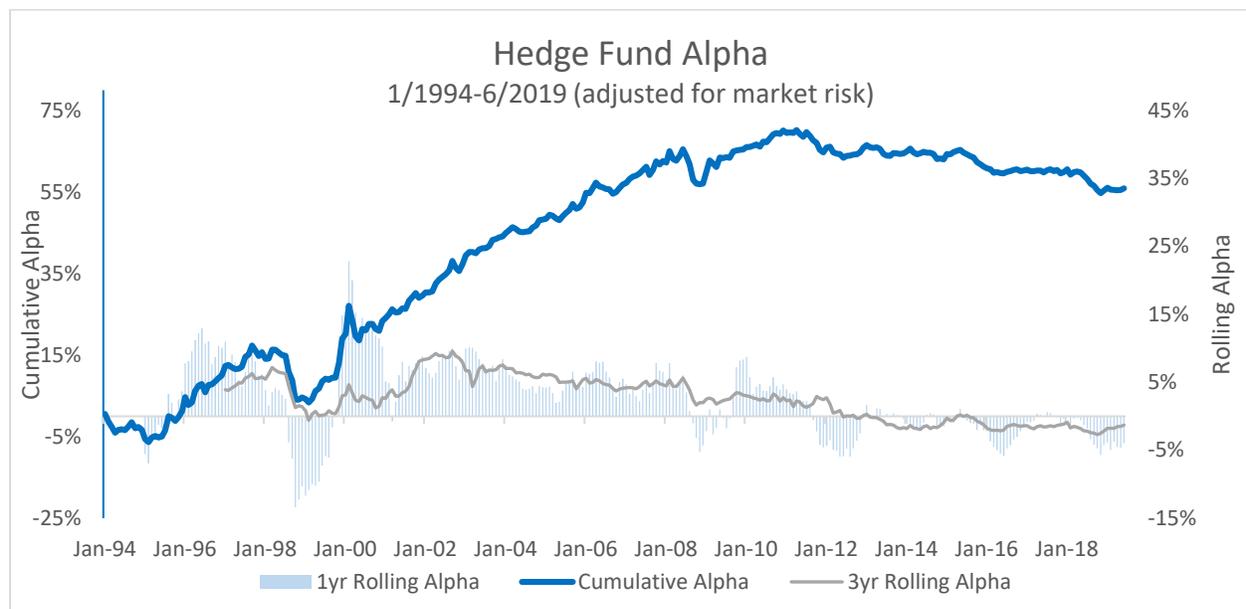
S\&P500_t is the total return of the S&P500 in month t

α_1 is the average annualized alpha, β are the regression coefficients, and ε is the error term.

t statistics shown in parenthesis. ***, **, * represent 99 percent, 98 percent and 95 percent confidence respectively

In this model, the total hedge fund beta with the market is the sum of the betas ($\beta_1 + \beta_2$). Consistent with other researchers (Asness 2018a), over the full 25 year period, I find a small statistically significant annual alpha and a strongly significant total market beta of 0.37. This means that hedge funds have on average a 37 percent long exposure to stocks and thus do at least partially hedge and should not be compared to 100 percent stock exposure. Next, using this equation, I calculate the cumulative hedge fund alpha over the full sample which is simply the difference between each month's unadjusted hedge fund return and the return attributed to the average market risk and add this to the prior month (I do not compound alpha). The cumulative alpha is shown as the solid line in Figure 1. I also show here the one-year and three-year rolling alpha to allow an easier comparison of the average level of hedge fund manager excess return over time. Taken together, we can see how much total market-adjusted alpha an investor would have received by investing in the average hedge fund over the 25 year period and how consistent is that alpha over time. As we know from Equation 1, the average alpha is 2.2% per year over the full period, but now we can also see how the level of alpha has changed over time as visualized in Figure 1.

Figure 1



Source: Author analysis using data from Bloomberg, Hedge Fund Research Institute and Credit Suisse. Hedged funds are defined as a blend of 50 percent HFRI and 50 percent CS HFFW returns each month. Alpha is hedged against the S&P 500. See appendix for more detail.

Here, we can see that hedge fund managers have added alpha cumulative after fees over the full period. We can also see a pattern emerge whereby hedge fund manager performance was in general stronger in the pre-GFC period, though underperforming during the internet bubble period of the late 90s and strongly out-performing following its bursting in early 2000, and a weakening of performance following the GFC in 2008. This weakening can be seen in both the flattening of the cumulative alpha curve (actually a slight downward sloping curve since 2009) and also in the low to negative rolling 1-year alpha (bars) beginning in 2008 with periods of negative performance over much of the recent decade. The 3-year rolling alpha makes this downward trend clear with mostly slightly negative alpha for hedge funds over the prior 36 months since the beginning of 2013.

By making a slight modification to the regression equation I now quantify the magnitude of the observed decline in risk-adjusted alpha for hedge funds since the 2008 GFC. To do this, I add a binary intercept “dummy” variable to Equation 1 which allows a separation of the estimated alpha for the 15 years ending in 2008 from the 10 years prior. As expected, the results from this regression, reported in Equation 2 and Figure 2, show a marked decline for both annualized alpha (from 3.8% per year to -0.2% per year on average) and appraisal ratio (from 0.73 to -0.08) for the collective group of hedge funds in the 10 years following the GFC when adjusted versus the market. Note that the estimated dummy parameter of -4.0 percent represents the change in alpha over the post-crisis period relative to the pre-crisis period, so that the average realized risk adjusted alpha over the post-crisis period equals -0.2 percent (3.8 percent plus -4.0 percent).² I find separately that the total summed beta is largely unchanged over the two periods at 0.37.

Equation 2

$$R_t = \alpha_1 + \beta_1 S\&P500_t + \beta_2 S\&P500_{t-1} + \alpha_2 D09 + \varepsilon_t$$

3.8%	0.30	0.07	-4.0%
(3.36)***	(17.68)***	(4.05)***	(2.27)**

$R^2 = 0.52$

Where

R_t is the monthly total return of hedge funds, net of fees, in month t

$S\&P500_t$ is the total return of the S&P500 in month t

$D09$ is a dummy variable equaling zero from 1/1994 to 12/2008 and 1 otherwise (1/2009-6/2019)

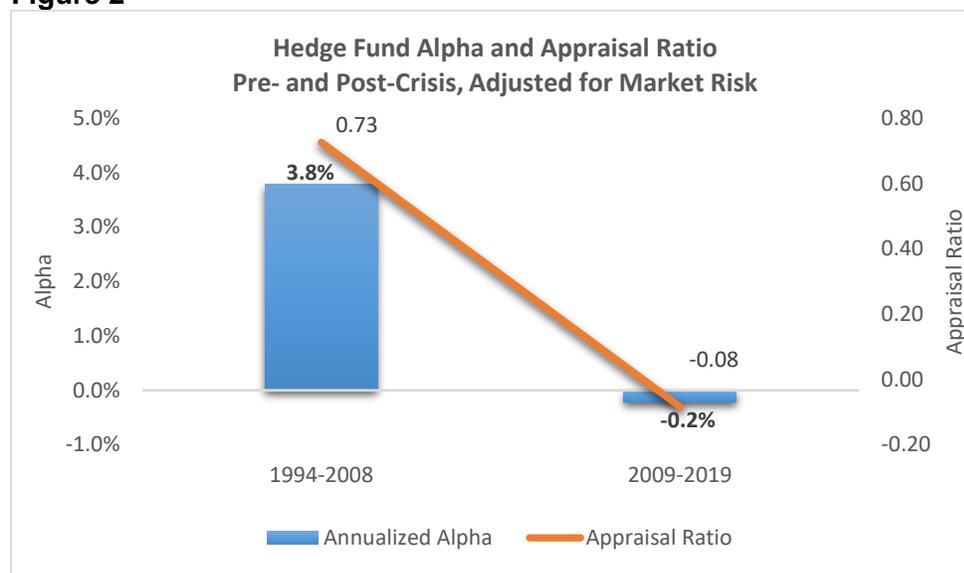
t statistics shown in parenthesis. ***, **, * represent 99 percent, 98 percent and 95 percent confidence respectively

α_1 is the average annualized alpha for the pre-crisis period (1/1994 to 12/2008). Average annualized alpha for the post-crisis period (1/2009-6/2019) is the sum of the two alphas ($\alpha_1 + \alpha_2$).

β are the regression coefficients, and ε is the error term.

² Another approach to estimate the change in alpha over the two periods is to simply run two separate regressions (one for each sub-period) and that omits the lag market variable yields very similar results.

Figure 2



Source: Author analysis using data from Bloomberg, Hedge Fund Research Institute and Credit Suisse. Hedged funds are defined as a blend of 50 percent HFRI and 50 percent CS HFFW returns each month. Alpha and appraisal ratio are hedged against the S&P 500. See appendix for more detail.

As we'll see later, the post-crisis decline in risk-adjusted alpha remains when performance is further adjusted for exposures to additional well-known risk factors beyond the market.³ Later in this paper, I will dig deeper into the results shown in Figure 2 by reviewing the performance of hedge fund strategies across time and adjusted for exposures to well-known risk factors for hedge funds overall as well as equity funds.

Quantifying Hedge Fund Value-Add

The performance of hedge fund managers as a group over the past ten years as discussed above and shown in Figure 1 and Figure 2 is clearly not good and have led many to question whether hedge fund alpha, after ten years of low to no alpha, has disappeared altogether. The commentary in recent years has not been kind to hedge funds, with many suggesting that hedge funds managers have destroyed considerable capital and that investors should shed all their hedge fund managers.⁴

To evaluate such claims of capital destruction, we need to quantify the degree to which hedge fund managers have added (or destroyed) value for investors over the past 25 years. We can quantify the impact on invested capital by using our above "alpha model" combined with the hedge fund industry AUM (shown in Figure 3) and applying the approach of Berk and van

³ As might be expected, as I'm applying this to overall hedge funds, a similar drop can be seen among many, though not all, of the various strategies (Credit Suisse identifies 9 such strategies) employed by hedge fund managers.

⁴ See for instance <https://www.marketwatch.com/story/be-like-calpers-dump-your-hedge-funds-2014-09-18> and <https://www.bloomberg.com/opinion/articles/2018-02-15/hedge-funds-underperform-yet-keep-attracting-pension-fund-money>

Binsbergen (2015). To do this, I simply multiply the average quarterly hedge fund AUM times the average risk-adjusted alpha (not compounded) over the same quarter. The result is the dollar value added by hedge funds for investors after fees (how much value did hedge managers, on average, add for their clients after fees) during each quarter from 2000 to 2019. I then calculate the rolling 1-year total value add to smooth the results and show this in Figure 4.

Figure 3

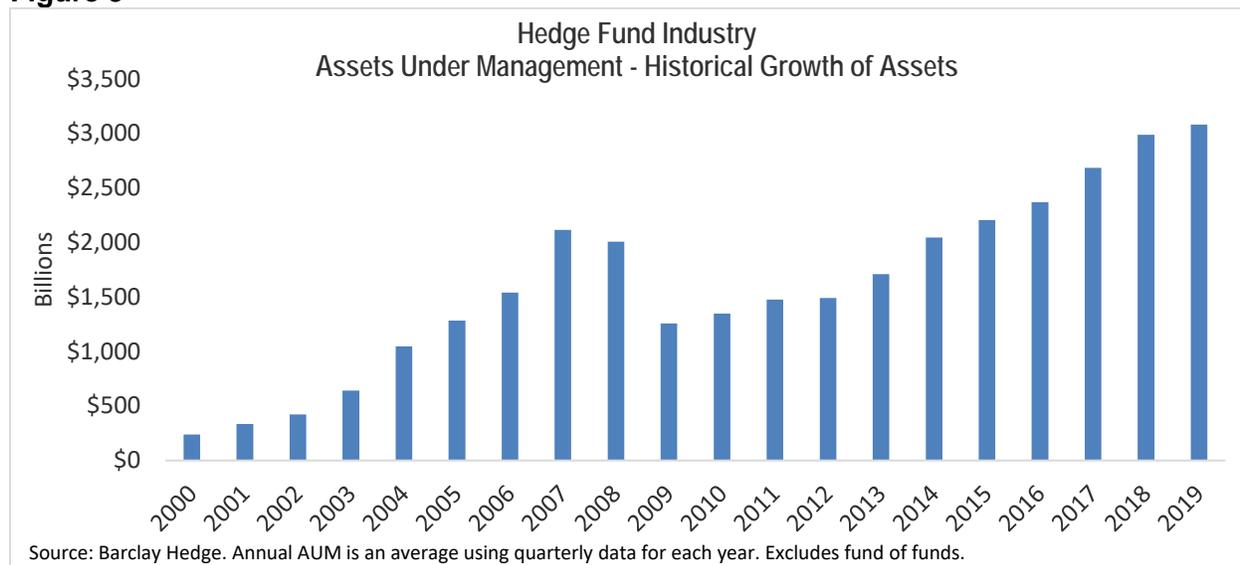
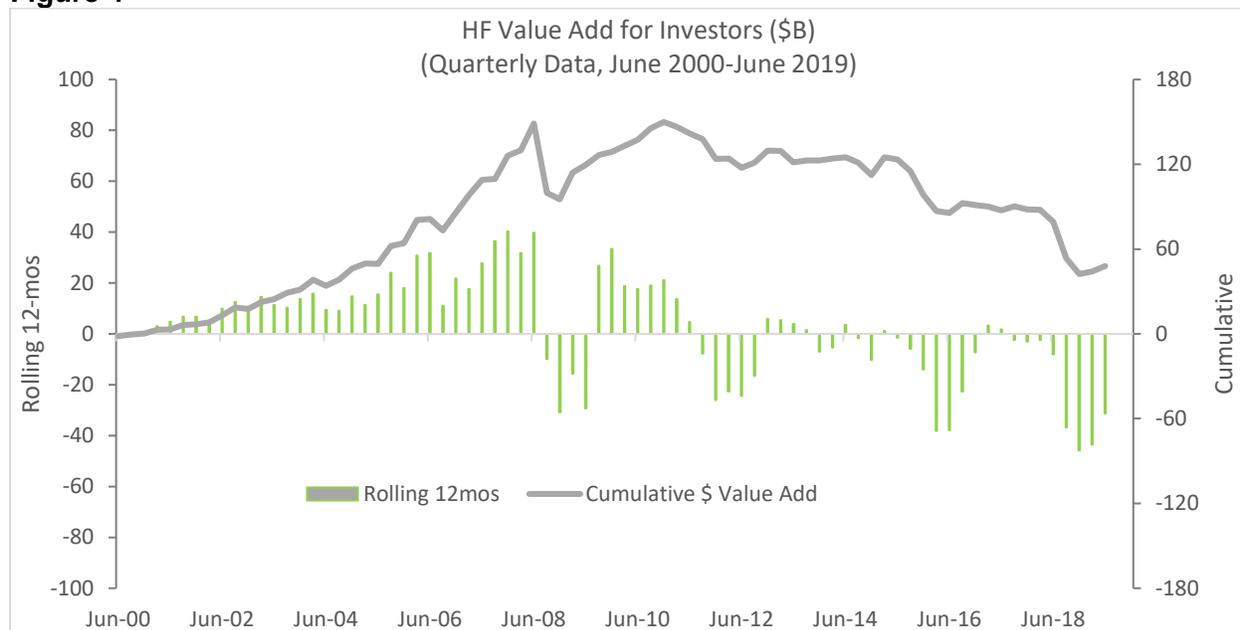


Figure 4



Consistent with our above discussion, after adding value for their clients in the early period, hedge fund value added has since declined, with the 12-month value add falling below zero around 2012 and mostly remaining there since. For the 12 months ending June 2019, hedge

fund managers subtracted \$31.3 billion in value on an average asset base of \$3.1 trillion. Also shown in Figure 4 is the cumulative dollar value added over the full period. Although this line has been falling in recent years (obviously, as consistent with the negative annual value add), hedge funds have created a cumulative \$48 billion in value for investors over the full period after accounting for risk and costs. Though these findings follow from our earlier discussion of hedge fund alpha, it is nonetheless interesting and important addition to the ongoing dialogue on hedge fund value add. This is especially so as so many commentaries raise concerns about hedge fund value-add but without quantifying the actual impact on invested capital.

Time will tell whether the sun has set on hedge fund alpha and the future is indeed dim for them. On the other hand, as others have suggested (Asness 2018), hedge fund managers may be experiencing a period of temporary (in statistical terms) weak performance and that over the longer-term, the strategies and risk premiums that many managers pursue are positive and worthwhile over the long-term. If so, performance of hedge funds could revert to their long-term averages and move back into positive territory in future years. My experience suggests a deeper dive is needed to better understand some of the key drivers behind hedge fund strategies and their performance. This information will help us to understand to what extent hedge fund performance can be explained through various risk factors, and how much of it is due to the random (idiosyncratic) nature of hedge fund alpha (or some combination of both). Hopefully from this we gain insight into historical drivers of performance and also the possible persistence of future performance be it from factors or alpha. Next, we'll make a closer inspection of this issue and reveal an interesting set of factors that describe, in part, hedge fund performance, but that a nuanced picture of the world of hedge fund performance remains. Armed with this information, investors are better positioned to make more informed decisions in deciding manager allocations.

Hedge Fund Performance and Additional Risk Factors

As mentioned, conclusions about hedge fund performance must account for their market risk exposure. In evaluating fund performance, the literature commonly goes beyond relying solely on market exposure to include factor exposures Carhart (1997). While informative, these models have important limitations and there is no broad agreement on which set of factors to employ. For instance, the literature has identified hundreds of potential pricing factors that could be used in attributing returns, and using systematic factors also runs the risk of overfitting (Harvey, Liu, and Zhu (2016), Harvey and Liu (2014), and Hou, Xue, and Zhang (2017)). The choice of factors to include in the modeling exercise will have a significant effect on any conclusions drawn and is subject to data snooping, hindsight bias and so forth. For these reasons, in evaluating alpha and value add, the market risk-adjusted model discussed above that compares hedge fund returns adjusted for their degree of risk to a passive market exposure is perhaps most appropriate; whenever hedge fund returns beat that risk-adjusted passive index return, then they add alpha and value.

Regardless of whether performance comes from idiosyncratic alpha or factor betas, investors today have awareness of sources of systematic returns beyond market risk. These “research factors” may be valuable from a return and risk standpoint and so should not be ignored altogether. In other words, while historically the main way for a fund to outperform was via idiosyncratic alpha or by simply taking more market risk, managers now have access to a suite of other risk/return factors allowing for a variety of ways to potentially add value. So while there are limitations to using factors to evaluate performance, it's nonetheless important to go beyond a market-adjusted estimate of alpha in order to more fully demystify hedge fund strategies. That

is, we want to evaluate performance that can be attributed to all systematic factors so that we can better understand the various risk exposures of managers over time.

To better gauge the degree to which risk factors beyond the market have historically driven hedge fund performance, I next seek to decompose risk and return for the hedge fund composite. I use systematic factors that employ a rules-based approach to investing and have been tested over time by many researchers, across markets, and are well-known. I note importantly here that any such analysis is backward looking and employs factors that are well-known today but may not have been well-known over the full study period. Nonetheless, a better understanding of which investment styles (if any) are part of a typical hedge fund manager's process will help to provide clear implications for evaluating the sources and risks hedge fund manager performance both past and future. For all these reasons, it's useful to understand how hedge funds may seek to add value even when their returns are below any performance that can be attributed to systematic research factors whether or not these factors are known in advance.

We'll therefore add to the analysis by adding to our model systematic risk factors that have been shown in the literature to impact performance over time. I narrow the "factor zoo" list of possibilities down to include a narrow list of those factors shown in the academic literature to possess positive risk premium over the long run for active managers, are well-known, and are independent (very low to no correlations to one another). Table 1 defines the variables and systematic investment factors considered in the analysis. I note here that the factors themselves cannot be produced for zero cost, and so a manager implementing these factor exposures would have a cost associated with doing so (I use net of fee cost and returns throughout, so this is not an issue in our analysis). All returns are determined on an unfunded basis, which is done by using futures, a dollar-neutral long-short portfolio, or using returns in excess of the 3-month T-Bill rate. I also note that most of the systematic factors used here relate specifically to stocks and so some may suggest they are not as relevant to evaluating the hedge fund composite as for an equity-related strategy. This is true, although the correlation of returns between our hedge fund composite and our equity hedge fund composite (we'll examine later) is a very high 89 percent over the full period making this a relevant exercise.

Following Harvey, Rattray, Sinclair, and Van Hemert (2017), I scale all research factors to have 10 percent volatility which allows for an easier comparison of betas to different factors; larger beta suggests that more variance is explained by that factor. Table 1 shows the full list of variables and instruments used. The traditional factors include the main large and easily investable asset classes, stocks (S&P500), bonds (Barclays US Treasury Index and Bloomberg Barclays Global-Aggregate). **[need to add the BBerg Tickers]**

As for the research factors, there are two Fama-French (1993) factors: size (small-minus-big US stocks) and cross sectional momentum (winner-minus-loser US stocks).⁵ Jegadeesh and Titman (1993) and Carhart (1997) report on cross-sectional momentum. The returns for these two factors can be obtained from Kenneth French's website. There are four factors from AQR: value (high-minus-low book value US stocks adjusted for more recent book value per Asness and Frazzini (2013)), quality (quality-minus-junk, Asness, Frazzini, and Pedersen (2019)), low beta (betting against beta, or low beta minus high beta, Frazzini and Pedersen (2013)), and time series momentum (recent outperforming indexes for stocks, bonds, currencies, and

⁵ see Ken French's website for the returns data for these factors:
http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

commodities, Moskowitz, Ooi and Pedersen (2011).⁶ For the equity volatility factor, I use the approach of Fung and Hsieh (2001, 2002) which is long an option straddle (long both a put and call stock option with the same strike price).⁷ Finally, for the currency carry (FX carry) factor, I use data from Deutsche Bank following Harvey, Rattray, Sinclair, and Van Hemert (2017).⁸

As mentioned, these factors were not all necessarily well-known over the entire sample period. Some have arguably been well-understood over the study period, like the Fama-French factors, while others, TSOM and QMJ, for instance were not published on until much later. As mentioned above, my purpose here is to evaluate risk and return factors contributing to historical performance, not to judge value add or minimize the importance of manager innovation. That is, the main point here is not to negate any value add from these factors should a manager employ them, but instead to better understand ex-post the risk factors that managers have been exposed to over the study period and how these influenced hedge fund returns.⁹

Table 1: Variable Descriptions

Category	Name	Instruments
Hedge Fund	Hedge fund composite	HFRI Fund Weighted Composite Index plus Credit Suisse Hedge Fund Index (50/50 weighted)
Traditional	Equity market	S&P 500 index
	Bond market	Barclays US Treasury index
		Bloomberg Barclays Global-Aggregate
Research Factors	Size (stocks)	Small-minus-big US stocks (SMB) (Ken French)
	Value (stocks)	High-minus-low book value US stocks (HMLdevil) (AQR)
	Momentum (stocks)	Winner-minus-loser US stocks (UMD) (Ken French)
	Quality (stocks)	Quality-minus-junk (QMJ) (AQR)
	Low Beta	Betting against beta (BAB) (AQR)
	Momentum (index time series)	Indices for stocks, bonds, foreign exchange, commodities (TSOM) (AQR)
	Equity Volatility	Return on stock lookback straddle (Equity Vol)
	FX Carry	Currency Carry (Deutsche Bank)

⁶See AQR website for the returns data for these factors: <https://www.aqr.com/Insights/Datasets>.

⁷ See David Hsieh's website for the returns data for this factor:

<http://faculty.fuqua.duke.edu/~dah7/DataLibrary/TF-FAC.xls>

⁸ Bloomberg ticker: DBHTG10U.

⁹ Although some factors may not have been well understood in the academic literature over the study period, the ideas behind them have likely been well-known in practitioner circles for many years. Consider Benjamin Graham (1934) discussed the importance of value and quality, Fischer Black (1972) evaluated how the capital market line was unexpectedly flat, and the idea that the "trend is your friend" has been practiced for decades [need cite].

Figure 5
Panel A

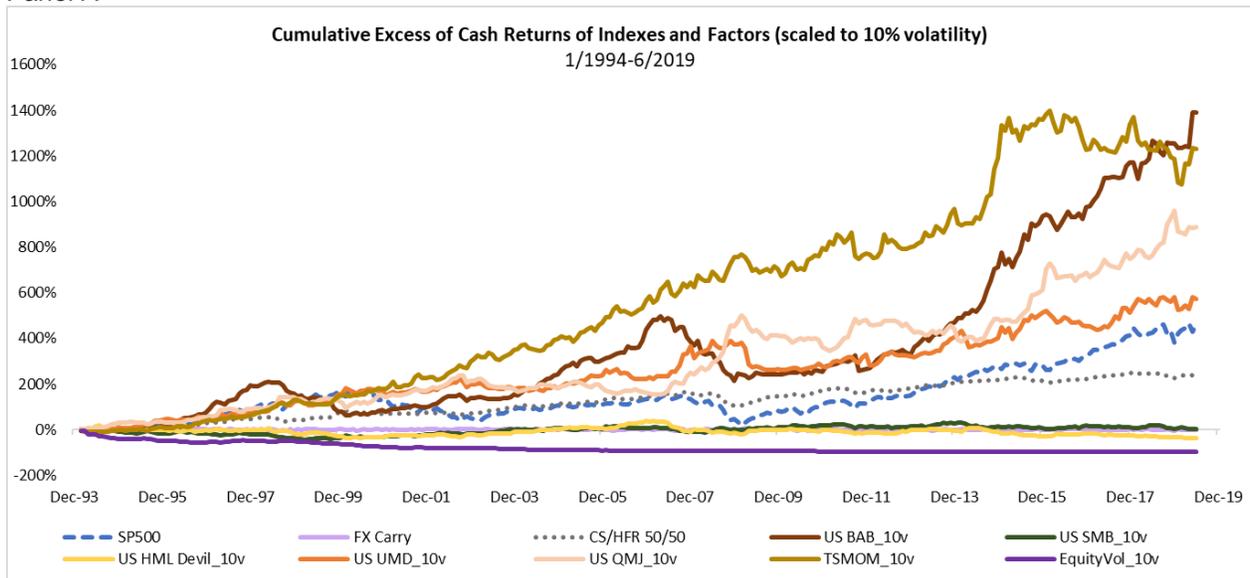


Figure 5

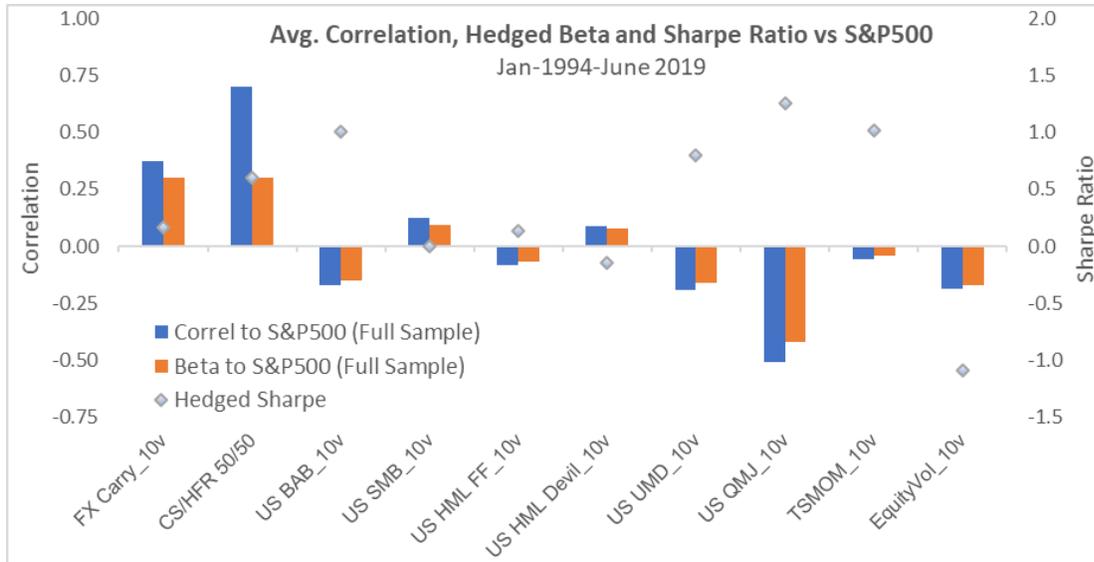
Panel B: Average Monthly Excess Returns (annualized) Jan1994-Jun 2019

CS/HFR 50/50	SP500	US SMB_10v	US HML Devil_10v	US UMD_10v	US QMJ_10v	US BAB_10v	TSMOM_ 10v	Equity Vol_10v	FX Carry_10V
5.1%	7.9%	0.7%	-1.2%	8.3%	9.7%	11.5%	10.8%	-15.5%	4.1%

Figure 5 Panel A shows the cumulative returns of the stock market, the hedge fund composite, and the systematic research factors over 1994-2019(June). Returns shown are compound, excess of cash, returns. Figure 5 Panel B shows the average annualized returns over the same period. The hedge fund, stocks, and research factors have a positive risk premium over the period, with the exception of the value factor, HMLdevil, which has a slight negative premium of -1.2 percent and the equity volatility factor returning -15.5 percent (being short volatility has a negative return due to the volatility risk premium, see Israelov (??)). I note that the related Fama-French HML factor (not reported here) has a slight positive risk premium over the study period and reported results are roughly unchanged whether using the HML devil or more traditional Fama-French HML factor.

In Figure 6, I report the correlations, betas, and Sharpe ratios (diamonds) for the different research factors and the hedge fund composite. The highest correlation and beta to the S&P 500 is the hedge fund composite with an average beta of around 0.3 and correlation of 70 percent. The research factors all have low to negative correlations with the S&P 500, with QMJ having the strongest negative correlation and beta and the highest Sharpe ratio. The research factors not only have low correlation to stocks, it's worth noting that they also have low to negative correlations to one another, meaning that their risk premiums are potentially diversifying, creating a strong case for including those factors with a positive expected return in a portfolio.

Figure 6



Empirical Analysis of Hedge Funds

In Panel A of Table 2, I report the results for the following regression:

Equation 3

$$R_t = \alpha + \sum_i \beta^i F_t^i + \varepsilon_t$$

Where

R_t is the monthly total return of the hedge fund composite, net of fees, in month t

F are factor excess returns, α is the annualized alpha, β are the regression coefficients, and ε is the error term.

t statistics shown in parenthesis. ***, **, * represent 99 percent, 98 percent and 95 percent confidence respectively [need to add]

In the first column of Table 2 Panel A, I list the regression variables with the hedge fund composite portfolio as the dependent variable. In the remaining columns I report the respective coefficients for each regression equation with the second row reporting the annualized alpha for each regression. I begin by showing in the second column the “Market Only” model that was reported in Equation 1 and discussed at the beginning of the paper. Next in column 3 I report the Fama-French (1993) three-factor model employing market, size, and value (but again we replace the traditional HML with HMLdevil); in column 4, a 6-factor model that adds cross-sectional momentum (UMD), quality (QMJ) and low volatility (BAB); then in column 5 I add to that time-series momentum (TSOM), equity volatility (EquityVol) and currency carry (FXcarry);

and finally in column 7, I show all variables plus a binary intercept “dummy” variable for the period 2009-2019 as done earlier.

The empirical results show that the market and research factors are almost all statistically significant at the 95 percent level of confidence (at least) across all of the models with only a few exceptions; both UMD and EquityVol in columns 5 and 6.¹⁰ Focusing on columns 5 and 6, we can see that hedge fund managers prefer securities that are smaller, more growth oriented (not value), have positive relative momentum (but not significantly so) and absolute (time series) momentum, lower quality (junkier), and have relatively lower beta. Finally, they are also long equity market volatility (but not statistically so), and currency carry.

The last row reports the R^2 statistic (the proportion of return variance explained by each model). We can see that the market-only model explains roughly half of the return variation, and each successive model explains an increasing proportion of return variation with the 9-factor explaining 74 percent of the return variation (same for the model that includes the 2009-2019 dummy variable). Taken together, we see that the market and academic factors appear to be rather impactful in helping us to better understand the systematic drivers of monthly returns of hedge funds as a group.

¹⁰ The significance levels are only suggestive. As mentioned, many factors have been tested by the literature. See Harvey, Liu and Zhu (2016) and Hou, Xue, and Zhang (2017).

Table 2
Panel A: Regression Coefficients: Hedge Fund Composite
 Jan-1994-Jun-2009

CS/HFR 50/50					
Regressions:	MKT Only	3 Factor (MKT,SMB, HML)	6 Factor (3Factor+ UMD,QMJ, BAB)	9Factor (6Factor+T SOM,EQVo I,FXCarry)	9Factor +Dum09
(1)	(2)	(3)	(4)	(5)	(6)
Alpha (Ann.)	2.19%	2.07%	3.55%	3.23%	4.69%
<i>T-Stat</i>	2.47	2.53	4.44	4.06	4.80
SP500	0.30	0.30	0.24	0.22	0.22
<i>T-Stat</i>	17.42	18.40	14.59	13.41	13.72
SP500(t-1)	0.07	0.06	0.03	0.03	0.03
<i>T-Stat</i>	3.83	3.89	2.11	2.35	2.55
US SMB_10v		0.13	0.06	0.05	0.05
<i>T-Stat</i>		5.86	2.99	2.77	2.75
US HML Devil_10v		(0.09)	(0.09)	(0.11)	(0.11)
<i>T-Stat</i>		(4.55)	(4.06)	(4.90)	(5.22)
US UMD_10v			0.05	0.02	0.01
<i>T-Stat</i>			2.43	0.80	0.58
US QMJ_10v			(0.20)	(0.20)	(0.20)
<i>T-Stat</i>			(8.92)	(9.46)	(9.63)
US BAB_10v			0.06	0.05	0.05
<i>T-Stat</i>			3.76	3.04	3.36
TSMOM_10v				0.09	0.08
<i>T-Stat</i>				4.61	4.29
EquityVol_10v				0.02	0.02
<i>T-Stat</i>				1.33	1.44
FX Carry_10v				0.07	0.07
<i>T-Stat</i>				4.07	3.83
dummy_2009	(Ann.)				-3.42%
<i>T-Stat</i>					(2.53)
<i>R</i> ²	0.52	0.59	0.70	0.74	0.74

Table 2
Panel B: Alpha: Hedge Fund Composite

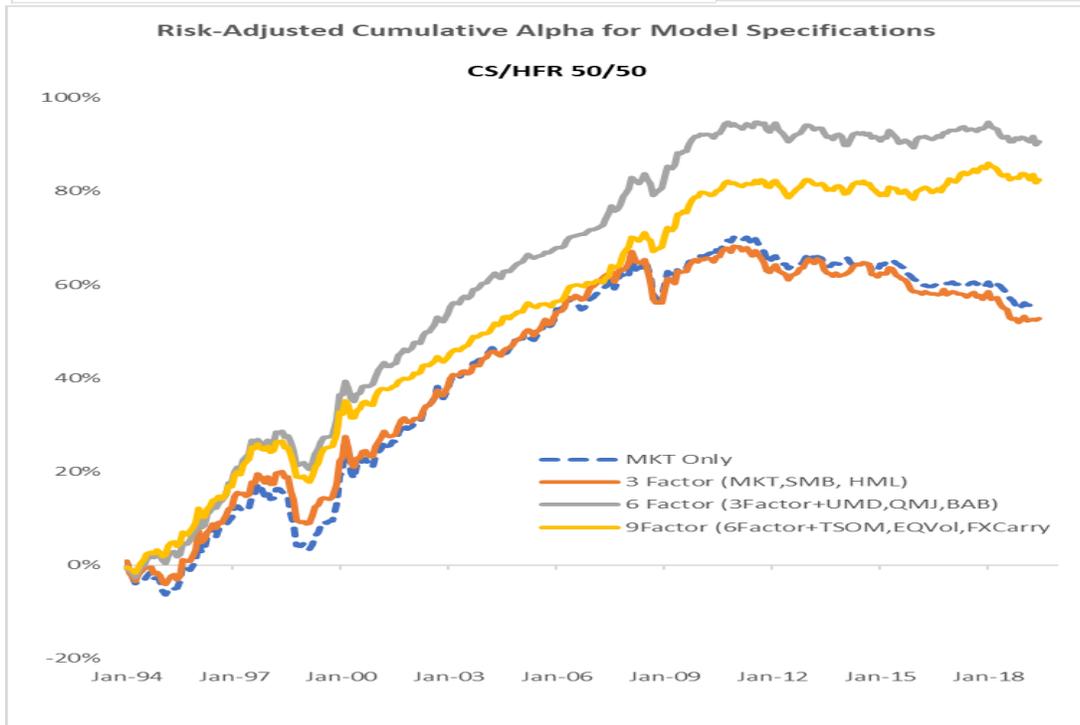
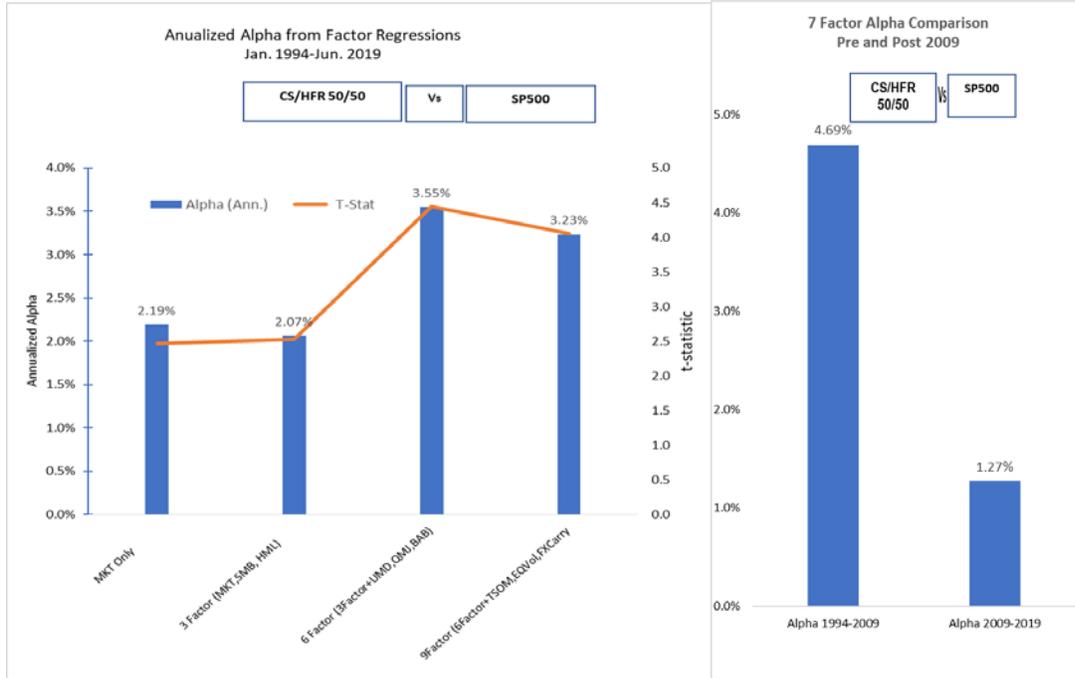


Table 2
Panel C: Performance (Annualized): Hedge Fund Composite
 Jan-1994-Jun-2009

CS/HFR 50/50					
<i>Performance</i>	MKT Only	3 Factor (MKT,SMB, HML)	6 Factor (3Factor+ UMD,QMJ, BAB)	9Factor (6Factor+T SOM,EQVo I,FXCarry)	9Factor +Dum09
(1)	(2)	(3)	(4)	(5)	(6)
HF Avg Rtn	5.07%	5.07%	5.07%	5.07%	5.07%
SP500	2.38%	2.34%	1.89%	1.72%	1.76%
SP500(t-1)	0.51%	0.48%	0.23%	0.25%	0.26%
US SMB_10v		0.09%	0.04%	0.04%	0.04%
US HML Devil_10v		0.10%	0.11%	0.12%	0.13%
US UMD_10v			0.45%	0.15%	0.11%
US QMJ_10v			-1.92%	-1.93%	-1.95%
US BAB_10v			0.72%	0.55%	0.61%
TSMOM_10v				0.95%	0.88%
EquityVol_10v				-0.30%	-0.33%
FX Carry_10v				0.30%	0.28%
<i>dummy_2009</i>					
Attrib to Market	2.89%	2.82%	2.12%	1.97%	2.02%
Attrib to Factors	0.00%	0.19%	-0.60%	-0.12%	-0.22%
Alpha	2.18%	2.05%	3.55%	3.22%	3.27%
<i>Alpha 94-08</i>					4.69%
<i>Alpha 09-19</i>					1.27%
Active Risk	4.36%	4.00%	3.42%	3.20%	3.21%
Appraisal Ratio	0.50	0.51	1.04	1.01	1.02
<i>Appraisal Ratio 94-08</i>					1.35
<i>Appraisal Ratio 09-19</i>					0.48

In Table 2 Panel B on the top left hand side, I show graphically the estimated alpha along with the t-statistics for each of the regressions reported in Table 2, Panel A. Beside that on the top right hand side of Panel B, I separate the alpha for the pre- and post-crisis periods resulting from the 9-factor model that includes the post-crisis period intercept dummy variable. Here, as before in Figure 2, we see again that hedge fund alpha declines markedly, in this case from 4.69 percent per year on average in the pre-crisis period to 1.27 percent per year on average during the post-crisis period.

Finally, the graph on the lower part of Table 2 Panel B reports the cumulative alpha (not compounded) for the various model specifications from Table 2, Panel A. As a starting point, I plot again the market-only model (the dashed line) which corresponds to that discussed earlier in Equation 1 and Figure 1. The cumulative alpha from the 3-factor model follows closely that of the market model. The cumulative alpha for the 9-factor model, that adjusts for the risk of all of our systematic research factors, has the same overall pattern as the other models but results in

a higher level of alpha versus the market-only model (this is as expected as shown in Panel A, the market-only model results in alpha of 2.19 percent per year on average vs 3.23 percent for the 9-factor model). To better understand the drivers behind the estimated alphas for the various models, I next turn attention to annualized performance attribution statistics for all of the models estimated above.

Panel C of Table 2 reports annualized performance statistics for each of the models in Table 2, Panel A. I include the annualized return attributed to factor exposures, annualized alpha, active risk, and appraisal ratio, each as defined below. Note that the return attributed to factors (Equation 4) can be extracted from the regression analysis by calculating the average value of each variable on both the left- and right-hand side of the regression (Equation 3 as shown in Panel A) with the knowledge that the average error is zero by construction (refer to Figure 5, Panel B for the average return of the market and factors).

Equation 4: $Avg[R] = \alpha + \sum_i \beta^i Avg[F^i]$

Equation 5: $Active Risk = \sigma(\alpha) * \sqrt{12}$

Equation 6: $Appraisal Ratio = \frac{\alpha}{Active Risk} * \sqrt{12}$

Hedge funds reported an average unadjusted annualized excess return (first row) of 5.07 percent over the full study period. Using the market-only model as an example, hedge fund annualized alpha is 2.18 percent on average over the full period, calculated as the average hedge-fund return minus the average return of the market times corresponding total beta ($0.0507 - 0.079 * 0.37 = 0.0218$). The return attributed to the research factors is shown individually and then combined in the row titled "Attrib to Factors." Here we can see that the alpha is what remains after subtracting the return attributed to the market and the return attributed to the combined research factors from the average hedge fund return.

Turning attention to return attribution for hedge funds as based on the 9-factor model in column 5, we can see that this model attributes lower return due to market exposure given its lower total beta attributed to the market versus the market-only model (beta of 0.37 for the market-only versus 0.25 for the 9-factor model). Also, for all factors combined for the 9-factor model, on net, only -0.12 percent of return is attributed to factors. It is interesting to note the return attribution of hedge funds due to the various research factors. To summarize, hedge fund managers:

- Have added excess return by preferring smaller growth stocks (recall that hedge funds dislike value stocks and the value factor has a slightly negative return over the full period) and by preferring lower volatility stocks;
- Deduct from excess return by going long underperforming junkier stocks and being long market volatility (long straddles);
- Have added return by going long (short) asset classes with recently positive (negative) returns, and being long currency carry.

Although factors altogether had little effect on returns, the individual contributions of factors provides interesting insight into the systematic return drivers of active hedge-fund managers. The reason that estimated alpha is higher for the 9-factor model than for the market-only model is because hedge funds have lower exposure to market beta in the market-only model and when including the systematic research factors, the market beta gives way to loadings on the other risk factors. The net result is that after adjusting returns for exposure for the market and the 8 research factors, the model, which explains 74 percent of the variation in excess returns of hedge funds, leaves more alpha remaining versus adjusting for the market alone.

This result is also reflected in the higher appraisal ratio shown for the 9-factor model versus the market-only model. Finally, in column 6, I report the attribution for the 9-factor model, but now include the dummy variable for the post-crisis period, 2009-2019. Here, we can see that both alpha and the appraisal ratio for the post-crisis period decline by around two-thirds; from 1.35 to 0.48 for the appraisal ratio and from 4.69 percent to 1.27 percent for annualized alpha.

Empirical Analysis of Equity-Focused Hedge Funds

I next conduct an analysis of the performance of equity-focused hedge funds. As all funds analyzed in this section focus on equities, and the research factors that I employ tend to be equity-centric, the resulting analysis and any conclusions drawn may be more informative versus the earlier analysis across a much more heterogeneous group of all hedge funds. For consistency and to avoid “data snooping” across as mentioned the hundreds of potential factors that have been studied, I make only one change to the factors included in the analysis; I replace the broad time series momentum factor (TSOM) that incorporates five asset classes (stocks, bonds, foreign exchange, commodities) with a time-series momentum factor focused on equities only (TSOM^{EQ}) once again scaled to 10 percent volatility.¹¹

For equity hedge fund returns, I use an equity hedge fund composite constructed with a 50/50 allocation of a Credit Suisse Equity Composite and the HFRI Equity Hedge Index. The Credit Suisse Equity Composite is constructed with an equal one-third weighting to each of the three equity-oriented Credit Suisse hedge funds: Emerging Markets Index, Equity Market Neutral Index, Long-Short Equity Index.

In Figure 6 I add equity hedge funds to the average correlations, beta and Sharpe Ratio shown earlier for the research factors. As can be seen, the correlations, beta and Sharpe Ratios for equity oriented hedge funds is quite similar to that of hedge funds overall.

¹¹ See Moskowitz, Ooi and Pedersen (2011) and the AQR website for the returns data for this factor: <https://www.aqr.com/Insights/Datasets>.

Figure 6

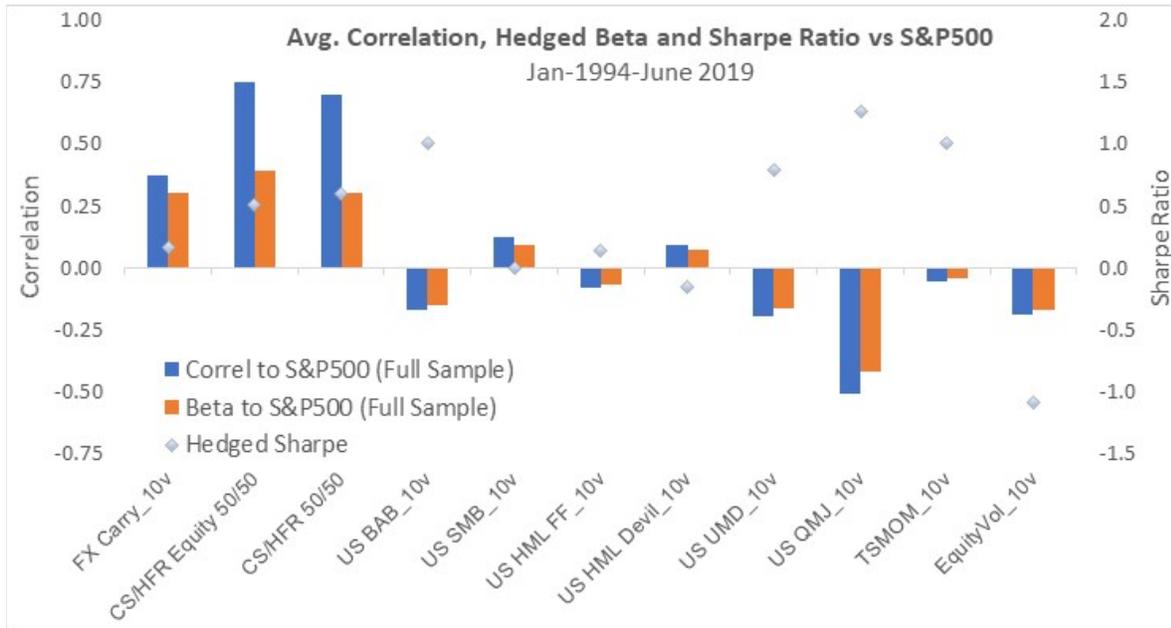


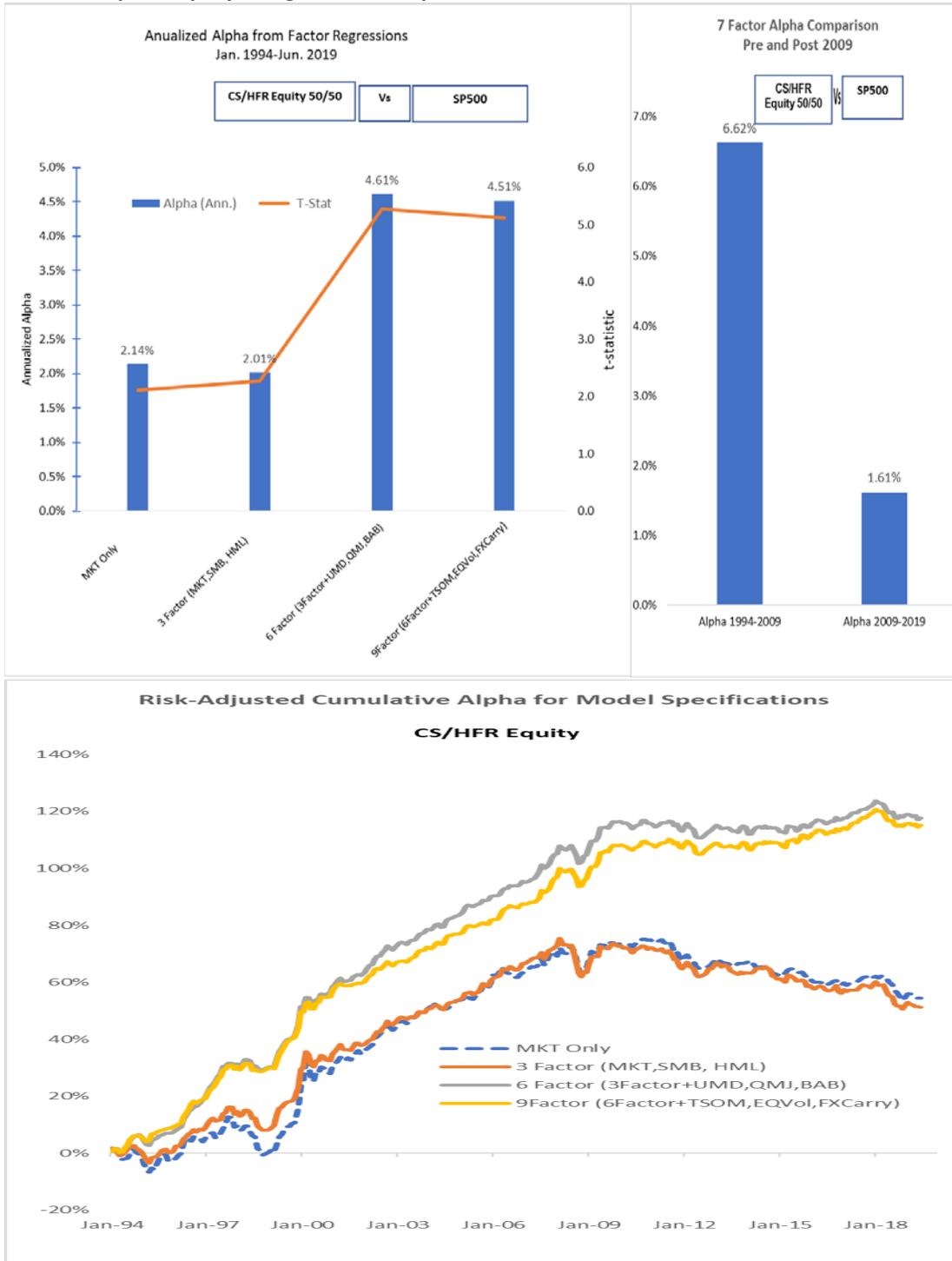
Table 3

Panel A: Regression Coefficients: Equity Hedge Fund Composite

Jan-1994-Jun-2009

Regression Results (Returns in Excess of Cash): Jan/1994-Jun/2019					
CS/HFR Equity 50/50					
Regressions:	MKT Only	3 Factor (MKT,SMB, HML)	6 Factor (3Factor+ UMD,QMJ, BAB)	9Factor (6Factor+T SOM,EQVo I,FXCarry)	9Factor +Dum09
(1)	(2)	(3)	(4)	(5)	(6)
Alpha (Ann.)	2.14%	2.01%	4.61%	4.51%	6.62%
<i>T-Stat</i>	2.11	2.27	5.28	5.11	6.17
SP500	0.39	0.38	0.30	0.27	0.28
<i>T-Stat</i>	19.85	21.94	16.96	14.95	15.49
SP500(t-1)	0.06	0.05	0.03	0.03	0.04
<i>T-Stat</i>	3.11	3.08	1.75	2.20	2.46
US SMB_10v		0.19	0.10	0.09	0.09
<i>T-Stat</i>		8.23	4.62	4.24	4.27
US HML Devil_10v		(0.11)	(0.13)	(0.14)	(0.15)
<i>T-Stat</i>		(5.14)	(5.29)	(5.78)	(6.26)
US UMD_10v			0.04	0.02	0.01
<i>T-Stat</i>			1.49	0.66	0.30
US QMJ_10v			(0.24)	(0.23)	(0.23)
<i>T-Stat</i>			(9.76)	(9.81)	(10.12)
US BAB_10v			0.02	0.01	0.02
<i>T-Stat</i>			1.21	0.62	1.04
TSMOM^EQ_10v				0.06	0.05
<i>T-Stat</i>				3.20	2.83
EquityVol_10v				0.02	0.02
<i>T-Stat</i>				1.05	1.17
FX Carry_10v				0.08	0.07
<i>T-Stat</i>				3.95	3.63
dummy_2009	(Ann.)				-5.01%
<i>T-Stat</i>					(3.34)

Table 3
Panel B: Alpha: Equity Hedge Fund Composite



[Discussion to be added]

Conclusions

[To Be added later]

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