A PERFORMANCE COMPARISON OF HEDGE FUNDS, HEDGED MUTUAL FUNDS AND HEDGE FUND ETFS

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Abstract

Hedged mutual funds and hedge fund ETFs are new entrants to the market that allow individual investors to invest in funds using hedge fund strategies. In this paper, we study the performance of these two funds relative to the traditional hedge funds to see if the three asset classes are comparable investments. We use four performance measurement models, including CAPM, Fama French three factor model, Carhart four factor model and Fung and Hsieh eight factor model, to test the fund performance for the period of 2004 to 2015. Our study shows hedge funds on average generate a positive alpha during the entire testing period and the sub-periods. Whereas, most hedged mutual funds constantly underperform the traditional benchmarks. During the period of April 2009 to January 2015, when hedge fund ETFs exist in the market, we find hedge fund ETFs outperform the hedged mutual funds, but underperform the traditional hedge funds. The conclusion may be justified by the hedge fund managers' asset allocation skills and the ability to quickly react to the macroeconomic factors.

Keywords: Hedge fund, Hedged mutual fund, Hedge fund ETF, Performance analysis

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1: Introduction

Hedge funds seek to generate positive alpha for investors through volatility and risk reduction. They normally have relatively low correlations with traditional assets. Thus, the popularity of the funds has skyrocketed in the past decades as the portfolio managers and investors often invest in hedge funds to reduce the volatility and risk of their investment portfolios (Fung and Hsieh, 1997). As of Quarter 3 of 2015, the estimated assets under management for the hedge fund industry is US $2.7 trillion (BarclayHedge data).

However, hedge funds are only available to institutional and high net worth investors since the funds have a high net worth requirement of about $1 million. Hedged mutual funds, the new breed of mutual funds born not long ago, with an average initial investing requirement of $5,000, allow retail investors to experience hedge fund like exposure and access funds using typical hedge fund strategies, such as leverage and short selling. Recently, a new type of hedge fund like instruments has entered into the market: hedge fund ETFs, which allow investors more easily to access hedge fund trading and investing strategies than both traditional hedge funds and hedged mutual funds. Hedge fund ETFs are traded like ETFs in the open markets with higher liquidity and lower costs. In this paper, we would like to identify whether hedge funds, hedged mutual funds and hedge fund ETFs are comparable investments in terms of the risk and return performance for investors.

Although the three asset classes using similar investment strategies, they are different in regulatory levels, liquidity, management fees, fund size and information transparency. As a result, their ability to generate alpha, the excess return, is different. Hedge funds outperform hedged mutual funds because of the under regulated nature of hedge funds (Agarwal, et. 2009). Another study of hedged mutual funds using long short strategy also found that the funds hardly generate a positive alpha (Broussard & Neely 2011). Since hedge fund ETFs are new to the market, research on their performance is limited. We expand the previous literature by adding hedge fund ETFs in the performance comparison analysis to examine if hedge funds, hedged mutual funds and hedge fund ETFs are comparable investments in terms of their risk and return performance. As hedge funds and hedged mutual funds are hedge fund like asset classes, we use hedge fund performance measurement frameworks.

We start the performance analysis with various asset pricing models including CAPM, Fama French (1993) three factor model, Carhart (1997) four factor model and Fung and Hsieh (2004) eight factor model. We analyze the performance of U.S. hedge funds and hedged mutual funds in the period between 2004 and 2015 and the performance of U.S. hedge fund ETFs during 2009 to 2015. We also conduct the sub-period analysis including the time period covers post dotcom bubble (2004–2006), subprime mortgage crisis (2007 – 2009), post financial crisis (2009-2015) where the hedge fund ETFs start existing.

Our findings of the hedge funds are supported by the existing literature. We find hedge funds on average generate an excess return to the investors during the entire testing period. Most hedged mutual funds do not generate a positive alpha. The hedge fund ETFs

underperform hedge funds, but outperform hedged mutual funds. We also find, although the three funds use similar investing strategies, hedge fund managers are more active and skilled in asset allocation and have stronger ability to adjust their trading tactics to react to the change in the economy.

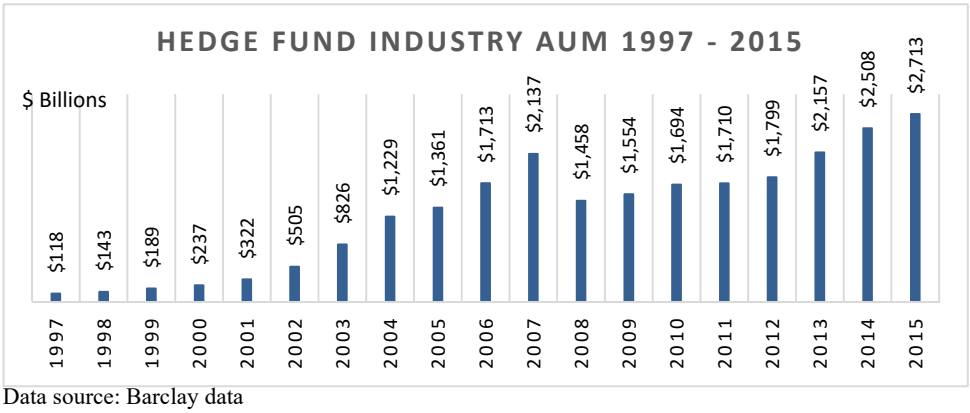
1.1 Hedge funds

Hedge funds are one of the largest asset classes in the world as they become popular for their aim to earn an absolute return at reduced risk to their investors regardless of the market conditions. Most hedge funds are setup as private placement and open-ended with high initial wealth requirements. Hedge funds generally have a longer lock up period that makes the funds less liquid than traditional asset classes and mutual funds. Hedge fund managers are high professional with well-defined investment strategies.

Hedge funds are often classified according to the investment strategy they employ. There are over 15 distinct hedge fund strategies defined by Morningstar. Among these strategies, most often used are long short, market neutral and multi strategy. Hedge funds using equity long short strategy are different from traditional long short investments through using of derivatives and hedging. Equity long short strategy involves buy stocks that are expected to outperform and short stocks that will underperform. Long short strategy remains popular in hedge funds because of its alpha earning ability and diversification potential. Previous study finds hedge funds using long short strategy earn positive alpha, but the performance is not persistent for more than a year (Manser and Schmid, 2009). Market neutral strategy aims to limit the market exposure to protect the

funds from systematic risk (have a beta close to 0). The strategy hedges against the market volatility. Market neutral strategy becomes very popular in the past few years as the market experiences large movements.

Graph 1:



Data source: Barclay data

Graph 1 shows the historical growth of assets under management (AUM) of hedge funds. The hedge fund AUM grows from $118 billion in 2007 to over $2.7 trillion in quarter 3 of 2015. U.S. is the world's largest hedge fund market with two third of the total AUM in the industry. The world's largest hedge fund management company is Bridgewater Associates with $197 billion AUM today.

1.2 Hedged mutual funds

Hedged mutual funds are funds managed by mutual fund managers employing hedge fund strategies. Similar to hedge funds, hedged mutual funds most commonly use equity long short and market neutral strategies. However, unlike hedge funds, hedged mutual funds are regulated by Securities and Exchange Commission. Thus, hedged mutual funds are subject to extensive regulations including covering short positions, leveraging up to 1.33 times net asset value, investing in less than 15% on illiquid

securities and prohibiting from investing in certain financial instruments. The returns of hedged mutual funds are largely impacted by these regulations. However, hedged mutual funds have less initial wealth requirements and are more liquid. Retail investors with less wealth and investment experience can invest in funds using hedge fund strategies through hedged mutual funds.

1.3 Hedge fund ETFs

Another open door to easily access hedge fund investing strategies for retail investors is hedge fund ETF, a new ETF category enters into the market since 2009. In the early of 2015, there are about 25 hedge fund ETFs in the market and the number is growing in an increasing trend as more investors participate. The common strategies used by hedge fund ETFs are equity long short, market neutral, managed futures and merger arbitrage. Hedge fund ETFs are traded in open markets and easily accessed by all types of investors. The average expense ratio is 0.84%, which is much lower than the cost of mutual funds and hedge funds. The largest hedge fund ETF is IQ Hedge Multi-Strategy Tracker ETF with $1.07 billion AUM.

2: Literature review

This paper relates to the literature that studies hedge fund performance, performance comparison between hedge funds and other alternative funds. There are many sophisticated performance studies have been done for hedge funds. Agarwal and Naik (2004) find hedge fund performance has a significant linear exposure to Fama French (1993) size and value factors and Carhart (1997) momentum factor. They also employ a two-step approach, using buy and hold and option-based risk factors, to analyze the performance of hedge funds and they find hedge funds have a non-linear exposure to equity index.

Followed by Liang (1999) and Agarwal and Naik (2000) who use single factor and multifactor models to estimate hedge fund alphas, Fund and Hsieh (2004) develop a multifactor model using asset-based style factors of hedge fund risk to measure the hedge fund returns. The model takes into the effect of the different strategies used by hedge funds. Other models are available for hedge fund performance analysis for specific investment strategies and markets, such as the emerging market asset class factor model (Eling and Faust, 2010).

Despite of the high attrition rate, hedge fund performance is found to be persistent in previous studies and has a positive correlation with the assets invested (Liang, 1999). Although hedge funds consistently outperform traditional mutual funds, their return volatility is higher (Ackermann et al, 1999). Since hedge funds have a low correlation

with other financial asset classes, investment managers frequently add hedge funds to their portfolios to improve the risk and return profile (Schneeweis and Spurgin, 1997; Fung and Hsieh, 1997). Cappocci, Corhay and Hubner (2005) test the hedge fund performance and persistence in bull and bearish markets and find that the reason that most hedge funds significantly outperform the market is due to the good performance during the bullish period and they do not find significant underperformance of individual hedge fund strategies during the bear period.

Hedged mutual funds, also called alternative mutual funds, are actively managed by traditional mutual fund managers. The most recent study in the hedged mutual fund performance, using the Carhart model and Fund and Hsieh model, identifies that hedged mutual funds do not generate positive alpha during the research period 1998 to 2011 (Kaburi and Mcleaod, 2014). Agarwal, Boyson and Naik (2009) find, under similar trading strategies, hedged mutual funds underperform hedge funds, but outperform mutual funds due to the flexibility to select trading strategies and managers' experience implementing hedge fund strategies.

3: Performance Measurement Model

We use four performance models in this paper. Our performance of the three funds start with the basic single factor model CAPM and the basic multifactor models, Fama French (1993) three factor model and Carhart (1997) four factor model. The first three models are linear models that cannot capture the active management strategies used by hedge funds and other hedge fund like portfolios (Agarwal and Naik, 2004). Thus, we extend our study using the most recent innovation in performance study of hedge funds, Fund and Hsieh (2004) eight factor model which is a non-linear performance measurement model.

3.1 Capital Asset Pricing Model

The first model we use is a single factor risk adjusted model which is called Jensen's alpha, based on the classical CAPM introduced by Treynor (1962), Sharpe (1964) and Lintner (1965).

$$R_{it} - R_{ft} = \alpha_i + \beta_i * (R_{mt} - R_{ft}) + \varepsilon_{it}, \qquad t = 1, 2, \ldots, T \tag{1}$$

Jensen's alpha (α_i) is the portfolio's return over the market portfolio given the portfolio's systematic risk (β_i). R_{ft} is the risk free rate. $R_{mt} - R_{ft}$ is the excess return of the market portfolio. R_{it} is the return of the specific portfolio i in month t. ε_{it} is an error term of the regression. The Jensen's Alpha model is the simplest and widely used performance model as it applies to various situation.

3.2 Fama French (1993) three factor model

Fama and French expands the basic CAPM model by adding two additional factors, the firm size and book-to-market equity. By factoring the two firm specific characteristics, the model takes account of the outperformance tendency since small firms and value stocks tend to outperform the market.

$$R_{it} - R_{ft} = \alpha_i + \beta_{im} * (R_{mt} - R_{ft}) + \beta_{iSMB} * SMB_t + \beta_{iHML} * HML_t + \varepsilon_{it},$$

$$t = 1, 2, \ldots, T \qquad (2)$$

β_{iSMB} and β_{iHML} are the coefficients of the portfolio size (*SMB* – small minus big) and portfolio book to market ratio *(HML* – high minus low). This multifactor model better measures the managers' performance (α_i) than CAPM.

3.3 Carhart (1997) four factor model

Carhart extends Fama French three factor model by adding a momentum (*MOM*) factor. The *MOM* is described as a trend-following strategy in stock markets. The factor is defined as buying stocks that were past winners and selling stocks that were past losers (Grinblatt et al., 1995). A stock with positive returns in the past 12 months has *MOM* effect.

$$R_{it} - R_{ft} = \alpha_i + \beta_{im} * (R_{mt} - R_{ft}) + \beta_{iSMB} * SMB_t$$

$$+ \beta_{iHML} * HML_t + \beta_{iMOM} * MOM_t + \varepsilon_{it},$$

$$t = 1, 2, \ldots, T \qquad (3)$$

3.4 Fung and Hsieh (2004) eight factor model

Fung and Hsieh (1997) develop an advanced performance model to capture the different strategies and various asset classes used by hedge funds. This Fung and Hsieh (2004) model considers option-like factors. The model includes an equity market factor - the Standard & Poor's 500 index excess returns (*SNPMRF*), a size spread factor - the Russell 2000 index minus the Standard & Poor's 500 (*SCMLC*), two bond-oriented factors – 10-year Treasury yields (*BD10RET*) and the change in the yield spread between 10-year T-bonds and Moody's Baa bonds (*BAAMTSY*), three trend-following factors – on bonds (*PTFSBD*), currencies(*PTFSFX*) and commodities (*PTFSCOM*), and an emerging market factor - the MSCI Emerging Market Index (*MSEMKF*) (Hsieh, 2009).

$$R_{it} - R_{ft} = \alpha_i + \beta_{iSNPMRF} * SNPMRF_t + \beta_{iSCMLC} * SCMLC_t + \beta_{iBD10RET} * BD10RET_t + \beta_{iBAAMTSY} * BAAMTSY_t + \beta_{iPTFSBD} * PTFSBD_t + \beta_{iPTFSFX} * PTFSFX_t + \beta_{iPTFSCOM} * PTFSCOM_t + \beta_{iMSEMKF} * MSEMKF_t + \varepsilon_i, \quad t = 1, 2, \ldots, T \tag{4}$$

4: Data

4.1 Data Selection

We use hedge fund data from Morningstar hedge fund database that contains data of 7,000 active reporting funds and more than 12,000 dead hedge funds. From this database, we select 1042 hedge funds classified as U.S. hedge fund category for which data is available from the database inception. The sample period is from January 2004 to January 2015. To minimize biases inherent in hedge fund data, we select funds exist more than 24 months which narrowed the sample to 948, the details of data selection regarding bias control such as survivorship bias and instant history bias are available in section 4.2.

The hedged mutual fund data is taken from Morningstar mutual fund database for the same period as for hedge funds. We extract 1100 mutual funds that classified as alternative mutual funds by Morningstar. Similar to hedge fund data selection, we select hedged mutual funds exist more than 24 months to avoid survivorship bias that narrows our sample down to 1006.

We obtain hedge fund ETF data from CRSP survivor-bias-free U.S. mutual fund database, which contains all U.S. ETF data. For hedge fund ETFs, we employ the same data selection principle used for hedged mutual funds. The hedge fund ETF has a very short history in the market that limits our sample size to 11 after taking the effect of multi-period bias. The sample period for hedge fund ETF is from April 2009 to January

2015, which covers our post financial crisis sub-period. All following data are monthly returns.

We compare hedge funds, hedged mutual funds and hedge fund ETFs with passive benchmark indices collected from Morningstar Database and Bloomberg data. One-month U.S. Treasury bill rate is used as risk free rate. Instead of choosing market performance index, we use the same value-weighted portfolio of all Amex, NASDAQ and NYSE stocks as *market proxy* that is used in Fama and French (1993) model and Carhart (1997) model. The results of the study should not be influenced by the *market proxy* chosen. The other two monthly Fama-French factors (*SMB* and *HML*), and the *momentum* factor were taken from the Wharton Research Data Services (WRDS) database. The three trend-following factors for Fung and Hsieh (2004) model were taken from David A. Hsieh's Data Library Website.

4.2 Data Biases

Unlike mutual funds or ETFs, hedge funds are mostly setup as private investments with minimum regulations, and the performance is only reported on a voluntary basis with a lag of 45 days on average. To obtain a more accurate estimation of the excess return of hedge funds, we follow Fung and Hsieh (2000) discussed biases: survivorship bias, instant history bias and multi-period bias.

Survivorship bias is an important issue in mutual funds performance studies and it may generate an upward bias if the data only contains survived funds (Liang 2000). Using Morningstar database, we include funds that have been liquidated or merged. In this case, more categories are available in order to avoid the potential bias for only

including the most successful funds. Since Morningstar mutual fund database is a survivor-bias-free database, survivorship bias for hedged mutual funds should not be a problem. In this study, we controlled our survivorship bias for hedge funds by include both living funds and dead funds like Eling and Faust (2010) did.

Instant history bias or so-called backfilling bias happens when a fund enters a database and the data vendors backfill the past fund performance which may cause another upward bias. Backfilling bias can be calculated by deleting the first 12 (24) months of return. Fung and Hsieh (2000) reported 1.4% return bias per year if the first 12 months of return are deleted. In our sample, eliminating the first 12 months of return reduces our average monthly excess return for all hedge fund about 0.8% per year. Because there is no backfilling problem for hedged mutual funds or hedge fund ETFs, this bias is not considered for these two groups. We follow Fung and Hsieh (2000) and delete the first 12 monthly returns of all hedge funds.

Multi-period sampling bias can exist for short-lived funds; thus a minimum return history is required for a meaningful performance analysis. Following Fung and Hsieh (1997) and Liang (2000), we eliminate hedge funds and hedged mutual funds with less than 24 months' life span. We do not add this criterion for hedge fund ETFs because the data is free of backfilling bias. Finally, we have 948 hedge funds, 1006 hedged mutual funds and 11 hedge fund ETFs in this performance comparison analysis.

5: Empirical Results

5.1 Summary Statistics

Table 1 below contains descriptive statistics on the monthly return distributions of 948 hedge funds, 1006 hedged mutual funds and 12 benchmark indices.

Table 1: Descriptive Statistics for Hedge Funds, Hedged Mutual Funds and 12 indices from January 2004 to January 2015

	Mean (%)	St. dev. (%)	Skew	Kurt.	Third Moment (%)	Fourth Moment (%)	Min. (%)	25% (%)	Median (%)	75% (%)	Max. (%)	Auto-corr. (lag1)
HF	0.77	1.98	-0.70	4.72	-5.42	71.91	-6.67	-0.42	0.98	2.07	6.06	0.25
HMF	0.19	1.48	-1.37	7.61	-4.47	36.97	-7.31	-0.63	0.49	1.11	3.46	0.29
Market proxy	0.62	4.21	-0.77	5.09	-57.18	1598.99	-17.23	-1.78	1.29	3.23	11.35	0.17
*SMB**	0.14	2.27	0.19	2.60	2.18	69.23	-4.28	-1.40	-0.08	1.59	5.78	-0.13
*HML**	0.09	2.33	-0.34	5.64	-4.28	164.84	-9.87	-1.11	-0.02	1.46	7.57	0.31
*Momentum**	0.07	4.62	-3.36	26.13	-331.83	11937.44	-34.70	-1.31	0.36	2.31	12.53	0.25
S&P 500	0.70	4.08	-0.86	5.32	-58.61	1473.16	-16.80	-1.52	1.36	3.20	10.93	0.18
MSCI EM	1.09	6.64	-0.65	5.00	-189.44	9734.98	-27.35	-1.91	1.14	4.88	17.14	0.17
*Size**	0.13	2.46	0.14	2.71	2.01	98.66	-4.93	-1.51	-0.05	1.72	6.32	-0.18
*Bond**	-0.02	0.22	-0.81	7.15	-0.01	0.02	-1.11	-0.15	-0.01	0.12	0.53	0.22
*Credit**	0.002	0.23	1.20	16.25	0.01	0.05	-0.99	-0.09	-0.01	0.07	1.45	0.47
*TFBond**	-3.40	14.57	1.42	5.30	4390.38	239116.67	-26.63	-13.41	-5.54	2.00	50.50	0.15
*TFCur**	-0.99	19.98	1.36	4.95	10856.77	789124.01	-30.00	-15.70	-5.97	8.03	69.22	0.10
*TFCom**	0.49	15.18	0.76	3.18	2664.59	168770.83	-24.65	-10.01	-2.10	9.13	42.87	0.03

Note1: All indices are analyzed on basis of excess returns, unless indicated with an asterisk (*).

Note2: The skewness is calculated by dividing the third moment by the standard deviation, while the kurtosis is calculated by dividing the fourth moment by the standard deviation.

The above table shows the first four central moments, skewness, kurtosis, the minimum and the maximum monthly return as well as three quantiles (25% quantile, median, 75% quantile) and the autocorrelation in returns (with lag of one month).

Following Capocci and Hübner (2004), we test each type of funds on portfolio level using an equal weighted method. The equal weighting allows all funds in each asset class playing at the same level of importance in the portfolio and make each type of funds more diversified.

During the period of 2004 to 2015, hedge funds (*HF*) have a higher return (0.77%) and standard deviation (1.98%) than hedged mutual funds (*HMF*) (0.19% and 1.49% respectively). Both hedge funds and hedged mutual funds have a much lower volatility compare to equity index, *S&P 500*. Not surprisingly, despite of the low risk, hedge funds yield a comparable return with *S&P 500*.

Hedge funds have a lower kurtosis and less negative skewness than both hedged mutual funds and the equity index. If we conclude by kurtosis and skewness along, hedged mutual funds are the least favourable investment instrument compared to hedge funds and the equity index, because hedged mutual funds have the most negative (negative skewness) extreme values (higher kurtosis) and put investors at the largest risk (Fung and Hsieh, 1999). However, kurtosis measurement may not be the best extreme value theory when comparing the funds with different standard deviations. Brulhart and Klein (2005) find kurtosis and skewness may give us a biased result as the high values can result from low standard deviation. Brulhart and Klein unveil the unscaled third and fourth moment method, which excludes the standard deviation effect, to measure the risk of extreme events. From Table 1, we can see hedged mutual funds, with the lowest fourth moment and the least negative third moment, are most attractive to investors. *S&P 500* has the most extreme outliers and the largest downside risk.

Table 2: Descriptive Statistics for Hedge Funds, Hedged Mutual Funds and 12 indices from January 2004 to December 2006 and from January 2007 to March 2009

	Mean (%)	St. dev. (%)	Skew.	Kurt.	Third Moment (%)	Fourth Moment (%)	Min. (%)	25% (%)	Median (%)	75% (%)	Max. (%)	Auto-corr. (lag1)
Subperiod: January 2004-December 2006												
HF	1.01	1.58	-0.36	2.37	-1.41	14.71	-6.67	-0.42	0.98	2.07	6.06	0.10
HMF	0.49	0.87	-0.67	3.01	-0.44	1.73	-7.31	-0.63	0.49	1.11	3.46	0.05
Market proxy	0.66	2.21	-0.31	2.31	-3.35	55.45	-4.06	-1.00	1.02	1.96	4.54	-0.08
*SMB**	0.13	2.32	0.18	2.46	2.32	71.63	-4.00	-1.24	-0.42	2.08	5.32	-0.08
*HML**	0.81	1.60	0.25	2.27	1.02	14.76	-1.79	-0.45	0.49	1.85	4.52	0.12
*Momentum**	0.22	2.34	-0.17	2.66	-2.25	80.01	-5.36	-1.40	0.38	2.08	5.25	-0.21
S&P 500	0.85	2.00	-0.37	2.24	-2.98	35.65	-3.31	-0.44	1.29	2.24	4.05	-0.10
MSCI EM	2.40	5.07	-0.62	3.10	-81.34	2047.02	-10.46	0.11	3.02	5.85	11.23	-0.06
*Size**	0.29	2.50	0.33	2.55	5.19	99.79	-3.87	-1.23	-0.43	2.47	6.32	-0.13
*Bond**	0.01	0.18	0.85	3.33	0.01	0.001	-0.25	-0.14	-0.03	0.11	0.52	0.24
*Credit**	-0.02	0.08	0.35	2.68	0.001	0.001	-0.17	-0.09	-0.02	0.03	0.16	0.20
*TFBond**	-7.61	9.13	0.43	3.79	325.53	26303.8	-25.95	-13.27	-8.26	-1.92	19.80	-0.07
*TFCur**	-0.48	18.31	1.14	3.50	6983.56	393258.70	-30.00	-11.77	-7.41	6.45	47.43	0.04
*TFCom**	0.16	14.58	0.92	4.23	2856.56	191433.67	-23.04	-9.68	-1.80	6.71	40.59	-0.04
Subperiod: January 2007-March 2009												
HF	-0.06	2.59	-1.02	3.55	-17.87	160.78	-6.67	-0.42	0.98	2.07	6.06	0.34
HMF	-0.64	2.17	-1.29	4.59	-13.09	100.93	-7.31	-0.63	0.49	1.11	3.46	0.42
Market proxy	-1.93	5.65	-0.67	3.38	-120.85	3441.96	-17.23	-5.98	-0.87	1.79	8.95	0.19
*SMB**	-0.06	2.01	0.39	2.68	3.21	43.84	-3.64	-1.37	-0.15	0.80	3.99	0.02
*HML**	-0.89	3.02	-0.94	4.68	-25.96	390.88	-9.87	-2.09	-0.38	0.27	4.40	0.32
*Momentum**	1.16	5.12	-0.27	3.30	-36.95	2274.16	-11.36	-1.06	0.33	4.55	12.53	-0.19
S&P 500	-1.77	5.63	-0.67	3.29	-120.57	3317.78	-16.80	-5.54	-0.69	1.51	8.76	0.21
MSCI EM	-1.06	9.45	-0.72	3.54	-610.20	28202.5	-27.35	-6.92	-0.58	5.22	14.38	0.26
*Size**	-0.15	2.38	0.07	2.74	0.93	87.81	-4.65	-1.89	0.17	0.92	4.74	-0.12
*Bond**	-0.06	0.29	-1.59	7.21	-0.04	0.05	-1.11	-0.19	-0.05	0.13	0.35	0.08
*Credit**	0.15	0.36	1.65	7.82	0.07	0.13	-0.41	-0.08	0.11	0.30	1.45	0.39
*TFBond**	0.30	13.62	1.06	4.00	2663.39	137603.61	-18.34	-11.63	-0.78	5.69	38.48	0.11
*TFCur**	5.04	22.82	1.34	4.82	15935.2	1308871.6	-25.75	-8.81	0.87	16.49	69.22	0.11
*TFCom**	3.52	15.90	0.60	2.26	2397.98	144439.37	-19.85	-8.14	1.15	12.48	33.09	0.18

Note1: All indices are analyzed on basis of excess returns, unless indicated with an asterisk (*).

Note2: The skewness is calculated by dividing the third moment by the standard deviation, while the kurtosis is calculated by dividing the fourth moment by the standard deviation.

In Table 2 and Table 3, we present the results for different subperiods to test the macroeconomic effect. We consider three sub-periods. Hedge fund ETFs (*HF ETF*) are only included in the last subperiod study as the funds start exist since March 2009. In the prior financial crisis period, from January 2004 to December 2006, except for credit spread change (*Credit*) and trend-following factors (*TFBond and TFCur*), all passive benchmarks, hedged mutual funds, and hedge funds have positive returns. However, during the financial crisis (2007 – 2009), all funds and the market indices yield a negative return with higher volatility than in the pre-crisis time.

From Table 2, we can see that the fourth moment for hedge funds, hedged mutual funds and *S&P 500* becomes extremely large during the financial crisis and the third moment turns to be more negative. Nearly all asset classes become highly volatile during the bad time. However, the magnitude of movements in performance and the change in risk of extreme values are different as the third and fourth moments of hedge funds and hedged mutual funds changed by 10 times, whereas, the two moments of the equity index changed about 100 times. We can see in the extreme events, such as the subprime mortgage crisis, equity indices are more risky to invest.

Table 3 shows the last subperiod data from April 2009 to January 2015. This period is selected because the bear market reversed course by the end of March 2009 (Kanuri and McLeod 2014). In this period, all three funds underperform both MSCI emerging market index (*MSCI EM*) and *S&P 500* index. We find that hedge funds perform best among the three funds in comparison. In contrast, hedge fund ETFs yield the lowest mean return among the three, but have the smallest volatility. Hedge fund

ETFs have a positive third moment and a lower fourth moment which may attract risk-averse investors.

Table 3: Descriptive Statistics for Hedge Funds, Hedged Mutual Funds, Hedge Fund ETFs and 12 indices from April 2009 to January 2015

	Mean (%)	St. dev. (%)	Skew	Kurt.	Third Moment (%)	Fourth Moment (%)	Min. (%)	25% (%)	Median (%)	75% (%)	Max. (%)	Auto-corr. (lag1)
Subperiod: April 2009-January 2015												
HF	0.97	1.82	0.11	3.41	0.66	37.41	-6.67	-0.42	0.98	2.07	6.06	0.13
HMF	0.30	1.27	-0.14	3.07	-0.07	9.16	-7.31	-0.63	0.49	1.11	3.46	-0.08
HF ETF	0.23	1.08	0.002	3.51	0.0025	4.78	-2.91	-0.46	0.22	0.81	2.85	-0.13
Market proxy	1.59	3.99	-0.18	3.09	-10.71	820.56	-7.89	-1.20	2.29	4.03	11.35	-0.09
*SMB**	0.22	2.36	0.11	2.60	1.30	80.21	-4.28	-1.57	0.28	1.62	5.78	-0.21
*HML**	0.09	2.23	0.76	4.15	7.98	99.66	-4.37	-1.40	-0.06	1.31	7.57	0.22
*Momentum**	-0.42	5.24	-4.26	27.56	-613.22	20423.28	-34.70	-1.16	0.37	1.90	6.64	0.23
S&P 500	1.57	3.84	-0.20	3.09	-10.68	700.97	-7.99	-1.13	2.16	3.81	10.93	-0.08
MSCI EM	1.15	5.92	0.29	3.75	72.28	4938.14	-14.56	-1.68	0.49	3.96	17.14	0.01
*Size**	0.15	2.49	0.05	2.74	0.75	103.47	-4.93	-1.55	-0.07	1.91	6.12	-0.24
*Bond**	-0.01	0.20	-0.19	4.15	0.00	0.01	-0.70	-0.15	-0.01	0.11	0.53	0.29
*Credit**	-0.04	0.20	-1.96	10.18	-0.02	0.02	-0.99	-0.11	-0.02	0.05	0.40	0.48
*TFBond**	-2.66	16.71	1.38	4.55	6415.59	351658.0	-26.63	-14.19	-6.79	2.34	50.50	0.15
*TFCur**	-3.76	19.19	1.44	5.28	10024.2	705902.4	-27.94	-18.11	-8.71	5.57	69.10	0.05
*TFCom**	-0.51	15.27	0.76	3.15	2774.07	173419.6	-24.65	-10.64	-4.29	8.96	42.87	-0.03

Note1: All indices are analyzed on basis of excess returns, unless indicated with an asterisk (*).

Note2: The skewness is calculated by dividing the third moment by the standard deviation, while the kurtosis is calculated by dividing the fourth moment by the standard deviation.

5.2 Correlation

Table 4 below shows the correlation coefficients among hedge funds, hedged mutual funds, hedge fund ETFs and 12 passive indices. All three funds have a strong and positive correlation among each other since they use similar investment strategies and have alike market exposure. During the study period, the three funds positively correlate with equity market indices (*S&P 500, Market Proxy, MSCI EM* and the size (*SMB*) and

value factors (*HML*)), because the most widely used hedge fund strategies are equity long short and market neutral which are major equity investing. On the other hand, the fixed income factors (*Bond and Credit*) and trend factors tend to move against the three funds under analysis. Exposure to these negatively correlated factors can reduce the risk of the hedge fund portfolios.

Table 4: Correlation among Hedge Funds, Hedged Mutual Funds, Hedge Fund ETFs and 12 indices from April 2009 to January 2015

	Jan 2004-Jan 2015		Jan 2004-Dec 2006		Jan 2007-Mar 2009		Apr 2009- Jan 2015		
	HF	HMF	HF	HMF	HF	HMF	HF	HMF	HF ETF
HF	1.00	0.93	1.00	0.93	1.00	0.93	1.00	0.96	0.83
HMF	0.93	1.00	0.93	1.00	0.93	1.00	0.96	1.00	0.85
HF ETF	-	-	-	-	-	-	0.83	0.85	1.00
Market Proxy	0.86	0.93	0.82	0.87	0.82	0.94	0.91	0.95	0.76
SMB	0.45	0.37	0.77	0.69	0.22	0.27	0.45	0.37	0.26
HML	0.22	0.32	-0.02	0.00	0.01	0.27	0.37	0.34	0.13
Momentum	-0.25	-0.29	0.50	0.46	-0.20	-0.30	-0.40	-0.37	-0.31
S&P 500	0.84	0.93	0.77	0.86	0.80	0.93	0.91	0.95	0.76
*Size**	0.47	0.42	0.77	0.69	0.27	0.40	0.46	0.40	0.27
*Bond**	0.24	0.15	-0.21	-0.22	0.12	-0.04	0.48	0.39	0.21
*Credit**	-0.50	-0.46	-0.11	-0.09	-0.59	-0.52	-0.45	-0.35	-0.25
*TFBond**	-0.34	-0.35	-0.04	-0.14	-0.34	-0.28	-0.40	-0.42	-0.35
*TFCur**	-0.16	-0.19	0.41	0.31	-0.42	-0.43	-0.17	-0.12	-0.08
*TFCom**	-0.16	-0.17	0.27	0.15	-0.21	-0.24	-0.28	-0.20	-0.15
MSCI EM	0.87	0.88	0.87	0.86	0.89	0.90	0.86	0.87	0.85

Trend-following factors are used to capture hedge fund dynamic trading strategies that have option-like returns (Fung and Hsieh 2001). The three trend-following factor correlation coefficients with hedged mutual funds indicate that alternative mutual funds, which also use hedge fund strategies, have the similar exposure to trend-following factors like hedge funds.

In the most recent period of April 2009 to January 2015, compare to hedge funds and hedged mutual funds, hedge fund ETFs have a relatively smaller correlation with all factors except for emerging market. One explanation for this relationship is that all these models are extensively tested on hedge funds and mutual funds and they may not be the best measures for ETFs. It may also because the sample size for hedge fund ETFs are too small which may not represent the true population. In the next session, we will analyze how well the models using these factors can measure the three funds in comparison.

5.3 Performance analysis

Table 5 below shows the alpha values for the four performance measurement models in the period of January 2004 to January 2015. The Carhart (1997) and Fung and Hsieh (2004) models explain 75.51% and 87.89% respectively for hedge fund performance and 88.59% and 94.49% respectively for hedged mutual fund performance. Consistently, the R-Square for hedge funds is about 8% lower than that of hedged mutual funds under both models. As expected, the Fung and Hsieh (2004) model gives a better measure compared to the Carhart (1997) and Fama and French (1993) models.

Table 5: Traditional Performance Measurement Factor Models in the period January 2004 to January 2015

	Hedge Funds			Hedged Mutual Funds		
	Alpha(%)	Tstat	R-Square	Alpha(%)	Tstat	R-Square
CAPM	0.41%	4.67	74.47%	-0.13%	-2.92	88.28%
Fama and French	0.41%	4.72	75.51%	-0.13%	-2.94	88.56%
Carhart	0.41%	4.69	75.51%	-0.13%	-2.96	88.59%
Fung and Hsieh (2004)	0.41%	6.31	87.89%	-0.16%	-4.93	94.49%

We find that the hedged mutual funds have a negative alpha in most cases and the alpha values are significantly different from zero. In Fung and Hsieh (2004) model, the hedged mutual funds underperform the benchmark indices while the hedge funds generate a positive income (0.41%). These findings indicate that hedged mutual funds on average underperform the benchmark indices. Our result is consistent with previous literature. Looking back to the 10 years before our study period (1994 – 2004), hedged mutual funds underperform hedge funds with different samples (Agarwal, et al., 2009).

5.4 Performance results for different subperiods

In order to test the robustness of the results over time, we present the performance measurement results for three different subperiods: post dotcom bubble (2004–2006), subprime mortgage crisis (2007 – 2009), post-financial crisis period (2009 -2015), as shown in Table 6 and Table 7 below. For the most recent subperiod, we select the period starting from the time that the bear market reversed from the financial crisis (Kanuri and McLeod 2014). Notice that hedge fund ETF only exists in the last subperiod so we only compare it in the last subperiod.

Table 6: Traditional Performance Measurement Factor Models in the period of January 2004 to December 2006 and the period of January 2007 to March 2009

	Hedge Funds			Hedged Mutual Funds		
	Alpha(%)	Tstat	R-Square	Alpha(%)	Tstat	R-Square
Jan 2004 to Dec 2006						
CAPM	0.39%	2.40	66.45%	0.02%	0.66	75.24%
Fama and French	0.20%	1.31	80.45%	-0.14%	-1.99	86.08%
Carhart	0.22%	1.42	80.87%	-0.13%	-1.77	86.68%
Fung and Hsieh (2004)	0.34%	3.13	93.67%	-0.09%	-1.07	88.56%

Jan 2007 to Mar 2009

CAPM	0.44%	1.44	66.55%	-0.18%	-1.19	88.63%
Fama and French	0.26%	0.97	77.75%	-0.21%	-1.38	89.33%
Carhart	0.24%	0.91	79.06%	-0.22%	-1.51	90.44%
Fung and Hsieh (2004)	0.31%	1.25	87.60%	-0.29%	-2.57	96.32%

Table 7: Traditional Performance Measurement Factor Models in the period of April 2009 to January 2015

	Hedge Funds			Hedged Mutual Funds			Hedge Fund ETFs		
	Alpha	Tstat	R-Square	Alpha	Tstat	R-Square	Alpha	Tstat	R-Square
CAPM	0.30%	3.12	83.25%	-0.15%	-2.71	89.56%	-0.10%	-1.10	57.26%
Fama & French	0.31%	3.16	83.44%	-0.16%	-3.06	90.62%	-0.13%	-1.49	60.98%
Carhart	0.31%	3.32	85.04%	-0.16%	-3.17	91.48%	-0.13%	-1.50	62.92%
Fung & Hsieh	0.41%	5.03	91.56%	-0.12%	-2.76	95.64%	-0.04%	-0.50	75.70%

Both Table 6 and Table 7 confirm the above findings that hedge funds on average perform better than hedged mutual funds in all three subperiods. The result indicates hedge funds on average generate more income than both hedged mutual funds and market indices regardless of the market condition. The alpha for hedged mutual funds is negative and reaches to the lowest during the bad time. The magnitude of alpha move is much larger than that of traditional hedge funds. In contrast, hedge fund alphas are positive with small changes across the periods. This implies hedge fund managers can respond to the market change quickly and efficiently, as they are more experienced in trading market dispersion. That may be also because hedge funds are less regulated and give more incentives for managers to act at their best (Agarwal, et. 2009).

It is commonly believed that hedged mutual funds should have provided absolute returns regardless of market conditions. However, in Table 6, during the financial crisis,

the performance results indicate that they are affected by the market conditions. From Table 6, we can see that over the first two subperiods, hedge funds generate a similar alpha regardless of the market condition. A possible explanation could be hedge funds have relatively low correlation with traditional passive benchmarks than hedged mutual funds.

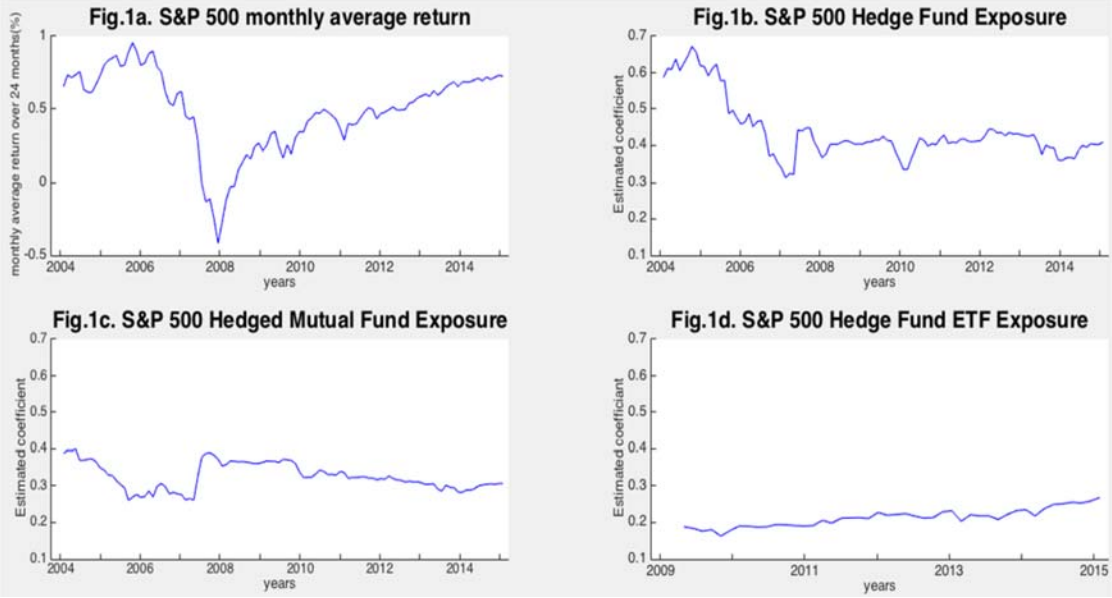
The four models used give us a consistent measure to compare the three funds. In the last period, when all three funds are compared, the size and direction of alpha under all models indicate the same result – hedge fund ETFs perform better than hedged mutual funds, but worse than hedge funds. For the two funds available to individual investors, hedge fund ETFs are preferred. Fung and Hsieh (2004) model give an r-square of 75.70% when measure the performance of hedge fund ETFs. It is significant and we can accept the model to measure ETFs. However, we have limitation to conclude this result as we only have 11 funds in our sample.

5.5 Rolling regression analysis

Figure 1-2 below examine hedge funds, hedged mutual funds and hedge fund ETFs exposure to the *S&P500* and *MSCI EM* using rolling regression with a 24-month time window. The top left part of the figure (Fig.1a and Fig.2a) presents the rolling regression of the average monthly return over 24 months of *S&P 500* and MSCI emerging market. The rest part of the figure (Fig.1b 1c 1d and Fig.2b 2c 2d) shows the analysis of the equally weighted hedge fund, hedged mutual fund and hedge fund ETF portfolio exposure to *S&P500* and MSCI emerging market. Note that the year 2004 (x-

asix) in figures means the rolling regression period from 2004 to 2006, the last rolling period is from 2013 to 2015.

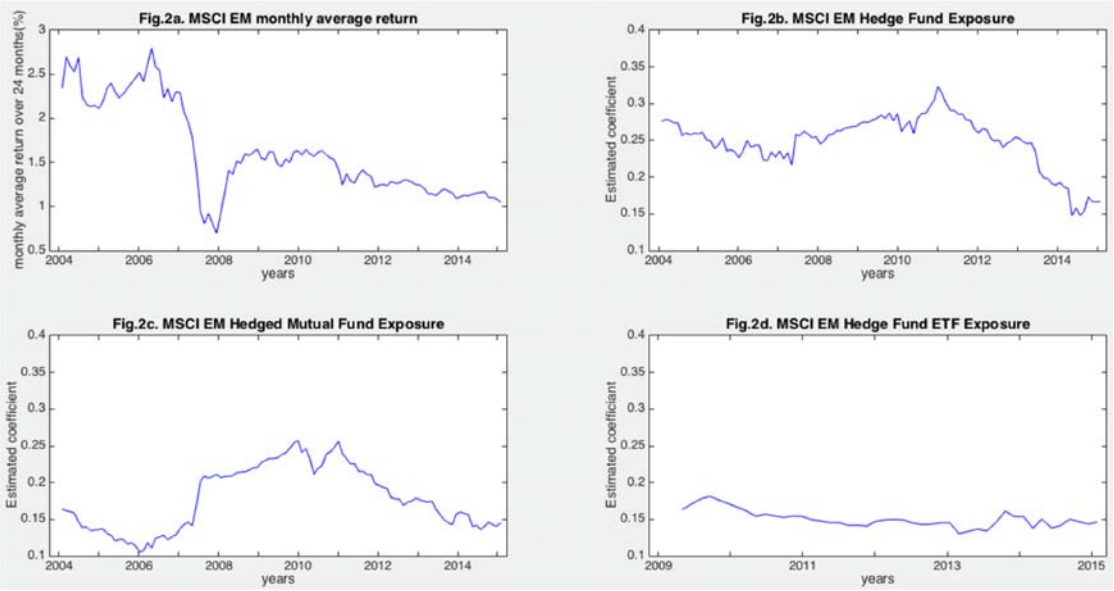
Figure 1



The rolling regressions in Figure 1 show, while the return of *S&P 500* falls sharply during the financial crisis, hedge funds respond to the market immediately by reducing the equity exposure from about 70% in 2005 to just above 30% in 2007. When market recovers from 2008, hedge funds increase their exposure to equity to about 43%. Hedged mutual funds also react to the change in the market but with a longer reaction time to the recovery that is evidenced by the wider dent in the graph during the crisis. The result shows hedge fund managers are more actively engaged in asset allocation. Hedged mutual funds still have genes inherited from mutual funds that employ passive investment strategies. After 2009, the exposure to *S&P 500* is relatively flat. Hedge funds remain the exposure around 40% level with moderate fluctuations. We can see hedge funds have learned a painful lesson from the crisis as they decide to have a huge tactical change in

asset allocations. Hedged mutual funds' exposure to *S&P 500* has a small downward trending to 31% in 2015. Hedge fund ETFs have the lowest exposure to *S&P 500* among the three funds, but they have smoothly increased their exposure from below 20% since the inception to about 30% in 2015.

Figure 2



** Fig. 1a and 2a: Rolling regression of average monthly return over 24 months of S&P 500 and MSCI Emerging market index. Fig. 1b 1c 1d and 2b 2c 2d Rolling regression of S&P 500 and MSCI Emerging market index factor exposure for hedge funds, hedged mutual funds and hedge fund ETFs. Note that x-axis year 2004 means the rolling regression period from 2004 to 2006, 2006 means the period from 2006 to 2008 etc.*

In Figure 2, we show the three funds' exposure to emerging market index, *MSCI EM*. The return of emerging market follows the same trend with *S&P 500* before the financial crisis and both the developed markets and the developing markets are hurt by the U.S. subprime mortgage crisis between 2007 and 2009. After the recession, the developed markets are smoothly recovered until now. The emerging market improves right after the crisis and is trending down until today. This trend can explain that both hedge funds and hedged mutual funds decrease their exposure to emerging market after

2011. During the period of 2008 to 2011, when both funds decrease the exposure to *S&P 500*, the exposure to emerging market increases. All fund managers are seeking diversification during that time and shifting the funding from U.S. to other countries that do not have a large correlation with U.S., like other developed countries, such as France and Germany. From this point, we can see hedged mutual funds and hedge funds follow the same investment strategy regarding to the macroeconomic factors, despite of one being less active managed than the other. In 2015, all three funds are at the same exposure level to the *MSCI EM* at about 15%. The hedge fund ETFs' exposure to *MSCI EM* is about 17% in 2009 which is different from hedge funds at that time, but it eventually merges with the other two funds in 2015. We can see the hedge fund ETF managers may have different asset allocation strategies from the other two funds. It may also because our sample is small, so the hedge fund ETFs may concentrate on a few number of hedge fund strategies.

Figure 3

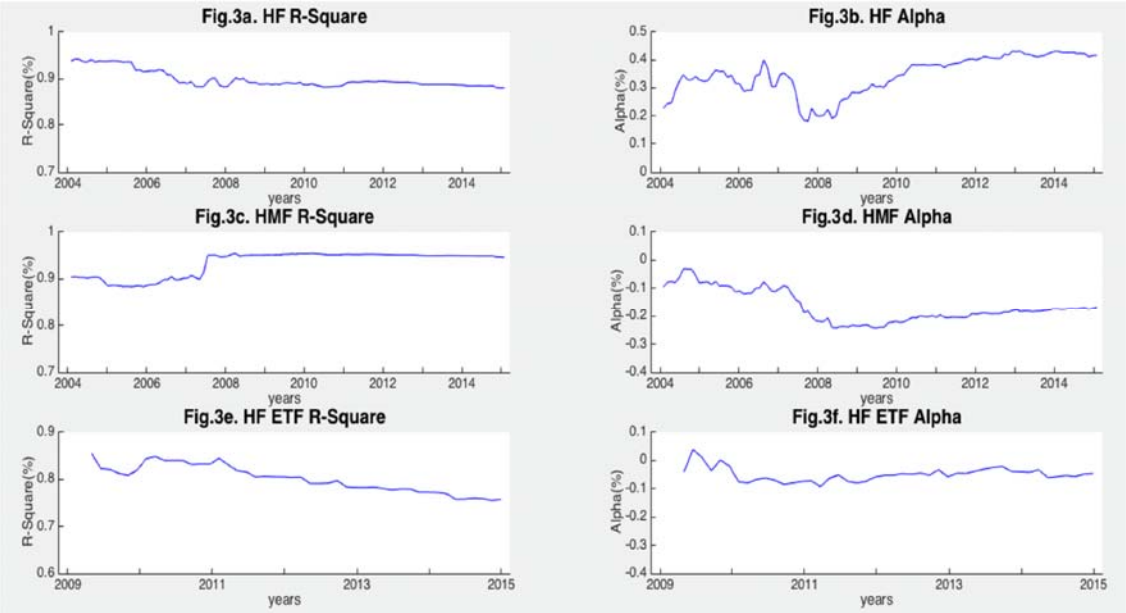


**Fig. 3a 3c and 3e: Rolling regression of R-square of hedge funds, hedged mutual funds and hedge fund ETFs (using Fung and Hsieh 2004 model). Fig 3b 3d 3f: alpha of the rolling regression for hedge funds, hedged mutual funds and hedge fund ETFs with 90% confidence interval. Note that x-axis year 2004 means the rolling regression period from 2004 to 2006, 2006 means the period from 2006 to 2008 etc.*

From Figure 3, we can see the alpha for both hedge funds and hedged mutual funds falls in 2008. The alpha for hedge funds stays low for about one year and increases. Hedged mutual funds, however, do not generate an alpha comparable to the pre-financial crisis period. The trend of the alpha indicates hedge fund managers have stronger ability to adjust to the change in the market and to bring their clients a better return than hedged mutual fund managers do. Hedge fund ETFs hardly generate a positive alpha and their performance are stable since they enter the market. Under Fung and Hsieh (2004) eight factor model, the r-square decreases over time which may imply that hedge fund ETFs expose to different factors than the other two funds.

6. Conclusion

In this article, we analyse the performance of hedge funds, hedged mutual funds and hedge fund ETFs using four performance measurement models. Our result shows that hedge funds constantly generate a positive alpha for institutional and high net worth investors in the period of 2004 to 2015. The two new entrants using hedge fund strategies do not generate a positive alpha. We identify the good performance of hedge funds can be explained by the fund managers' asset allocation skills and ability to adjust the fund to recover from bad economies. Comparing the two funds available to retail investors, hedge fund ETFs perform better than the hedged mutual funds and have the lowest volatility. Since the hedge funds have a relatively low correlation with traditional asset classes, individual investors may also benefit from adding these funds to their portfolios to diversify the risk.

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