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Three Essays on Hedge Funds

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Three Essays on Hedge Funds

A Dissertation Presented

by

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DEDICATION

To my parents and my husband.

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ABSTRACT

THREE ESSAYS ON HEDGE FUNDS

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In Essay 1, using a large panel data, we investigate the dynamics of hedge fund leverage from 2002 to 2011 and find considerable variations in both time series and cross-section. On average, hedge funds decrease leverage prior to the beginning of the financial crisis, with leverage remaining below the pre-crisis levels. We also find that younger funds with lower current leverage and stricter fund governance are more likely to increase leverage following favorable performance; funds exposed to higher risk, higher management fee and higher current leverage tend to delever. Managers increase leverage in order to enhance future performance following superior returns only to be disappointed. Newborn funds with higher incentive fees, shorter notice periods, higher minimum investments, high-water mark provisions, managers' co-investments, and younger family ages tend to have higher leverage when the short-term borrowing cost is low and the market risk is also low. We find mixed evidence on the performance difference between levered and unlevered funds, but levered funds do survive longer.

In essays 2, using a combination of the TASS database and the Barclay hedge fund database from January 2000 to December 2010, we study the performance of emerging market hedge fund by examining the sources of performance, the relation between performance and investor flows as well as the relation between performance and fund size. We find that the presence of the management companies in their investment region is the most important source of the risk-adjusted performance.

The funds with a presence in their investment region outperform other funds by 4.2 % per year. The local information advantage is significant for all major geographical regions. On average, 18% of the emerging market hedge funds have delivered positive and statistically significant alpha. Funds producing significant alphas (have-alpha funds) experience greater capital inflows than the remainder (beta-only funds). Have-alpha funds that experience high investor inflows do not have higher probabilities of being classified as beta-only funds nor have worse risk-adjusted returns in the future.

In essay 3, we study the dynamics in the performance report of hedge funds and investigate the determinants of return revisions from 2002 to 2013. We find that historical returns are routinely revised. About two-thirds of the hedge funds in our sample have revised their previously reported performance. On average, more than one-fifth of monthly returns were revised after being first reported. We find that positive revisions significantly outnumber negative revisions to returns of December. We also find an obvious decreasing time trend in both the number and proportion of return revisions, even after adjusting for performance report recency. We find a strong connection between return revisions and desirable fund characteristics such as strong fund governance at the overall fund level, the individual fund level, and the individual revision level. The revised funds outperform unrevised funds after revisions. Our findings suggest that correction may be a plausible explanation for the return revisions in hedge fund performance report. We have not found direct evidence that hedge fund managers manipulate returns.

Keywords: hedge funds, leverage, financial crisis, newborn funds, survival, emerging market, presence, performance, size, capital flows, hedge funds return, return manipulation, correction, governance

TABLE OF CONTENTS

PAGE

LIST OF TABLES

Table Page

LIST OF FIGURES

Figure Page

ESSAY 1

HEDGE FUND LEVERAGE: 2002-2011

1.1 Introduction

Excessive leverage is said to be the root cause of Global Financial Crisis in 2008 and the European sovereign debt crisis.[1] The excessive use of leverage in the hedge fund industry has created concerns for the risk of the industry and its impact on market stability. The debacle of Long Term Capital Management (LTCM) in 1998 and the blow-up of two Bear Stearns credit strategy funds in 2007, all related to exorbitant leverage levels, heightened concerns over the risks associated with high leverage and the possible impact on systemic risk. Monitoring the dynamic usage of leverage in hedge funds and investigating the implications of leverage are important issues not only for investors, but also for the regulatory authorities.

The hedge fund industry is one of the fastest growing sectors in finance. Hedge funds are generally characterized as highly leveraged and sophisticated investment vehicles. The widespread use of leverage is one of the dimensions in which hedge funds differ from other managed portfolios. Unlike mutual funds, hedge funds are not explicitly governed by regulations that limit their leverage level. Leverage plays an essential role in hedge funds' investment strategies. Hedge funds not only use leverage to take advantage of investment opportunities, but also vary leverage dynamically in order to adjust market risk exposure, aiming at amplifying returns while attaining a level of volatility desired by investors, which are otherwise unachievable.

[1] Speech by Mr. Norman T. L. Chan, Chief Executive of the Hong Kong Monetary Authority, at the Economic Summit 2012 "Roadmap to Hong Kong Success", Hong Kong, 9 December 2011.

Like any other market which is driven by supply and demand, hedge fund leverage reflects the changes in credit demand and supply. The leverage employed by hedge funds is acquired through direct financing, derivatives transactions, repurchase agreements, and short sales. Leverage allows hedge funds to magnify their exposures and thus magnify their risks and returns. However, the use of leverage by a hedge fund is constrained by other players, either directly or indirectly. The first group of players is the fund's creditors and trading counterparties such as the prime broker, which is the main leverage supplier. Hedge funds must consider margin and collateral requirements at the transaction level, and any credit limits imposed by trading counterparties such as the prime broker. Therefore, hedge funds are often limited in their use of leverage by the willingness of creditors and counterparties to provide the leverage.

The second category of players is the hedge fund clients, who are generally institutional investors and also strategic players. These investors have their own leverage policy which would in turn limit the use of leverage by the hedge funds. For example, CalPERS adopted the System Statement of Investment Policy for Leverage with the intention to "set limits and standards on the use of leverage that reasonably balance investment flexibility with risk management."[2] In addition, the contract between the hedge fund and its clients related to the fee arrangement, consideration for withdrawals and submissions of new money also affect the use of hedge fund leverage (Titman (2010)).

The nature of voluntary reporting for hedge funds to data vendors complicates the monitoring of their use of leverage. In addition, research on hedge fund leverage and the

[2] California Public Employees' Retirement System Statement of Investment Policy for Leverage, November, 2011.

implication for hedge fund operations as well as market stability is relatively scarce in academic literature.

In this paper, we explore hedge fund leverage on a cross-sectional and time series basis. Our data consist of all hedge funds covered by the Lipper TASS Hedge Fund database (hereafter, TASS) from January 2002 to August 2011. Based on the monthly average leverage ratio over time, we examine the following research questions: What are the dynamics of hedge fund leverage? What drives the changes in leverage level over time? How do these changes relate to each other and to a fund's past performance, flows, and other characteristics? What are the effects of the changes in hedge fund leverage on future performance, risk-taking behavior, and capital flows from investors? What determines the leverage level of newborn hedge funds? What is the relation between hedge fund leverage and their performance and survivorship?

Our empirical findings provide important insights on several theoretical predictions relating to the dynamics of hedge fund leverage. On average, hedge funds decreased their leverage in mid-2007 prior to the financial crisis. In fact, we find that funds newly added to TASS over our sample period, which is from January 2002 to August 2011, deleveraged an average of seven months earlier. We also find that when compared to their peers, funds tend to enhance leverage usage when the current fund return is high, leverage level is low and the fund is young. Funds with stronger governance are generally able to obtain credit more easily and thus are more likely to increase leverage. This finding is consistent with established funds having good performance choosing a higher leverage level in order to augment their returns further when both the fund and the lender feel safe to do so. On the other hand, hedge funds tend

to deleverage when the current return volatility is high and their leverage level is high. Deleveraged funds also tend to charge a higher management fee. This finding is in line with the general belief that fund managers decrease leverage usage in order to reduce risk when the fund's leverage and risk are already high and when the interests of the managers and the investors are better aligned. In the cross-section of newborn hedge funds, we find that from the macro-economic perspective, higher Volatility Index (VIX) and TED spread lead to lower leverage. In addition to the economy-wide factors, fund-specific variables have a profound impact on the leverage level of newborn funds. Specifically, higher incentive fees, high-water mark provisions, manager co-investments, shorter notice periods, higher minimum investment amounts, and younger fund family ages are all associated with higher fund leverage.

We also examine the impact of leverage change on fund performance, risk and investor flows. We find that increases in leverage do not result in improved performance. On the contrary, the performance for leverage increased funds is worse not only than their performance prior to the increases, but also than their peers and the deleveraged funds. The fund flows indeed increase after funds increase their leverage. Funds deleverage when risk and current leverage is high. We find economically lower return volatility in deleveraged funds, though the difference between the reductions in volatilities of deleveraged funds and of the unchanged funds is not statistically significant. From the newborn funds, we find that levered funds show better performance than unlevered funds, but funds with higher leverage do not necessarily have stronger performance. We also find that funds employing leverage generally are more likely to survive longer, and a higher leverage usage is associated with a longer lifetime,

consistent with the operational risk literature (see Brown, Goetzmann, Liang, and Schwarz 2008, 2012).

Our study contributes to the research on hedge fund leverage in several ways. First, our exploration on the dynamics of hedge fund leverage is related to estimating the leverage. Estimating hedge fund leverage is a difficult task as these funds have significant flexibility as to the types of assets they can invest in. Weak reporting requirements for hedge funds complicate the monitoring of their use of leverage. McGuire and Tsatsaronis (2008) use factor regressions with time varying betas to estimate hedge funds' use of leverage on the basis of publicly available data. Employing the data drawn from two annual surveys of 647 managers, Eichengreen and Park (2002) provide evidence that hedge funds reduced their use of leverage and credit following the Russia-LTCM crisis. Ang, Gorovyy and Inwegen (2011) track hedge fund leverage in time series from a dataset provided by a fund-of-hedge fund over the period from December 2004 to October 2009. They find that hedge fund leverage decreased prior to the start of the financial crisis in mid-2007. In this paper, we investigate the dynamics of hedge fund leverage using the monthly average leverage data provided by TASS over the period from January 2002 to August 2011. Consistent with Ang, Gorovyy and Inwegen (2011), we find that on average, hedge funds decreased their leverage in mid-2007. Secondly, our study on hedge fund leverage is also related to the previous work on the determinants of hedge fund leverage. Eichengreen and Park (2002) find that larger funds employ more leverage. Schneeweis *et al*. (2004) document that hedge fund strategies with relatively lower risk generally report higher leverage. Brown *et al*. (2008) discover that hedge funds with higher operational risk tend to have lower leverage, which is an indicator that

lenders and equity investors were already aware of the operational risk of the problem funds. Ang, Gorovyy and Inwegen (2011) document that changes in hedge fund leverage tend to be more associated with economy-wide factors than with fund-specific characteristics. Decreases in funding costs or increases in asset prices predict the increases in hedge fund leverage over the next month, while increases in fund return volatility predict the decreases in hedge fund leverage. Lan, Wang, and Yang (2011) find that incentive fees and strong fund performances provide strong incentives for managers to increase leverage. Thirdly, this paper relates to the literature on the impact of hedge fund leverage. Agarwal and Naik (2004) find no empirical evidence of significant underperformance or overperformance between levered funds and unlevered funds by comparing the averages and distributions of alphas and information ratios of funds that use leverage with those that do not. Similarly, Schneeweis *et al*. (2004) find no statistically significant difference between the risk adjusted performance of funds with below median leverage usage and those with above median usage. Moreover, within particular hedge fund strategies, at the fund level, there is little evidence showing a systematic relationship between the use of leverage and the level of risk-adjusted performance. Teo (2011) demonstrate that leverage amplifies the effects of capital flows on hedge fund performance, which is consistent with the findings of Brunnermeier and Pedersen (2009). Leveraged speculators such as hedge funds are susceptible to a margin spiral if margins are increasing in market illiquidity. Recently, Cao, Liang, Lo, and Petrasek (2014) find that hedge fund ownership in general improves stock market efficiency, but during liquidity crisis, this positive role is reversed especially for levered hedge funds because of margin calls and investor withdrawals.

Our paper also contributes to a growing body of work on the dynamics of hedge funds. Fung and Hsieh (1997) were among the first to point out that hedge fund strategies are highly dynamic, unlike the buy-and-hold strategies of most mutual funds. Chen and Liang (2007) illustrate that the market exposure of self-claimed market-timing hedge funds varies with future changes in market return and volatility. Schwarz (2007) study the dynamics of hedge fund fee structures. Bollen and Whaley (2009) show that a sizable percentage of hedge funds shift their risk exposures significantly over time. Patton and Ramadorai (2013) propose a new method to capture hedge fund dynamics by using high frequency instruments. Cai and Liang (2012) investigate whether or not hedge funds allocate assets dynamically among asset classes such as equity, bond, commodity, currency and credit. Deuskar *et al*. (2011) investigate the dynamics of hedge fund compensation contracts and find considerable cross-sectional and time series variations in hedge fund fees. They also study predictions on the dynamics of compensation contracts. Agarwal and Ray (2011) examine the determinants and consequences of changes in hedge fund fee structures including changes in the management fee, incentive fee, and high-water mark provisions.

The remainder of this paper is organized as follows: Section 1 describes the data. Section 2 presents the dynamics of hedge fund leverage, including the leverage level and changes in time series, the determinants of the changes, and the implications of the changes on future fund performance, risk and investor flows. Section 3 examines the leverage of newborn hedge funds and the relationship between fund performance and the leverage of the newborn funds. Section 4 explores the relationship between hedge fund leverage and their survival probabilities. Finally, Section 5 concludes.

1.2 Data

We obtain data from TASS. The main database consists of historical returns and fund characteristics such as the average leverage ratio, leverage indicator, maximum leverage ratio, inception date, redemption frequency and lockup periods, management fee, incentive fee, high-water mark provision, personal capital indicator, and the date of last audit. Variables reflecting hedge fund leverage usage in TASS are the average leverage ratio, a leverage indicator, and the maximum leverage ratio. Our study focuses on the average leverage ratio (which we refer to as ‘‘leverage’’ hereafter).

The TASS data have been widely used in a large number of hedge fund studies. We believe, however, that we are the first to use the average leverage-change data over a ten-year period from 2002 to 2011. Moreover, the TASS data which we use are proprietary and track leverage changes by funds at a monthly level. The average leverage in TASS was changed from characteristic to numeric in February 2002. Since it is difficult to change all the characters to numbers without additional information, we decided to include only the hedge funds with observation date in TASS after January 2002.[3] As a result, our sample period spans from January 2002 to August 2011. The sample of our study includes only the hedge funds in the snapshots of TASS datasets downloaded each month over the period from February 2002 to August 2011 except for three months (September 2002, December 2006 and August 2007). Altogether, we have 170 monthly snapshots of TASS data sets because for some months we have more than one snapshot. These monthly snapshots allow us to identify not only leverage change since the previously updated version, but also other characteristics at various points in

[3] The observation date of a fund in each snapshot is set to be the PerformanceEndDate in the file of ProductDetails of TASS.

time and the entire history of returns for each fund that experiences these leverage changes. We compare 170 monthly snapshots downloaded from February 2002 to September 2011. At each of these snapshots $s \in \{1, 2, \cdots, 170\}$, we track changes to leverage for all hedge funds. Not every hedge fund updates their information in TASS on the same date of each month, and the snapshots were not downloaded on the same date of the month either. For the months when a fund's information is not updated, we simply compare leverage in the newer snapshot with that in the latest snapshot.

An important issue on hedge fund leverage is how the leverage is calculated at the fund level. The basic form of hedge fund leverage is simply the unadjusted balance sheet leverage. But for those derivatives-specialized hedge funds, this may understate the true leverage, in some cases dramatically. Some funds may have estimated their leverage by adjusting derivative exposures. Like the data used by Ang, Gorovyy and Inwegen (2011), ours are self-reported. There may be the issue of inconsistency of leverage definition. But this issue may be attenuated through style fixed effects in our analysis. Moreover, our focus is on the commonality across hedge funds, not on the leverage of a specific hedge fund.

We apply some standard filters to the data. First, we remove 149,659 fund/months that belong to one of the following situations: (1) the average leverage is missing; (2) the maximum leverage number is less than the average leverage; (3) the TASS data set indicates no use of leverage in a certain month but the average leverage is positive. Second, we remove 326 fund/months that report data on a quarterly basis. Third, we remove 1,750 fund/months that do not report net of fee returns. After these data filters are applied, a total of 9,389 unique hedge funds remain in our sample with 280,572 monthly

observations. Unlike many of the studies on hedge funds, we include hedge funds that are not denominated in US dollars. To facilitate meaningful comparison, we convert all returns, net asset values, and minimum investment requirement to US dollars using the corresponding currency exchange rates from Morningstar Direct.

To attenuate the backfilled bias, we remove the first 12 months of return data from each fund. Among the 280,572 fund/months of leverage, the 99th percentile is 500, while the maximum leverage is 6,000. To mitigate the impact from extreme values, we winsorize the leverage at the 1st and 99th percentiles (see Fung et al. (2008)) for all the analyses, except in the process to identify instances where the recorded leverage in any given month differs from those recorded in the previous month.

1.2.1 Summary Statistics

Table 1 presents the summary statistics for 280,572 fund/month observations in our sample. The mean average leverage is 47, which means on average the amount of leverage is 47% of fund's equity. While the use of leverage is central to the hedge fund industry, hedge funds vary substantially in the degree and the nature of leverage usage. Average leverage exhibits considerable dispersion with a standard deviation of 155.53%. The mean maximum leverage is 107.58%, while the standard deviation is about 260%. On average, over 73% of the fund/months indicate the use of leverage. The mean management fee and incentive fee are 1.46% and 15.96%, respectively. Approximately, 68% of fund/month observations have high-water mark provision, while 29% involve personal capital investment by fund managers. The average minimum capital requirement is $0.74 million. The average redemption notice period is 37 days, while the average

lockup period is about 3 months. The average fund age and fund family age are about 71 and 105 months, respectively. 74% of the fund/months are located offshore. The average of assets under management of all the fund/month observations is about $210 million. The fund governance measure GOV (see Ozik and Sadka (2014)) has an average of 1.31 out of 4. The average time period since the last audit date is about 30 months.

Table 2 breaks down the funds by investment style and reports the pattern of leverage changes over time. Panel A shows that out of the 9, 389 funds in our sample, 246 funds had one change in leverage, 24 funds had 2 changes, and 4 funds had 3 or more changes, adding up to a total of 315 changes during our sample period between January 2002 and August 2011. As shown in Panel B, more than 50% (163 out of 315 instances) of the leverage changes occurred in 2008 and 2009, each with approximately one quarter of the total change cases. The least leverage changes occurred in years 2006 and 2007, with only about 1% of all changes in each of the 2 years. In the rest of the years, except for 2011 when we have only the first 8 months of data, the number of leverage changes ranges from 6.35% to 10.48%.

Panel C provides the breakdown of leverage changes by investment style. It shows that fund of funds accounts for more than 37% of leverage changes, followed by long/short equity which contributes over one-fifth of the leverage changes. Funds of funds many not use leverage directly but leverage changes at the underlying hedge fund level will result in the change at the fund of fund level. Accordingly, we take into account the style specific information of leverage changes in our analysis.

Panels D and E show the level of leverage prior to the changes and the magnitude of the changes. A clear pattern emerges that leverage levels prior to an increase are, on

average, much lower than the leverage levels prior to a decrease. In Panels D and E, the average leverage prior to an increase (decrease) is 16.73% (133.05%) compared to the overall mean of 47.45% from Table 1. In terms of the magnitude of leverage changes, the average increase (decrease) is 41.18% (103.9%). The magnitude of these changes is economically significant given the average level of leverage before the change and the overall average of leverage.

Admittedly, the leverage that hedge funds reported to the TASS database may not capture exactly the actual leverage levels used by the funds. Our variable is the average of leverage used by a hedge fund over a certain time period. The average process may smooth out the changes in the leverage to some extent. The changes in leverage identified in our study may just be the tip of the iceberg. However, such noise in the data will bias against finding any significant results.

1.2.2 Variable Definitions

1.2.2.1 Fund Performance, Volatility and Fund Flows

We measure the performance of hedge funds using the mean-adjusted return. The mean return is computed each month as the equally weighted average return of the hedge funds in our sample. Then for each fund, we calculate the mean-adjusted return as the excess return relative to the benchmark return. We also use alpha based on the 7-factor model, as established in Fung and Hsieh (2001, 2004)), to measure hedge fund performance. We use monthly data over a three-year period to estimate the alpha. The seven factors comprise return on the Standard & Poor's 500 index (equity market factor),

return on the Russell 2000 index return less the Standard & Poor's 500 return (equity size-spread factor), monthly change in the 10-year treasury constant maturity yield (bond factor), monthly change in the Moody's Baa yield less the 10-year treasury constant maturity yield (credit spread factor), and returns on the trend-following risk-factors on bonds, currencies, and commodities.

We use hedge fund flows to examine the relationship between leverage change and investor reactions as well as the impact of leverage changes on new money flows of the funds. We construct fund-level flows over the past three months using the return and AUM information from the following formula:

$$Flow_{i,t,3} = \frac{AUM_{i,t-1}}{AUM_{i,t-4}} - \prod_{j=1}^{3}(1+R_{i,t-j}) \qquad (1)$$

where $Flow_{i,t,3}$ is the past 3-month flow in hedge fund *i*, $AUM_{i,t-1}$ is assets under management of fund *i* at the end of month *t*-1, and $R_{i,t-j}$ is the monthly return of fund *i* in month *t-j*. The flows over the past six months and last year are the products of two and four non-overlapping past 3-month flows, respectively. We also examine the effect of volatility, measured as the standard deviation of raw returns. We compute these measures using monthly data over either a six-month or a one-year period.

1.2.2.2 Fund Governance

We study herein the impact of fund governance on leverage change and leverage level. On one hand, strong fund governance may align managers' interest with those of investors, leading the managers to undertake the best leverage decision for the investors' interests. On the other hand, a fund with strong fund governance is more likely to have better access to credit. Inspired by the corporate-governance literature (La Porta *et al*.

(2002), Gompers, Ishii, and Metrick (2003), and Ozik and Sadka (2014)), we consider several fund characteristics to act as a proxy for fund governance: whether the fund had been audited in the past 12 months, whether it has a high-water mark, whether it as an onshore domiciliation, and whether registration with the SEC exist. Following Ozik and Sadka (2014), we aggregate these variables to devise a measure of fund governance.

Taken as a group, the funds without a listed audit date have less oversight than the funds with an audit date listed (Liang (2003)). But for a lender, the updated or recent auditing may mean much more than an outdated one. A date for a completed financial audit reported by a fund may not be sufficient to indicate strong governance. We assign a fund a score of one only if the audit date is within the past 12-month time period, otherwise, a score of zero is assigned to the fund.

The high-water mark contract allows the fund manager to receive the performance bonus only when the net asset value of the fund at the end of the evaluation period exceeds the high-water mark, not just when returns are positive during the evaluation period. The high-water mark contract more closely aligns managerial incentives with those of the limited partners in the hedge fund, and thus improves the governance structure. A fund is assigned a high-water mark score of one if it carries the high-water mark provision and zero otherwise.

Offshore hedge funds enjoy a lighter regulation since offshore hedge funds are not registered in the United States (Aragon, Liang, and Park (2014)). Along the domiciliation dimension, we assign a value of one to onshore funds and zero to offshore funds.

Unlike mutual funds which are required to be registered with the SEC, hedge funds are lightly regulated investment vehicles[4]. Domestic and foreign hedge funds are required to fill out 13F forms quarterly for all U.S. equity positions worth over $200,000 or consisting of more than 10,000 shares only if their AUM are over $100 million. Some hedge funds may choose to register with the SEC to signal better institutional quality (see Brown et al. (2008)). We assign a score of one to funds registered with the SEC and zero otherwise.

1.2.2.3 Macro Variables

We employ various macro variables designed to proxy for the economic environment in order to capture the relationship between the leverage of newborn hedge funds and the state of economy. Our macro variables are monthly returns on the S&P 500 Index, monthly VIX volatility index, the three-month Treasury over Eurodollar (TED) spread and the term spread, which is the difference between the 10-year Treasury bond yield and the yield on three-month Treasury. The TED spread represents the aggregate cost of short-term borrowing for large financial institutions. In turn, the cost of short term borrowing for hedge funds is the TED spread plus a spread imposed by the prime broker as a risk premium.

The recent global financial crisis was a difficult time for all hedge funds. In order to assess the impact of this crisis on hedge fund leverage, we include an indicator which is one for the crisis period defined as the period between August 2007 and June 2009, and zero otherwise.

[4] The Dodd-Frank Act requires major hedge funds with $150 million under management to be registered with the SEC.

1.3 Dynamics of Hedge Fund Leverage

1.3.1 Leverage Levels and Changes in Time Series

First of all, we are interested in how the cross-sectional average leverage changes over time. We address this question in Figure 1 which displays the time series averages of monthly leverage across all funds and the averages for the funds that are newly added to the TASS datasets. The monthly averages of leverage across all funds can be divided into three periods. The first period spans from January 2002 to July 2007. During this period, the monthly cross-sectional means for hedge fund leverage stays in the range of 50% to 60%. The second period is a declining period which is relatively short from August 2007 to May 2008. The monthly averages of hedge fund leverage drop from over 50% to below 30% in only 10 months. The monthly averages became stable in the third period from June 2008 to August 2011, which is the end of our sample period. In the third period, the overall level of leverage stays in the range of 24% to 30%. At the end of our sample, in August 2011, we estimate the average of leverage across all hedge funds to be 27.7%, while for the entire sample, the mean of the leverage is about 47.5%.

The trend of monthly average of hedge fund leverage is consistent with that of Ang, Gorovyy and Inwegen (2011), who use a data set from a fund of hedge funds to track hedge fund leverage in time series from December 2004 to October 2009.

Note that the monthly means of hedge fund leverage are well above those of the winsorized sample at the 1 and 99% leverage level, especially for the first period as shown by the solid line vs. the round dot line in Figure 1. The cross-sectional monthly

average of the original hedge fund leverage is about 15% higher than those of winsorized means in the first period. Therefore, in order to reduce the impact of the extremely high leverage levels on our analysis, we winsorize those outliers over the 99th percentile of leverage in our sample.

Figure 1.A also presents the monthly means of leverage across the hedge funds that are newly added to TASS in each month. Comparing the lines for the monthly means of all funds with those of the newly added funds, we find that the general pattern of the lines is similar, with the line for added funds being more volatile. This pattern can be explained by the much smaller number of each month's newly added funds compared to the number of the existing funds in each month. The decrease of the monthly average of leverage for the overall hedge funds in the second period is preceded by the rapid declining of that of the newly added funds. The decrease for the added funds began from January 2007. In the following six months, the leverage averages across newly added hedge funds dropped over 80%. This reconciles the contradiction seen in the decrease of leverage monthly mean of the overall hedge funds and the few unexpected cases of changes in the leverage. The decline of the leverage levels of newly added funds contributes to most of the decrease in the leverage monthly mean of overall hedge funds. Figure 1.B shows the monthly leverage averages across the hedge funds that have been newly added to TASS and those removed from TASS in each month. Both lines are volatile. The movement of the leverage averages for removed funds can largely be predicted by the changes in the leverage averages of the newly added funds.

To summarize, hedge funds reduced their leverage usage prior to the latest financial crisis and the leverage remained lower compared to the first stage in our sample

period. This reduction of leverage usage may be the consequence of the volition of hedge funds themselves, or may be the result of brokers' unwillingness to grant the credit considering the credit risk involved.

1.3.2 Determinants of Hedge Fund Leverage Change

What characteristics of hedge funds can predict future leverage changes? To address this question, we firstly compare the fund characteristics of each fund/month with changed leverage to those of a comparable fund/month. The peer or matched fund/month for the fund/month with changed leverage is assigned from within the same month, having the same strategy (investment style) and nearest asset size but having unchanged leverage from previous months. If the asset size of the fund/month with changed leverage is missing, we exclude it from this analysis. The match process results in 139 peers matched to the funds that increased their leverage and 108 to the fund/months that decreased their leverage.

The comparisons between the matched pairs are reported in Table 3. We can see that many of the characteristics for funds with leverage increases are quite different from those of their peers. Funds with average leverage increases tend to have better past performance measured by raw returns or the mean-adjusted returns. Compared to their matched peers, the funds with leverage increases have lower average leverage usage previously. They also have shorter redemption frequencies and lockup periods (indicating higher liquidity), higher incidence of using the high-water mark provision. Moreover, the funds with leverage increases also show stronger governance evidenced by their higher aggregated governance score and more frequent audits as well as higher proportion of

funds that are audited in the past 12 months. In addition, funds that increase their leverage usage tend to be younger and from families with shorter history than their counterparts without leverage changes.

In a strong contrast, results in Table 3 show that funds with leverage decreases tend to have higher leverage usage and longer notice period (less liquid) than their counterparts that do not change leverage. The differences between funds with leverage changes and those without changes showing from the last two columns are largely consistent with the differences between the funds with leverage increases. This may be because the number of funds with leverage increases matched with unchanged funds is more than that of the funds with leverage decreases. Interestingly, the minimum investment requirement for both the leverage-increased and decreased funds is significantly higher than those of the matched funds.

While Table 3 compares funds with increased or decreased leverage to their peers in a univariate setting, Table 4 reports results from multivariate regressions that model the probability of leverage increases, decreases and changes. For comparability of estimating the marginal effects from the probit analysis of the determinants, all variables are standardized to have a zero mean and a unit variance across the funds with leverage increases, decreases and changes, respectively. In the first column of each fund group, we include the aggregated past governance variable, while in column 2 we include all the components of the governance, namely the domicile, high-water mark, audit, and SEC file indicators, to identify which governance factor really matters for the increase or decrease of the leverage.

Consistent with the univariate results, we find that superior past performance strongly predicts leverage increases. Specifically, the first column of Table 4 shows that the probability that a fund takes on more leverage increases by 0.35 per one standard deviation increase in the past month performance. We hypothesize that the fund manager increases leverage in order to amplify fund returns based on the existing good performance. The predictive relationship between the probability of leverage increases and the past month performance is consistent with that creditors are more willing to grant credit to funds with better performance.

Reasonably, fund managers are more likely to enhance leverage usage in the next month only when the current leverage level is relatively low, which is evidenced by the negative relationship between the probability of leverage increase and the prior leverage level. Specifically, a one standard deviation reduction in leverage in the current month would predict a probability of leverage increase of 0.37 in the next month. Moreover, levered funds are more likely to further increase leverage. This can be explained by the established relationship with lenders for these levered funds.

Table 4 shows that younger funds are more likely to increase leverage. This may be explained by the difference in capital demand between the young funds and the more established funds. The longer the funds have been in business, the better their investing reputation may be, and the less dependable they would be on the leverage to take advantage of investment opportunities. In contrast, younger funds are more eager to establish the reputation (Chevalier and Ellison (1999)).

Next, we turn to the governance characteristics. We find a significant positive relationship between the probability of fund leverage increase and its governance score.

The probability increases by about 0.3 per one standard deviation increase in the aggregated fund governance. Higher fund governance means lower credit risk/operational risk. Creditors are more willing to grant credit to borrowers with lower credit risk/operational risk, other things being equal. In the second probit regression for the fund group with leverage increase, we replace the aggregated fund governance variable with its four components, namely, the dummy variables of domicile, high-water mark, indicators representing whether fund has audit in the past 12 months and whether the fund is registered with the SEC. The results show that out of the four variables that reflect fund governance from different perspectives, only the dummy variables of audit and SEC registration are significantly related to the probability of a fund leverage increase although other two coefficients have the correct signs. If the fund has an audit conducted in the past 12 months or the fund is registered with the SEC, the fund is more likely to get loans which result in a higher leverage. Funds that were audited or registered with the SEC go through the scrutiny of third parties. Facing the lack of transparency and high operational risk in the hedge funds industry, creditors value independent oversight[5].

The second group of funds in Table 4 is those that decreased their leverage. Their peer funds have the same style and are closest in size measured in the same month as when the decrease occurs. The variable specifications are the same as those for the group of funds with increased leverage and matched funds except that we exclude the dummy variable indicating the fund leverage usage, because all the funds have a value of one on this variable. Clearly, only the funds currently using leverage have the possibility to decrease.

[5] See Brown, Goetzmann, Liang, and Schwarz (2008, 2012).

First, we find that the higher the fund volatility, the higher the probability that a fund will decrease its leverage. In particular, the probability of leverage reduction increases by 0.45 per one standard deviation increase in the volatility. This significantly negative relationship between return volatility and leverage is consistent with the finding in Ang, Gorovyy and Inwegen (2011). Highly volatile funds may avoid using high leverage to enhance the risk further.

Turning to the current fund leverage, we find a significant positive relationship between the probability of a fund leverage decrease in the next month and the current leverage. A one-standard deviation increase in the current leverage is associated with a 0.7 increase in the probability of decrease in leverage, other things equal. This result suggests that hedge funds tend to reduce leverage-related risk when the leverage usage is already high.

From Table 4, we further note that higher management fees lead to a higher probability of leverage decrease, which is consistent with the theoretical model of Lan, Wang, and Yang (2011). Management fees give the manager an "equity-like" stake in the fund and thus mitigate managerial risk seeking that could otherwise be induced by incentive fees. As a result, management fees encourage the manager to practice prudent risk management and hence reduce leverage, ceteris paribus.

Interestingly, the coefficient on the aggregated fund governance in the first regression is approximately zero. The coefficients on each fund governance component in the second regression are all insignificant. This finding suggests that the reduction of leverage for our sample funds is not involuntarily deleveraging, resulting from poor fund governance. The coefficient on past performance is positive but insignificant. Our

findings suggest that hedge fund deleveraging may be a voluntary activity of fund managers undertaken to reduce risk following unstable performance. This voluntary deleveraging is probably induced by the relationship arising from the compensation contract between the managers and investors. The leverage reduction in our sample may also be involuntarily deleveraging because the prime brokers increase margins and/or reduced credit lines in light of the high volatility in the fund returns or in bad macroeconomic conditions.

The only fund characteristic that has the same direction of significant effect on leverage increase and decrease is the minimum investment requirement. The higher the minimum investment requirement, the more likely a fund is to change its leverage. By imposing a high minimum investment, fund managers can effectively weed out short-term investors and regulate cash inflows to the fund, which gives managers more flexibility in managing the fund leverage.

In conclusion, leverage change (either increase or decrease) can be predicted by hedge fund characteristics although the same predictor can serve an opposite role for a fund to increase or decrease its leverage. In addition to fund return volatility that can affect leverage increase or decrease as evidenced by Ang, Gorovyy and Inwegen (2011), other fund specific variables as detailed above also play important roles in predicting fund leverage change. All these fund characteristics explain the heterogeneity of fund leverage existing in the hedge fund industry.

1.3.3 Impact of Leverage Changes on Performance, Risk and Investor Flows

Here, we examine how leverage change affects future fund performance and the risk-taking behavior of fund managers, and how investors respond to the leverage changes in terms of capital inflows. Specifically, we examine the mean-adjusted return, fund flows, and the standard deviation of returns, measured over the 6-month and one-year periods using monthly observations. Table 5 reports the comparison of mean-adjusted returns, standard deviation of returns and fund flows between the leverage changed funds and matched funds in 6 and 12 months after the leverage alterations.

If the fund managers intend to attain higher returns by increasing fund leverage, the results from Table 5 suggest that the managers would be disappointed. The average mean-adjusted return of the changed funds in the 6 months following the changes is significantly lower than that of the matched funds, though the difference is negligible in the 12-month period after the leverage changes. For the deleverage funds, both the post 6-month and 12-month period mean-adjusted returns are similar to those of the unchanged funds. This finding is not surprising since from the previous section we find that the main purpose of the fund managers to deleverage is to reduce risk instead of enhancing fund returns.

The 6-month and 12-month risks, proxied by the standard deviation of fund returns, of the deleveraged funds are both lower than those of the matched funds. Even though statistically insignificant, the difference is economically significant, especially the 6-month risk of the deleveraged funds which is over 10% lower than that of the matched funds. As expected, fund managers greatly increase fund risk by increasing leverage,

even though they may fail to enhance fund returns in doing so. The 6-month risk of leverage increased funds is not only economically higher, but also statistically (marginally) higher than the risk of their peers. The 12-month risk of the leverage increased fund is over 18% higher than that of the matched funds, even though the difference of the two risks is statistically insignificant, it is economically significant.

Next, we proceed to explore the impact of leverage changes (increase or decrease) on fund flow. Although the differences between the fund flows of the leverage changed funds are not statistically significant, they are economically significant. Specifically, fund flows over the 6-month and 12-month periods after leverage changes are 3.84 times and 3 times those of the fund flows of matched funds, respectively.

Table 5 also presents the comparison of the changes in fund performance, risk and fund flows 6 or 12 months following and preceding the leverage changes. Compared to the matched funds, the leverage increased funds experience a much larger drop in the mean-adjusted returns over 6 or 12 months following the leverage changes from the returns prior to the leverage increase. This finding is not surprising since Table 3 shows that the mean-adjusted returns are significantly higher than those of the matched funds during the 6 or 12 month periods prior to the leverage increase, while the returns are much lower for the leverage increased funds 6 or 12 months following the leverage changes from the first two rows of Table 5. The increase in the 6-month fund flows for the leverage increased funds following leverage changes from the 6-month fund flows prior to leverage changes is marginally statistically larger than that for the matched leverage unchanged funds. For the deleverage funds, the decreases in fund performance, risk and fund flows are all larger than those of the matched funds. Though the difference

in the reduction of risks is not statistically significant, it is economically significant for both the 6-month and 12-month periods.

To understand further the impact of leverage changes on fund performance, we next examine the cumulative average abnormal return (CAAR) of leverage-increased and decreased funds over an event window of 12 months prior to and 12 months after the changes. The abnormal fund returns are measured relative to Fung and Hsieh 7-factor model. They are calculated as fund excess returns minus the factor realizations times the estimated factor loadings. Figure 2.A shows that the CAARs of the increased funds and decreased funds run side by side until 3 months before the leverage changes. Then the CAAR of increased funds increases steadily and well above that of the deleveraged funds until 3 months following the changes. When the changes happen, the CAAR is 15.4% for the funds which have increased their leverage, contrasting to 8.45% for the deleveraged funds. But the CAAR of funds with increased leverage drop continuously in the 3 months following the leverage change to be even lower than the CAAR of deleverage funds. Our findings are consistent with Bares, Gibson, and Gyger (2003) who find that the persistence in hedge fund performance is short term (1 to 3 months) and decays rapidly.

Figure 2.B. shows the CAARs of the leverage-increased and deleveraged funds over the 12- month event window since the leverage change. In 2 months after leverage changes, the CAAR of the funds with increased leverage is 5.73% which is 4.2 times that of the deleveraged funds in the same period. But since month 4 after the leverage change, the CAARs of the leverage increased funds are at least 3.5% less than that of the deleverage funds.

The CAAR pattern of the leverage increased funds is not a result of momentum, because the pattern persists even when we use the abnormal return adjusted by Fung and Hsieh 7 factors and the momentum factor. The pattern may result from mean reversal. The CAAR patterns for leverage increased funds and deleveraged funds are similar to those in Figure 2 where the CAARs are based on the mean-adjusted returns.

To sum up, even though the funds increase their leverage based on better past performance than the deleveraged funds, the favorable performance persists only for a short period. Thus increasing leverage does not appear to help much to prevent the decay of performance persistence.

1.4 Leverage of Newborn Hedge Funds

As we indicated before, leverage may be determined endogenously based on past performance, risk, and the existing leverage level. To treat leverage more exogenously and understand how funds set up leverage from the inception, in this section we investigate the determinants of the leverage for newborn hedge funds and the relationship between their leverage and their performance in the 12 months after the newborn funds are added to TASS. Following the study of Deuskar et al. (2011), we define newborn funds as the funds with age less than two years in the first observed snapshots. Altogether, we have 4,678 newborn funds over our sample period. The average of the leverage of these new funds is 37.59% and the standard deviation is 84.44%. Compared to the data in Table 1, both the mean and standard deviation of the leverage of the new funds are much lower.

1.4.1 Determinants of the Leverage of Newborn Hedge Funds

First, we investigate the determinants of the leverage of newborn hedge funds, after which we estimate the OLS regression models to examine the effects of macro and fund specific variables on the leverage level of the newborn funds. All the models are controlled for the style effect. The results are reported in Table 6.

Table 6 shows a significantly positive relationship between the level of leverage and the incentive fee. The call optionality embedded in incentive fees encourages excessive managerial risk taking (Goetzmann, Ingersoll, and Ross (2003)). The managers tend to take on more leverage when the fund's AUM is close to its high-water mark. The closer the fund's AUM is to its high-water mark, the more leverage the managers use because the manager is more likely to be able to collect the incentive fees (Lan, Wang, and Yang (2011)). This is shown in the significantly positive relationship between the high-water mark dummy and the leverage level. To examine the interactive effect of incentive fee and high-water mark, we include the interactive term of the two items in Model (2). In this model, the coefficients of incentive fee and high-water mark are no longer significant. The significant coefficient of the interaction term means that the combination effect of incentive fee and high-water mark dominates the effect of incentive fee alone or high-water mark alone. No matter under what situation, with contractual incentive fee, manager is effectively risk seeking. The higher the incentive fees, the higher the fund leverage as shown in Table 6.

Unlike the relationship between the probability of reduced fund leverage and the dummy of manager’s personal investment in Table 4, the relationship between the leverage level of newborn funds and manager co-investment is significantly positive.

From Table 4, we find that manager investment in her own fund aligns the interests of investors' and that of managers and thus motivate managers to behave in a more prudent way by deleveraging when volatility is high. Here, for the newborn funds, managers' personal investment functions as a better fund governance structure. Funds with managers' wealth have stronger governance than those without managers' capital investment; as a result, brokers are more willing to grant credit to the newborn hedge funds.

Table 6 shows that shorter notice periods and higher minimum investment amounts are associated with higher leverage for the newborn funds. For example, Model (1) shows that a 30-day longer notice period is associated with 6.6% lower leverage. The impact of minimum investment is also significant at the 1% significance level. A one million dollar increase in the minimum investment is associated with a 3.13% increase in fund leverage. Our results show that the leverage of new funds is negatively associated with family age. A fund that comes from a young family may rely more on leverage in order to take advantage of the investment opportunity since the young fund family has not built a reputation to attract investors yet. As a result, the young family is unable to provide a newborn fund with strong financial support.

Model (3) includes the variable GFC to capture the global financial crisis effect on the leverage of newborn funds for the period of August 2007 to June 2009. As expected, the model reveals a negative and statistically significant coefficient on GFC. The global financial crisis significantly reduces fund leverage. Specifically, on average, newborn funds added to TASS during the global financial crisis have a 19% lower leverage, other things being equal.

Model (4) examines the impact of macro variables in the month prior to the addition of the newborn fund to TASS. Our result shows that all the macro variables, with the exception of term spread, significantly predict changes in leverage when controlled for the style effect. We observe that the higher the volatility (as measured by VIX), or the riskier the assets (as measured by the TED spread in one month before the newborn fund is added to TASS), the higher the leverage of the newborn fund. In fact, the largest coefficient in magnitude is on TED spread, where for a 1% increase in TED spread, the leverage of a newborn hedge fund shrinks by 13.7% on average. A widening of the TED spread is typically associated with higher borrowing costs (Gupta and Subrahmanyam (2000)). Hedge funds would borrow less when the borrowing cost is higher. A 1% movement in VIX predicts that leverage of a newborn fund would decline by 0.7% in the next month. This finding is consistent with the finding related to the economy-wide leverage. Fostel and Geanakoplos (1998) observed that economy-wide equilibrium leverage rises in times of normal state (low volatility) and falls in periods where uncertainty is high and agents have very disperse beliefs. In model (4), the sign on the S&P 500 Index is unexpectedly negative. We might expect higher S&P 500 returns predicting higher leverage of newborn hedge funds. Instead, the coefficient on the S&P 500 Index is negative at -1.42. In fact, the S&P 500 returns, the TED spread, and VIX are highly correlated over our sample period. To alleviate multicollinearity, we only include VIX and the TED spread when combining the macro variables and fund specific characteristics in the same regression to examine their impact on leverage of new funds. In the joint regression, the two macro variables and fund specific variables have the same signs and remain in similar significance levels as the two categories of variables used

separately in the regressions except that the family age becomes marginally significant. Our results again demonstrate that not only macro variables but also the fund characteristics variables affect the leverage level of hedge funds.

We also examine the leverage determinants of the newborn funds with age less than 1 year[6]. The impacts of the variables on the leverage of newborn funds are similar to those on the leverage of funds with age less than 2 years as detailed above except that the coefficient on family age is no longer statistically significant.

1.4.2 Leverage and the Performance of Newborn Hedge Funds

Next, we examine the relationship between leverage and the performance of the newborn funds in 12 months after they are added to TASS. On one hand, managers increase leverage to take advantage of investment opportunities in order to amplify returns. On the other hand, investors require higher returns because of bearing higher risk when managers take on higher leverage. As a result, we expect that hedge funds with leverage usage should achieve better performance than those that do not use leverage. But previous researches do not support this expectation. For example, Agarwal and Naik (2004) found out that levered funds do not necessarily perform better or worse compared to unlevered funds. Unlike the study of Agarwal and Naik (2004) which uses the leverage data in a single snapshot, in our study, we use the first snapshots of all the newborn funds in our sample period to investigate the impact of leverage on fund performance.

Table 7 reports the results of the performance regressions on leverage usage of newborn funds based on the variable of leverage in TASS, after controlling for style and other fund characteristics.

[6] These results are not reported but are available from the authors upon request.

We find, as expected, a newborn fund with average leverage larger than zero earns approximately 5.2% more annual excess return than that of a fund with zero average leverage in the 12 months following the fund joining TASS.[7] Measured by the 7-factor alpha, a levered newborn fund on average outperforms an unlevered fund by about 3.9% on an annual basis. Whether in excess return or 7-factor adjusted return, the differences between the performance of a levered and unlevered fund are statistically significant at the 1% level. Our result showing that leverage may improve fund performance does not mean the higher the leverage, the higher the fund performance. In line with Schneeweis et al. (2004), in untabulated results we find that the difference in the risk-adjusted performance between funds with below median leverage usage and those with above median usage is statistically insignificant. The same is true for the difference in terms of excess returns. We also construct tercile portfolios using the levered newborn funds. We find that all the differences among the averages of 7-factor adjusted returns and the differences among the averages of excess returns for the three terciles are statistically insignificant. This finding is not surprising, since high leverage is not equal to high risk. The actual risk of a fund or the investor's actual risk depends not only on the leverage the fund takes on, but also on the underlying or inherent risk of the assets held by the fund.[8] In fact, a levered fund investing in low-risk assets may carry less risk than unlevered funds holding high-risk assets. Managers intend to magnify returns by using leverage, but sometimes, things do not turn out as they expect. Particularly, during a liquidity crunch, leverage amplifies the effect of losses (Brunnermeier and Pedersen

[7] In this sub-section, we refer a fund with average leverage greater than zero as a levered fund and a fund with zero average leverage as an unlevered fund.

8 "Measuring Off-Balance-Sheet Leverage," by Peter Breuer, International Monetary Fund (IMF)'s Working Paper (WP/00/202), Pages 6-8.

(2009)), asset fire sales (Shleifer and Vishny's (1992)), and decrease market efficiency (Cao et al. (2014)). In a volatile market, high level of leverage increases the likelihood that a levered fund will fail. As a result, leverage usage may enhance fund performance, but its relationship is not linear. This is where the management on optimal fund leverage can come into play.

In addition to the finding that leverage usage augments newborn funds' abnormal returns, we find that newborn funds with manager capital co-invested outperform the funds without managerial personal investment by more than 5% of annual 7-factor adjusted return and more than 3% of the annual raw return in excess of the risk free rate. The positive relationship between high-water mark and the 7-factor adjusted return of newborn funds is marginally significant. Both the manager co-investment and the high-water mark provision align the manager interest with that of investors and motivate the manager to attain strong performance. We also find that offshore newborn funds outperform onshore funds by over 4% in terms of the 7-factor adjusted return. This is consistent with Brown, Goetzmann, and Ibbotson (1999) who use a sample containing only offshore hedge funds and find positive risk-adjusted performance. However, unlike Brown, Goetzmann, and Ibbotson (1999), we cannot attribute offshore fund performance to the style effects since we have already controlled for the style effect. The outperformance may be explained by the flexibility that offshore funds enjoy.

1.5 Leverage and Hedge Fund Survival

Finally, we examine the impact of leverage on hedge fund survival. Similar to Liang and Park (2010), we apply the Cox proportional hazard models controlling for

right-censoring for our sample period. The dependent variable is hedge funds' lifetime or failure time, which is the length of time from when the fund enters the TASS database until its death or the time of our last snapshot in August 2011. Early hedge fund studies treat funds that were dropped out of the live fund database as failed funds because such funds on average have poor performance (Liang (2000), Gregoriou (2002), Malkiel and Saha (2005)). As indicated by the drop reason codes provided by TASS, liquidation is not the only reason why hedge funds are moved to the graveyard fund database. Other reasons include: stop reporting, unable to contact, closed to new investment, merged into another fund, and dormant funds (Getmansky, Lo, and Mei (2004), Baquero, Horst, and Verbeek (2005), and Rouah (2005)). We conduct survival analysis by defining a dead fund in two different ways: One is the graveyard fund and the other is the liquidated fund in the graveyard. Our primary independent variable is leverage. We also control fund characteristics including contractual fee structure, high-water mark provision, manager co-investment, share restrictions, fund domicile, and fund style as indicated in the snapshots in which they appear for the first time over our sample period.

We investigate the effect of leverage on fund survival for the newborn funds and the funds newly added to TASS over our sample period.[9] The estimates are presented in Table 8. To simplify the interpretation of the results, we report the hazard ratios rather than the coefficients. Table 8 shows that no matter which definition we use for dead funds, funds employing leverage are significantly more likely to survive longer than the unlevered funds. Moreover, highly levered funds will survive longer when compared with less levered funds. For example, the hazard ratio of 0.904 for all exits combined

[9] Newborn funds are the funds with age less than two years in the first observed snapshots. Newly added funds refer to funds that are added to TASS over our sample period as indicated by their "date added to TASS" and appear in the first observed snapshots.

suggests that one percent increase in leverage decreases the hazard of disappearance of the newborn funds by 9.6%. The hazard ratio of 0.856 indicates that one percent increase in the leverage of newborn decreases the risk of liquidation by 14.4%. Similarly, for funds newly added to TASS over our sample period, one percent increase in leverage decreases the risk of the hazard of all exit reasons by 6.6%, but decreases the hazard of liquidation by 13.2%. Investors are therefore more protected from liquidation by high leverage than suggested when all exit reasons are combined. Our findings are consistent with the operational risk literature (see Brown, Goetzmann, Liang, and Schwarz, 2008, 2012) that hedge funds with low operational risk tend to have higher leverage since lenders are able to distinguish high operational risk funds from low operational risk funds.

Our findings are different from those of Gregoriou (2002), who found that funds with low leverage survive longer than funds with high leverage. Gregoriou (2002) used the data provided by Zurich Capital Markets, spanning from January 1990 to December 2001. The inconsistency may be explained by the different sample periods in the two studies. After the debacle of LTCM which happened in the sample period of the study of Gregoriou (2002), the hedge fund industry became more prudent in employing leverage as documented by Eichengreen and Park (2002). Creditor also became more critical when granting credit to hedge funds. Funds with better performance find credit easier to obtain and thus are more likely to have higher leverage, other things being equal. In turn, funds with higher leverage tend to last longer since better performance is associated with longer lifetime (Liang (2000), Brown, Goetzmann, and Park (2001) and Rouah (2005)). Brown *et al*. (2008) indicate that lenders are able to screen high operational risk funds from low

risk funds; as a result, high operational risk funds cannot get enough funding from the lender. They also find out that operational risk predicts future performance negatively.

We further document that when we define dead funds as graveyard funds, we find that higher management fee, lower incentive fee, lower minimum investment requirement, and manager co-investment predict longer lifetime. When the death of funds is defined as liquidated funds, we find that onshore funds outlive domestic funds. Similarly, funds with longer lockup periods tend to survive longer.

1.6 Conclusion

In this paper, we study the dynamics of hedge fund leverage using the average leverage ratio that managers report to the TASS data. Our comprehensive data sets include 170 monthly snapshots of the TASS data, which provide us with both a time series of the leverage ratio from January 2002 to August 2011 and the cross-sectional information which allow us to investigate the determinants of hedge fund leverage. To the best of our knowledge, we are the first to use such a long time series to study hedge fund leverage. We uncover several interesting and important results.

First, we examine the time series pattern of hedge fund leverage. We find that, on average, hedge funds decrease leverage prior to the financial crisis in mid-2007. For the funds newly added to TASS, leverage decreases even seven months earlier than that of the overall hedge funds. Next, we investigate what causes the changes in leverage. We find that the factors determining hedge fund leverage increase are not the same as those that cause funds to delever. Fund characteristics can predict future fund increase/decrease in leverage in addition to fund performance and risk. Superior fund performance, lower

leverage ratio, younger fund age, stronger fund governance (specially representing recent audit and the SEC registration) are associated with an increase in fund leverage. However, higher return volatility, higher current leverage and higher management fee tend to be associated with fund deleveraging. According to the newborn funds, the factors that affect fund leverage include not only the micro economic factors but also fund specific factors. In particular, higher incentive fee, the existence of a high-water mark, managers' co-investment, shorter notice period, higher minimum investments, and younger fund family age are all associated with higher fund leverage. Economy-wide factors that affect the leverage of newborn hedge funds are VIX and the TED spread. Both are negatively related to fund leverage, which reflects deteriorated market environment when the volatility is high and the funding cost is also high.

Our findings about fund leverage level and change are in line with the basic demand and supply theory. For hedge funds, leverage demand is motivated and constrained by the contractual relationship between managers and investors, taking into consideration of fund performance and risk. On the other hand, the willingness of creditors to supply leverage to hedge funds is associated with fund performance, risk and governance.

We also examine the impact of fund leverage changes on fund performance, risk and investor flows. We find that compared to their peers, funds with increased leverage do not perform well in the six months following the leverage change. Moreover, they also tend to become more risky than their peers although fund flows indeed increase in the half a year after the leverage change. On the contrary, the deleveraged hedge funds are not statistically different from their peers in fund performance, risk and fund flows, but their return volatility in the six months following deleveraging are economically lower

than that of their peers and lower than that of the volatility in the six months prior to the leverage decrease. We compare the CAARs of funds with increased leverage with those of the deleveraged funds over a 24-month event window from one year before to one year after the leverage change. We find that funds that increased their leverage have much higher CAARs than those of the deleveraged funds, but the better performance only persist for a short period after the leverage increase.

When it comes to the impact of leverage on newborn funds, we find that on average the levered funds earn 3.9% higher abnormal return than unlevered funds in the 12 months after being added to TASS, but do not find a linear relationship between leverage usage and fund performance. Moreover, we show that levered funds generally survive longer than unlevered funds and the higher the leverage, the less the probability of fund liquidation or disappearance.

Overall, our results provide important insights into the determination of hedge fund leverage, and on the impact of leverage and/or leverage change on fund performance, risk, investor flows, and survival probability in the hedge fund industry.

Table 1. Descriptive Statistics

	Number of Observations	Mean	Standard Deviation	P1	P50	P75	P99
AVGLEV	280,572	47.45	155.53	0	0	18	500
LEVID	280,572	0.73	0.45	0	1	1	1
MAXLEV	280,572	107.58	259.64	0	0	150	1,000
MININV	279,213	0.74	2.3	0	0.25	1	5
MFEE	280,380	1.46	0.68	0	1.5	2	3.5
IFEE	280,324	15.96	7.47	0	20	20	25
WATERID	280,437	0.68	0.47	0	1	1	1
OFF	280,572	0.74	0.44	0	1	1	1
NOTICE	280,572	36.81	29.31	0	30	45	100
LOCKUP	280,572	2.99	6.84	0	0	0	24
PERSNCAPID	280,572	0.29	0.45	0	0	1	1
AUM	194,284	209.92	11,884.13	0	46.43	151	2,237
AUDITM	220,389	30.19	85.12	1	19	33	116
GOV	220,315	1.31	0.87	0	1	2	3
AGEFDM	280,551	70.75	52.38	4	58	96	237
AGEFMM	280,572	104.97	64.58	8	95	141	305

This table provides descriptive statistics for the hedge fund characteristics of our sample hedge funds over the period from January 2002 to August 2011. AVGLEV is the average leverage (in percentage) the fund uses. LEVID is an indicator variable equal to 1 when the fund uses leverage. MAXLEV is the maximum leverage (in percentage) the fund uses. MFEE and IFEE give the magnitude of management and incentive fees, respectively. WATERID is an indicator variable equal to 1 when there is a high-water mark provision for charging incentive fee. MININV is the minimum amount (in millions of dollars) an investor has to invest in a hedge fund. PERSNCAPID is an indicator variable set to 1 when fund managers invest personal capital in the fund. LOCKUP is the period (in months) over which investors cannot withdraw their investment. The variables NOTICE denotes the fund's redemption notice period (in days). The variable OFF is an indicator variable equal to one if the fund is offshore. AUM is defined as the monthly reported estimated asset value (in millions of dollars). AUDITM is the number of months between its observation date and the date of last audit. GOV is calculated as the sum of four individual governance variables: auditing, high-water mark, country of domicile, and SEC registration. AGEFDM is defined as the number of months between a fund's observation date and its inception date. AGEFMM is defined as the number of months between a fund's observation date and the earliest inception date across all funds within the same fund family.

Table 2. Patterns of Leverage Changes

Panel A

	Number of Funds	Percentage
No Change	9,115	97.08%
One Change	246	2.62%
Two Changes	24	0.26%
Three or More Changes	4	0.04%
Total	9,389	100.00%

Panel B

	Avg. lev. Increase	Avg. lev. Decrease	Avg. lev. Change	Percentage
2002	16	17	33	10.48%
2003	14	10	24	7.62%
2004	15	10	25	7.94%
2005	14	6	20	6.35%
2006	3	1	4	1.27%
2007	1	2	3	0.95%
2008	60	26	86	27.30%
2009	23	54	77	24.44%
2010	18	14	32	10.16%
2011	1	10	11	3.49%
Total	165	150	315	100%

Panel C. Investment Style

	Convertible Arbitrage	Dedicated Short Bias	Emerging Markets	Equity Market Neutral	Event Driven	Fixed Income Arbitrage
Avglev Increase	19	0	2	8	4	5
Avglev Decrease	3	1	9	12	6	10
Total	22	1	11	20	10	15
	Fund of Funds	Global Macro	Long/Short Equity Hedge	Managed Futures	Multi-strategy	Other
Avglev Increase	73	10	33	4	3	4
Avglev Decrease	45	11	34	14	3	1
Total	118	21	67	18	6	5

Panel D. Average Leverage Increase

	Mean	Median	Min	Max
Prior Avglev	16.73	0	0	250
Avglev Change	141.18	100	1	1,600

Panel E: Average Leverage Decrease

	Mean	Median	Min	Max
Prior Avglev	133.05	110	0.82	1,200
Avglev Change	103.9	70.5	0.82	1,200

This table reports leverage changes. Panel A reports the number of funds with different number of changes in average leverage. Panel B reports the number of instances of average leverage increase and decrease. Panel C reports the distribution of these changes over the styles (strategies). Panels D and E provide magnitude of average leverage prior to change and magnitude of change. The sample period is from January 2002 to August 2011.

Table 3. Comparison between Leverage Changed Funds and Matched Funds

	Increased Funds (1) and Matched Funds (2)		Decreased Funds (1) and Matched Funds (2)		Changed Funds (1) and Matched Funds (2)	
Variable	Mean(1-2)	*t* -Value	Mean(1-2)	*t* -Value	Mean(1-2)	*t* -Value
RET1	0.016**	2.31	0.011*	1.97	0.014***	2.99
RET12	0.061***	3.13	0.057	1.35	0.059***	2.69
RETID1	0.016**	2.38	0.011**	2.10	0.014***	3.12
RETID12	0.062***	3.34	0.049	1.41	0.056***	2.99
FLOW6	-0.059	-0.65	-16.132	-1.00	-6.777	-1.00
FLOW12	-0.206	-1.35	-0.006	-0.03	-0.125	-1.04
VOL12	0.116	0.36	0.594	1.23	0.333	1.18
AVGLEV	-32.125***	-3.13	84.314***	5.92	18.98**	2.09
LEVID	0.222***	4.35	0.330***	7.19	0.269***	7.66
MAXLEV	7.861	0.38	124.475***	4.17	59.07***	3.32
IFEE	-0.186	-0.20	1.223	1.19	0.420	0.61
MFEE	-0.053	-0.83	0.085	0.89	0.008	0.14
LOCKUP	-1.422**	-2.23	0.071	0.11	-0.762*	-1.66
NOTICE	-11.801***	-3.66	7.302**	2.11	-3.377	-1.40
LOGMIN	1.073***	5.29	0.921***	2.94	1.012***	5.61
PERSNCAPID	-0.024	-0.43	0.086	1.31	0.024	0.55
OFF	0.063	1.20	-0.041	-0.65	0.018	0.44
WATERID	0.189***	3.22	0.095	1.44	0.146***	3.35
LADTDTM	-15.894***	-5.86	12.17	0.76	-4.597	-0.68
ADTID	0.351***	5.66	0.080	1.19	0.245***	5.19
GOV	0.451***	4.19	0.120	0.85	0.318***	3.66
AGEFDM	-27.589***	-5.17	-1.892	-0.23	-16.514***	-3.42
AGEFMM	-32.643***	-5.51	3.391	0.38	-16.934***	-3.23

We match each hedge fund with size data which changed average leverage to the hedge fund which has the same strategy and the nearest asset size in the same calendar month according to TASS. This table provides the comparison of fund characteristics, fund returns, volatility, and fund flows between the matched funds and the funds are grouped based on whether a fund increases, decrease or changed its average leverage. RET1and RET12 are the buy-and-hold returns in the past 1 and 12 months, respectively. RETID1 and RETID12 are the buy-and-hold mean-adjusted returns in the past 1 and 12 months, respectively. FLOW6 and FLOW12 are the hedge fund flows over the past 6 and 12 months, respectively. VOL12 is the volatility of the hedge fund's returns computed using monthly data over the past 12 months. All the variables mentioned below are the fund specific characteristics in the past month. AVGLEV is the average leverage (in percentage) the fund uses. LEVID is an indicator variable equal to 1 when the fund uses leverage. MAXLEV is the maximum leverage (in percentage) the fund uses. MFEE and IFEE give the magnitude of management and incentive fees, respectively. LOCKUP is the period (in months) over which investors cannot withdraw their investment. The variables NOTICE denotes the fund's redemption notice period (in days). LOGMIN is the logarithm of the minimum amount (in millions of dollars) an investor has to invest in a hedge fund. PERSNCAPID is an indicator variable set to 1 when fund managers invest personal capital in the fund. The variable OFF is an indicator variable equal to one if the fund is offshore. WATERID is an indicator variable equal to 1 when there is a high-water mark provision for charging incentive fee. AUDITM is the number of months between its observation date and the date of last audit. ADTID is an indicator variable equal to one if a fund reports a completed financial audit in the past 12 months. GOV is calculated as the sum of four individual governance variables: auditing, high-water mark, country of domicile, and SEC. AGEFDM is defined as the number of months between a fund's observation date and its inception date. AGEFMM is defined as the number of months between a fund's observation date and the earliest inception date across all funds within the same fund family. Statistical significance of 1, 5, and 10% is indicated by ***, **, and *, respectively.

Table 4. Determinants of Changes in the Average Leverage

	Increased Funds		Decreased Funds		Total Funds	
	(1)	(2)	(1)	(2)	(1)	(2)
RET1	0.35**	0.00	0.01	0.05	0.22**	0.26**
	(4.22)	(0.00)	(0.01)	(0.10)	(5.01)	(6.34)
VOL12	-0.18	-0.35*	0.45**	0.51**	0.08	0.15
	(-1.18)	(-3.30)	(4.72)	(5.79)	(0.64)	(2.21)
FLOW6	0.34	-0.1	(0.38)	-8.52	-10.28	-15.97
	(1.64)	(-0.78)	(-0.01)	(-0.06)	(-1.01)	(-1.66)
AVGLEV	-0.37***	-0.4***	0.7***	0.72***	0.02	0.06
	(-7.10)	(-6.72)	(15.1)	(14.75)	(0.06)	(0.37)
LEVID	0.32***	0.31**			0.41***	0.41***
	(7.37)	(5.03)			(18.88)	(17.54)
IFEE	-0.25**	-0.16	-0.1	-0.15	-0.14	-0.07
	(-4.18)	(-1.20)	(-0.47)	(-0.85)	(-2.42)	(-0.47)
MFEE	-0.11	-0.16	0.39***	0.41***	0.15*	0.15*
	(-0.65)	(-0.97)	(7.11)	(6.70)	(2.89)	(2.71)
LOCKUP	-0.27**	-0.29*	-0.28*	-0.26*	-0.19**	-0.13
	(-4.14)	(-3.69)	(-3.79)	(-2.96)	(-4.40)	(-1.78)
NOTICE	-0.16	-0.09	0.19	0.18	-0.13	-0.07
	(-1.46)	(-0.33)	(1.04)	(0.94)	(-1.81)	(-0.46)
LOGMIN	0.86***	0.78***	0.43*	0.51*	0.53***	0.57***
	(20.82)	(15.26)	(3.17)	(3.57)	(16.79)	(17.42)
PERSNCAPID	0.05	0.03	0.21	0.25*	0.09	0.13
	(0.20)	(0.05)	(2.30)	(2.96)	(1.04)	(1.95)
AGEFDM	-0.59***	-0.59***	-0.11	-0.06	-0.27***	-0.23**
	(-15.84)	(-12.14)	(-0.59)	(-0.14)	(-9.20)	(-5.99)
OFF		0.13		0.05		0.03
		(0.93)		(0.09)		(0.11)
WATERID		0.04		0.09		0.00

		(0.06)		(0.28)		(0.00)
ADTID		0.41***		0.16		0.4***
		(8.26)		(1.16)		(16.23)
SEC		0.43***		-0.16		-0.03
		(6.84)		(-1.52)		(-0.08)
GOV	0.29**		-0.01		0.15*	
	(5.80)		(-0.01)		(2.90)	
Pseudo R^2	0.405	0.435	0.319	0.336	0.271	0.306

This table reports the effects of covariates on the probability of a hedge fund's increasing, decreasing or changing its leverage. The dependent variable is a dummy variable equal to one if the fund increase, decrease or change its leverage in the following month (that is, all covariates are lagged by 1 month except VOL12 and FLOW6) and zero for the fund matched to the former funds which has the same strategy and the nearest asset size in the same calendar month according to TASS. The matched fund does not change its leverage. RET1 is the raw buy-and-hold returns in the past month. FLOW6 is the hedge fund flow over the past 6 months. VOL12 is the volatility of the hedge fund's returns computed using monthly data over the past 12 months. All the variables mentioned below are the fund specific characteristics in the past month. AVGLEV is the average leverage (in percentage) the fund uses. LEVID is an indicator variable equal to 1 when the fund uses leverage. MFEE and IFEE give the magnitude of management and incentive fees, respectively. LOGMIN is the logarithm of the minimum amount (in millions of dollars) an investor has to invest in a hedge fund. PERSNCAPID is an indicator variable set to 1 when fund managers invest personal capital in the fund. LOCKUP is the period (in months) over which investors cannot withdraw their investment. The variables NOTICE denotes the fund's redemption notice period (in days). AGEFDM is defined as the number of months between a fund's observation date and its inception date. The variable OFF is an indicator variable equal to one if the fund is offshore. WATERID is an indicator variable equal to 1 when there is a high-water mark provision for charging incentive fee. ADTID is an indicator variable equal to one if a fund reports a completed financial audit in the past 12 months. SEC is an indicator variable equal to 1 if a fund is registered with the SEC. GOV is calculated as the sum of four individual governance variables: auditing, high-water mark, country of domicile, and SEC. These variables are standardized to have a zero mean and variance of one across funds. The Wald Chi-Square statistics are reported in the parentheses. Statistical significance of 1, 5, and 10% is indicated by ***, **, and *, respectively.

Table 5. The Impact of Leverage Changes on Fund Performance, Risk and Investor Flows

	Increased Funds (1) and Matched Funds (2)		Decreased Funds (1) and Matched Funds (2)		Changed Funds (1) and Matched Funds (2)	
Variable	Mean (1-2)	*t*-Value	Mean (1-2)	*t*-Value	Mean (1-2)	*t*-Value
RETIDFD6	-0.036**	-1.97	0.000	0.00	-0.022	-1.64
RETIDFD12	0.003	0.15	0.005	0.14	0.003	0.16
VOLFD6	1.020*	1.84	-0.321	-0.86	0.499	1.34
VOLFD12	0.663	1.35	-0.057	-0.11	0.373	1.03
FLOWFD6	0.090	1.15	0.000	-0.01	0.058	1.04
FLOWFD12	0.104	0.55	-0.024	-0.24	0.059	0.49
RETIDCHNG6	-0.079***	-3.35	-0.029	-1.20	-0.006***	-3.43
RETIDCHNG12	-0.067**	-2.27	-0.036	-0.72	-0.055**	-2.02
VOLCHNG6	0.903	1.43	-0.202	-0.64	0.490	1.21
VOLCHNG12	0.263	0.48	-0.760	-1.21	-0.136	-0.33
FLOWCHNG6	0.212*	1.88	-0.083	-0.78	0.103	1.27
FLOWCHNG12	0.451**	2.04	-0.177	-0.91	0.215	1.38

This table provides the comparison of fund performance, risk and fund flows following leverage change between the matched funds and the funds grouped based on whether a fund increased, decreased or changed its average leverage. A matched fund is a fund which has the same strategy and the nearest asset size in the calendar month as the hedge fund with size data which changed average leverage. RETIDFD6, VOLFD6, and FLOWFD6 are defined as the buy- and-hold mean-adjusted returns, standard deviations of fund returns and fund flows over the 6 months following leverage change, respectively. RETIDFD12, VOLFD12, and FLOWFD12 are the buy-and-hold mean-adjusted returns, standard deviations of fund returns and fund flows during the 12 months following leverage change, respectively. RETIDCHNG6 is the difference between mean-adjusted returns for the 6 months following the leverage change and the mean-adjusted returns during the 6 months preceding the leverage change. VOLCHNG6 is defined as the difference between the standard deviation of fund returns for the 6 months following the leverage change and the standard deviation of fund returns during the 6 months prior the leverage change. FLOWCHNG6 is the difference between the fund flows for the 6 months following the leverage change and the fund flows in the 6 months prior the leverage change. Similarly, RETIDCHNG12, VOLCHNG12, and FLOWCHNG12 are for 12-month period. Statistical significance of 1, 5, and 10% is indicated by ***, **, and *, respectively.

Table 6. Determinants of the Leverage of Newborn Hedge Funds

	Model 1	Model 2	Model 3	Model 4	Model 5
MFEE	-0.26	0.98	-0.13		-0.09
	(-0.16)	(0.58)	(-0.08)		(-0.05)
IFEE	0.82***	0.26	0.77***		0.82***
	(3.99)	(1.04)	(3.72)		(4.01)
WATERID	18.12***	-4.34	16.71***		16.22***
	(5.60)	(-0.67)	(5.16)		(5.01)
IFEEWATER		1.51***			
		(4.04)			
PERSNCAPID	7.61**	7.73**	8.42***		6.60**
	(2.40)	(2.44)	(2.66)		(2.08)
NOTICE	-0.22***	-0.21***	-0.22***		-0.22***
	(-5.24)	(-4.99)	(-5.33)		(-5.19)
LOCKUP	-0.25	-0.27	-0.27		-0.27
	(-1.41)	(-1.51)	(-1.53)		(-1.54)
LOGMIN	3.13***	3.29***	3.05***		3.01***
	(4.15)	(4.37)	(4.07)		(4.01)
OFF	-1.90	-1.85	-1.91		-0.12
	(-0.59)	(-0.58)	(-0.60)		(-0.04)
AGEFMM	-0.05**	-0.05**	-0.05**		-0.04*
	(-2.35)	(-2.08)	(-2.18)		(-1.86)
GFC			-19.18***		
			(-5.78)		
LAGSP500				-1.42***	
				(-4.20)	
LAGVIX				-0.74***	-0.43***
				(-3.40)	(-2.68)
LAGTEDSPREAD				-13.7***	-10.32***

				(-4.70)	(-4.34)
LAGTERMSPREAD				0.34	
				(0.25)	
STYLE EFFECT	Y	Y	Y	Y	Y
ADJ. R^2	0.11	0.11	0.11	0.10	0.11

This table provides the results of OLS regressions of the leverage of newborn hedge funds on fund-specific variables and macro variables. The sample consists of the first snapshots of average leverage for newborn hedge funds. The dependent variable is the average leverage of a hedge fund. MFEE and IFEE give the magnitude of management and incentive fees, respectively. WATERID is an indicator variable equal to 1 when there is a high-water mark provision for charging incentive fee. IFEEWATER is defined as the product of IFEE and WATERID. PERSNCAPID is an indicator variable set to 1 when fund managers invest personal capital in the fund. The variables NOTICE denotes the fund's redemption notice period (in days). LOCKUP is the period (in months) over which investors cannot withdraw their investment. LOGMIN is the logarithm of the minimum amount (in millions of dollars) an investor has to invest in a hedge fund. The variable OFF is an indicator variable equal to one if the fund is offshore. AGEFMM is defined as the number of months between a fund's observation date and the earliest inception date across all funds within the same fund family. GFC captures the global financial crisis fixed effect between August 2007 and June 2009. All the variables with the first three letters as "LAG" are the macro variables in the month before a hedge fund appears in the first snapshot. SP500 is the monthly total return on the S&P500 index. VIX is the monthly level of the VIX volatility index. TEDSPREAD represents TED spread which is the difference between the three-month LIBOR yield and the three-month T-bill yield. TERMSPREAD is defined to be the difference between the 10-year Treasury yield and the three-month T-bill. The *t*-statistics are reported in the parentheses. Statistical significance of 1, 5, and 10% is indicated by ***, **, and *, respectively.

Table 7. Relation between the Leverage of Newborn Funds and Fund Performance

	7-factor Adjusted 12-Month Return		12-Month Return in Excess of the Risk-Free Rate	
	Model 1	Model 2	Model 3	Model 4
AVGLEVID	3.88***	3.86***	5.22***	5.24***
	(2.94)	(2.92)	(3.05)	(3.06)
MFEE	0.50	0.48	0.77	0.80
	(0.72)	(0.69)	(0.86)	(0.88)
IFEE	-0.03	-0.01	0.37***	0.36***
	(-0.25)	(-0.13)	(2.69)	(2.59)
NOTICE	0.00	0.00	0.00	0.00
	(0.01)	(-0.09)	(-0.08)	(0.00)
LOCKUP	0.20	0.20	0.37**	0.36**
	(1.58)	(1.58)	(2.29)	(2.29)
LOGMIN	0.04	0.04	0.75	0.75
	(0.10)	(0.10)	(1.48)	(1.48)
PERSNCAPID	5.42***	5.52***	3.36*	3.26*
	(3.73)	(3.80)	(1.78)	(1.73)
WATERID	2.62*	2.34	3.60*	3.87*
	(1.72)	(1.52)	(1.82)	(1.94)
OFF	4.18***	4.29***	0.27	0.16
	(2.72)	(2.79)	(0.14)	(0.08)
GFC		-4.01		3.97
		(-1.25)		(0.95)
STYLE EFFECT	Y	Y	Y	Y
ADJ. R^2	0.051	0.052	0.089	0.089

This table reports the Determinants of newborn fund performance in 12 months after appearing in the first snapshots of our sample. The dependent variable is hedge fund Fung and Hsieh 7-factor adjusted 12-month returns and 12-month raw returns in excess of risk free return. They are both in percentage. AVGLEVID is the dummy variable which is one if average leverage is positive, zero otherwise. MFEE and IFEE give the magnitude of management and incentive fees, respectively. The variables NOTICE denotes the fund's redemption notice period (in days). LOCKUP is the period (in months) over which investors cannot withdraw their investment. LOGMIN is the logarithm of the minimum amount (in millions of dollars) an investor has to invest in a hedge fund. PERSNCAPID is an indicator variable set to 1 when fund managers invest personal capital in the fund. WATERID is an indicator variable equal to 1 when there is a high-water mark provision for charging incentive fee. The variable OFF is an indicator variable equal to one if the fund is offshore. GFC captures the global financial crisis fixed effect between August 2007 and June 2009. The *t*-statistics are reported in the parentheses. Statistical significance of 1, 5, and 10% is indicated by ***, **, and *, respectively.

Table 8. Leverage and Fund Survival

	Failure: Graveyard Funds				Failure: Liquidated Funds			
	Added Funds		New Funds		Added Funds		New Funds	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
AVGLEV	0.93***		0.90***		0.87***		0.86***	
	(7.81)		(12.87)		(10.48)		(10.76)	
AVGLEVID		0.84***		0.80***		0.74***		0.73***
		(15.98)		(17.51)		(16.29)		(13.12)
MFEE	0.93**	0.94	0.86***	0.87***	1.014	1.02	1	1.01
	(6.23)	(5.64)	(14.77)	(13.41)	(0.12)	(0.23)	(0.00)	(0.06)
IFEE	1.01***	1.01***	1.02***	1.02***	1	1	1	1
	(20.52)	(20.06)	(13.49)	(13.11)	(0.02)	(0.03)	(0.14)	(0.19)
NOTICE	1	1	1	1	1	1	1	1
	(0.45)	(0.81)	(0.27)	(0.53)	(0.00)	(0.01)	(0.13)	(0.23)
LOCKUP	1	1	1	1	0.99***	0.99	0.98**	0.99**
	(1.50)	(0.88)	(0.00)	(0.12)	(6.78)	(5.70)	(6.35)	(5.36)
LOGMIN	1.05***	1.05***	1.04**	1.04**	1.02	1.02	1.03	1.03
	(18.95)	(19.96)	(5.83)	(5.67)	(1.21)	(1.41)	(1.48)	(1.36)
PERSNCAPID	0.81***	0.82***	0.81***	0.81***	0.81**	0.83**	0.89	0.90
	(15.27)	(13.27)	(12.09)	(11.24)	(5.13)	(4.09)	(1.33)	(1.11)
WATERID	1.05	1.06	1.02	1.02	1.06	1.07	1	1.01
	(1.27)	(1.71)	(0.10)	(0.15)	(0.65)	(0.87)	(0.00)	(0.01)
OFF	1.24***	1.24***	1.10	1.10	1.63***	1.63***	1.33***	1.32***
	(17.27)	(16.69)	(2.48)	(2.25)	(25.84)	(25.27)	(7.14)	(6.78)
STYLE EFFECT	Y	Y	Y	Y	Y	Y	Y	Y
OBSERVATIONS	5,728	5,728	3,540	3,540	5,728	5,728	3,540	3,540

This table reports results of a Cox proportional hazards model investigating the impact of hedge fund leverage on their survival. The dependent variable is the right-censored lifetime of a hedge fund. The independent variable AVGLEV is the average leverage (in percentage) the fund uses. AVGLEVID is the dummy variable which is one if average leverage is positive, zero otherwise. MFEE and IFEE give the magnitude of management and incentive fees, respectively. The variables NOTICE denotes the fund's redemption notice period (in days). LOCKUP is the period (in months) over which investors cannot withdraw their investment. LOGMIN is the logarithm of the minimum amount (in millions of dollars) an investor has to invest in a hedge fund. PERSNCAPID is an indicator variable set to 1 when fund managers invest personal capital in the fund. WATERID is an indicator variable equal to 1 when there is a high-water mark provision for charging incentive fee. The variable OFF is an indicator variable equal to one if the fund is offshore. The table displays hazard ratio for each explanatory variable with the chi-square statistics in the parenthesis. Statistical significance of 1, 5, and 10% is indicated by ***, **, and *, respectively.

Figure 1. Time Series of the Average Leverage

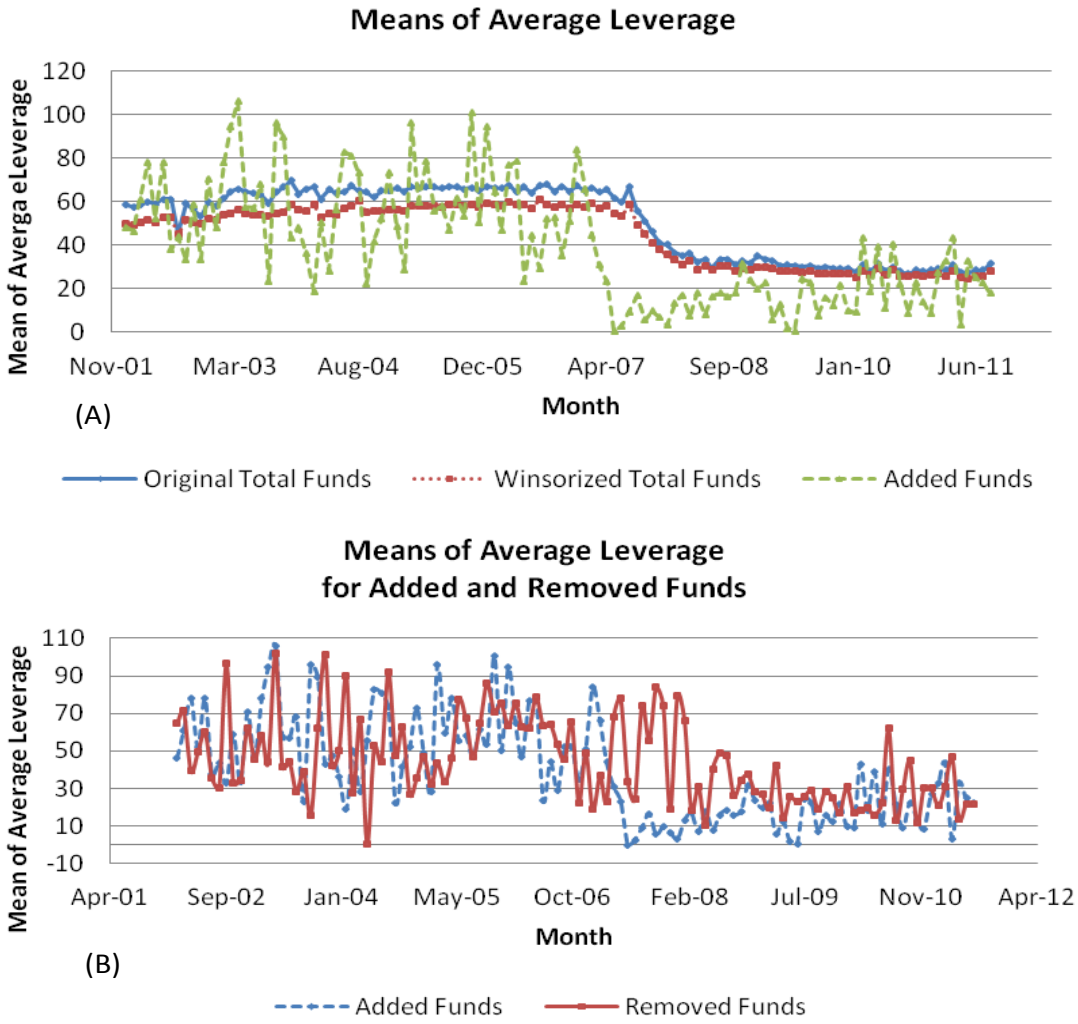


Figure 1(A) shows the dynamics of the monthly means of original average leverage (blue solid line), the monthly means of average leverage winsorized at 1% and 99% levels (red round dot line), and monthly means of original average leverage for the funds newly added to TASS (green dashed line). Figure 1(B) displays the dynamics of the monthly means of original average leverage for the funds newly added to TASS (blue dashed line), and monthly means of original average leverage for the funds removed from TASS (red solid line).

Figure 2. CAARs of Funds with Changes in the Average Leverage

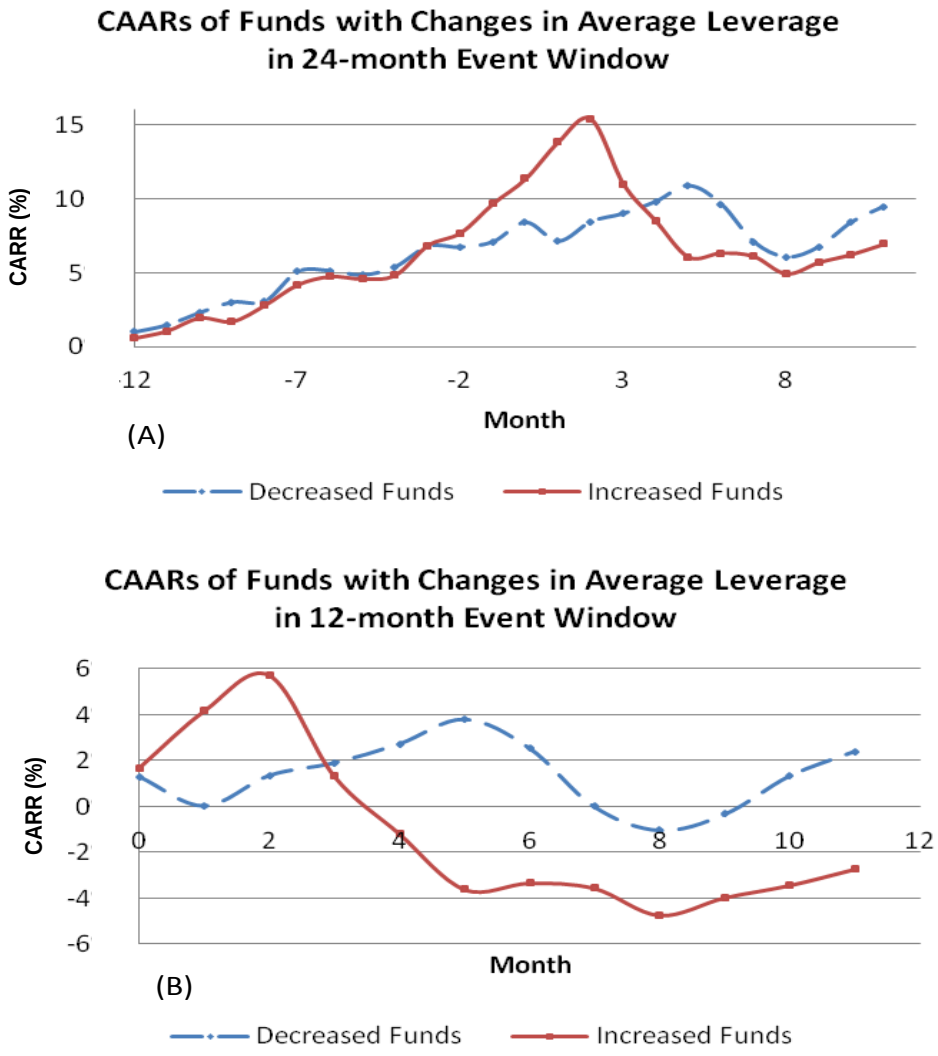


Figure 2(A) presents the cumulative average abnormal returns over a 24-month event window for funds increased their leverage (red solid line) and deleveraged funds (blue dashed line). The abnormal return is Fung and Hsieh 7-factor adjusted return. Figure 2(B) presents the cumulative average abnormal returns over a 12-month event window for funds increased their leverage (red solid line) and deleveraged funds (blue dashed line). The abnormal return is Fung and Hsieh 7-factor adjusted return.

ESSAY 2

PERFORMANCE OF EMERGING MARKET HEDGE FUNDS

2.1 Introduction

Emerging markets with the potential for high investment returns have generated much investor interest in recent years. Increasingly, emerging markets are becoming important engines of the global economic growth. These countries make up 82% of the world's population[10] and 36% of the world's economic output[11]. According to an April 2012 International Monetary Fund (IMF) estimate, emerging market economies are expected to grow two to three times faster than their developed counterparts. Emerging markets are rising in importance as investment destinations because returns in mature markets like the U.S. and Europe are likely to stay low in the near future. Another benefit for investors is the diversification that the emerging markets can provide. The emerging markets generally tend to be less correlated with developed markets since the former is less integrated with the latter due to economic, legal, and political reasons. Therefore, from the perspective of an international investor, emerging markets are ideal candidates for portfolio diversification to achieve optimal risk-return trade-offs.

The financial liberalization and improvements in market infrastructure and transparency, combined with better corporate governance have facilitated foreign investor participation in many emerging markets that were previously not accessible to outside investors. For example, China opened its stock exchanges to foreign investors in 2002 by

[10] The United Nations, as of June 2012.
[11] The International Monetary Fund, December 2011.

launching the Qualified Foreign Institutional Investor (QFII) program. Since then China has revised QFII regulation several times with the purpose to make it easier for QFIIs to invest in China, part of the nation's efforts to free up capital flows and accelerate the opening of domestic capital markets.

As one of the fastest growing sectors in finance, hedge funds have played major roles in the price formation process and providing liquidity to the market. Cao et al. (2013) demonstrate that as arbitragers hedge funds trade underpriced securities and help restoring market efficiency through their trading activities. Given the strong competition in the domestic markets, hedge funds should have strong incentive and be well equipped to take advantage of the opportunities in emerging markets due to their flexibility in investment strategies and lockup provisions. As a result, the last decade has witnessed tremendous growth in hedge fund assets and emerging market investments, which has been driven particularly by international investors and tax-exempt US institutions. As of December 2012, hedge funds managed about $2.25 trillion assets globally with 6.17% belonging to emerging market hedge funds.[12]

In this paper, we try to address the following questions: What is the appropriate model to capture emerging market hedge fund performance? How did emerging market hedge funds perform in absolute terms and risk-adjusted settings? What are the sources of performance of these emerging market hedge funds? Is a physical presence of the investment company in the investment region important? What are investors' reactions to the performance of emerging market hedge funds through capital flows? What is the optimal fund size for emerging market hedge funds and have they reached their capacities yet? Finally, how did investor flows affect the future performance of emerging market

[12] Hedge Fund Research, Inc., December 2012.

hedge funds? In other words, is there a "smart money" effect in emerging market hedge funds?

To address these questions, we use a comprehensive dataset by combining the TASS database with the Barclay hedge fund database from January 2000 to December 2010. We study the performance of emerging market hedge funds by examining the sources of performance, the relationship between performance and investor flows, as well as the relationship between performance and asset size of emerging market hedge funds.

We employ a five-factor model to adjust for risk which can account for about 95% of the variations in portfolio returns of emerging market hedge funds. Among the five factors is the emerging market factor, which is identified through principal components analysis. We find that the presence of the management companies in their investment region is the most important characteristics that affect emerging market risk-adjusted performance in our model. The funds with a presence in their investment region outperform other funds by 4.2 % per year. The local information advantage is significant for all major geographical regions. Indeed, it may be the single most important source of performance for Asian emerging market hedge funds. We find that, on average, 18% of the emerging market hedge funds deliver positive and statistically significant alpha. Funds producing significant alpha (have-alpha funds) experience greater capital inflows than the remainder (beta-only funds). Have-alpha funds that experience high capital inflows do not have higher probabilities of being classified as beta-only funds in the future.

Our study contributes to the literature in several ways. Most specifically, our paper contributes to the study on the performance of emerging market hedge funds. Even

though there are a large number of hedge fund studies including the ones on hedge fund performance[13], research on the combination of emerging markets and hedge funds is scarce, partly due to lack of data. The two earliest papers dealing with this issue are Eichengreen, Mathieson, Chadha, Jansen, Kodres and Sharma (1998) and Fung and Hsieh (2000). Strömqvist (2007) finds that at the strategy level emerging market hedge funds have, on average, only been able to provide a risk-adjusted return in the last three years during their sample period from 1994 to 2004. Kotkatvuori-Örnberg et al. (2008) suggest that emerging market hedge funds are able to beat their benchmarks but do not show market timing ability. Füss and Kaiser (2009) analyze the short- and long-term relationships between hedge funds and traditional financial assets and find that emerging market hedge funds in general are redundant securities for long-term investment horizons. Cao and Jayasuriya (2011) reveal that the stock and bond market volatility do not have a significant impact on the returns of emerging market hedge funds. Cao (2012) finds little evidence of volatility timing in the stock markets for these hedge fund indices. Furthermore, only the Eastern Europe hedge fund index demonstrates statistically significant volatility timing ability in the bond market. Caglayan and Ulutas (2012) argue that hedge funds are better off by increasing their exposures to emerging market securities.

Our paper also contributes to the study on home bias in investment and fund performance. Coval and Moskowitz (2001) find that U.S. mutual fund managers earn abnormal returns from their local investments relative to their nonlocal holdings. Ivkovi´c and Weisbenner (2005) find a similar pattern with U.S. retail investors. Hau (2001)

[13] See, for example, Ackermann et al. (1999), Brown et al. (1999), Liang (1999), Edwards and Caglayan (2001), Fung and Hsieh (2001, 2002a, 2002b, 2004), Mitchell and Pulvino (2001), Agarwal and Naik (2004), Gatev et al. (2006), and Fung et al. (2008).

demonstrates that local traders outperform foreign traders in the German market. Teo (2009) analyzes the relationship between the risk-adjusted performance of hedge funds and their proximity to investments using data on Asia-focused hedge funds. He finds that hedge funds with a physical presence (head or research office) in their investment region outperform other hedge funds by 3.72% per year.

Our study is also related to the literature of hedge fund size and performance. Liang (1999) finds a positive relationship between AUM and performance. Hedges (2003) shows that smaller funds outperform larger funds, while mid-sized funds underperform both smaller funds and larger funds. Gregoriou and Rouah (2003) find little-to-no correlation between size and performance. Ammamm and Moerth (2006) provide evidence that asset size and performance have a concave relationship for hedge funds. In contrast, Teo (2010) finds a convex relationship between fund size and future performance. Getmansky (2012) shows that the asset size-performance relationship varies among different hedge fund categories, most of which are concave, indicating that an optimal asset size can be obtained.

In addition to performance-size relationship, this paper contributes to the studies of the interaction of fund performance and fund flows. Goetzmann, Ingersoll, and Ross (2003) studied offshore hedge funds and report that money flows out of the top-performing hedge funds. Both Agarwal et al. (2004) finds that hedge funds with better performance experience greater money inflows. Xiong et al. (2007) confirm that funds of hedge funds that have better performance experience greater capital inflows. They find that the worst-performing funds experienced net capital outflows and top-performing funds experienced net capital inflows. Fung, et al. (2008) classify the fund of hedge funds

universe into two categories: Have-Alpha funds and Beta-Only funds. They find that Have-Alpha funds experience larger capital inflows than Beta-Only funds. Fund flows also affect future fund performance. Agarwal et al. (2004) show that hedge funds with greater inflows perform worse in the future. Fung et al. (2007) report that have-alpha funds of hedge funds which experience above-median capital inflows are less likely to produce positive abnormal returns in the future than the have-alpha funds that experience below-median capital inflows. Zhong (2008) finds that fund-level inflows have a positive (negative) impact on the future performance of small (large) funds, while inflows at the strategy level are negatively related to future fund performance. Finally, Getmansky et al. (2012) find that the flow-performance relation is affected by share restrictions; with share restrictions the relation is concave while it is convex without restrictions.

The remainder of the paper is organized as follows. Section I describes the data and methodology. Section II presents the performance evaluation and analyzes the determinants of risk-adjusted performance of emerging market hedge funds. Section III examines the relationship between performance and investor flows as well as the relationship between performance and fund size. Finally, Section IV concludes.

2.2 Data and Methodology

In order to expand sample size, we combine hedge fund data from Lipper TASS database with those from BarclayHedge database. For our specific analysis on emerging markets, we use information on hedge funds that classify themselves as Emerging Market (as their investment style) to the TASS database or BarclayHedge database. We use both the live and dead hedge fund databases to mitigate survivorship bias in our sample. Only

funds that provide monthly net of fee returns and denominated in US dollars are retained. To minimize backfill bias, we drop the returns of funds in TASS prior to the "date added to database." Since BarclayHedge does not provide ''date added to database", we drop the first 24 months to control for backfill bias. In addition, we also delete all the returns of the funds in Barclay database before January 2000 because Barclay did not include any defunct funds in the database prior to 2000. Our data from BarclayHedge ends in December 2010. To be consistent, we select January 2000 as the start of our sample period and employ our analyses on hedge fund returns only for the period from January 2000 to December 2010, even though our TASS data extends coverage to 2012.

The sample also includes data on a host of fund characteristics including management fee, incentive fee, high-water mark provision, advanced notice period, lock-up period, investment geographical region, fund registration location and manager address, fund size, and minimum investment. The investment region information is from "Geographic Focus" in TASS and from "Fund Geographical Focus" in BarclayHedge. Our main results in this paper reflect only funds with the investment region information. In the end, 802 out of 1,729 funds survived our data cleaning process and remained in our sample.

2.2.1 Summary Statistics

Table 9 provides the summary statistics of the 802 hedge funds on the number of funds, returns, assets under management (AUM), ages, and fee structures. Panel A reports, for each year from 2000 to 2010, the number of hedge funds, total AUM at the end of the year (in billion dollars), and the mean, median, standard deviation, minimum,

and maximum monthly returns on an equally-weighted portfolio of emerging market hedge funds.

From Panel A we observe a steady increase in the number of emerging market hedge funds from 2000 to 2009. This is a reflection on the growth in the hedge fund industry and the increasing attraction of emerging markets. But in 2010, the number of emerging market funds decreased for the first time after continuous growth over a decade. This drop in the number of emerging market funds reflects the aftermath of the latest financial crisis.

One important feature in Panel A is the sharp reversal in the growth of emerging market hedge fund AUM in 2008, the year when the extreme negative effects of the financial crisis were felt heavily in the hedge fund industry. In particular, from 2000 to 2007, the number of hedge funds increased on average by 15.4% per year while the AUM grew on average by 49% per year. However, this big surge came to a sudden halt in 2008 even though the number of hedge funds continues to grow in years 2008 and 2009. The total AUM dropped by 45.5% just in 2008. The pattern of the change in AUM is the same even when we expand our number of sample funds by relaxing the entry requirements. Figure 3 vividly shows the dramatic change in the AUM for all funds and funds with different geographical focuses. Unlike Table 9, the total AUM in Figure 3 is for the funds without considering their return denomination and the availability of geographical focus information. This figure shows that the average annual growth rate from 2000 to 2007 is 52.3% for all funds, and 46.6%, 67.2%, 41.1% and 52.3% for funds with a geographical investment focus in Asia, Eastern Europe, Latin America and Global area, respectively. In 2008, the total AUM for all funds fell by 58.8%. While the funds invested in Asia,

Eastern Europe, Latin America and Global area experienced a decrease of 60.9%, 67.5%, 49.3% and 57.1%, respectively. Compared to the change in total AUM for the 802 funds we actually use in our main analysis, the change for the expanded sample is more dramatic.

The equally-weighted portfolio return in each year shows that in 6 out of the 11 sample years, the average monthly return of the emerging market hedge funds is in the range of 1% and 2%. The worst return appeared in 2008 with an average of -3.85% per month. This partly explains why the amount of total asset under management was slashed almost in half in 2008, from $110.14 billion to $60.08 billion, even though the number of emerging market hedge funds continued to grow in the same year.

Panel B of Table 9 reports the cross-sectional mean, median, standard deviation, minimum, and maximum statistics for emerging market hedge fund characteristics including returns, size, age, management fee, and incentive fee.

For the sample period, the best performed fund experienced an average monthly return of 6.82% over its life, while the worst performed fund had an average monthly return of -12.43%. The mean of the average monthly returns of all emerging market hedge funds is only 0.71%. The median is lower than one-tenth of the average monthly return of the best performed fund. From Panel B we can also observe the large size variation among all funds, where size of a fund is measured as the average monthly AUM over the life of the fund. Based on our data, the median size is only $48.88 million, while the mean size is $142.2 million. This shows the existence of very few emerging market hedge funds with very large assets under management in the hedge fund industry. The largest fund in our sample is four times the size of the median-sized fund. Interestingly,

the median fund age (number of months in existence since inception) is only 73 months, approximately 6 years, while the average age of emerging market funds in our sample is about 7 years. The short life span may partly be explained by the existence of a high-water mark provision. The manager of a hedge fund with high-water-mark provision may choose to close his/her fund when recent fund performance is poor or the current superior performance is unlikely to continue in a foreseeable future. The mean (median) incentive fee is 17.71% (20.00%) in our sample, and goes up as high as 30.00% for a few emerging market hedge funds.

Panel C of Table 9 provides the mean, median, standard deviation, minimum, and maximum of eight risk factors over our sample period of 2000 to 2010. The eight risk factors are Morningstar MSCI index, market factor, size factor, term spread and credit spread factors, and three trend-following factors on bonds, currencies, and commodities. We will describe the eight factors in detail in Section 2.2.

2.2.2 Risk-Adjusted Factor Model

To adjust for risk, we come up with a model that can explain most of the variations in the portfolio returns of emerging market hedge fund. Following Fung and Hsieh (1997), we employ a principal components analysis to locate a factor that can account for most of the variations in the returns of nine emerging market hedge fund portfolios. The nine portfolios are formed by the funds based on their source of database and their geographical investment focus. They are Africa funds, Asia funds, Eastern Europe funds, Latin American funds and Global funds in TASS; Asia funds, Eastern Europe funds, Latin American funds, and Global funds in BarclayHedge. As

BarclayHedge provides a direct classification of emerging market hedge funds into regions, it is straightforward to classify the funds into different portfolios. However, it is challenging to classify the TASS funds since some funds provide more than one geographic focuses in emerging market. In this case, we classify these funds as emerging market funds that invest in global markets. Table 10 reports the *R*-squares from the regression of fund regional returns on each of the principal components, as well as the percentage of the total variation explained by each principal component. It indicates that the first principal component alone can account for about 75.85% of the variations in fund regional returns. This compares favorably with Fung and Hsieh (1997), who find that the top five principal components can account for 43% of the variations in onshore and offshore fund returns. Each of the second and third components only accounts for about 7.2% of the variations in the nine portfolio returns.

Next, we find an index whose returns that have the highest correlation with the returns of the factor identified in the principal component analysis. We sort the correlations between the returns of more than 13,000 economic indexes from Morningstar Direct and the first principal component returns, and find that Morningstar MSCI index achieves the highest correlation of 0.969. The highest correlations between the indexes and the second and third principal components are only 0.4 and 0.31, respectively. Considering the low explanation power of the second and third principal components as well as the weak correlations between the indexes available and the two components, we decide to only retain the index that has the highest correlation with the first principal component as one of the risk factors.

Then we combine the risk factor identified above with the most frequently used risk factors in hedge fund research to construct different risk factor models. Specifically, we use the following factors: Emerging market factor which is the excess return on Morningstar MSCI index; Market factor which is the excess return on the value-weighted return on all NYSE, AMEX, and NASDAQ stocks minus the one-month Treasury bill rate; Size factor which is as in Fama and French (1993); Term spread factor which is the excess return on Fama Treasury bond portfolio with maturities greater than ten years (as in Jagannathan et al. (2010)); Credit spread factor which is the excess return on the Citi group corporate BBB 10+ year index minus TERM (as in Jagannathan et al. (2010)); TFBD, TFFX, and TFCOM which are the excess returns on the portfolios of look back straddle options on bonds, currencies, and commodities, respectively (as in Fung and Hsieh(2001)). In addition, we include the two lags of the emerging market factor and the market factor. We construct five different risk factor models from the above factors. Table 11 presents the comparison of the explanatory power of these models.

The results in panel A of Table 11 indicate that the 5-factor model, which includes the emerging market factor, market factor, size factor, term spread, and credit spread, explains most of the variations in the portfolio returns of all emerging market funds. The adjusted *R*-square for the 5-factor model is 95% or a meaningful 29% more than that for the 7-factor model. Also, it is not surprising that the factor loading on the emerging market factor is statistically significant at the 1% level with a *t*-statistic above 23, given the high correlation of the Morningstar MSCI index with the first principal component. When we estimate similar regressions for fund portfolios stratified by investment regions (Asia, Eastern Europe, Latin America and Global), we also find that

the 5-factor model well explains the variation in the returns of the four regional portfolios. The results by fund regions indicate that the 5-factor model explains at least 65% of the variation in returns for each regional portfolio. All of the four regions load significantly on the Morningstar MSCI emerging market factor, with the *t*-statistic ranging from 5.2 to 22. In sharp contrast, none of the four regional portfolios and the portfolio of all emerging market hedge funds loads significantly on any of the three trend-following factors on bonds, currencies, and commodities. The weak explanatory power of the trend-following risk-factors may simply reflect the relatively less developed nature of the emerging market. The securities traded in the emerging market are generally simpler relative to those in the developed market. As a result, funds investing in the emerging market usually do not have option-like payouts for which trend following factors have high explanatory power[14]. Based on the above comparison, we decide to employ the 5-factor model to adjust for the risk in this paper.

2.3 Performance of Emerging Market Hedge Funds

Employing the 5-factor risk model, we can compare the risk-adjusted returns for the four different regional portfolios and the overall performance of the emerging market hedge funds. From Table 11, we can see that on average the Eastern Europe funds earn an annual risk-adjusted return of 4.56% which is the highest among all regional funds, followed by the Latin America funds whose annual return is 2.16%. The Asian fund has a negligible alpha of 0.12% per year, and the risk-adjusted return for the Global emerging market fund is -1.1% per year. The insignificant alphas of all the four regional portfolios may be explained by the significant loading on the emerging market factor and the

[14] Fung and Hsieh(2001)

market factor. Compared from the perspective of raw return, Easter European funds are the best performer with the global funds being the worst. The emerging market hedge funds, on average, earn a significant raw return of 9.72% per year over our sample period, but the risk-adjusted return is only 0.65 per year based on the 5-factor model.

Admittedly, we are interested in the performance of emerging market funds, but we are more interested in the question as to what factors significantly affect their performance. To address this question, we firstly calculate monthly abnormal return for each fund as fund excess returns minus the factor realizations times loadings estimated over the entire sample period (See equation (1)).

$$ALPHA_{im} = r_{im} - (b_{1im}MMSCIEM + b_{2im}MKTRF + b_{3im}SMB + b_{4im}TERMSPREAD + b_{5im}CREDITSPREAD) \quad (1)$$

where i= 1, . . . , n funds, m = 1, . . . , M months, $ALPHA_{im}$ is the abnormal return of fund i for month m, r_{im} is fund return in excess of the risk-free rate, and the other variables are as defined in the 5-risk factor model.

Then we estimate a pooled regression of hedge fund alpha obtained using Equation (1) on variables that may be associated with emerging market hedge fund performance. We create an indicator variable for investment region presence. Investment region presence is set equal to 1 if the management company is in any of the constituent countries underlying the MSCI Emerging Markets Index[15] as of June 2012 and the constituent countries are in its investment region. Otherwise, investment region presence is set equal to 0. In order to explore the relationship between fund asset illiquidity and

[15] The constituent countries underlying the MSCI Emerging Markets Index as of June 2012: Brazil, Chile, Colombia, Mexico, Peru, Czech Republic, Egypt, Hungary, Morocco, Poland, Russia, South Africa, Turkey, China, India, Indonesia, Korea, Malaysia, Philippines, Taiwan, and Thailand. These countries are classified into emerging markets regions: Africa (Egypt, Morocco, and South Africa), Asia Pacific (Turkey, China, India, Indonesia, Korea, Malaysia, Philippines, Taiwan, and Thailand), Eastern Europe (Czech Republic, Hungary, Poland, Russia), and Latin America (Brazil, Chile, Colombia, Mexico, Peru).

fund performance, we measure fund asset illiquidity using θ_0 in Equation (2) developed in Getmansky, Lo, and Makarov (2004).

$$
\begin{aligned}
&R_t^0 = \theta_0 R_t + \theta_1 R_{t-1} + \cdots + \theta_k R_{t-k} \\
&\theta_j \in [0.1],\ j = 0, \ldots, k \qquad (2) \\
&\text{and} \\
&1 = \theta_0 + \theta_1 + \cdots + \theta_k
\end{aligned}
$$

Table 12 reports the results of the pooled regression. We only include results for funds with at least twenty-four months of return data. The second column of Panel A shows that the high-water mark provision is associated with high risk-adjusted performance. This is consistent with the findings of Agarwal and Naik (2009) who study all hedge funds, not limited to the emerging market hedge funds. With the high-water mark provision, managers collect incentive fees only if they can make up previous losses. The existence of the high-watermark provisions effectively make the incentive fee contract a call option or a sequence of options written by the investors on the assets under management16. Such features motivate hedge fund managers to improve performance. This design seems to achieve its purpose: Emerging market hedge funds with high-water mark provisions delivered superior performance.

Results in Panel A of Table 12 also show that funds with lockup restrictions have greater performance than funds without such restriction.[17] According to Aragon (2007) funds with lockups may take on greater liquidity risk and achieve higher expected returns. Aragon (2007) also finds a positive relation between a fund's underlying asset illiquidity and the use of share restrictions, while we find a negative but insignificant

[16] Goetzmann and Ross (2003) and Panageas and Westerfield (2009)

[17] When we replace the lockup dummy variable with lockup period, we obtain a similar result: The longer the lockup period, the better the fund performance.

relation between the two. Aragon et al. (2012) find that onshore hedge funds have stricter share restrictions than their offshore counterpart. However, onshore funds trade more liquid assets than offshore funds as onshore funds impose lockups may be for reasons other than illiquidity (like avoiding registration) and the funding costs for onshore funds are high due to limited partnership structure. Although lockup period can effectively prevent early redemption, provide more flexibility in investment, reduce cash holdings, and allow managers to focus on relatively long horizons, managers do not necessarily trade more illiquid securities depending on the legal structure of the hedge funds (see Aragon et al. (2012)). Panel A also shows a negative relation between fund age and the risk-adjusted returns. This finding is consistent with Liang (1999), Boyson (2008), and Aggarwal and Jorion (2008) who study the performance of all hedge funds, not only emerging market funds. One explanation is that managers of young funds have particularly strong incentives to create performance in order to build up their reputation and to attract more investors. In addition, younger funds may be more nimble than established ones.

While high-water mark provisions, lockup restrictions, fund asset illiquidity and age are significantly associated with the risk-adjusted performance of all emerging market funds in our sample, only the coefficients of two factors mentioned above are significant at the 1% level over the whole sample and for most regional funds. These two factors are fund presence and fund size. Next, we investigate the relationship between fund performance and these two factors in detail.

2.3.1 The Presence Effect

There are two effects for the presence of management company in the investment region. On one hand, the proximity to investments may be helpful for emerging market hedge funds. According to Coval and Moskowitz (2001), investors possess significant information advantages in evaluating nearby investments. Malloy (2005) also finds that geographically proximate analysts are more accurate than other analyst. The information advantage of proximity is even crucial for emerging market investors. The information disclosed in emerging market is often being late or even misleading. Investors in emerging markets often make their investment decision basing upon poor quality information disclosed by companies and governments in emerging markets[18]. While information disclosure requirements have become more stringent globally, the rules still require much less information be disclosed in emerging markets than in developed markets. In fact, it is not unusual for significant and material information to be withheld in some emerging markets[19]. To overcome the information gap, investors and analysts in emerging markets often obtain pertinent information through non-public informal channels. This practice likely gives some investors a competitive advantage. Being close to their investments or target firms allows emerging market hedge funds to maintain close contact with senior management and stay abreast of the latest developments. Fund managers can learn valuable information not only from the target firms but also from their suppliers and customers, which is otherwise unavailable through the public channel because of being far away from the investments in the emerging markets where

[18] See Levich (1998).
[19] See Damodaran (2010).

information asymmetry is stronger. Therefore, emerging market hedge funds with a presence in the investment region may outperform funds without such a presence.

On the other hand, fund management companies in developed markets have access to better resources and expertise than those in proximity with their investments, which may allow them to overcome any informational disadvantage. Management companies located in distant, more developed markets are close to their business partners. This proximity facilitates the cultivation of close relationships with prime brokers and administrators. In addition, it is easier for the management companies located in developed countries to hire and retain top talent. Therefore, there is a trade-off between local informational advantage and resource advantage in the choice of the presence in the investment region.

Table 12 shows that funds with their management companies in their investment region outperform other funds. The coefficient estimate on the investment region presence variable for all the emerging market hedge funds with their management companies in their investment region outperform other funds by 5.88% per year after adjusting for other fund characteristics. The effect is statistically significant at the 1% level (*t*-statistics = 7.82).

The coefficient estimates on the investment region presence variable for regional funds are statistically and economically significant except for Eastern Europe funds. After adjusting for other fund characteristics, funds with their management companies in the investment regions of Asia, Latin America, and Global area outperform other funds by 5.4%, 9.48%, and 6.72% per year, respectively.

Since hedge funds claim to focus on raw returns, it is important to show that the results hold for raw returns as well. The coefficients reported in Panel B of Table 12 for the regressions on raw returns suggest that funds with presence in their investment region outperform other funds no matter one compares raw returns or risk-adjusted returns.

To further estimate the economic implication of the local informational advantage, we construct portfolios of funds based on fund investment region presence and compare their risk-adjusted performance. Specifically, we form an equally-weighted portfolio of funds with investment region presence (portfolio A) and an equally-weighted portfolio of funds without it (portfolio B). Then, we measure the performance of the spread between portfolios A and B relative to the 5-factor model. The alpha of the spread portfolio represents the value added to investors of investing in emerging market hedge funds with investment region presence and avoiding funds without it. The results are displayed in Table 13.

From the results of all emerging market hedge funds in our sample, we find that the funds with investment region presence outperform the funds without investment region presence by 4.20% per year (*t*-statistic = 2.68). This suggests that shrewd emerging market hedge fund investors can benefit from the local informational advantage of funds with investment region presence. The investors of the funds with their geographical focus in Asia, Eastern Europe, Latin America, or Global area would earn 3.12%, 6.6%, 8.28%, and 5.52%, respectively, if the funds' management companies are in the same regional emerging market countries than if they are not. The *t*-statistics for the spreads are 2.13, 2.12, 3.02, and 2.6, respectively. They are all statistically significant at least at the 5% significance level. Teo (2009) find a presence spread of 9.97% per year

for 43 Asian emerging market hedge funds. This spread is also significant at the 5% level (*t*-statistics is 2.02). Collectively, our results suggest that emerging market hedge funds with a presence in their investment regions enjoy a local informational advantage.

2.3.2 The Size Effect

The effect of fund size on performance is one of the debated issues in studies on hedge funds. On one hand, we can conjecture that small hedge funds, being more flexible to concentrate the capital under management on their best investment ideas, are more nimble to take advantage of the limited profitable opportunities. On the other hand, we can also argue that larger hedge funds may outperform smaller funds because of lower expense ratio and they are also less distracted by concerns over their financial well-being.

We have seen in Panel A of Table 12 a positive relation between fund size and risk-adjusted returns for all emerging market hedge funds and for Eastern Europe and Global emerging market funds. The fund size in Table 12 is measured at the end of each month, contemporaneous with the measure of fund return.

Berk and Green (2004) set up a model in which rational investors chase past performance but investor flows can adversely impact future fund performance. Therefore, in the next step we investigate whether an increasing asset base of emerging market hedge funds will dilute future performance. To do so, we first construct five quintile portfolios of emerging market hedge funds based on past month's fund size and compare their risk-adjusted performance. Specifically, in each month from January 2000 to December 2010, we sorted all emerging market funds in the order of past month's AUM and then assigned them into quintiles. As a result, Quintile 1 contains the smallest 20% of

the emerging market hedge funds and Quintile 5 contains the largest 20% of the funds. The number of emerging market hedge funds during any given month may or may not be perfectly divisible into five portfolios. The quintiles which get one extra fund than the others are selected randomly. Next, we calculate the equally-weighted portfolio monthly returns of each quintile. Every month, the five quintile portfolios are rebalanced and the return calculation process is repeated.

Figure 4 shows the relationship between the size of emerging market hedge funds and their future performance. It presents the histograms of the 131 monthly risk-adjusted returns and raw returns for each of the 5 portfolios. The distribution of monthly risk-adjusted returns in Panel A shows that more funds earn positive risk-adjusted returns in the top quintile than in the bottom quintile. Quintile 1 has more spread and has a longer left tail, while quintile 5 is more right skewed. Examining the distribution of raw returns of five portfolios in Panel B of Figure 3 leads us to the same conclusion. The portfolio in larger size performs better than the portfolio with smaller funds. Our results are consistent with the findings of Liang (1999), Amenc and Martellini (2003), and Ibbotson and Chen (2006) who found that larger hedge funds outperform smaller ones.

Some of previous literature found a concave relation between fund size and fund performance using fund of hedge funds or funds in different investment strategies (Ammamm and Moerth (2006), Getmansky (2012), Xiong et al. (2007)), while others found a largely convex relationship between fund size and future returns (Hedges (2003) and Teo (2007)). To further check whether the relationship between size and the risk-adjusted performance of emerging market hedge funds, we again construct 20 portfolios of funds based on fund size following Getmansky (2012) since the number of quintile

portfolios are not sufficient to carry out the effective analysis. The process to form the 20 portfolios is the same as that described in the construction of five portfolios except in each month the emerging market hedge funds are assigned into 20 portfolios rather than into 5 portfolios. Thus we have 131 monthly equal-weighted averages of fund size and risk-adjusted returns and raw returns for each of the 20 portfolios. We then calculate the averages of the 131 monthly size and performance for each portfolio. Figure 5 presents the average of monthly sizes and monthly risk adjusted-returns for the 20 size-based portfolios from January 2000 to December 2010. The points illustrate the relationship between fund size and average monthly returns. We attempt to fit a non-linear function to the data points. Using a polynomial curve with an order of smoothing function of two, we get the best-fit curve that is concave. The coefficient on the lagged asset size is positive and that of the square of lagged size is negative.

The fitted curve peaks around the 70th percentile corresponding to Portfolio 13. According to the polynomial curve, the average monthly risk-adjusted return increases with assets under management to this point and then decreases with assets under management. Theoretically this point represents the optimal fund size which would provide the best risk-adjusted performance. From Figure 5, we can also see that for the first three portfolios which represents the smallest 15% of the funds, the curve is steep and the increase in asset under management is followed by rapid improve of performance. The largest 10% of funds suffer from apparent diseconomies of scales. The deterioration of performance of the funds between the 70^{th} percentile and 90^{th} percentile is gradual. The averages of the monthly fund size in the smallest three portfolios are all below $10 million. It is suggested that a fund needs a critical mass of $10 million to $20

million to support its operating expenses. Most of the emerging market hedge funds are below the optimal size. They can still take advantage of economies of scale.

The change in asset size is mainly driven by fund performance and investor flows. Hence, we explore the relationship between the two driving factors of the size of emerging market hedge funds in the next section.

2.4 Fund Performance and Investor Flows

Fund performance and investor flows interact with each other. The conclusions of previous literature on the relationship between the two are mixed. To explore the interactions between fund performance and investor flows, we first examine the impact of performance of emerging market hedge funds on investor flows. That is how the investors react to the realization of fund performance by infusing or withdrawing capital. Then, we investigate the effect of investor capital inflow on the fund's future performance.

2.4.1 Impact of Fund Performance on Investor Flows

To examine the impact of fund performance on investor flows, following Fung, et al. (2008), we break the emerging market hedge funds into two categories: "Have-Alpha funds" and "Beta-Only funds." The "have-alpha" funds are defined as the emerging market hedge funds whose alpha is positive and statistically significant. The critical values used to decide whether an alpha is statistically significant are generated through bootstrap experiment using the nonparametric procedure of Kosowski et al. (2006). The bootstrap helps us to relax the assumptions of independence, normality, and zero serial

correlation for the residuals from the factor regressions and enables us to find the correct critical values. We require all funds included in the bootstrap experiment should have 24-month return history in the 2-year classification period. The number of funds that satisfy this requirement is reported in the first column of Table 14. The second and third columns of the table report the percentage of the total number of funds in the have-alpha and beta-only categories.

From Table 14, first we see a steady increase in the number of funds selected in each of the 2-year period over time. This is a reflection both of the growth in the hedge fund industry and the increasing interest in investment in emerging markets. Second, on average across our sample period, more than four-fifths of the emerging market hedge funds are classified as beta-only funds, while a much smaller percentage of funds are classified as have-alpha funds. Another interesting feature to note is that the lowest percentage of total funds allocated to the have-alpha group happened in the classification periods of 2002 to 2003 and 2003 to 2004, but not in the periods of 2008 to 2009 or 2009 to 2010 as we might have expected. The highest percentage appeared in the 2001 to 2002 classification period with a percentage of 24%, which almost double that of the lowest level of 13% at the end of 2003 and 2004. The averages of fund risk-adjusted return for have-alpha funds and beta-only funds are shown in the fourth and fifth columns. Averages fund alpha in the 10 classification periods are all above 12% per year. This alpha level is high compared to the 0.6% of alpha for the portfolio comprising all our sample funds. This sharp difference results from the stringent requirement of funds being classified as have-alpha funds. Only the funds with positive and statistically significant alpha can be classified as have-alpha funds.

The last three columns of Table 14 report the equally-weighted average annual flows into have-alpha and beta-only funds in each year following their classification. On average, the have-alpha funds experience a statistically and economically significant inflow of 24% per annum in the year following the classification. While the capital inflow experienced by the beta-only funds is only 1%, which is significantly insignificant and negligible compared to the inflow experienced by the have-alpha. Table 14 shows that both have-alpha funds and beta-only funds experienced the highest inflows in 2004. The have-alpha funds experienced an average inflow of 90% of end-2003 AUM over the subsequent year, the average inflow is 38% for the beta-only funds. Moreover, the only years in which beta-only funds received significant net inflow are 2003 and 2004. In 2008 and 2009, the years of the financial crisis, both the have-alpha group and beta-only group experienced net outflows, but the outflows of beta-only funds were much higher and statistically significant. The outflows from beta-only funds continued even in the year following the financial crisis, while have-funds funds experienced significantly investor inflows in 2010.[20]

Figure 6 confirms this analysis. The figure displays the equally-weighted quarterly flows in each year for each group, created by scaling December 2001 to 100 and multiplying this level by the compounded growth in out-of-sample. The figure shows that the have-alpha flow index reaches a level of 442 at the end of December 2010. In sharp contrast, the beta-only flow index drops to a level of 74. Figure 6 also shows that the two quarters that have-alpha funds receive the most of investor capital are the last quarter of 2004 and the first quarter of 2005. The cumulative quarterly flows for the

[20] The average hedge fund regained its high-water mark by October 2010, according to "AIMA's Roadmap to Hedge Funds", the 2012 Edition.

have-alpha group jump from an index level of 250 to 390 in these two quarters. Since the second quarter of 2005, the cumulative quarterly flows of the have-alpha group have been fluctuating around 400. The line for the cumulative quarterly flows of the beta-only group is relatively flat. The highest cumulative quarterly flows are only about 140, compared to a level of 471 at the peak of the line for the have-alpha group. Therefore, from Figure 6, we observe a sharp contrast between the capital inflows to the two groups of emerging market hedge funds.

Both Table 14 and Figure 6 report investor flows using the average flows across funds. Next, we further explore the impact of fund performance on investor flows by regressing the flows of each fund in the year following classification on its previous classification in the univeriate approach and control for other fund characters in the multivariate regressions. Table 15 reports the results of regressions which further confirm that the funds' performance classification helps explain investor flows. The coefficient from the regression of flows on the performance classification dummy alone is 0.24, with a *t*-statistics of 3.76. This reliable positive relation persists no matter what other explanatory variables are included in the regressions; the coefficients on the previous classification dummy are always more than 3.7 standard errors from 0. The explanatory powers of the fund characteristic variables are all statistically insignificant except the variable notice which is marginally significant. The coefficient of the variable presence is insignificant, but the negative sign of the coefficient is consistent with Teo (2009) who finds that distant funds are able to raise more capital.

The results in Tables 14 and 15 as well as Figure 6 collectively confirm that better performed emerging market hedge funds experience greater investor flows. This is

consistent with the findings of Agarwal et al. (2004) and Getmansky (2012) that study all hedge funds and the findings of Xiong et al. (2007) and Fung, et al. (2008) that study funds of hedge funds.

The previous results of the impact of risk-adjusted return on investor flows suggest that some investors can differentiate have-alpha funds from beta-only funds and invest more capital in the former. These investors are sophisticated investors. But how do those unsophisticated investors who cannot detect the presence of alpha choose to invest? The intuition is to put money into the funds that have earned high raw returns or to follow the trend. To address the question, we inspect the flow–performance relationship for each group using the following regression:

$$F_q = a + b_1 R_{q-1} + b_2 F_{q-1} + e_q \quad (3)$$

Where $F_q =$ investor flow in quarter q

$F_{q-1} =$ investor flow in quarter $q-1$ or lagged quarterly flow

$R_{q-1} =$ return in quarter $q-1$ or lagged quarterly returns

We employ the Newey and West (1987) covariance matrix using four quarterly lags to account for any possible autocorrelation and heteroskedasticity in the residuals. The regression results are reported in Table 16 which shows that for the beta-only group, both of the coefficients of lagged quarterly returns and lagged quarterly flows are positive and statistically significant. For the beta-only funds, high (low) returns, high (low) flows over a quarter precede statistically significant increases (decreases) in capital flows in the subsequent quarter. The flows into beta-only funds show evidences of return-chasing and/or trend following behavior. However, this is not true for the flows into the have-alpha funds. For the have-alpha funds, the coefficient on lagged quarter flows is

insignificant. The coefficient on lagged quarterly return is only marginally significant. This may be resulted from the correlation between raw return and alpha. These results are consistent with a scenario in which unsophisticated investors are attracted to beta-only funds by chasing returns and following flow trend while sophisticated investors such as smart high net worth individuals, pension funds, and university endowments[21] who are able to detect the presence of alpha provide capital to have-alpha funds.

2.4.2 Impact of Investor Flows on Future Fund Performance

In the previous subsection, we found that an emerging market hedge fund with better performance attract more investor flows. It seems like it is beneficial to a fund if it can attract investors' favor, but capacity constraint can be a major concern in the hedge fund industry. One issue closely related to the concern is that investor inflows would have an adverse effect on their future performance. To investigate whether investor inflows affect the ability of have-alpha funds to deliver alpha in the future, we examine the 2-year transition probabilities of have-alpha funds conditional on the inflows experienced in the final year of the classification period. Table 17 presents the results of this exercise.

Over all our sample years, a have-alpha fund that experienced an above-median investor flows has a 25 percent probability of being classified as a have-alpha fund in the subsequent period (non-overlapping) if they still report to the databases. The result shows the lack of long term persistence in performance, at least in the 2-year period. While for the below-median flow and have-alpha funds, there is a 21 percent probability of being classified as a have-alpha fund in the subsequent period. The results indicate that the

[21] See Cohen et al. (2001) and Froot and Ramadorai (2008).

probability of being classified as a have-alpha fund in the subsequent period is higher for an above-median flow and have-alpha fund than for below-median flow and have-alpha fund, even though these differences are not statistically significant.

The last two columns of Table 18 present the future *t*-statistic of alpha and the future level of alpha conditional on the level of capital flows experienced by the have-alpha funds. As we can expect that for the have-alpha funds, average future alpha and future *t*-statistic of alpha are both below those of the classification period since most of the have-alpha funds are classified as beta-only funds in the subsequent period as shown in the third column. Above-median-flow have-alpha funds exhibit an average alpha *t*-statistic of 0.66, while for the below-median-flow have-alpha funds, the comparable number is only 0.38. Similarly, have-alpha funds experiencing high inflows appear to have higher future levels of alpha, but this difference is statistically insignificant.

Panel B of Table 18 repeats the same analysis for the beta-only funds. Panel B reveals, akin to the results for the transition probabilities in Panel A, that the ability of above-median-flow beta-only funds to transition to the have-alpha group is higher than that of below-median-flow beta-only funds, even though the difference is statistically insignificant. Finally, Panel B shows that the beta-only funds receiving above-median flows have higher level of alpha and *t*-statistic in the subsequent classification period than the funds experiencing below-median flows.

Collectively, our findings indicate that investor flows have primarily been directed toward have-alpha funds. Even though the beneficiary effect of these inflows on the future risk-adjusted performance of the have-alpha funds is not consistently statistically significant, at least we can conclude that these inflows have had no

significant adverse effect on their risk-adjusted performance. Our findings contrast with those in Agarwal et al. (2004) and Fung, et al. (2007) who find an adverse impact of greater inflows on the future performance of hedge funds or funds of hedge funds. The difference can be explained by the fact that many emerging market hedge funds are still relatively small and have not reached the optimal capacity yet.

2.5 Conclusion

In this paper, we study emerging market hedge fund performance by looking at the sources of performance, the relationship between performance and investor flows as well as the relationship between performance and fund size. The data we employ is a combination from the TASS database and the Barclay hedge fund database covering the period from January 2000 to December 2010.

The 5-factor model we employed to adjust for risk can account for about 95% of the variations in portfolio returns of the emerging market hedge funds. The emerging market factor among the five risk factors is identified through principal components analysis, which is the most important risk factor among all. We find that the presence of the management companies in their investment region is the most important fund characteristic that affect emerging market performance. The hedge funds with a presence in their investment region outperform others by 4.2 % per year. The local information advantage is significant for all major geographical regions. Indeed, it may be the single most important source of performance for Asian emerging market funds..

We find that, on average, 18% of the emerging market hedge funds deliver positive and statistically significant alphas. We separate these alpha-producing funds

(have-alphas) with the remainder (beta-only), and explore the impact of performance on investor flows by analyzing the differences of flows between these two groups. We find that have-alpha funds experience greater capital inflows than beta-only funds. Capital flows into beta-only funds significantly respond to past returns and past flows. Furthermore, have-alpha funds that experience high capital inflows do not have higher probabilities of being classified as beta-only funds in the future. This finding is in contrast to the widely documented deteriorating effect that capital inflows into have-alpha funds have on their future performance. This finding may indicate that the overall emerging market hedge funds can still benefit from economies of scale. Capacity constraint is not an issue for emerging market hedge funds, at least over our sample period.

Table 9. Descriptive Statistics

Panel A: Summary statistics year by year (2000–2010)

Year	Year End	Total AUM (billions $)	Equal-weighted hedge fund portfolio monthly returns (%)				
			Mean	Median	Std. dev.	Minimum	Maximum
2000	167	6.78	-0.38	0.84	4.2	-5.77	5.52
2001	189	8.97	1.22	2.58	4.13	-6.21	6.57
2002	207	12.26	0.33	1.73	3.09	-4.6	4.28
2003	211	22.54	2.97	3.17	2.13	0.09	6.13
2004	253	36.9	1.32	2	2.3	-3.46	3.98
2005	316	60.35	1.66	1.85	2.67	-2.95	5.45
2006	358	74.98	1.88	1.99	2.78	-4.42	6.27
2007	454	110.14	1.87	2.18	2.3	-2.38	5
2008	542	60.08	-3.85	-4.07	5.31	-15.43	2.41
2009	575	66.62	3.1	1.92	3.94	-2.32	11.32
2010	515	73.02	1.03	0.71	2.89	-5.49	4.94

Panel B: Cross-sectional statistics (Over sample period: 2000–2010)

	N	Mean	Median	Std.dev	Minimum	Maximum
Average monthly return over the life of the fund (%)	798	0.71	0.72	1.45	-12.43	6.82
Average monthly AUM over the life of the fund(millions$)	711	142.20	48.88	267.56	0.10	2,188.30
Age of the fund(# of months in existence)	798	87.29	73	47.3	13	326
Management fee (%)	798	1.62	1.50	0.41	0	2.5
Incentive fee (%)	798	17.71	20	5.59	0	30

Panel C: Time-series statistics (Over sample period: 2000–2010)

	N	Mean	Median	Std. Dev	Minimum	Maximum
MMSCIEM	132	0.65	1.06	2.8	-12.1	9.46
MKTRF	132	0.06	0.9	5	-18.55	11.04
SMB	132	0.53	0.24	3.9	-16.62	22.06
TermSpread	132	0.47	0.69	2.94	-8.59	12.85
CreditSpread	132	0.04	0.31	2.83	-10.56	9.58
TFBD	132	-3.28	-6.51	13.88	-25.61	43.4
TFFX	132	0.39	-3.52	18.53	-30.25	68.97
TFCOM	132	-0.99	-3.31	13.73	-23.29	40.34

The sample period is from January 2000–December 2010, Panel A reports the number of hedge funds, total assets under management (AUM) at the end of each year by all hedge funds (in billions$), and the mean, median, standard deviation, minimum, and maximum monthly returns on the equal-weighted hedge fund portfolio. Panel B reports the cross-sectional mean, median, standard deviation, minimum, and maximum statistics for hedge fund characteristics including returns, size, age, management fee, and incentive fee. Panel C reports the time-series mean, median, standard deviation, minimum, and maximum monthly returns of the 8 financial and macroeconomic risk factors. MMSCI is the emerging market factor which is the excess return on Morningstar MSCI index; MKTRF is the market factor which is the excess return on the value-weighted return on all NYSE, AMEX, and NASDAQ stocks minus the one-month Treasury bill rate3; SMB is the size factor which is as in Fama and French (1993); Term spread is the excess return on Fama Treasury bond portfolio with maturities greater than ten years (as in Jagannathan et al. (2010)); Credit spread factor is the excess return on the Citi group corporate BBB 10+ year index minus TERM (as in Jagannathan et al. (2010)); TFBD, TFFX, and TFCOM are the excess returns on the portfolios of look back straddle options on bonds, currencies, and commodities, respectively (as in Fung and Hsieh(2001)).

Table 10. Explaining Emerging Market Hedge Fund Returns: A Principal Components Analysis

			Principal components								
Investment region	Number of funds	Return months	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9
FT	10	428	**0.52**	0.02	0.32	0.1	0.04	0	0	0	0
AT	105	4,119	**0.77**	0.01	0.06	0.12	0	0.01	0.03	0	0
AB	102	5,970	**0.83**	0.01	0.03	0.09	0	0	0.04	0	0
ET	51	2,964	**0.74**	0.16	0.08	0	0.01	0	0	0.01	0
EB	64	4,010	**0.78**	0.15	0.06	0	0	0	0	0.01	0
LT	48	1,807	**0.55**	0.27	0.1	0.03	0.05	0.01	0	0	0
LB	25	1,558	**0.75**	0.01	0	0.1	0.14	0	0	0	0
GT	208	10,437	**0.94**	0	0	0.01	0	0.04	0	0	0
GB	189	12,539	**0.97**	0.01	0	0	0	0.01	0	0	0.01
Percentage of the total variance explained (%)			75.85	7.26	7.23	4.98	2.58	0.92	0.77	0.25	0.16

R-squares from regressions of equity long/short hedge fund region portfolio returns on their principal components. The equal-weighted portfolio of the region returns is constructed for each region. FT is the portfolio returns of emerging market funds from TASS with the geographic investment focus in Africa; AB is the portfolio returns of emerging market funds from Barclayhedge with the geographic investment focus in Asia. AT, ET, LT, and GT represent the portfolio returns of emerging market funds from TASS with the geographic investment focus in Asia, Eastern Europe, Latin America, and Global area, respectively. EB, LB, and GB represent the portfolio returns of emerging market funds from Barclay with the geographic investment focus in Eastern Europe, Latin America, and Global area, respectively. Principal components analysis is used to break the returns of the region portfolios into orthogonal principal components. The returns of each region portfolio are then regressed on each principal component, and the *R*-squares from the regressions recorded. PC1 denotes the top principal component; PC2 denotes the second principal component, etc. *R*-squares that are greater than or equal to 0.50 are in **bold** for convenience. The sample period is from January 2000 to December 2010.

Table 11. Explaining Emerging Market Hedge Fund Returns

Panel A. All Emerging Market Hedge Funds

Return (%/month)	Alpha (%/month)	MSCIEM	MKTRF	SMB	Term Spread	Credit Spread	TFBD	TFFX	TFCOM	EL1	EL2	ML1	ML2	Adj. R^2
0.81	0.05	1.12	0.14	0.01	0.04	0.00								0.95
(2.48)	(0.62)	(25.92)	(5.68)	(0.53)	(1.18)	(0.08)								
0.81	0.67		0.5	0.05	0.18	0.35	0.00	0.00	0.00					0.66
(2.48)	(3.26)		(10.05)	(0.97)	(2.42)	(3.61)	(0.24)	(0.00)	(0.02)					
0.81	0.04	1.12	0.14	0.01	0.04	0.02	0.00	0.01	0.00					0.95
(2.48)	(0.52)	(25.84)	(5.67)	(0.41)	(1.17)	(0.37)	(0.02)	(1.4)	(-0.43)					
0.81	0.07	1.11	0.14	0.01	0.04	0.01	0.00	0.01	0.00	0.01	-0.04	0.01	0.03	0.95
(2.48)	(0.78)	(23.76)	(5.75)	(0.45)	(1.21)	(0.24)	(0.28)	(1.11)	(0.44)	(0.32)	(-0.94)	(0.38)	(1.03)	

Panel B. Regional Emerging Market Hedge Funds

Portfolio	Return (%/month)	Alpha (%/month)	MSCIEM	MKTRF	SMB	Term Spread	Credit Spread	TFBD	TFFX	TFCOM	Adj. R^2
	0.70	0.01	1.17	0.14	0.05	-0.03	-0.02				0.81
Asian	(1.89)	(0.04)	(12.76)	(2.84)	(1.04)	(-0.45)	(-0.30)				
Pacific	0.70	0.01	1.17	0.15	0.03	-0.04	0.04	0.02	0.01	0.01	0.82
	(1.89)	(0.04)	(13.13)	(3.01)	(0.77)	(-0.64)	(0.47)	(1.8)	(1.35)	(1.12)	
	1.75	0.38	2.05	0.12	-0.15	-0.01	-0.26				0.74
Eastern	(3.10)	(1.19)	(12.47)	(1.35)	(-1.93)	(-0.10)	(-1.75)				
Europe	1.75	0.38	2.06	0.12	-0.14	0.00	-0.29	-0.02	0.01	-0.03	0.74
	(3.10)	(1.19)	(12.49)	(1.31)	(-1.84)	(0.02)	(-1.89)	(-1.05)	(0.55)	(-1.27)	
	0.59	0.18	0.52	0.18	0.00	0.05	0.26				0.65
Latin	(2.05)	(0.95)	(5.29)	(3.43)	(0.10)	(0.74)	(2.93)				
America	0.59	0.18	0.51	0.18	0.01	0.06	0.24	-0.01	0.00	0.00	0.65
	(2.05)	(0.95)	(5.22)	(3.36)	(0.16)	(0.80)	(2.63)	(-0.56)	(-0.31)	(-0.18)	
	0.56	-0.09	0.91	0.13	0.05	0.05	0.05				0.94
	(1.98)	(-1.10)	(21.96)	(5.55)	(2.34)	(1.65)	(1.22)				
Global	0.56	-0.09	0.91	0.13	0.04	0.05	0.05	0.00	0.00	0.00	0.93
	(1.98)	(-1.10)	(21.71)	(5.49)	(2.27)	(1.59)	(1.25)	(-0.03)	(0.52)	(-0.28)	

The performance on emerging market hedge fund portfolio is estimated relative different combinations of risk factors. MMSCI is the emerging market factor which is the excess return on Morningstar MSCI index; MKTRF is the market factor which is the excess return on the value-weighted return on all NYSE, AMEX, and NASDAQ stocks minus the one-month Treasury bill rate; SMB is the size factor which is as in Fama and French (1993); Term spread is the excess return on Fama Treasury bond portfolio with maturities greater than ten years (as in Jagannathan et al. (2010)); Credit spread factor is the excess return on the Citi group corporate BBB 10+ year index minus TERM (as in Jagannathan et al. (2010)); TFBD, TFFX, and TFCOM are the excess returns on the portfolios of look back straddle options on bonds, currencies, and commodities, respectively (as in Fung and Hsieh(2001)). The sample period is from January 2000 to December 2010.

Table 12. Regressions of the Performance of Emerging Market Hedge Funds on Fund Characteristics

Panel A: Dependent Variable: Monthly Alpha

	Dependent Variable: Monthly Alpha				
Independent Variables	All EM Funds	Asian EM Funds	Eastern Europe EM Funds	Latin America EM Funds	Global EM Funds
presence	0.49***	0.45***	0.57	0.79***	0.56***
	(7.82)	(3.85)	(1.43)	(4.08)	(6.83)
mfee	0.10	0.18	-0.29	0.02	-0.10
	(1.62)	(0.94)	(-1.24)	(0.06)	(-1.35)
ifee	-0.003	0.02	-0.02	-0.03	0.00
	(-0.7)	(1.41)	(-0.89)	(-1.23)	(0.08)
min	0.01	-0.03	-0.06	-0.03	0.05***
	(0.61)	(-0.76)	(-0.6)	(-0.28)	(2.63)
water	0.17**	-0.09	0.39*	-0.02	0.09
	(2.14)	(-0.46)	(1.65)	(-0.04)	(0.97)
size	0.11***	-0.02	0.19***	0.11	0.16***
	(6.54)	(-0.47)	(3.05)	(1.80)	(8.44)
age	-0.15**	0.01	0.01	-0.66	-0.24***
	(-2.01)	(0.06)	(0.02)	(-1.75)	(-3.23)
notice	-0.16*	0.07	0.14	-0.93	-0.16*
	(-1.89)	(0.41)	(0.38)	(-2.84)	(-1.81)
lockup	0.20***	-0.03	0.18	0.3	0.02
	(3.10)	(-0.21)	(0.79)	(1.02)	(0.26)
theta0	0.46***	-0.59	1.57*	1.25	0.48**
	(2.52)	(-1.06)	(1.93)	(1.18)	(2.48)
year dummy	Yes	Yes	Yes	Yes	Yes

Panel B: Dependent Variable: Monthly Returns

Independent Variables	Dependent Variable: Monthly Return				
	All EM Funds	Asian EM Funds	Eastern Europe EM Funds	Latin America EM Funds	Global EM Funds
presence	0.47***	0.33**	1.28**	0.81***	0.53***
	(5.26)	(2.11)	(2.21)	(3.53)	(4.53)
mfee	0.26***	0.14	-0.27	0.5	0.08
	(2.85)	(0.55)	(-0.76)	(1.49)	(0.78)
ifee	-0.01*	0.01	-0.02	-0.05*	-0.01
	(-1.69)	(0.35)	(-0.82)	(-1.96)	(-0.9)
min	-0.05**	-0.04	-0.13	0.06	0.01
	(-2.01)	(-0.73)	(-0.96)	(0.58)	(0.4)
water	0.12	-0.16	0.67**	0.46	0.02
	(1.15)	(-0.63)	(1.91)	(1.36)	(0.19)
size	0.14***	0.09	0.38***	0.07	0.15***
	(6.24)	(1.62)	(4.33)	(0.91)	(5.79)
age	-0.01	-0.05	0.25	-0.11	-0.04
	(-0.15)	(-0.31)	(0.66)	(-0.35)	(-0.42)
notice	-0.16	-0.22	0.23	0.28	-0.11
	(-1.54)	(-1.03)	(0.43)	-0.73	(-0.91)
lockup	0.29***	0.14	0.28	-0.25	0.03
	(3.17)	(0.60)	(0.87)	(-0.68)	(0.28)
theta0	0.55**	-0.85	3.06***	-0.46	0.47*
	(2.25)	(-1.36)	(2.98)	(-0.59)	(1.75)
year dummy	Yes	Yes	Yes	Yes	Yes

Pooled OLS regressions are estimated on the cross-section of hedge fund performance. The dependent variable is monthly return or monthly alpha measured relative to the 5-risk factor model. The five risk factors are: Emerging market factor MMSCI which is the excess return on Morningstar MSCI index; market factor MKTRF which is the excess return on the value-weighted return on all NYSE, AMEX, and NASDAQ stocks minus the one-month Treasury bill rate; size factor SMB which is as in Fama and French (1993); Term spread is the excess return on Fama Treasury bond portfolio with maturities greater than ten years (as in Jagannathan et al. (2010)); Credit spread factor is the excess return on the Citi group corporate BBB 10+ year index minus TERM (as in Jagannathan et al. (2010)). The independent variables are hedge fund characteristics. Presence denotes investment region presence which is an indicator variable that equals 1 when the fund has a physical presence (management company) in the geographical region it invests in and equals 0 otherwise; mfee represents management fee; ifee is performance fee; min is minimum investment; water is an indicator variable equal to 1 when there is a high-water mark provision for charging incentive fee; size represents fund size which is the logarithm of fund asset under management; age is defined as the number of months between a fund's performance date and its inception date; the variable notice denotes the fund's redemption notice period (in days); lockup is an indicator variable equal to 1 when the period (in months) over which investors cannot withdraw their investment is greater than 0. Theta0 denotes fund asset liquidity which is measured using the equation developed in Getmansky, Lo, and Makarov (2004). The *t*-statistics are in parentheses. The sample period is from January 2000 to December 2010. *Significant at the 10% level; **significant at the 5% level. ***significant at the 1% level.

Table 13. Portfolios Based on the Investment Region Presence of Emerging Market Hedge Funds

Variable	Alpha	*t* statistic of Alpha	MMSCIEM	MKTRF	SMB	TERM SPREAD	CREDIT SPREAD	Adj. R^2
	All EM Funds							
Portfolio A	0.31	2.35	1.00	0.16	-0.01	0.01	0.09	0.95
Portfolio B	-0.03	-0.42	1.12	0.14	0.01	0.04	0.00	0.86
Spread (A-B)	0.35	2.68	-0.12	0.03	-0.02	-0.03	0.09	0.01
	Asian EM Funds							
Portfolio A	0.10	0.52	1.10	0.11	-0.02	-0.04	-0.04	0.75
Portfolio B	-0.16	-0.96	1.22	0.17	0.08	-0.03	-0.01	0.82
Spread (A-B)	0.26	2.13	-0.12	-0.07	-0.10	-0.01	-0.03	0.23
	Eastern Europe EM Funds							
Portfolio A	0.56	1.22	2.66	-0.12	0.07	-0.13	-0.43	0.68
Portfolio B	0.00	0.01	2.15	0.06	0.08	-0.02	-0.36	0.82
Spread (A-B)	0.55	2.12	0.51	-0.18	-0.01	-0.11	-0.07	0.07
	Latin America EM Funds							
Portfolio A	0.84	3.67	1.05	0.07	-0.14	-0.01	0.22	0.81
Portfolio B	0.16	1.01	0.47	0.06	0.03	0.02	0.11	0.74
Spread (A-B)	0.69	3.02	0.57	0.00	-0.16	-0.03	0.10	0.54
	Global EM Funds							
Portfolio A	0.32	1.73	0.78	0.22	0.02	0.05	0.19	0.74
Portfolio B	-0.15	-2.01	0.90	0.12	0.04	0.05	0.03	0.94
Spread (A-B)	0.46	2.60	-0.12	0.10	-0.02	0.00	0.16	0.06

Emerging market hedge funds are sorted based on whether they have a presence in the geographical region they invest in. Portfolio A is the equal-weighted portfolio of funds with investment region presence. Portfolio B is the equal-weighted portfolio of funds without investment region presence. Alpha is estimated relative to a 5-factor model. The five risk factors are: Emerging market factor MMSCI which is the excess return on Morningstar MSCI index; market factor MKTRF which is the excess return on the value-weighted return on all NYSE, AMEX, and NASDAQ stocks minus the one-month Treasury bill rate; size factor SMB which is as in Fama and French (1993); Term spread is the excess return on Fama Treasury bond portfolio with maturities greater than ten years (as in Jagannathan et al. (2010)); Credit spread factor is the excess return on the Citi group corporate BBB 10+ year index minus TERM (as in Jagannathan et al. (2010)). The sample period is from January 2000 to December 2010.

Table 14. Investor Flows into Have-Alpha and Beta-Only Emerging Market Hedge Funds

		Proportion		Alpha		Fund Flows (t+1)				
Classification period	# of Funds	Have-Alpha	Beta-Only	Have-Alpha	Beta-Only	Have-Alpha		Beta-Only		Stat. Sig. Diff.?
2000-2001	131	0.19	0.81	1.77	-0.38	0.58	***	-0.03		***
2001-2002	144	0.24	0.76	1.81	-0.6	0.75	*	0.22	**	
2002-2003	163	0.13	0.87	1.35	-0.29	0.9	**	0.38	**	
2003-2004	179	0.13	0.87	1.16	-0.35	0.32	**	0.06		*
2004-2005	197	0.15	0.85	1.06	-0.33	0.02		0.05		
2005-2006	228	0.2	0.8	1.3	-0.12	0.18	**	0.1		
2006-2007	276	0.2	0.8	1.62	-0.09	-0.03		-0.2	***	***
2007-2008	286	0.21	0.79	1.3	0.07	-0.08		-0.2	***	*
2008-2009	372	0.19	0.81	1.37	-0.32	0.27	**	-0.05	*	***
2009-2010	446	0.16	0.84	1.34	-0.37					
Overall	242	0.18	0.82	1.4	-0.26	0.24	***	0.01		***

The first column is the classification period; the second column is the total number of funds with 2 full years of return history in each of the classification periods; the third and fourth columns are the percentage of the total classified as have-alpha funds and as beta-only funds, respectively; The fifth and sixth columns are average alpha for have-alpha funds and beta-only funds, respectively. The seventh and eighth columns are average annual flows for the subsequent year across all funds in the have-alpha fund group and beta-only fund group, respectively. The final column reports the results from a hypothesis test that the have-alpha and beta-only flows are the same for each time period denoted in rows. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, ***, and *, respectively.

Table 15. Regression on the Annual Investor Flows Subsequent to the Classification Period

	pgroup	mfee	ifee	min	water	notice	lockup	presence	theta0
Model 1	0.240***								
	(3.76)								
Model 2	0.246***	0.066	-0.01	0.016	0.043	-0.001*	0.050	0.049	
	(3.78)	(0.88)	(-1.05)	(0.99)	(0.91)	(-1.96)	(0.62)		
Model 3	0.265***	0.079	-0.01	0.018	0.051	-0.001*	0.048	-0.029	0.365
	(4.02)	(1.15)	(-1.12)	(1.06)	(1.03)	(-1.95)	(0.60)	(-0.52)	(0.90)

The dependent variable is annual investor flow of a fund in the year subsequent to the classification period. The independent variable pgroup is an indicator variable that equals 1 if the fund is classified as a have-alpha fund in the previous classification period, and equals 0 if the fund is classified as a beta-only fund; mfee represents management fee; ifee is performance fee; min is minimum investment; water is an indicator variable equal to 1 when there is a high-water mark provision for charging incentive fee; the variable notice denotes the fund's redemption notice period (in days); lockup is an indicator variable equal to 1 when the period (in months) over which investors cannot withdraw their investment is greater than 0; presence denotes investment region presence which is an indicator variable that equals 1 when the fund has a physical presence (management company) in the geographical region it invests in and equals 0 otherwise; theta0 denotes fund asset liquidity which is measured using the equation developed in Getmansky, Lo, and Makarov (2004). The *t*-statistics are in parentheses. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, ***, and *, respectively.

Table 16. Return Chasing and Trend Following in Have-Alpha and Beta-Only Funds

	Have-Alpha Flows	Beta-Only Flows
Intercept	0.017	-0.007
	(1.09)	(-0.70)
Ret (L1)	0.457*	0.276**
	(2.03)	(2.36)
Flow (L1)	0.248	0.342**
	(0.98)	(2.66)
Number of Quarters	36	36

The quarterly investor flow is regressed on lagged quarterly flows and lagged quarterly returns. The column headings indicate the subgroup (have-alpha or beta-only) for which the regression equation is estimated. The Newey-West autocorrelation and heteroskedasticity-consistent standard errors are presented below the coefficients, estimated using four quarterly lags. *Significant at the 10% level; **significant at the 5% level. ***significant at the 1% level.

Table 17. Transition Probabilities and Measures of Alpha for Above- and Below-Median Flows into Have-Alpha Funds or Beta-Only Funds

Panel A. Have-Alpha Funds

			P (2-year Transition)			Measures of Alpha	
Classification period	Flow Group	Number of Funds	Have-Alpha	Beta-Only	Stop Reporting	Level of Alpha	*t*-statistic of Alpha
2000-2001	Above median	10	0.20	0.80	0.00	0.12	0.59
	Below median	11	0.20	0.80	0.09	0.38	0.83
2001-2002	Above median	15	0.20	0.80	0.00	0.62	1.19
	Below median	15	0.18	0.82	0.27	0.03	0.02
2002-2003	Above median	14	0.78	0.22	0.00	0.71	2.37
	Below median	15	0.57	0.43	0.30	0.24	1.48
2003-2004	Above median	10	0.44	0.56	0.10	0.35	1.27
	Below median	11	0.50	0.50	0.27	0.27	1.28
2004-2005	Above median	14	0.08	0.92	0.07	0.16	0.36
	Below median	15	0.50	0.50	0.33	-0.08	0.82
2005-2006	Above median	21	0.21	0.79	0.10	0.32	0.62
	Below median	22	0.05	0.95	0.14	-0.04	0.06
2006-2007	Above median	25	0.19	0.81	0.08	-0.38	-0.13
	Below median	25	0.10	0.90	0.16	0.24	0.35
2007-2008	Above median	27	0.21	0.79	0.27	-0.11	0.30
	Below median	27	0.10	0.90	0.22	-0.04	-0.30
Overall	Above median	164	0.25	0.75	0.11	0.16	0.66
	Below median	170	0.21	0.79	0.22	0.10	0.38

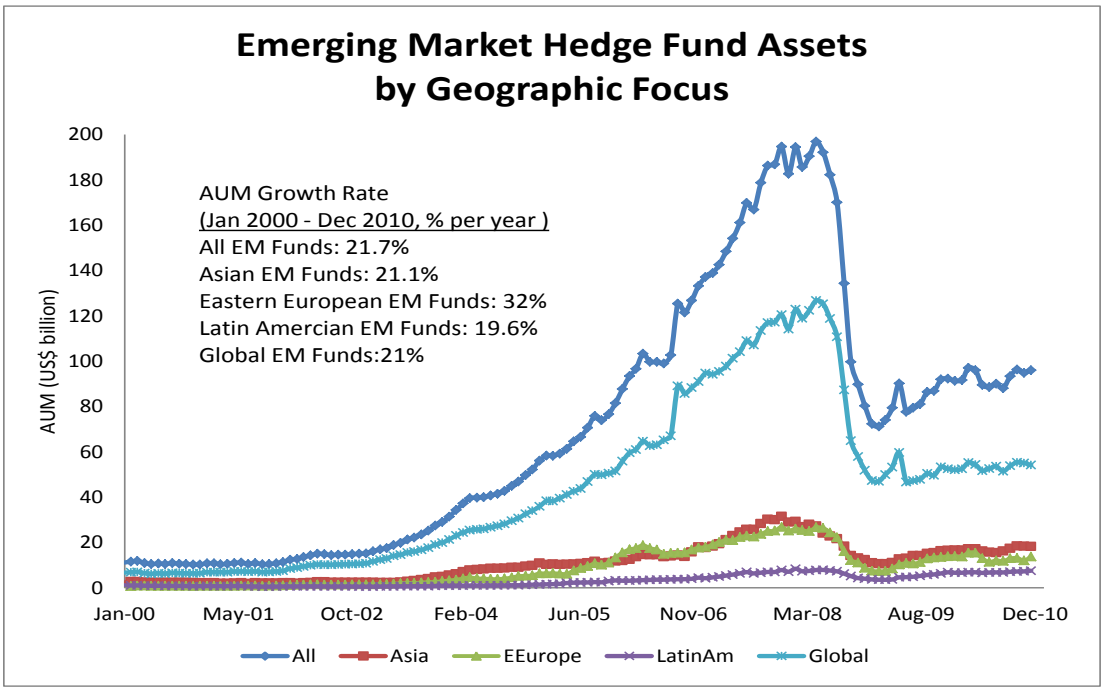
Panel B. Beta-Only Funds

			P (2-year Transition)			Measures of Alpha	
Classification period	Flow Group	Number of Funds	Have-Alpha	Beta-Only	Stop Reporting	Level of Alpha	*t*-statistic of Alpha
2000-2001	Above median	41	0.10	0.90	0.27	-0.27	-0.24
	Below median	42	0.00	1.00	0.21	-0.17	-0.36
2001-2002	Above median	46	0.08	0.92	0.15	-0.24	-0.09
	Below median	46	0.03	0.97	0.24	-0.28	-0.25
2002-2003	Above median	57	0.00	1.00	0.05	-0.41	-0.75
	Below median	58	0.14	0.86	0.12	0.02	0.11
2003-2004	Above median	66	0.17	0.83	0.12	0.12	0.03
	Below median	67	0.20	0.80	0.18	0.08	0.04
2004-2005	Above median	70	0.22	0.78	0.16	0.40	0.36
	Below median	70	0.08	0.92	0.27	-0.06	-0.17
2005-2006	Above median	75	0.18	0.82	0.20	0.32	0.51
	Below median	76	0.16	0.84	0.43	0.19	0.23
2006-2007	Above median	94	0.23	0.77	0.22	0.14	0.20
	Below median	94	0.19	0.81	0.39	0.32	0.30
2007-2008	Above median	94	0.25	0.75	0.16	0.10	0.38
	Below median	95	0.19	0.81	0.23	-0.19	0.02
Overall	Above median	543	0.17	0.83	0.17	0.06	0.10
	Below median	548	0.14	0.86	0.27	0.00	0.02

The rows correspond to the 2-year period in which funds are classified as have-alpha funds. The columns are: The group affiliation, that is, whether the average fund classified as a have-alpha experienced inflows (in the second year of the classification period) that were above or below the median have-alpha inflow in that year; the number of have-alpha funds in each group; the percentage of the flow group members classified as have-alpha funds in the subsequent classification period; the percentage of the flow group members classified as beta-only funds; the percentage of stopped reporting funds; the annual average magnitude of alpha for the survived funds in the subsequent classification period; and the average *t*-statistic of alpha for the survived funds in the subsequent classification period. Panel A is for have-alpha funds and Panel B is for beta-only funds.

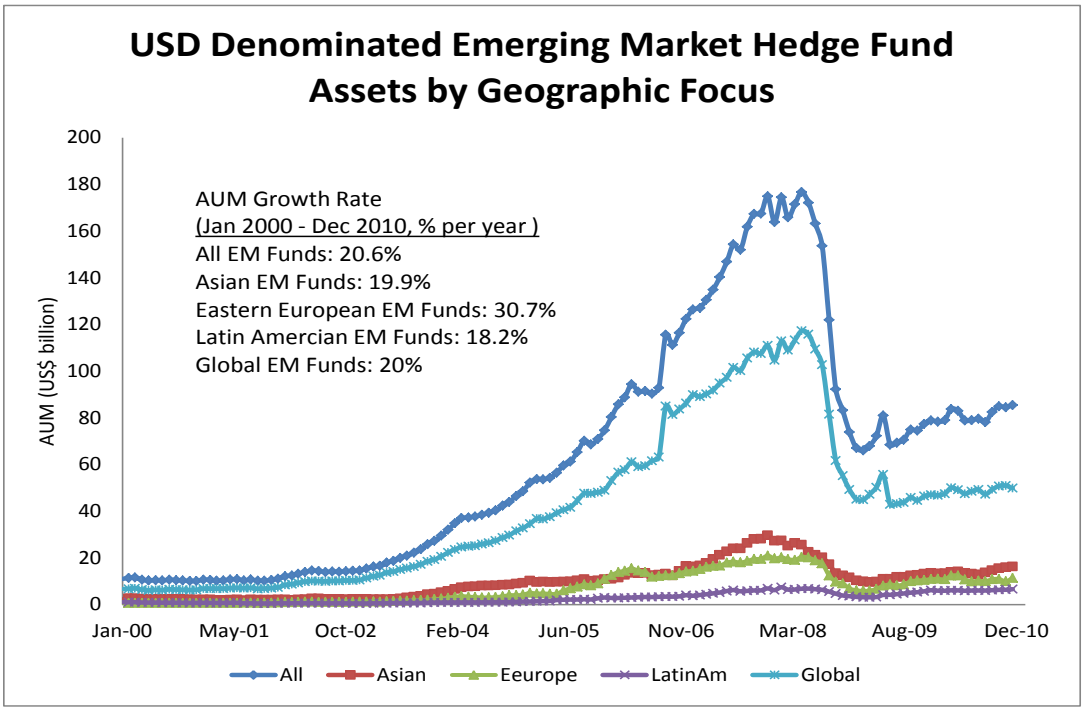
Figure 3. The Assets of Emerging Market Hedge Funds

Panel A. The Assets of Emerging Market Hedge Funds by Geographic Focus



	Number of Funds		Assets under Management (AUM, US$ billion)	
	Jan-00	Dec-10	Jan-00	Dec-10
All EM Funds	294	964	11.06	95.90
Asian EM Funds	38	253	2.21	18.14
Eastern European EM Funds	45	122	0.65	13.68
Latin American EM Funds	23	91	1.05	7.49
Global EM	156	422	6.67	54.12
African EM Funds	3	14	0.01	0.06
Other EM Funds	29	69	0.47	2.45

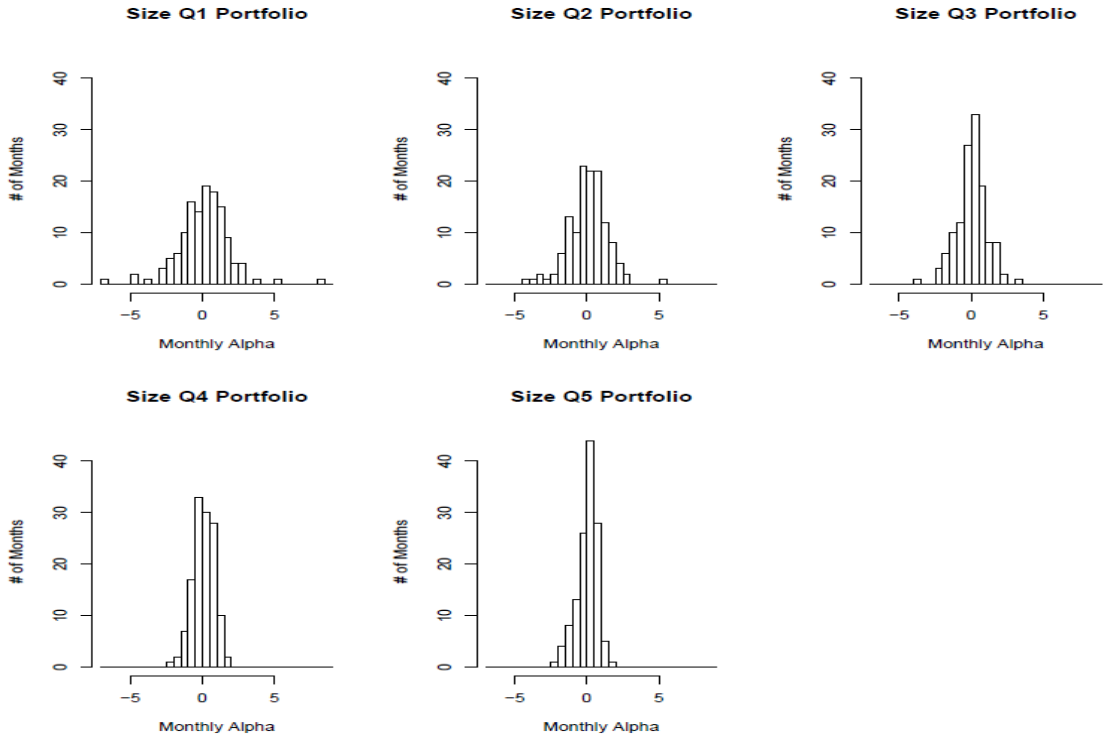
Panel B. The Assets of USD Denominated Emerging Market Hedge Funds by Geographic Focus



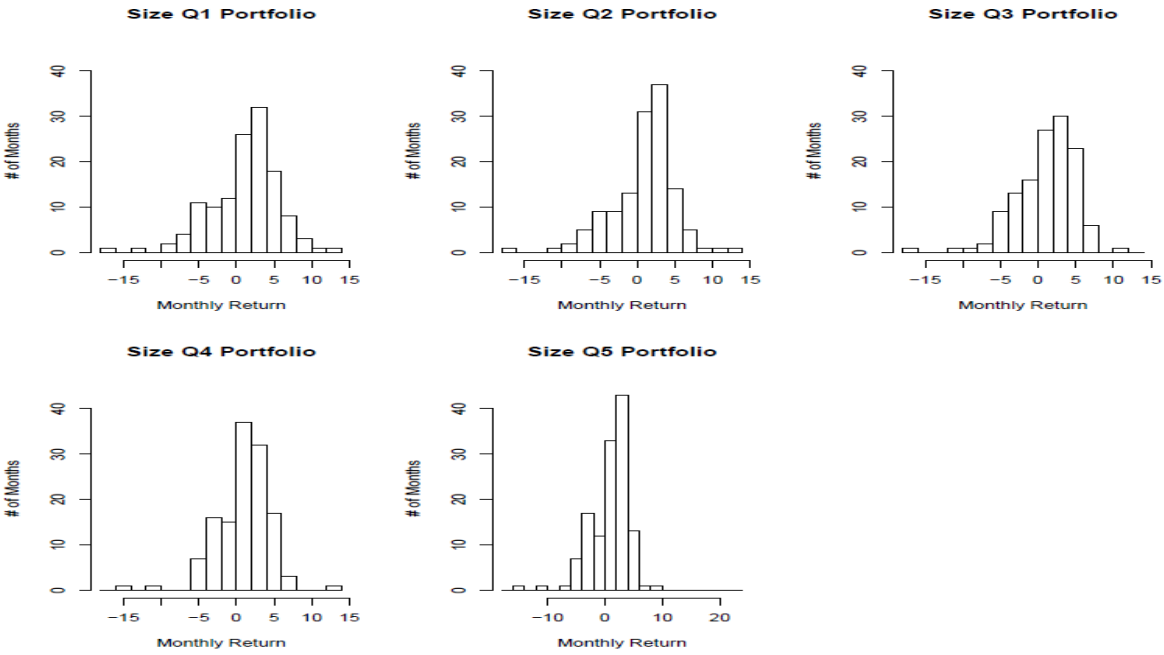
	Number of Funds		Assets under Management (AUM, US$ billion)	
	Jan-00	Dec-10	Jan-00	Dec-10
All EM Funds	239	720	10.93	85.46
Asian EM Funds	30	206	2.21	16.28
Eastern European EM Funds	37	91	0.60	11.40
Latin American EM Funds	19	81	1.05	6.57
Global EM	127	299	6.65	49.87
African EM Funds	2	4	0.01	0.06
Other EM Funds	24	42	0.40	1.32

Figure 4. Distribution of Monthly Equal-Weighted Alphas and Raw Returns

Panel A: Distribution of Monthly Equal-Weighted Alphas

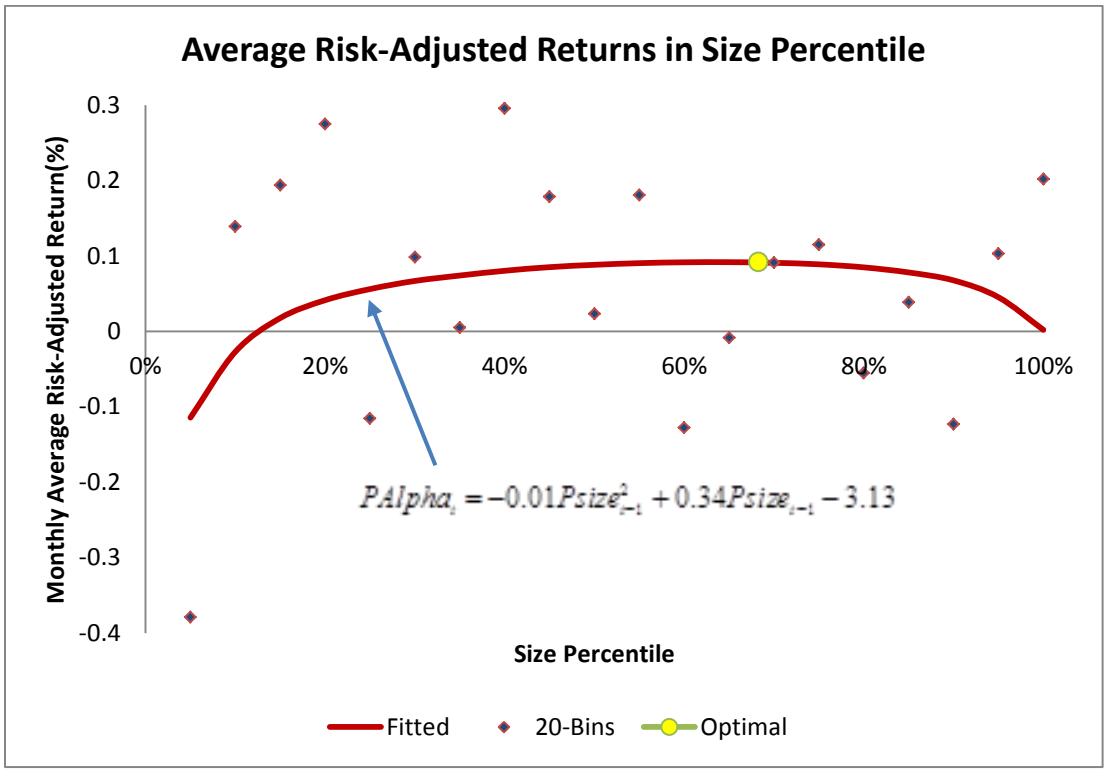


Panel B. Distribution of Monthly Equal-Weighted Raw Returns



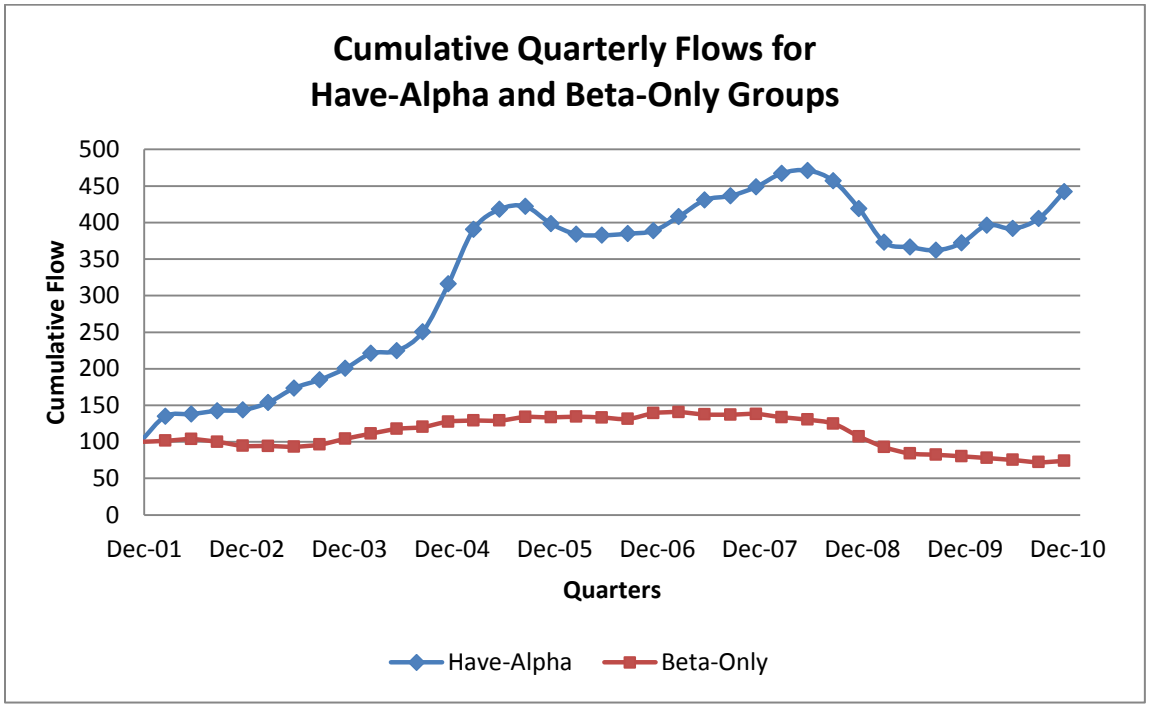
Emerging market hedge funds are sorted based on their size in each month. In each month from January 2000 to December 2010, all of the emerging market hedge funds are sorted by asset size and then assigned them into quintiles. Alpha is estimated relative to a 5-factor model. The five risk factors are: Emerging market factor MMSCI which is the excess return on Morningstar MSCI index; market factor MKTRF which is the excess return on the value-weighted return on all NYSE, AMEX, and NASDAQ stocks minus the one-month Treasury bill rate; size factor SMB which is as in Fama and French (1993); Term spread is the excess return on Fama Treasury bond portfolio with maturities greater than ten years (as in Jagannathan et al. (2010)); Credit spread factor is the excess return on the Citi group corporate BBB 10+ year index minus TERM (as in Jagannathan et al. (2010)).

Figure 5. Average Risk-Adjusted Returns in Size Percentile



Hedge funds are sorted based on their size in each month. In each month from January 2000 to December 2010, all the emerging market hedge funds are sorted in order of asset size and then assigned into 20 bins. $PAlpha_t$ is the equal weighted averages of fund risk-adjusted returns in month *t*. $Psize_{t-1}$ is the equal weighted averages of fund size in month *t-1*. The diamond in the graph represents the mean of monthly equal-weighted averages of risk-adjusted returns for the funds in each bin. Alpha is estimated relative to a 5-factor model. The five risk factors are: Emerging market factor MMSCI which is the excess return on Morningstar MSCI index; market factor MKTRF which is the excess return on the value-weighted return on all NYSE, AMEX, and NASDAQ stocks minus the one-month Treasury bill rate; size factor SMB which is as in Fama and French (1993); Term spread is the excess return on Fama Treasury bond portfolio with maturities greater than ten years (as in Jagannathan et al. (2010)); Credit spread factor is the excess return on the Citi group corporate BBB 10+ year index minus TERM (as in Jagannathan et al. (2010)).

Figure 6. Cumulative Flows for Have-alpha and Beta-only Funds



The *X*-axis shows the quarters for which the flow index is plotted on the *Y*-axis. The index begins at a value of 100 in December 2001 and successive values are given by $Index_{gq} = Index_{gq-1} * (1 + F_{gq})$ where F_{gq} is the flow percentage for group *g* (*g* is have-alpha or beta-only) for quarter *q*.

ESSAY 3

HEDGE FUND RETURNS: BELIEVE IT OR NOT

3.1 Introduction

In contrast to a regulated mutual fund or exchange-traded fund, hedge funds are lightly regulated financial institutions that are generally not required to report information about their characteristics, strategies, and performance to regulatory authorities or databases.[22] Hedge funds are protective of their trading positions and models because they regard revealing these information would be precarious both to the funds and the investors. As a result, hedge funds are among the least transparent market participants, even though some hedge funds choose to voluntarily report to a commercial database as a cheap way to reach the potential investor groups. One important piece of information that is self-reported by thousands of hedge funds to one or more commercial databases is their monthly performance. However, the substantial discretion hedge fund managers have in reporting performance concerns the regulators, academics, investors, and the media. Due to the light regulatory environment where hedge funds operate in and their secretive nature, there is long-standing disbelief of hedge fund performance disclosure to the public due to the voluntary reporting nature.

In this paper, we investigate the dynamics in the performance report of hedge funds and try to shed light on the determinants of return revisions. We track changes to the statements of historical performance of about 9,500 hedge funds recorded in publicly available databases (TASS), at different points in time between 2002 and 2013. We find

[22] New regulations introduced in the US and the EU as of 2010 require hedge fund managers to report more information, leading to greater transparency.

that as many as two-thirds of hedge funds (over 6,500 individual funds) have revised their previously reported performance, with more than two-fifths of funds later changing a previous monthly return by at least 0.5%. On average, more than one-fifth of monthly returns were revised after being first reported. Positive revisions are more common.

We find that the uneven distribution of revisions to the returns in 12 calendar months occurred in the early half of our sample period. We also find that the average number of revisions to increase the returns of December is significantly larger than that to decrease the returns of December. This finding may provide an alternative explanation for the December spike detected in the literature on hedge fund misreporting.

We find an obvious decreasing time trend in both the number and proportion of return revisions, even after adjusting for performance report recency. The declining trend is accompanied by the strengthening of hedge fund governance. We find that revisions are more common among larger funds with stronger governance, higher incentive fee, and better past performance. At the micro-level, the returns are more likely to be revised for older funds with stronger governance and managers' co-investment in funds prior to the return being first reported, while the return revisions tend to occur in the next month when a fund with higher governance score has better past performance. Return revisions also tend to happen when a fund have stronger governance and become more liquid and more volatile compared to the fund in the month when the return was first reported. These drivers of return revisions are significant no matter the revisions are to increase or decrease the previously reported returns. Therefore, we find a strong connection between return revisions and desirable fund characteristics at the overall fund level, the individual fund level, and the individual revision level. The comparisons between the hedge funds

that have revised their returns with those that have not show that revised funds outperform the unrevised funds no matter the comparisons are at fund level or at revision level.

Our paper contributes to the growing body of literature on the reliability of self-reported hedge fund returns. The fact that hedge fund managers voluntarily report returns to hedge fund databases means that they are able to choose if and when to start reporting, and when to stop reporting. This leads to potential biases not seen in traditional databases. Ackermann, McEnally, and Ravenscraft (1999), Fung and Hsieh (2000), Fung and Hsieh (2009) and Liang (2000) provide an overview of these biases such as survivorship, self-selection, and backfill biases.

Self-reporting also leads to the possibility of using different models to value assets, as well as the possibility of return smoothing. Getmansky, Lo, and Makarov (2004) document high serial correlation in reported hedge fund returns relative to other financial asset returns, and consider various reasons such as underlying asset illiquidity to explain this pattern. Asness, Krail, and Liew (2001) argue that the presence of serial correlation leads reported returns to appear less risky and less correlated with other assets than they truly are, thus providing an incentive for hedge fund managers to intentionally smooth their reported returns. Cassar and Gerakos (2011) match due diligence reports with smoothing measures, and find that smoother returns are associated with managers who have greater discretion in sourcing the prices used to value the fund's investment positions.

Bollen and Pool (2008) extend Getmansky, Lo, and Makarov (2004) to consider autocorrelation patterns that change with the sign of the return on the fund. They find

evidence that hedge fund managers have a greater incentive to smooth losses than gains. This finding is reinforced using a different approach in Bollen and Pool (2009), who document that the amount of small gains far exceeds that of small losses. They show that these discontinuities are a result of deliberate return misreporting. Jylha (2011) extends Bollen and Pool (2009) on misreporting by conditioning the search for pooled distribution discontinuities on various fund attributes. In a recent study, Bollen and Pool (2012) propose a variety of flags for potential fraudulent activity based just on reported returns, and link these to an indicator for whether the fund has been charged with legal or regulatory violations.

In addition to Bollen and Pool (2009), Agarwal, Daniel, and Naik (2011), Cici, Kempf, and Puetz (2011), Patton and Ramadorai (2013), and Patton, Ramadorai, and Streatfield (2013) provide evidence of return misreporting in hedge funds. Agarwal, Daniel, and Naik (2011) find that hedge fund returns in December are suspiciously higher than during the rest of the year. They conclude that this December spike is evidence of return management and link it to the managerial incentives induced by performance based compensation. They find strong evidence that funds inflate December returns by underreporting returns earlier in the year but only weak evidence that funds borrow from January returns in the following year. At higher frequencies, Patton and Ramadorai (2013) find that the estimated hedge fund risk exposures appear to be the highest at the beginning of the month, and lowest just prior to the end of month reporting periods. Cici, Kempf, and Puetz (2011) provide more direct evidence on misreporting by showing that hedge funds systematically mis-value their stock positions. Finally, Patton, Ramadorai,

and Streatfield (2013) find that hedge funds rewrite history by restating reported returns in some systematic ways.

However, disagreeing with Bollen and Pool (2009) who infer misreporting based on a kink at zero, Jorion and Schwarz (2013) provide plausible non-manipulation explanations for the observed discontinuities in the distributions of the net returns of hedge funds. These include the effect of the incentive fee accrual process, the boundary at zero for fixed income yields, and the impact of asset illiquidity. In particular, they show that incentive fees can mechanistically create a kink in the net return distribution and conclude that the observed hedge fund return discontinuities are not direct proof of manipulation.

The paper is organized as follows: Section 2 describes the data and provides summary statistics for all hedge funds in our sample and the summary statistics for return revisions. Section 3 presents the calendar distribution and time trend of return revisions. Section 4 examines the determinants of return revisions at the overall fund level, the individual fund level, and the individual revision level. Section 4 also examines the determinants of revision direction and revision magnitude. Section 5 presents the impact of return revisions on future performance of hedge funds. Section 6 presents robustness checks. Finally, Section 6 concludes.

3.2 Data

We obtain data from Lipper TASS (hereafter TASS). The main database consists of historical returns, asset under management (AUM), and fund characteristics such as the inception date, redemption frequency and lockup period, management fee, incentive

fee, high-water mark provision, personal capital investment, leverage, and the date of last audit.

The TASS data has been widely used in a large number of hedge fund studies. To the best of knowledge, we are the first to compile monthly downloaded data and use these return data over a twelve-year period from 2002 to 2013. The TASS data which we use are proprietary and track changes in reported returns by funds at a monthly level. The sample of our study includes the hedge funds in the snapshots of TASS datasets downloaded each month over the period from February 2002 to January 2014 except for three months (September 2002, December 2006, and August 2007). Altogether, we have 219 monthly snapshots of TASS data sets because for some months we have more than one snapshot. These monthly snapshots allow us to identify not only changes in returns since the previously updated version, but also other characteristics at various points in time and the entire history of returns for each fund that experiences these reported return changes. Not every hedge fund updates their information in TASS on the same date of each month, and the snapshots were not downloaded on the same date of the month either. We define each return data $R_{i,t,s}$ in our overall dataset by three dimensions: fund *i*, return month *t*, and return reported month *s*, where return month *t* is set to be the Date in the file of ProductPerformance and return reported month *s* is set to be the PerformanceEndDate in the file of ProductDetails of TASS. We compare the returns for each fund and each return month reported in consecutive months to locate the revisions in returns. We track changes to return of each month for all hedge funds. For the months when a fund's information is not updated, we simply compare the returns for all the previous months for each fund reported at later time with those reported in the latest point in time. Therefore,

the return revisions is defined as $RV_{i,t,s} = R_{i,t,s} - R_{i,t,s-1}$. If $RV_{i,t,s} \neq 0$ there is a return revision to the return of month *t* for fund *i*. The return reported month *s* is also called revision month if $RV_{i,t,s} \neq 0$. If $RV_{i,t,s} > 0$, the revision is to increase the initially reported return; If $RV_{i,t,s} < 0$, the revision is to decrease the initially reported return.

We apply some standard filters to the data. Only funds that provide monthly net of fee returns and denominated in US dollars are retained. To minimize backfill bias, we drop the first 12 months' returns for each fund. We remove the returns with extremely large or small numbers to eliminate a possible source of error (truncating between monthly return limits of -90%, and +200%). In addition, we remove the observations that are for the months prior to January 2002. In the end, 9,494 funds survived our data cleaning process and remained in our sample.

3.2.1 Summary Statistics of All Hedge Funds

Table 18 provides the summary statistics of the 9,494 hedge funds on the number of funds, returns, assets under management (AUM), age, and fee structure. Panel A and Panel B report, for each year from 2002 to 2013, the number of hedge funds and the mean, median, standard deviation, minimum, and maximum monthly returns on an equally-weighted portfolio of hedge funds. The summary statistics in Panels A and B are calculated using the first reported returns and last reported returns, respectively.

From Panel A we observe a steady increase in the number of hedge funds from 2000 to 2007. This is a reflection on the growth in the hedge fund industry and the increasing attraction of hedge funds to the investment community. But in 2008, the number of hedge funds decreased and this drop coincides with the financial crisis. In fact,

during the financial crisis not only the number of hedge funds reported to TASS decreased, but the average monthly return also plummeted in 2008. The equally-weighted portfolio return calculated using the first reported returns in each year shows that the worst return appeared in 2008 with an average of -1.64% per month. In 10 out of the 12 sample years, the average monthly return is positive with 4 years in the proximity of 1% or above.

The summary statistics of monthly returns on an equally-weighted portfolio of hedge funds reported in Panel B are calculated between January 2002 and December 2013, but these numbers are the last reported returns in all our snapshots. We can see that the statistics for returns in Panel A are quite close to those in Panel B. In 8 out of the 12 years, the average monthly returns calculated using the last reported values are slightly higher than those calculated using the originally reported returns. This may indicate that the average revision magnitude of monthly return was to increase the originally reported return.

Panel C reports the cross-sectional mean, median, standard deviation, minimum, and maximum statistics for the 9,494 hedge fund characteristics including returns, size, age, management fee, and incentive fee. For the sample period, the best (worst) performed fund experienced an average monthly return of 17.4% (-22.09%) over its life, based on the last reported returns. The mean (median) of the average monthly returns of all hedge funds is only 0.33% (0.4). From Table 18 we can also observe the large size variation among all funds, where size is measured as the average monthly AUM over the life of the fund. Based on our data, the mean (median) size is only $149.04 million ($38.09 million). This shows the existence of very few emerging market hedge funds

with very large assets under management in the hedge fund industry. The largest fund in our sample is more than 400 times the size of the median-sized fund. Interestingly, the average (median) fund age (number of months in existence since inception) is only 80.6 (66) months. The short life span may partly be explained by the existence of a high-water mark provision. The manager of a hedge fund with high-water mark provision may choose to close his/her fund when the recent fund performance is poor or the current superior performance is unlikely to continue in a foreseeable future. The mean (median) management fee is 1.45% (1.5%) in our sample with a maximum of 22% for a few hedge funds. The mean (median) incentive fee is 15.1% (20%) in our sample, and goes up as high as 50% for a few hedge funds.

3.2.2 Summary Statistics of Return Revisions

Table 19 shows the summary statistics of return revisions occurred during our sample period. Panel A shows that out of the 9,494 funds in our sample, less than one-third (2,927 funds) have never changed their originally reported returns in the month after the returns were first reported to TASS. About one-tenth (1,059 funds) had one return revision. About one-fourth (2,439 funds) had 3 to 13 revisions. One-tenth of funds had more than 38 return revisions. The fund with most revisions made changes to its previously reported returns by 398 times!

Panel B reports summary statistics on the size of revisions observed in our sample. We observe that 43.7% (4,145 funds) of funds revise their returns at least once by 50 basis points or more, and 33% of funds revise at least once by 1 percent or more. If we only count the revisions happened more than 3 months after they were first reported,

14.6% of funds revise at least once by at least 1 percent. Panel C reveals that altogether we have observed 119,017 return revisions during our sample period. The mean absolute revision is 64.5 basis points. To provide an appropriate comparison, the mean monthly return across hedge funds, as reported in Table 18, is approximately only half of the mean absolute monthly revision. Therefore, the revisions that we have detected are substantial. The total number of positive revisions is larger than that of negative revisions, which means, on average, more revisions were to increase the previously reported returns. Panel D further shows that the average number of monthly revisions in the direction of increase is significantly higher than that of decrease. The difference is more dramatic in the early half of our sample period. This explains why the average monthly returns in most of the years are higher when calculated using the last reported returns than using the initially provided returns. The larger number of positive revisions indicates that the conjecture of overstating returns in the literature of hedge fund misreporting is not confirmed by the large number of negative revisions, if the overstating really exists.

Panel E of Table 19 reports the "recency" of revisions which is defined as the number of months k between the month in which a revision was detected and the month of the return. For example, if the return for the month of January 2005 was revised in the report month July 2005, then this revision recency would be 6 months. Each of the columns of Panel D shows the proportion of revising funds remaining once we exclude revisions near the report month. For example, for $k > 3$, we ignore revisions of returns that occurred within three months of the return. As we increase k, the proportion of funds that are lagged as having revised their returns declines, from 56% in total revised funds when we ignore the revision in three months down to 16% when we ignore any revision

within a 24 months of the return month. Based on revisions, 34.5% of revisions occurred more than 3 months after they are originally reported and about 13% of revisions occurred more than 2 years after they are originally reported.

Panel F reports the status of the returns for the revisions before and after the changes. Among all the revisions, 39% of the revisions which occurred within 3 months of the returns and the numbers were changed from "estimated" to "actual" returns. Or about 60% of revisions which happened in 3 months of the returns were made because managers could figure out the actual returns to replace the previously estimated returns which were inaccurate. Therefore, most of the revisions within 3 months of the return month may be motivated by correcting a return report. Our study for the motivation of revising returns thus focuses on the revisions occurred more than 3 months after the return month.

Panel G shows return revisions defined by the fund and return month in each investment style as the percentage of the number of return month of all the funds in each style and as the percentage of all the revisions. 23.56% of returns of fixed income arbitrage funds were revised after originally reported. This is the highest percentage among all the 12 categories, while the smallest percentage is from the multi-strategy category, which is only 13.86%. Fixed income arbitrage is one of the most illiquid hedge fund categories. It is surprising that 22.74% of the fund returns in managed futures category were revised even though this style is among the most liquid. This tells us that illiquidity may be one of the factors that affect return revisions, but some other factors may also play important roles. The return revisions in the fund of funds category account for more than one-third of all revisions. This is not only because the large percentage of

funds of funds, but also because the returns of funds of funds are directly related to the returns of the constituent hedge funds. If the returns reported by the underlying hedge funds are revised, so are the returns of the funds of funds.

3.2.3 Time Trend of Fund Characteristics

Our unique dataset enables us to document the time series of fund characteristics over the entire sample period. To present the time trend of fund characteristics, we calculate the annual averages of fund characteristics as the means of the monthly averages of the values of each characteristic across all the funds alive in that month.

We also consider a variety of fund characteristics. The lockup and advanced notice periods are restrictions imposed by the fund on its investors. These restrictions provide liquidity safeguards for fund managers but may also allow managers to hide the reputational consequences from changing data within the lockup period. We also include an indicator variable which takes one if a fund manager invests personal capital in her own fund. The fee structure variables, such as management fee and especially incentive fee, tie the managers' incentive directly to fund performance and penalize them for losses. A dummy variable of 1 if a fund takes on leverage and 0 otherwise is also included. Finally, four fund characteristics deserve special mention. The aggregate of these four variables, called governance variable in our paper, helps us better understand the incentives for fund managers to revise returns (see Ozik and Sadka (2011)).

We study herein the impact of fund governance on return revisions. On one hand, strong fund governance may align managers' interest with those of investors, leading the managers to undertake the best decision for the investors' interests. Inspired by the

corporate-governance literature (see La Porta et al. (2002), Gompers, Ishii, and Metrick (2003), and Ozik and Sadka (2011)), we consider several fund characteristics to act as a proxy for fund governance: whether the fund had been audited in the past 6 months or in the next 6 months, whether it has a high-water mark, whether it is an onshore domiciliation, and whether registration with the SEC exists. Following Ozik and Sadka (2011), we aggregate these variables to devise a measure of fund governance.

Taken as a group, the funds without a listed audit date have less oversight than the funds with an audit date listed (Liang (2003)). But for a lender, the updated or recent auditing may mean much more than an outdated one. A date for a completed financial audit reported by a fund may not be sufficient to indicate strong governance. Hence, we assign a score of one only if the audit date is within the past 6-month or next 6-month time period, otherwise, a score of zero is assigned.

The high-water mark provision more closely aligns managerial incentives with those of the limited partners in the hedge fund, and thus improves the governance structure. It requires the manager to make up the previous losses before charging an incentive fee. A fund is assigned a high-water mark score of one if it carries the high-water mark provision and zero otherwise.

Offshore hedge funds enjoy a lighter regulation since offshore hedge funds are not registered in the United States or with the SEC (Aragon, Liang, and Park (2012)) and they are largely tax-free jurisdictions. Along the domiciliation dimension, we assign a value of one to onshore funds and zero to offshore funds.

Unlike mutual funds which are required to be registered with the SEC, hedge funds are lightly regulated investment vehicles . Domestic and foreign hedge funds are

required to fill out Form 13F on a quarterly basis for all U.S. equity positions over $200,000 or consisting of more than 10,000 shares only if their AUM are over $100 million. We assign a score of one to funds registered with the SEC and zero otherwise.

In addition to the fund characteristics listed above, we also examine the effect of return volatility on performance revision, measured as the standard deviation of returns. We compute these measures using monthly data over a one-year period.

Figure 7 shows the time series of fund characteristics from funds that have revised their returns three months after the first report and those have never revised their returns. We see that the aggregate governance variable for both the revised funds and unrevised funds are largely in an upward time trend, with the curve for revised funds always above that of the unrevised funds.

3.3 Calendar Distribution and the Time Trend of Return Revision

3.3.1 Return Revision in Calendar Months

Agarwal, Daniel, and Naik (2011) find that hedge fund returns in December are suspiciously higher than during the rest of the year. They conclude that this December spike is an evidence of return management and link it to the managerial incentives induced by performance- based compensation. They also find strong evidence that funds overstate December returns by underreporting returns earlier in the year but only weak evidence for funds to borrow returns from January in the following year. Their sample period extends from January 1994 to December 2006.

To explore whether there is an overstatement in December returns and underreporting of returns in other calendar months, we test the equality of return revisions in number and percentage among the 12 calendar months. The results of the comparisons using one-way GLM are shown in Table 20. Panel A reports the test results for all the revisions and Panel B for the revisions that occurred more than 3 months after they are initially reported. From Panel A, we find that the revisions to January returns are higher than those of the rest of the year both in number and in percentage. Based on the numbers of revisions, we cannot reject the hypothesis of equal means of revisions across all 12 months. But in terms of the percentage, the hypothesis of equal means of revisions among the 12 months are rejected at the 10% significance level over the entire sample period and are rejected at the 1% significance level for the period from 2002 to 2007. From Panel B, using the revisions that occurred more than 3 months after they are first reported, we reject the hypothesis of equal means of revisions in number and in percentage across the 12 months from 2002 to 2007 at the significance levels of 1% and 10%, respectively. Therefore, the uneven distribution of return revisions mainly happened over the first half of our sample period which is part of the sample period of Agarwal, Daniel, and Naik (2011).

Next we move on to compare the revisions in increase and decrease directions in January, February, November, and December. The results of comparison for all return revisions and the revisions that occurred more than 3 months after their first report are reported in Panel C of Table 20. From Panel C we see that when all revisions are considered, over the full sample period and the sub-period from 2002 to 2007, the numbers of positive revisions are much higher than the numbers of negative revisions.

For the revisions that occurred more than 3 months after their initial report, the numbers of positive revisions and those of negative revisions are quite close during the full sample period and the two sub-periods except in December of the first sub-period. Therefore, the higher percentage of revisions in January may not be the result of return reversal because of the inflation of returns reported in December. One interesting feature in Panel C is that over the period of 2002 to 2007, the positive revisions significantly outnumber the negative revisions no matter all revisions are considered or only the revisions occurred more than 3 months after their initial report are considered. The number of positive revisions is 48% higher than that of the negative revisions when all revisions are considered. It is reasonable to doubt whether the December spike identified by Agarwal, Daniel, and Naik (2011) would still be significant or even exist if only the initially reported returns are used in their analysis. It is hard to link the larger number of positive revisions to the managerial incentives induced by performance based compensation as argued by Agarwal, Daniel, and Naik (2011). Positive revisions significantly outnumber negative revisions even when only the revisions happened more than three months after their first report. The public have access to the increased returns of December after May of the next year. This would hardly affect the managers' performance-based compensation in a timely manner.

3.3.2 The Time Trend of Return Revisions

To find out the time trend of return revisions, we first calculate the total number of returns that have been revised more than 3 months after they are initially perceived for each month during our sample period. Based on these total revision numbers for each

month, we obtain the total number of revisions as a percentage of the number of returns for each month. Then, we average the monthly total number of revisions and the percentage of revisions in each year. The results are shown in Table 21 of Panel A. The monthly average numbers of return revisions in the first four years from 2002 to 2005 are around 360. The largest number of return revision happened in 2007 which is coincident with the peak of number of funds as we have seen in Table 18. From 2008 to 2013, the average numbers of return revisions in each year appeared to be linearly decreasing. The overall average monthly percentage of return revisions during our sample period is 7.57%. The average monthly percentages of return revisions from 2002 to 2007 are all above the overall average percentage, while those from 2008 to 2003 are the same as or below the overall percentage. Figure 1 Panel A shows the almost linearly declining line representing the average monthly percentages of return revisions in each year when only the revisions happened more than 3 months after they are originally reported are considered. When all revisions are considered, the line for average monthly percentage of revisions is largely declining, but no longer monotonously.

It is natural to question whether the smaller number of average monthly revisions and lower percentage of revisions in the latter half of our sample period result from the fact that the more recent month of return, the less likely the return would be detected revised in our sample period. To address the issue, we first find out the actual distribution of return revision recency using the recency data of the 119,017 revisions we have detected. Then we multiply the monthly total numbers of return revisions actually observed in our dataset by an adjustment factor as shown in Figure 8 Panel B. The adjustment factor is defined as "2-cumulative percentage of revision recency". The

average monthly total numbers of return revisions adjusted by the adjusted factor in each year are shown in Panel B of Table 21 along with the average monthly percentages of return revisions calculated using the adjusted average monthly total numbers of return revisions in each month. We can see that the time trend of the adjusted average monthly total numbers and percentages of return revisions in each year are similar to those of the unadjusted numbers.

3.4 The Determinants of Return Revisions

Among the characteristics of funds, we begin by identifying the factors that are related to the time trend. Next, we analyze the determinants of return revisions for individual hedge funds. Then we go on to the even micro-level to investigate the drivers of return revisions at the individual reported return level. These analyses at different levels help us to shed light on the incentives for funds to engage in their revising behavior. Last, we analyze the determinants of the size and sign of revisions, documenting the differences between initially perceived and final histories.

3.4.1 Relation between Time Series Return Revisions and Fund Characteristics

To examine the relation between time series return revisions and fund characteristics, we regress the average monthly percentage of return revisions on the average monthly characteristics of all the funds in each year. As most of the time series of average monthly fund characteristics in each year are highly correlated, to avoid collinearity, we only carry out the univariate regressions. The results of the regressions of the unadjusted average monthly percentage of return revision are shown in Table 22.

From this table we can see that the decrease of percentage of return revisions is accompanied by the strengthening of overall fund governance. The stronger governance in hedge funds may have improved the quality of performance reporting and results in fewer return corrections. We also find that there is a significant negative relation between the time series of return revisions and management fee, lockup period, advanced notice period, fund age, and high-water mark provision, respectively; while the relationship between the return revisions and incentive fee, the dummy variables indicating funds' use of leverage, and fund manager's own wealth in the fund is significantly positive. The latter set of variables generally signals the quality of a fund manager. They vary in the same direction as that of average monthly percentage of return revision. The observed significant relations listed above are the same when we regress the adjusted average monthly percentage of return revisions on these fund characteristics.

3.4.2 Which Funds Revise?

To investigate the determinants of return revisions at the individual fund level, we employ different sets of probit regression. Among the explanatory variables in these probit regressions, for a fund that has revised its returns, the variables representing management fee, incentive fee, notice and lockup periods, dummies indicating leverage usage and manager personal capital in the fund are defined by the characteristics in the months prior to the first return revision, while these variables of an unrevised fund are defined by the characteristics in the months prior to the final histories. The variables of mean return and mean size of a fund that has revised its returns are the average of all returns and average of all sizes in the months prior to the first return revision. The

variable of return volatility of a revised fund is the standard deviation of all the returns prior to the first return revision. The definitions of the mean return, mean size, and return volatility of an unrevised fund are similar to those for the revised fund, except that for the unrevised fund, the returns or sizes used are from the months prior to the last reported month captured in our dataset. We use a measure of fund illiquidity suggested by Getmansky, Lo, and Makarov (2004), namely the first-order autocorrelation coefficient of all available returns. In each regression, we include the style fixed effects in our specifications to control for the possibility that differences in volatility and liquidity occasioned by the use of these different strategies, as well as differential access to information about these strategies might lead to differences in the propensity to revise returns.

As shown in Panel A of Table 19, there is a wide variation in the number of return revisions among funds which experienced revisions. 11.15% of all funds only revised their returns once, while 1.98% of all funds had more than 90 times return revisions. To take this difference into consideration, we use ordered probit regression to examine the effects of covariates on the probability of a hedge fund's return revisions. In the ordered probit regression, the dependent variable is 4 if the number of revision *n* is more than 20 times, 3 if *n* is between 7 and 20, 2 if *n* is between 3 and 6, 1 if *n* is 1 or 2, and 0 if no revision. The first two columns in Table 22 report the results of ordered probit regression. When we only examine the impact of fund governance, we find a significant positive relation between fund governance and its return revisions. The stronger the governance, the higher is the probability a fund to revise its previously reported returns.

When we control for other fund characteristics, we find that the variable governance is still statistically significant at the 1% significance level.

In the probit regression, the dependent dummy variable equals to one if the fund has revised its returns at least once, and 0 otherwise. In the probit increase regression, the dependent variable is 1 if all the return revisions of a fund sum up to be positive, and 0 if the fund has never revised its returns. In the probit decrease regression, the dependent variable is 1 if all the return revisions of a fund sum up to be negative, and 0 if the fund has never revised its returns. The results are reported in Table 23.

In these four sets of regressions, the coefficients of governance are all significantly positive. Funds which experienced return revision(s) seems to have higher governance score compared with the unrevised funds. Stronger governance leaves funds less latitude to manipulate performance reporting. It may be the case that strong governance such as auditing could trigger corrections in returns. Other variables that have significant coefficients in all the four probit regression settings are incentive fee, average fund return, average fund size, and the dummy variable for manager's personal investment in the fund. The higher the incentive fee, the more likely the fund revises its return. Better performed funds tend to revise their returns. This excludes the possibility that funds with poor performance overstate their historical returns through return revision after they are initially reported in order to show a rosier set of past performance numbers to prospective investors. Larger funds have higher probability to revise their returns. This may be because larger funds usually have larger number of different holdings. The revelation of the value of any of the investments after the returns are initially reported may require a return revision for the purpose of correction.

3.4.3 Determinants of Return Revision at Individual Revision Level

Sections 4.1 and 4.2 examine the determinants of return revisions of hedge funds at the overall fund level and individual fund level, respectively. Next, we explore the factors that drive return revisions at a more micro level-the individual revision level. The number of return revisions captured in our sample period accounts less than 1% of all our basic return observations defined by fund, return month, and report month. To make the probit regression more meaningful, we match each hedge fund with size data which revised its return at month *s* to the return of month *t* to the hedge fund which has the same strategy and the nearest asset size in the same return month and same month as the fund revised its return but did not revise its return at month *s* to the return of month *t*. The dependent variable is a dummy variable equal to 1 if a fund revised its return at month *s* to the return of month *t* and 0 for the matched fund. We use three sets of explanatory variables in our probit regressions. The first set of variables is defined by the funds' characteristics at return month *t*. The second set of variables is defined by the funds' characteristics at return revision month *s*, and the third set is the differences between the variables corresponding to variables defined by the funds' characteristics at return month *t* and return revision month *s*. To examine whether there is any difference in the impact of these variables on return revisions between different time periods, we run the probit regression over our whole sample period and two sub-periods, one is from 2002 to 2007 and the other is from 2008 to 2013.

Panel A of Table 24 reports the results of probit regressions on the variables defined by the funds' characteristics in return month *t*. We find that the coefficients of

governance is strongly significant in any of the periods no matter in the univariate regression specification or in the specification controlled for other fund characteristics. The higher the governance score a fund has in the return month, the more likely the return of the month would be revised more than three months after its initial reporting. This is consistent with the finding of Dimmocka and Gerkenb (2014) who use the SEC rule changes to show that regulatory oversight reduces return misreporting by hedge funds. Hoffman (2013) also finds that audit regulation stifles the misreporting of returns by hedge funds. We also find that funds which revised their returns have better past performance than unrevised funds. One posit about hedge fund performance misreporting is that fund managers overstate their returns in order to collect performance fees and/or to reduce the risk of fund outflows as investors withdraw funds from poorly performing investments (Green (2010)). If this is true, we would expect higher probability of return revision for funds with poorer governance and poorer past performance in the return months. Therefore, we have not found direct evidence that hedge fund managers manipulate returns in initial return reporting.

Panel B of Table 24 reports the results of probit regressions on the variables defined by the funds' characteristics at return revision month *s*. The variables are the values of funds' characteristics in the month prior to the revision month. The mean return, return volatility, and the first order autocorrelation are calculated using the returns in the past 12 months. Similar to Panel A, we find that the coefficients of governance are strongly significant in any of the periods no matter in the univariate regression specification or in the specification controlled for other fund characteristics. Stronger governance leaves less room for return report manipulations such as downward revision

to the return history to lower the high-water mark with the intention of inflating performance fee reward, or upward revision to make the return history more attractive to potential investors. The finding that funds with higher governance score are more likely to revise returns leads us to conclude that correction may be a plausible explanation for the return revisions instead of manipulations.

We also examine the effect of the changes in characteristics from the return month to revision month on return revisions. We use the probit regressions with the independent variables as the difference between the variables in the regressions in Panel B and those in Panel A. The results are shown in Panel C of Table 24. We find that when a fund has stronger governance score in the month before the report month than the score in the return month, the fund tend to revise its previously reported return. This finding again confirms the important role of governance in hedge fund return revisions. We also find that the probability of return revision is higher if funds' returns become more volatile in the return reporting month compared to the fund in the month when the return was first reported. There is significant negative relation between the increase in the first order autocorrelation of fund returns and the probability of return revisions. Funds tend to revise their returns when the funds become more liquid in the months of return reporting than in the return months. The improvement in fund liquidity may help funds to evaluate the correct value of their investment and make correction to the previously reported returns.

3.4.4 Determinants of the Direction and Size of Return Revisions

Having determined the factors that drive the revisions in return reporting without considering the direction of the revisions, we turn next to understanding the impact of

these factors on the direction of return revisions. In Section 4.2, we explore the determinants of return revisions at the individual fund level, where we examine the effect of fund characteristics on the revision direction which is defined as the sign of the sum of all the revisions that a fund have experienced. Since a fund may have experienced multiple revisions in different directions, the direction of revision at the fund level defined in this way may not be representative. Using our unique dataset, we can examine the determinants of revision direction at the individual return revision level. The samples we use to run the probit regressions are the same as those in Section 4.3. We use the revisions in both directions and the matched returns without return revision. In the regression for positive revisions, the dependent variable is a dummy variable equal to 1 if a fund reported its return at month *s* to the return of month *t* is greater than what it previously reported, and 0 for the matched fund. In the regression for the revisions to decrease returns, the dependent variable is a dummy variable equal to 1 if a fund reported its return at month *s* to the return of month *t* is smaller than what it previously reported, and 0 for the matched fund. As in Section 4.3, we examine three sets of explanatory variables: the variables defined by the characteristics in return month, in revision month, and the difference between the two months.

Results of the analysis described above are reported in Table 25. One eye-catching feature in the results is that the positive coefficients for governance in all the probit regressions are all strongly significant no matter the revisions are upward or downward. If funds manipulate return reporting, the funds with poor governance in the return month are more likely to decrease return after their initial reporting because they have more latitude to report higher than actual returns when the returns are initially

reported. Likewise, if funds manipulate return reporting through return revisions, funds with poorer governance and poorer past performance would tend to increase their previously reported returns, while funds with poorer governance and higher incentive fees would tend to decrease their historical returns. But in reality we find that funds with stronger governance and better past performance are more likely to increase their returns and funds with higher governance scores and lower incentive fees are more likely to decrease previously reported returns. Therefore, we have not found any direct evidence that hedge funds misreport their returns in the return month or manipulate their returns through revisions to their previously reported returns. Correction may be a plausible explanation about return revisions of hedge funds.

We also examine the determinants of the magnitude of return revisions. The dependent variables in the OLS regressions are the absolute values of the individual return revisions. The independent variables are the three sets of characteristics described above. The results of this analysis are shown in Table 26. We find that funds with stronger governance, lower incentive fee, shorter notice period and lockup period, higher return volatility, and with leverage usage are related to larger revision magnitude.

3.5 Impact of Return Revision on Future Performance

Admittedly, we care about what factors are related or drive the revisions of previously reported returns in hedge funds. We are more concerned about the impact of such revisions on the future performance of funds experienced return revisions. As in Section 4, we investigate the impact of return revisions from the perspectives of fund level and revision level.

3.5.1 Performance Comparison at the Fund Level

First, we follow the approach adopted by Patton, Ramadorai, and Streatfield (2013). In each month, we allocate funds to unrevised group vs. revised group. If a fund has never revised its returns up till a point in time, then the fund is classified as unrevised fund at this time point. A fund is categorized as revised fund at the point when it revises its returns for the first, and would remain in the revised group ever since. Therefore, at each time period, the unrevised portfolio includes the returns of all funds that have never revised their returns and the returns of the revised funds prior to their first revisions. The revised portfolio contains the returns of the revised funds after their first revisions. For each portfolio, we equally weight all monthly returns of funds, and obtain two time series of portfolio returns. Next, we compare the performance of the two portfolios by computing the differences of the two time series of portfolio returns and regressing the differences on the Fung-Hsieh 7-factor model. The two numbers in the upper left corner of Table 27 Panel A are the results of this process. The alpha is negative but insignificant, which means that the risk-adjusted performance of the unrevised funds is poorer than that of revised funds, but the difference is not significant. We also define unrevised funds and revised funds in a slightly different way. From Table 19 Panel F we know that over 70% of the revisions occurred within 3 months of initial reporting are revisions to previously estimated returns. We then treat funds with all the revisions occurred in 3 months of first reporting always as unrevised funds. The effective revised funds are those funds after their first return revisions that occurred more than 3 months after they are initially reported (Revised Funds 2 in Table 27). The alpha is negligibly small at 0.4% and

statistically insignificant. There, unlike Patton, Ramadorai, and Streatfield (2013), we have not found that funds experienced revision would underperform unrevised funds when we employ the same approach to compare their performance. From the results we obtained thus far we may conclude that the revisions are innocuous and provide no information about future performance. In the following, we provide reasons on why we find different results from Patton et al. (2013).

We first compare the performances of revised funds before and after their first revisions to further examine the impact of return revision on fund performance. Unfortunately we find that, compared to the performance prior to their first revisions, the performance of those same funds become significantly worse after their first return revisions. Is a return revision an omen of deleterious future fund performance? Or is this a coincidence of the trend that hedge fund alpha decrease over time documented by Fung, Hsieh, Naik, and Ramadorai (2007), Naik, Ramadorai, and Stromqvist (2007), and Zhong (2008)? One possible explanation of the decreasing alpha is capacity constraint hypothesis. In fact we find that the average size of the revised funds after their first revisions are significant larger than the average size of the funds prior to their first revisions.

Next, we compare the performance of revised funds prior to their first revisions with that of the unrevised funds which only contain the funds that have never revised their returns. We find that the former significantly outperforms the latter funds. In a different comparison, we also find that the unrevised funds when only contain the funds that have never revised their returns significantly underperform revised funds after their first revisions. But previously we found that the unrevised funds when defined as the

funds including all funds that have never revised their returns and the funds prior to their first revisions show no significant difference in performance compared to the revised funds after their first revision. It is reasonable for us to wonder whether the significant overperformance of the unrevised funds evidenced in Patton, Ramadorai, and Streatfield (2013) is driven by the super performance of the revised funds prior to their first revision.

As mentioned above, we cannot draw a conclusive conclusion that the underperformance of revised funds after their first revisions compared to that prior to first revisions result from the revisions. We would like to compare the performance of the unrevised funds and revised funds in the same period. But we cannot classify the unrevised funds into earlier period and post-revision period as we classify the revised funds since the unrevised funds have never revised their returns. To address this issue, we firstly calculate the percentage time point of lifecycle for funds in each month over our sample period. For example, if fund A reported returns from January 2002 to December 2008. It revised its return(s) in March 2003 which is the 15^{th} month of its lifecycle in our sample period. The percentage time point of this revision is 25% or 0.25. Similarly, we can calculate the percentage time point of lifecycle for each fund in each month. We calculate the average percentage points in time for all the first revision of the revised funds and use this average percentage time point to allocate funds into unrevised funds and revised funds prior to or after their first revisions. Then we compare their performances. The alphas and *t*-statistics are reported in Panel B of table 27. Like the revised funds, unrevised funds after their first hypothetical first revisions significantly underperform the unrevised funds prior to the hypothetical revisions. The revised funds prior to their average first revision time point significantly outperform unrevised funds

prior to the same average revision time point. The same is true for the funds after their hypothetical revisions. In addition to the average percentage points in time of revision, we also employ different hypothetical revision percentage time points. The results always hold that the revised funds outperform the unrevised in the same period of their lifecycle. The positive impact of revisions on the future performance of revised funds leads us to conclude that the revisions are a sign of honesty, in the sense that funds correct their past errors or inaccuracy in return evaluation.

3.5.2. Performance Comparison at Revision Level

Our unique dataset allows us to investigate the impact of return revisions at the individual revision level. Specifically, we carry out event study to compare the cumulative average abnormal returns (CAARs) of the revised funds and matched unrevised funds in 12 months before the revisions and 12 months after the revisions. Our focus is on the 12-month event window after revisions.

To avoid the compounding effect of multiple revisions, we dropped the revisions with other revisions 12 months before or 12 months after the revisions. We require the funds that experience the revisions have all the 24 months in our 24-month event window. The requirement is the same for the matched funds. In the end, we obtain 7,072 revisions that occurred more than 3 months after they are initially reported and 7,072 matched revisions. We first calculate monthly abnormal return for each fund revision as fund excess return minus the Fung-Hsieh 7-factor realization times loadings estimated over the 36-month estimation period prior to the revision. Based on the monthly abnormal return for each fund, we compute the cumulative average abnormal returns over the 24-month

event window and 12-month after revision window for the revised funds and matched unrevised funds, respectively. The results are presented in Figure 9.

Similar to the comparison at the fund level, we find that in the 24-month event window and in the 12-month after revisions, the CAARs of the revised funds are higher than those of the matched unrevised funds, no matter the revision is upward or downward. The higher performance of revised funds at the revision level again signifies that the revisions are not indicators of either poor operational controls or dishonesty. On the contrary, it may indicate a motivation to correct past inaccuracy in the return estimation following standard hedge fund operation.

3.6 Robustness Checks

In this section, we present the results of a series of robustness checks to our main findings reported in Sections 3, 4, and 5.

3.6.1 Different Governance Measure

As presented in Section 3, we find that funds with stronger governance are more likely to revise past returns. We posit that stronger governance restrains funds from manipulating performance. Our governance is measured by the aggregated variable composed of dummy variables of audit, high-water mark provision, country domicile, and SEC registration. Even though high-water mark provision closely aligns managerial incentives with those of the limited partners in the hedge fund, and thus improves the governance structure, it may also provide managers with strong incentives to manipulate return report in order to collect higher or collect earlier incentive fees, as evidenced by

Agarwal, Daniel, and Naik (2011) and Patton, Ramadorai, and Streatfield (2013). Therefore, we construct another governance measure which excludes high-water mark provision from our original governance measure. We carry out the probit and OLS regressions with the new governance variable and high-water mark provision as explanatory variables in order to locate the determinants of revision, revision direction, and revision magnitude. The results are shown in Panels A of Tables 28, 30, and 31, as well as Panels A1, B1, and C1 of table 29. Our main finding hold true with this new governance measure. It worth pointing out that from Table 30 Panel A, we see that funds with high-water marks are more likely to revise past returns both upward and downward. Unlike Patton, Ramadorai, and Streatfield (2013), we haven't found the evidence that the funds with high-water marks intend to revise downward, whereas funds without high-water marks revise upwards.

3.6.2 Exclude Funds of Funds

Funds of funds invest in hedge funds of different strategies. They revise their past returns whenever their holding hedge funds revise their past returns. In this case, the revisions of funds of funds are corrections of past returns. Funds of funds may also have stronger governance as they perform due diligence in their investment. It is possible that our main findings are dominated by funds of funds. To check whether our findings are affected by funds of funds, we carry out the analyses using the sample funds without funds of funds. The results are reported in Panels B of Tables 28, 30, and 31, as well as Panels A2, B2, and C2 of table 29. Figure 10 Panel A also present the results of performance comparison

without funds of funds in our analysis. Our findings remain true even excluding funds of funds from our samples.

3.6.3 Different Measures of Returns

One concern remains that the higher future performance of revised funds may be attributable to a few extreme returns. To address the issue, we compare the differences of median returns between the revised funds and unrevised funds. The results are reported in Table 32. From the table we can see that the better performance of revised funds is not driven by the extreme high performance of a few revised funds.

One may also worry that the better performance of hedge funds that revised their returns result from the more upward revisions in our sample. Therefore, we compare the performance of unrevised funds and revised funds using their initially reported return rather than their most recently reported return as in our previous analysis. The results are shown in Figure 10 Panel B. Our findings hold when using the first reported return. The better performance is not attributable to the higher number and percentage of positive revisions.

3.7 Conclusion

In this paper, we investigate the dynamics in the performance report of hedge funds and try to shed light on the determinants of return revisions. We track changes to the statements of historical performance of about 9,500 hedge funds recorded in publicly available databases (TASS), at different points in time between 2002 and 2013.

We find that as many as two-thirds of funds (over 6,500 individual funds) revised their previously reported performance, with more than two-fifths of funds later changing a previous monthly return by at least 0.5%. On average, more than one-fifth of monthly returns were revised after being first reported. Positive revisions are more common than negative revisions.

We test whether the return revisions in number or percentage are evenly distributed among the 12 calendar return months. We find that the uneven distribution of revisions to the returns in 12 calendar months occurred in the early half of our sample period. We also find that the average number of revisions to increase the returns of December is significantly larger than that to decrease the returns of December. This finding may provide an alternative explanation for the December spike detected in the literature on hedge fund misreporting.

We find an obvious decreasing time trend in both the number and proportion of return revisions, even after adjusting for performance report recency. The declining trend is accompanied by the strengthening of hedge fund governance. We find that revisions are more common among larger funds with stronger governance, higher incentive fee, and better past performance. At the micro-level, the returns are more likely to be revised for older funds with stronger governance and managers' co-investment in funds prior to the return being first reported, while the return revisions tend to occur in the next month when a fund with higher governance score has better past performance. Return revisions also tend to happen when a fund have stronger governance and become more liquid and more volatile compared to the fund in the month when the return was first reported. These drivers of return revisions are significant no matter the revisions are to increase or

decrease the previously reported returns. Therefore, we find a strong connection between return revisions and desirable fund characteristics at the overall fund level, the individual fund level, and the individual revision level. The comparison between the hedge funds that have revised their returns with those that have not shows that revised funds outperform the unrevised funds no matter the comparisons are at the fund level or the revision level. Our findings hold under various robustness checks.

These findings suggest that correction may be a plausible explanation for the return revisions in hedge fund performance report. We have not found any direct evidence that hedge fund managers manipulate returns.

Table 18. Fund Characteristics Summary

Panel A. Summary Statistics Year by Year (2002–2013), based on the First Reported Returns

Year	# of Funds	Equal-weighted hedge fund portfolio monthly returns (%)				
		Mean	Median	Std.dev.	Minimum	Maximum
2002	3128	0.236	0.545	0.926	-1.534	1.542
2003	3581	1.389	1.163	0.986	-0.226	3.488
2004	4084	0.670	0.779	1.250	-1.411	2.926
2005	4677	0.730	1.292	1.371	-1.554	1.971
2006	5148	0.988	1.326	1.424	-1.686	3.323
2007	5379	0.954	0.941	1.531	-1.878	3.103
2008	5349	-1.644	-1.947	2.666	-6.381	1.854
2009	4637	1.422	1.300	1.567	-0.945	4.808
2010	4405	0.745	0.919	1.747	-2.969	3.098
2011	4074	-0.523	-0.333	1.691	-3.584	1.966
2012	3544	0.493	0.614	1.237	-2.154	2.434
2013	2896	0.728	0.881	1.053	-1.710	2.428

Panel B. Summary Statistics Year by Year (2002–2013), based on Last Reported Returns

Year	# of Funds	Equal-weighted hedge fund portfolio monthly returns (%)				
		Mean	Median	Std.dev.	Minimum	Maximum
2002	3128	0.246	0.555	0.934	-1.560	1.557
2003	3581	1.397	1.180	0.995	-0.233	3.509
2004	4084	0.673	0.776	1.255	-1.407	2.924
2005	4677	0.733	1.300	1.372	-1.552	1.968
2006	5148	1.005	1.346	1.434	-1.682	3.370
2007	5379	0.963	0.929	1.529	-1.854	3.135
2008	5349	-1.671	-1.970	2.689	-6.444	1.856
2009	4637	1.423	1.307	1.579	-0.942	4.835
2010	4405	0.751	0.920	1.769	-2.996	3.150
2011	4074	-0.537	-0.326	1.712	-3.641	2.014
2012	3544	0.493	0.613	1.250	-2.193	2.449
2013	2896	0.710	0.899	1.071	-1.743	2.440

Panel C. Cross-sectional Statistics (Over Sample Period: 2002–2013)

	N	Mean	Median	Std.dev	Minimum	Maximum
Average monthly return over the life of the fund (%) First Reported	9494	0.330	0.403	1.262	-17.074	17.397
Average monthly return over the life of the fund (%) Last reported	9494	0.327	0.402	1.272	-22.087	17.397
Average monthly AUM over the life of the fund(millions$)	7652	149.04	38.09	414.02	0.001	15516.67
Age of the fund(# of months in existence)	9492	80.60	66.00	56.72	1.00	480.00
Management fee (%)	9472	1.45	1.50	0.63	0.00	22.00
Incentive fee (%)	9441	15.10	20.00	7.88	0.00	50.00

Table 18 Panel A and Panel B report the number of hedge funds and the mean, median, standard deviation, minimum, and maximum monthly returns on the equal-weighted hedge fund portfolio. The statistics of returns in Panel A and Panel B are based on the returns reported for the first time and the returns that were reported for the last time in the snapshots, respectively. Panel C reports the cross-sectional mean, median, standard deviation, minimum, and maximum statistics for hedge fund characteristics including returns, size, age, management fee, and incentive fee. The first two rows of the table are average monthly return over the life of the fund based on the returns reported for the first time and the returns that were reported for the last time in the snapshots, respectively. The sample period is from January 2002–December 2013

Table 19. Revision Summary

Panel A. Fund Revision Summary

# of Changes	Number of Funds	Percentage	Cumulative Percentage
0	2,927	30.83%	30.83%
1	1,059	11.15%	41.98%
2	667	7.03%	49.01%
3~13	2,439	25.69%	74.70%
14~38	1,472	15.50%	90.20%
39~90	742	7.82%	98.02%
91~398	188	1.98%	100.00%

Panel B. Fund Revision Magnitude

		at least 0.01%	at least 0.1%	at least 0.5%	at least 1%
All Revisions	Funds	6567	5806	4145	3155
	% of Funds	69.17%	61.15%	43.66%	33.23%
Revisions Occur 3 Months Later	Funds	3660	2825	1830	1389
	% of Funds	38.55%	29.76%	19.28%	14.63%

Panel C. Summary Statistics for the Distribution of all Revisions

	Revisions	Absolute Revisions	Positive Revisions	Negative Revisions
Count	119017	119017	63651	55366
Mean	0.008%	0.645	0.603	-0.693
Meandian	0.02	0.105	0.103	-0.107
95th	1.164	2.541	2.305	-0.02
5th	-1.213	0.02	0.02	-2.812
Std Dev.	3.215	3.149	3.011	3.3

Panel D. Return Revision Direction Comparison

		2002-2013		2002-2007		2008-2013	
		Increase	Decrease	Increase	Decrease	Increase	Decrease
All Revisions	Average Number of Monthly Revisions	445.1	387.2	521.9	404.9	367.2	369.2
	T value of Mean Equality Test	3.49		5.93		0.09	
Revisions Occurred More than 3 Months Later	Average Number of Monthly Revisions	148	144.9	192.9	184.8	100.5	102.6
	T value of Mean Equality Test	0.43		2.04		0.22	

Panel E. Recency of Revisions

	1 or more months	more than 3 months	more than 6 months	more than 12 months	more than 24 months
Funds	6,531	3,642	2,618	1,744	1,074
% of Funds	100%	55.76%	40.09%	26.70%	16.44%
Revisions	119,017	41,010	31,488	23,267	15,507
% of Revisions	100%	34.46%	26.46%	19.55%	13.03%

Panel F. Return Status in Revisions

Revision		Estimated or Actual Returns before and After Revision					
		Missing	AA	AE	EA	EE	Total
Revisons in 3 months	# of Revisions	29	22,695	456	46,250	8,577	78,007
	% of Total Revisions	0.02	19.07	0.38	38.86	7.21	65.54
Revisions after 3 months	# of Revisions		34,393	1,065	3,866	1,686	41,010
	% of Total Revisions		28.9	0.89	3.25	1.42	34.46
Total	# of Revisions	29	57,088	1,521	50,116	10,263	119,017
	% of Total Revisions	0.02	47.97	1.28	42.11	8.62	100

Panel G. Proportion of Revisions in Style

-	Convertible Arbitrage	Dedicated Short Bias	Emerging Markets	Equity Market Neutral	Event Driven	Fixed Income Arbitrage
Percentage of revisions in the same style	22.34	19.49	17.51	19.15	20.75	23.56
Percentage of all the revisions	2.71	0.52	6.76	3.84	7.68	3.63
	Fund of Funds	Global Macro	Long/Short Equity hedge	Managed Futures	Multi-strategy	Other
Percentage of revisions in the same style	22.46	16.79	15.4	22.74	13.86	16.48
Percentage of all the revisions	34.93	3.67	21.05	7.52	4.76	2.92

This table shows summary statistics of changes in returns reported at different points in time. Panel A reports the number of funds with different number of changes in reported returns. Panel B shows the proportion of revising funds with at least one revision that is at least as large as the size thresholds listed, Panel C shows various percentiles of (positive, negative and net) revisions, and their absolute values. Panel D shows the average number of returns that were increased and decreased compared to the previously reported returns in each month over the time periods from 2002 to 2013, from 2002 to 2007, and from 2008 to 2013. It also shows the t-value of the equality test of the average number of revisions in the direction of increase and decrease in each month. Panel E shows the proportions of revising funds with at least one revision that relates to a return that is at least as old as the "recency" thresholds listed, Panel F shows the proportions of revisions with the return status listed. AA indicates that the actual return as stated by fund manager before the revision and is still to actual return after the revision; AE indicates the return revision is from actual return as stated by fund manager to estimated return and EA indicates exactly the opposite; and EE indicates revision from estimated return to estimated return. Panel G shows return revisions of hedge funds in each style as the percentage of the number of all the funds in each style and as the percentage of all the revisions.

Table 20. Calendar Distribution of Revisions

Panel A. All Revisions

	Revisions in Numbers			Revisions in Percentage		
	2002-2013	2002-2007	2008-2013	2002-2013	2002-2007	2008-2013
1	959.25	1048.83	869.67	25.57	28.57	22.56
2	859.00	916.67	801.33	22.88	24.83	20.94
3	865.17	972.67	757.67	22.83	25.92	19.75
4	846.08	937.00	755.17	22.24	24.76	19.73
5	835.00	944.50	725.50	21.99	24.68	19.30
6	843.42	918.00	768.83	22.12	23.85	20.38
7	807.58	918.33	696.83	21.35	23.72	18.97
8	754.83	822.50	687.17	19.71	20.74	18.68
9	778.92	894.83	663.00	20.25	22.79	17.71
10	786.25	871.00	701.50	20.65	22.01	19.30
11	759.50	897.67	621.33	19.81	22.49	17.13
12	897.91	979.33	800.20	23.18	24.57	21.51
F	0.55	0.28	0.28	1.79	6.26	0.63
P-Value	0.8609	0.9847	0.983	0.0795	<0.0001	0.7817

Panel B. Revisions Occurred More than 3 Months Later

	Revisions in Numbers			Revisions in Percentage		
	2002-2013	2002-2007	2008-2013	2002-2013	2002-2007	2008-2013
1	352.75	448.17	257.33	9.53	12.62	6.45
2	320.17	407.00	233.33	8.59	11.33	5.85
3	309.17	405.17	213.17	8.33	11.24	5.41
4	297.83	398.00	197.67	7.95	10.89	5.00
5	284.50	384.67	184.33	7.56	10.42	4.70
6	283.33	380.50	186.17	7.45	10.18	4.71
7	279.92	377.83	182.00	7.35	10.05	4.64
8	260.25	343.67	176.83	6.79	9.07	4.50
9	277.18	337.00	205.40	7.19	8.82	5.23
10	276.09	335.00	205.40	7.14	8.66	5.33
11	263.64	335.17	177.80	6.82	8.65	4.61
12	306.27	380.83	216.80	7.98	9.88	5.70
F	0.44	11.65	0.16	0.54	1.95	0.24
P-Value	0.929	<0.001	0.9983	0.8687	0.0845	0.9914

Panel C. Comparison of Number of Revisions in Different Directions between Different Calendar Months

			2002-2013		2002-2007		2008-2013	
			Increase	Decrease	Increase	Decrease	Increase	Decrease
All Revisions	Jan	Mean	515.9	443.3	587.2	461.7	444.7	425
		F value	1.64		2.71		0.06	
	Feb	Mean	459.3	399.7	520.8	395.8	397.8	403.5
		F value	1.59		4.72*		0.01	
	Nov	Mean	404.5	355	507.7	390	301.3	320
		F value	0.6		2.63		0.04	
	Dec	Mean	503.2	394.6	582.3	397	408.4	391.8
		F value	3.09*		7.15**		0.03	
Revisions Occurred More than 3 Months Later	Jan	Mean	175.8	177	222.7	225.5	128.8	128.5
		F value	0		0.15		0	
	Feb	Mean	161.8	158.4	206.5	200.5	117	116.3
		F value	0.02		0.6		0	
	Nov	Mean	130.5	133.2	169.5	165.7	83.6	94.2
		F value	0.01		0.24		0.1	
	Dec	Mean	157	149.27	202.2	178.7	102.8	114
		F value	0.09		4.41*		0.08	

This table reports the results of ANOVA to test the equality of mean revisions to the returns in different calendar months. The revisions are in numbers or in proportion. Panels A and B report the results of ANOVA to test the equality of means of the return revisions among the 12 calendar months. Panel A includes all the return revisions and Panel B only includes the revisions that occurred 3 months after the return months. Panel C reports the paired ANOVA tests of the equality of the means of revisions to increase the returns and those to decrease the returns of January, February, November, and December. Statistical significance of 1, 5, and 10% is indicated by ***, **, and *, respectively.

Table 21. Average Number and Proportion of Return Revision in Each Year

Panel A. Original Average Monthly Number and Proportion of Return Revision in Each Year

		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Overall
Original Revision	# of Revisions	367	373	354	368	392	412	345	308	208	150	107	50	286
	% of Revisions	13.31	11.63	9.74	8.9	8.7	8.63	7.57	7.57	5.33	4.16	3.44	1.88	7.57

Panel B: Average Adjusted Number and Proportion of Return Revision in Each Year

		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Overall
Original Revision	# of Revisions	367	373	355	370	397	420	357	323	224	167	124	62	295
	% of Revisions	13.31	11.64	9.76	8.95	8.8	8.8	7.83	7.96	5.74	4.62	3.99	2.33	7.81

Table 4 Panel A shows the average monthly number of returns and proportion of returns that have been revised more than three months after the return month in each year during our sample period. The average monthly number of return revision in each year is calculated as the mean of the 12 monthly numbers of return revisions in each year. The proportion of return revisions in each month is the number of revisions to the returns of that month as a percentage of the total number returns of that month. The average monthly proportion of return revision in each year is calculated as the mean of the 12 monthly proportions of return revisions in each year. Panel B shows the average monthly number of returns and proportion of returns that have been revised later than three months after the return month in each year during our sample period. The number and proportion of returns that have been revised are adjusted for the return report recency using the adjust factor shown in Panel B.

Table 22. Determinants of Average Proportion of Return Revision in Each Year

	Gov1	Mfee	Ifee	Levid	Notice	Lockup	Personalcapid	Waterid	Return	Stdret	Size	Age
Coeff.	-0.173	-0.580	0.053	0.774	-0.015	-0.040	0.700	-0.524	0.146	-0.172	0.029	-0.003
Sig.	***	***	***	***	***	**	***	***			**	***
Adj. R	0.317	0.397	0.499	0.304	0.724	0.026	0.510	0.570	0.000	0.000	0.026	0.791

This table shows the univariate regression of average monthly percentage of return revision in each year on average monthly characteristic of all funds in each year. The percentage of returns is the proportion of returns that have been revised more than three months after the return month in each year during our sample period. In panel B, the number and proportion of returns that have been revised are adjusted for the return report recency using the adjust factor shown in Figure 7 Panel B. Governance is calculated as the sum of four individual governance variables: auditing, high-water mark, country of domicile, and SEC. The variable auditing is equal to one if a fund reports a completed financial audit in the past 6 months or in the next 6 months. High-water mark variable is equal to 1 when there is a high-water mark provision for charging incentive fee. The variable representing country of domicile is an indicator variable equal to one if the fund is offshore. Sec is a variable equal to 1 if a fund is registered with the SEC. Mfee and Ifee give the magnitude of management and incentive fees, respectively. Levid is an indicator variable equal to 1 when the fund uses leverage. The variables Notice denotes the fund's redemption notice period (in days). Lockup is the period (in months) over which investors cannot withdraw their investment. Personalcapid is an indicator variable set to 1 when fund managers invest personal capital in the fund. Return is the return of a month reported in that month. Stdret is the standard deviation of the fund's returns in the past 12 months. Age is defined as the number of months between a fund's observation date and its inception date. Size is defined as the logarithm of asset under management. Statistical significance of 1, 5, and 10% is indicated by ***, **, and *, respectively.

Table 23. Determinants of Return Revisions at Individual Fund Level

	Ordered Probit		Probit		Probit Increase		Probit Decrease	
Governance1	15.34 ***	9.5 ***	16.11 ***	7.58 **	15.73 ***	7.7 **	16.48 ***	7.5 **
Mfee		-8.77 **		-4.5		-5.54		-4.12
Ifee		1.79 ***		1.95 ***		1.64 ***		2.19 ***
Levid		6.64		10.08 **		12.44 **		7.09
Notice		0.28 ***		0.14 *		0.18 *		0.08
Lockup		0.08		0.6		0.94 *		0.32
Personalcapid		12.17 ***		12.28 **		12.04 *		14.42 **
Theta		-10.7 **		-8.01		-15.92 ***		-3.04
Meanreturn		27.43 ***		29.68 ***		31.04 ***		29.95 ***
Stdret		-1.56 *		-1.33		-4.08 ***		0.89
Meansize		8.63 ***		9.57 ***		11.1 ***		8.56 ***
Style effect	Y	Y	Y	Y	Y	Y	Y	Y
R square	0.0359	0.1338	0.033	0.1177	0.0346	0.1335	0.0287	0.1097

This table reports the effects of covariates on the probability of a hedge fund's return revisions. In the ordered probit regression, the dependent variable is 4 if a fund changed its returns more than 20 times, 3 if the number of revisions is between 7 and 20, 2 if the times of revisions is between 3 and 6, 1 if the number of revisions is 1 or 2, and 0 is a fund have never revised its returns. In the probit regression, the dummy variable dependent variable equals to one if the fund has revised its returns at least once, 0 otherwise. In the probit increase regression, the dependent variable is 1 if all the return revisions of a fund sum up to be positive, 0 if the fund has never revised its returns. . In the probit decrease regression, the dependent variable is 1 if all the return revisions of a fund sum up to be negative, 0 if the fund has never revised its returns. The revisions in this table are those that occurred more than 3 months after the return months. Governance is calculated as the sum of four individual governance variables: auditing, high-water mark, country of domicile, and SEC. The variable auditing is equal to one if a fund reports a completed financial audit in the past 6 months or in the next 6 months. High-water mark variable is equal to 1 when there is a high-water mark provision for charging incentive fee. The variable representing country of domicile is an indicator variable equal to one if the fund is offshore. Sec is a variable equal to 1 if a fund is registered with the SEC. Mfee and Ifee give the magnitude of management and incentive fees, respectively. Levid is an indicator variable equal to 1 when the fund uses leverage. The variables Notice denotes the fund's redemption notice period (in days). Lockup is the period (in months) over which investors cannot withdraw their investment. Persncapid is an indicator variable set to 1 when fund managers invest personal capital in the fund. The variables Governance, Mfee, Ifee, levid, Notice, Lockup, and Personalcapid of a fund that has revised its returns are defined by the characteristics in the months prior to the first return revision. While these variables of an unrevised fund are defined by the characteristics in the months prior to the last return. Theta denotes fund asset liquidity which is measured using the equation developed in Getmansky, Lo, and Makarov (2004). Meanreturn of a fund that has revised its returns is the average of the returns in the months prior to the first return revision. Meanreturn of a unrevised fund is the average of the returns in the months prior to the last return. Stdret of a fund that has revised its returns is the standard deviation of the fund's returns in the months prior to the first return revision. Stdret of a unrevised fund is the standard deviation of the returns in the months prior to the last return. Meansize of a fund that has revised its returns is the average of the sizes in the months prior to the first return revision. Meansize of a unrevised fund is the average of the sizes in the months prior to the last return. Size is defined as the logarithm of asset under management. All independent variables are divided by 100. Statistical significance of 1, 5, and 10% is indicated by ***, **, and *, respectively.

Table 24. Determinants of Return Revision at Individual Revision Level

Panel A. Return Month Characteristics

	$X_{\text{Return Month}}$ 2002-2013		$X_{\text{Return Month}}$ 2002-2007		$X_{\text{Return Month}}$ 2008-2013	
Governance1	8.51 ***	3.24 ***	6.4 ***	2.82 **	11.84 ***	6.40 ***
Mfee		-1.84		-0.81		-3.92 *
Ifee		-0.43 ***		-0.55 ***		-0.27
levid		-0.50		0.09		-0.47
Notice		0.05		-0.19 ***		0.29 ***
Lockup		0.22 *		0.27		0.06
Personalcapid		6.60 ***		5.25 **		6.05 **
meanreturn		2.41 ***		5.77 ***		0.28
Autocorr		11.39 ***		-5.49		24.24 ***
Stdret		1.59 ***		0.56		1.96 ***
Flow3		0.01		-4.51		0.01
age		0.05 ***		0.04 **		0.06 **
R square	0.0036	0.0054	0.0021	0.0075	0.0068	0.0169

Panel B. The Month before Revision Month Characteristics

	$X_{Revison\ Month-1}$ 2002-2013				$X_{Revison\ Month-1}$ 2002-2007				$X_{Revison\ Month-1}$ 2008-2013			
Governance1	11.97	***	9.71	***	19.6	***	14.63	***	8.02	***	5.76	***
Mfee			-2.97	**			-6.04	***			-0.81	
Ifee			-1.05	***			-0.16				-1.35	***
levid			-4.90	***			-5.12	**			-6.09	***
Notice			0.09	***			0.07				0.07	**
Lockup			0.12				0.70	***			-0.15	
Personalcapid			1.73				-2.40				8.20	***
meanreturn			5.47	***			8.63	***			5.26	***
Autocorr			-5.18	*			-24.93	***			5.13	
Stdret			2.04	***			0.12				2.08	***
Flow3			-0.24	***			28.03	***			-0.25	***
age			0.02	*			-0.07	***			0.03	**
R square	0.0067		0.0183		0.0176		0.0342		0.003		0.0156	

Panel C. The Change of Characteristics between the Return Month and the Month before Revision Month

	$X_{Revison\ Month-1} - X_{Return\ Month}$ 2002-2013		$X_{Revison\ Month-1} - X_{Return\ Month}$ 2002-2007		$X_{Revison\ Month-1} - X_{Return\ Month}$ 2008-2013	
Governance1	8.24 ***	18.65 ***	1.33	11.07 ***	11.38 ***	21.85 ***
Mfee		-23.75 ***		10.1		-26.54 ***
Ifee		0.44 ***		-0.497 **		0.76 ***
levid		2.12		-21.84		5.30
Notice		-0.16 *		-0.64 ***		-0.08
Lockup		0.19		-0.402		0.41
Personalcapid		-17.65 ***		-30.51 **		-15.09 **
meanreturn		-0.02		-0.01		-0.04
Autocorr		-20.91 ***		-2.8		-25.67 ***
Stdret		1.55 ***		2.85 **		1.37 ***
Flow3		0		9.19 **		-0.01
Age		0.174 **		-0.67 ***		0.22 ***
R square	0.001	0.0127	0	0.0107	0.0021	0.0202

This table reports the results of probit regression of return revision dummy on fund characteristics in monthly level. We match each hedge fund with size data which revised its return at month s to the return of month t to the hedge fund which has the same strategy and the nearest asset size in the same return month and same month as the fund revised its return but did not revise its return at month s to the return of month t. The dependent variable is a dummy variable equal to 1 if a fund revised its return at month s to the return of month t and 0 for the matched fund. In Panel A, the independent variables are defined by the funds' characteristics at return month t. In Panel B, the independent variables are defined by the funds' characteristics at return revision month s. In Panel C, the independent variables are differences between the variables corresponding variables defined by the funds' characteristics at return month t and return revision month s. Governance is calculated as the sum of four individual governance variables: auditing, high-water mark, country of domicile, and SEC. The variable auditing is equal to one if a fund reports a completed financial audit in the past 6 months or in the next 6 months. High-water mark variable is equal to 1 when there is a high-water mark provision for charging incentive fee. The variable representing country of domicile is an indicator variable equal to one if the fund is offshore. Sec is a variable equal to 1 if a fund is registered with the SEC. Mfee and Ifee give the magnitude of management and incentive fees, respectively. Levid is an indicator variable equal to 1 when the fund uses leverage. The variables Notice denotes the fund's redemption notice period (in days). Lockup is the period (in months) over which investors cannot withdraw their investment. Persncapid is an indicator variable set to 1 when fund managers invest personal capital in the fund. Meanreturn12 is the average of the fund's returns in the past 12 months. Meanreturn3 is the average of the fund's returns in the past 3 months. Autocorr is first order autocorrelation in the past 3 months. Autocorr is first order autocorrelation in the past 12 months. Stdret is the standard deviation of the fund's returns in the past 12 months. Flow3 is the capital flow in the past 3 months. Age is defined as the number of months between a fund's observation date and its inception date. All independent variables except Meanreturn and Stdret are divided by 100. Statistical significance of 1, 5, and 10% is indicated by ***, **, and *, respectively.

Table 25. Determinants of Return Revision Direction

	$X_{Return\ Month}$		$X_{Revison\ Month-1}$		$X_{Revison\ Month-1} - X_{Return\ Month}$	
	Increase	Decrease	Increase	Decrease	Increase	Decrease
Governance1	2.99 **	5.74 **	8.9 ***	8.83 ***	22.53 ***	14.36 ***
Mfee	-3.36 *	-0.425	-2.46	-1.25	-23.87 ***	-23.95 ***
Ifee	-0.31 *	-0.91 ***	-0.50 ***	-0.65 ***	0.24	0.63 ***
levid	0.67	-2.45	-4.35 **	-2.26	-8.70	15.01 *
Notice	0.01	0.14 **	0.04 **	0.11 ***	-0.22	-0.10
Lockup	0.61 ***	-0.33	0.51 ***	-0.22	0.14	0.35
Personalcapid	11.7 ***	2.12	5.88 ***	-2.12	-25.69 ***	-8.50
Meanreturn12	1.11	6.07 ***	3.19 ***	6.15 ***		
Meanreturn3			0.00		0.01	-0.06
Autocorr	0.14 ***	0.14	0.00	-0.14 ***	-0.18 ***	-0.24 ***
Stdret	0.94 **	3.69 ***	1.71 ***	1.78 ***	1.74 ***	1.27 ***
Flow3	0.31	-0.80	0.32	-0.40	-0.30	0.27
Age	0.04 **	0.08 **	0.04 **	0.06 ***	0.12 **	0.23 ***
R square	0.0063	0.0077	0.013	0.0157	0.0149	0.012

This table reports the results of logistic regression of direction dummy of return revision on fund characteristics in monthly level. We match each hedge fund with size data which revised its return at month s to the return of month t to the hedge fund which has the same strategy and the nearest asset size in the same return month and same month as the fund revised its return but did not revise its return at month s to the return of month t. In the columns of "Increase", the dependent variable is a dummy variable equal to 1 if a fund reported its return at month s to the return of month t is greater than what it previous reported, and 0 for the matched fund. In the columns of "Decrease", the dependent variable is a dummy variable equal to 1 if a fund reported its return at month s to the return of month t is smaller than what it previous reported, and 0 for the matched fund. In the first two columns, the independent variables are defined by the funds' characteristics at return month t. In the third and fourth columns, the independent variables are defined by the funds' characteristics at return revision month s. In last two columns, the independent variables are differences between the variables corresponding variables defined by the funds' characteristics at return month t and return revision month s. Governance is calculated as the sum of four individual governance variables: auditing, high-water mark, country of domicile, and SEC. The variable auditing is equal to one if a fund reports a completed financial audit in the past 6 months or in the next 6 months. High-water mark variable is equal to 1 when there is a high-water mark provision for charging incentive fee. The variable representing country of domicile is an indicator variable equal to one if the fund is offshore. Sec is a variable equal to 1 if a fund is registered with the SEC. Mfee and Ifee give the magnitude of management and incentive fees, respectively. Levid is an indicator variable equal to 1 when the fund uses leverage. The variables Notice denotes the fund's redemption notice period (in days). Lockup is the period (in months) over which investors cannot withdraw their investment. Persncapid is an indicator variable set to 1 when fund managers invest personal capital in the fund. Meanreturn is the average of the fund's returns in the past 12 months. Autocorr is first order autocorrelation in the past 12 months. Meanreturn3 is the average of the fund's returns in the past 12 months. Autocorr is first order autocorrelation in the past 3 months. Stdret is the standard deviation of the fund's returns in the past 12 months. Flow3 is the capital flow in the past 3 months. Age is defined as the number of months between a fund's observation date and its inception date. All independent variables except Meanreturn and Stdret are divided by 100. Statistical significance of 1, 5, and 10% is indicated by ***, **, and *, respectively.

Table 26. Determinants of Revision Magnitude

	$X_{Return\ Month}$		$X_{Revison\ Month-1}$		$X_{Revison\ Month-1} - X_{Return\ Month}$	
Governance1	20.96	***	23.43	***	124.76	***
Mfee	90.43	***	7.39		-538.20	***
Ifee	-4.63	***	-5.96	***	1.44	*
levid	46.81	***	25.04	***	-93.78	***
Notice	-0.54	***	-0.37	***	2.36	***
Lockup	-2.31	***	-1.49	***	9.23	***
Personalcapid	20.85	**	18.04	**	-84.35	**
meanreturn12	3.51		1.51			
meanreturn3					0.51	
Autocorr	-0.44	*	-64.68	***	-0.17	
Stdret	17.56	***	11.47	***	1.37	
Flow3	0.05		-14.60		0.06	
age	-0.27	***	0.01		1.23	***
R square	0.0277		0.0205		0.1024	

This table reports the results of OLS regression of magnitude of return revision on fund characteristics in monthly level. We match each hedge fund with size data which revised its return at month s to the return of month t to the hedge fund which has the same strategy and the nearest asset size in the same return month and same month as the fund revised its return but did not revise its return at month s to the return of month t. The dependent variable is the absolute value of the revision a fund made at month s to the return of month t. The dependent variable equals to 0 for the matched fund. In the first column, the independent variables are defined by the funds' characteristics at return month t. In the second column, the independent variables are defined by the funds' characteristics at return revision month s. In last column, the independent variables are differences between the variables corresponding variables defined by the funds' characteristics at return month t and return revision month s. Governance is calculated as the sum of four individual governance variables: auditing, high-water mark, country of domicile, and SEC. The variable auditing is equal to one if a fund reports a completed financial audit in the past 6 months or in the next 6 months. High-water mark variable is equal to 1 when there is a high-water mark provision for charging incentive fee. The variable representing country of domicile is an indicator variable equal to one if the fund is offshore. Sec is a variable equal to 1 if a fund is registered with the SEC. Mfee and Ifee give the magnitude of management and incentive fees, respectively. Levid is an indicator variable equal to 1 when the fund uses leverage. The variables Notice denotes the fund's redemption notice period (in days). Lockup is the period (in months) over which investors cannot withdraw their investment. Persncapid is an indicator variable set to 1 when fund managers invest personal capital in the fund. Meanreturn12 is the average of the fund's returns in the past 12 months. Autocorr is first order autocorrelation in the past 12 months. Meanreturn3 is the average of the fund's returns in the past 12 months. Autocorr is first order autocorrelation in the past 3 months. Stdret is the standard deviation of the fund's returns in the past 12 months. Flow3 is the capital flow in the past 3 months. Age is defined as the number of months between a fund's observation date and its inception date. All independent variables except Meanreturn and Stdret are divided by 100. Statistical significance of 1, 5, and 10% is indicated by ***, **, and *, respectively.

Table 27. Fund Level Performance Comparisons

Panel A. Portfolios Based on Actual Revision Points

				Revised Funds 2	
			Rvised Funds 1	prior to First Revision	post First Revision
	Unrevised Funds 1	Alpha	-0.014		
			(-0.59)		
	Unrevised Funds 2	Alpha			0.004
					(0.14)
	Unrevised Funds 3	Alpha		-0.359 ***	-0.072 **
				(-13.35)	(-2.56)
Revised Funds 2	prior to First Revision	Alpha			0.167 ***
					(4.71)

Panel B. Portfolios Based on Average Revision Points

			Unrevised Funds 2	Revised Funds 2	
			post Average Revision Point	prior to Average Revision Point	post Average Revision Point
Unrevised Funds 2	prior to Average Revision Point	Alpha	0.158 **	-0.261 ***	
			(3.62)	(-3.5)	
	post Average Revision Point	Alpha			-0.242 ** *
					(-7.22)
Revised Funds 2	prior to Average Revision Point	Alpha			0.175 **
					(-2.34)

This table reports the estimated alpha from regression of the difference in returns between the unrevised fund portfolio and revised fund portfolio from January 2002 December 2013 on Fung-Hsiech 7-factor model. The difference in returns is between the portfolio in the left column and the portfolio on the upper row. Unrevised funds 1 include all unrevised funds and all revised funds prior to first revisions. Unrevised funds 2 include all unrevised funds, revised funds with all revisions in 3 months after first reporting, and other revised funds prior to first revisions. Unrevised funds 3 include all unrevised funds. Revised Funds 1 include all revised funds after their first revisions no matter whether the first revisions occurred within 3 months of initial reporting or more than 3 months after the initial reporting. Revised Funds 2 include revised funds after the first revisions occurred more than 3 months after initial reporting. Average revision point is the average of the percentages of fund lifecycle over our sample period. Regression alphas are shown, with t-statistics in parentheses beneath them. Statistical significance of 1, 5, and 10% is indicated by ***, **, and *, respectively.

Table 28. Robustness Check: Determinants of Return Revisions at Individual Fund Level

Panel A. Difference Governance Measure

	Ordered Probit		Probit		Probit Increase		Probit Decrease	
Governance2	18.27 ***	14.54 ***	18.09 ***	11.77 ***	18.97 ***	11.96 ***	17.09 ***	11.16 **
Mfee		-8.39 **		-4.23		-5.33		-3.78
Ifee		2.09 ***		2.21 ***		1.89 ***		2.42 ***
Waterid		-1.05		-1.13		-1.45		0.06
Levid		7.19 *		10.57 **		13.12 **		7.41
Notice		0.29 ***		0.15 *		0.19 **		0.09
Lockup		0.11		0.61		0.93 *		0.33
Personalcapid		10.67 **		11.08 **		10.97 *		13.38 **
Theta		-10.72 **		-7.94		-15.95 ***		-2.82
Meanreturn		27.17 ***		29.41 ***		30.86 ***		29.66 ***
Stdret		-1.54 *		-1.3		-4.03 ***		0.9
Meansize		8.73 ***		9.64 ***		11.17 ***		8.63 ***
Style effect	Y	Y	Y	Y	Y	Y	Y	Y
R square	0.034	0.1356	0.0349	0.1186	0.033	0.1345	0.0253	0.1104

Panel B. Excluding Funds of Funds

	Ordered Probit		Probit		Probit Increase		Probit Decrease	
Governance1	9.17 ***	4.81	10.45 ***	2.39	7.63 ***	0.97	13.06 ***	2.76
Mfee		-12.08 ***		-10.85 **		-8.89		-13.27 **
Ifee		2.21 ***		2.41 ***		2.1 ***		2.65 ***
Levid		8.07		12.64 **		20.72 ***		4.53
Notice		0.04		-0.1		-0.01		-0.18
Lockup		-0.05		0.61		0.68		0.61
Personalcapid		5.28		4.73		0.24		10.69
Theta		-8.09 *		-5.87		-10.85 **		-2.25
Meanreturn		24.85 ***		26.57 ***		29.23 ***		26.46 ***
Stdret		-0.29		-0.53		-2.87 **		1.51
Meansize		7.82 ***		8.1 ***		9.53 ***		6.98 ***
Style effect	Y	Y	Y	Y	Y	Y	Y	Y
R square	0.035	0.0862	0.033	0.1032	0.0359	0.117	0.0307	0.1004

This table reports the effects of covariates on the probability of a hedge fund's return revisions. In the ordered probit regression, the dependent variable is 4 if a fund changed its returns more than 20 times, 3 if the number of revisions is between 7 and 20, 2 if the times of revisions is between 3 and 6, 1 if the number of revisions is 1 or 2, and 0 is a fund have never revised its returns. In the probit regression, the dummy variable dependent variable equals to one if the fund has revised its returns at least once, 0 otherwise. In the probit increase regression, the dependent variable is 1 if all the return revisions of a fund sum up to be positive, 0 if the fund has never revised its returns. . In the probit decrease regression, the dependent variable is 1 if all the return revisions of a fund sum up to be negative, 0 if the fund has never revised its returns. The revisions in this table are those that occurred more than 3 months after the return months. Governance is calculated as the sum of four individual governance variables: auditing, high-water mark, country of domicile, and SEC. The variable auditing is equal to one if a fund reports a completed financial audit in the past 6 months or in the next 6 months. High-water mark variable is equal to 1 when there is a high-water mark provision for charging incentive fee. The variable representing country of domicile is an indicator variable equal to one if the fund is offshore. Sec is a variable equal to 1 if a fund is registered with the SEC. Mfee and Ifee give the magnitude of management and incentive fees, respectively. Levid is an indicator variable equal to 1 when the fund uses leverage. The variables Notice denotes the fund's redemption notice period (in days). Lockup is the period (in months) over which investors cannot withdraw their investment. Persncapid is an indicator variable set to 1 when fund managers invest personal capital in the fund. The variables Governance, Mfee, Ifee, levid, Notice, Lockup, and Personalcapid of a fund that has revised its returns are defined by the characteristics in the months prior to the first return revision. While these variables of an unrevised fund are defined by the characteristics in the months prior to the last return. Theta denotes fund asset liquidity which is measured using the equation developed in Getmansky, Lo, and Makarov (2004). Meanreturn of a fund that has revised its returns is the average of the returns in the months prior to the first return revision. Meanreturn of a unrevised fund is the average of the returns in the months prior to the last return. Stdret of a fund that has revised its returns is the standard deviation of the fund's returns in the months prior to the first return revision. Stdret of a unrevised fund is the standard deviation of the returns in the months prior to the last return. Meansize of a fund that has revised its returns is the average of the sizes in the months prior to the first return revision. Meansize of a unrevised fund is the average of the sizes in the months prior to the last return. Size is defined as the logarithm of asset under management. All independent variables are divided by 100. Statistical significance of 1, 5, and 10% is indicated by ***, **, and *, respectively.

Table 29. Robustness Check: Determinants of Return Revision at Individual Revision Level

Panel A. Return Month Characteristics

Panel A.1. Different Governance Measure

	$X_{\text{Return Month}}$ 2002-2013		$X_{\text{Return Month}}$ 2002-2007		$X_{\text{Return Month}}$ 2008-2013	
Governance2	8.2 ***	2.17 *	5.98 ***	2.56	11.29 ***	3.57 *
Mfee		-1.90		-0.82		-3.85 *
Ifee		-0.47 ***		-0.56 ***		-0.44 **
Waterid		5.40 ***		3.29		14.08 ***
levid		-0.64		0.06		-0.94
Notice		0.05		-0.19		0.28 ***
Lockup		0.21		0.26		0.07
Personalcapid		6.97 ***		5.33 **		6.67 **
meanreturn		2.43 ***		5.76 ***		0.41
Autocorr		11.14 ***		-5.57		24.35 ***
Stdret		1.59 ***		0.57		2.02 ***
Flow3		0.00		-4.49		0.00
age		0.05 ***		0.04 **		0.07 ***
R square	0.0021	0.0055	0.0011	0.0075	0.0042	0.0176

Panel A.2. Excluding Funds of Funds

	$X_{\text{Return Month}}$ 2002-2013		$X_{\text{Return Month}}$ 2002-2007		$X_{\text{Return Month}}$ 2008-2013	
Governance1	6.92 ***	3.33 ***	6.29 ***	3.55 **	7.6 ***	5.79 ***
Mfee		1.97		2.04		1.29
Ifee		0.91 ***		0.94 ***		1.12 ***
levid		-3.84 *		-2.39		-4.83
Notice		0.05		-0.16 ***		0.22 ***
Lockup		-0.16		-0.03		-0.38 *
Personalcapid		9.51 ***		10.55 ***		6.10 *
meanreturn		3.39 ***		6.64 ***		1.18 *
Autocorr		0.19 ***		0.01		0.39 ***
Stdret		1.50 ***		1.06 **		1.24 ***
Flow3		0.02		-855.00 **		0.01
age		0.07 **		0.07 ***		0.08 ***
R square	0.0023	0.0106	0.0019	0.0138	0.0026	0.0184

Panel B. The Month before Revision Month Characteristics

Panel B.1. Different Governance Measure

	$X_{Revison\ Month-1}$ 2002-2013		$X_{Revison\ Month-1}$ 2002-2007		$X_{Revison\ Month-1}$ 2008-2013	
Governance2	13.12 ***	7.84 ***	21.73 ***	14.14 ***	9.10 ***	4.61 ***
Mfee		-2.98 **		-6.04 ***		-0.80
Ifee		-1.14 ***		-0.18		-1.42 ***
Waterid		14.04 ***		15.64 ***		8.70 ***
levid		-5.11 ***		-5.17 **		-6.25 ***
Notice		0.08 ***		0.07		0.07 **
Lockup		0.11		0.69 ***		-0.15
Personalcapid		2.26		-2.23		8.44 ***
meanreturn		5.48 ***		8.60 ***		5.27 ***
Autocorr		-5.70 *		-25.04 ***		4.81
Stdret		2.02 ***		0.15		2.06 ***
Flow3		-0.24 ***		28.04 ***		-0.25 ***
age		0.03 *		-0.07 ***		0.04 ***
R square	0.0051	0.0143	0.013	0.0342	0.0025	0.0195

Panel B.2. Excluding Funds of Funds

	$X_{Revison\ Month-1}$ 2002-2013		$X_{Revison\ Month-1}$ 2002-2007		$X_{Revison\ Month-1}$ 2008-2013	
Governance1	9.3 ***	6.86 ***	17.66 ***	10.96 ***	4.13 ***	2.71 **
Mfee		2.38 *		-2.83		4.91 ***
Ifee		-0.05		0.34		-0.26
levid		-6.47 ***		-3.27 ***		-9.01 ***
Notice		0.16 ***		0.09 *		0.17 ***
Lockup		-0.27 **		0.32		-0.56 ***
Personalcapid		4.67 ***		-6.07 **		13.75 ***
meanreturn		5.72 ***		9.24 ***		4.88 ***
Autocorr		-17.10 ***		-47.41 ***		-2.14
Stdret		2.26 ***		1.16 **		2.21 ***
Flow3		-0.46 ***		32.33 ***		-0.51 ***
age		0.02		-0.04		0.03 *
R square	0.0038	0.0199	0.014	0.0362	0.0007	0.0224

Panel C. The Change of Characteristics between the Return Month and the Month before Revision Month

Panel C.1. Different Governance Measure

	$X_{Revison\ Month-1} - X_{Return\ Month}$ 2002-2013		$X_{Revison\ Month-1} - X_{Return\ Month}$ 2002-2007		$X_{Revison\ Month-1} - X_{Return\ Month}$ 2008-2013	
Governance2	8.26 ***	18.1 ***	0.58	-0.067	12.00 ***	27.28 ***
Mfee		-23.93 ***		5.97		-24.89 ***
Ifee		0.44 ***		-0.476 **		0.76 ***
Waterid		20.10 ***		49.93 ***		9.06 *
levid		2.08		-17.51		5.89
Notice		-0.16 *		-0.57 **		-0.06
Lockup		0.19		-0.49		0.47
Personalcapid		-17.76 ***		-27.36 **		-13.83 **
meanreturn		-0.02		-0.02		-0.04
Autocorr		-0.21 ***		-2.52		-25.81 ***
Stdret		1.55 ***		3.04 ***		1.38 ***
Flow3		0		9.21 **		0.00
Age		0.17 ***		-0.81 ***		0.24 ***
R square	0.001	0.0127	0	0.0149	0.0018	0.0208

Panel C.2. Excluding Funds of Funds

	$X_{Revison\ Month-1} - X_{Return\ Month}$ 2002-2013		$X_{Revison\ Month-1} - X_{Return\ Month}$ 2002-2007		$X_{Revison\ Month-1} - X_{Return\ Month}$ 2008-2013	
Governance1	4.7 ***	15.92 ***	-2.78	12.54 ***	8.70 ***	17.92 ***
Mfee		-16.55 ***		10.13		-18.81 ***
Ifee		-1.20 ***		-1.08 ***		-1.22 ***
levid		12 *		-8.34		16.85 **
Notice		0.03		-0.63 **		0.13
Lockup		0.16		-1.09		0.57
Personalcapid		-24.53 ***		-34.21 **		-20.93 ***
meanreturn		-0.09		0.00		-0.13 *
Autocorr		-0.3 ***		-0.16 *		-0.34 ***
Stdret		1.81 ***		3.17 ***		1.60 ***
Flow3		0		0.14 ***		0.00
Age		0.10 **		-0.53 ***		0.12 **
R square	0.0003	0.0153	0.0001	0.0132	0.0012	0.0208

This table reports the results of probit regression of return revision dummy on fund characteristics in monthly level. We match each hedge fund with size data which revised its return at month s to the return of month t to the hedge fund which has the same strategy and the nearest asset size in the same return month and same month as the fund revised its return but did not revise its return at month s to the return of month t. The dependent variable is a dummy variable equal to 1 if a fund revised its return at month s to the return of month t and 0 for the matched fund. In Panel A, the independent variables are defined by the funds' characteristics at return month t. In Panel B, the independent variables are defined by the funds' characteristics at return revision month s. In Panel C, the independent variables are differences between the variables corresponding variables defined by the funds' characteristics at return month t and return revision month s. Governance is calculated as the sum of four individual governance variables: auditing country of domicile, and SEC. The variable auditing is equal to one if a fund reports a completed financial audit in the past 6 months or in the next 6 months. High-water mark variable is equal to 1 when there is a high-water mark provision for charging incentive fee. The variable representing country of domicile is an indicator variable equal to one if the fund is offshore. Sec is a variable equal to 1 if a fund is registered with the SEC. Mfee and Ifee give the magnitude of management and incentive fees, respectively. Levid is an indicator variable equal to 1 when the fund uses leverage. The variables Notice denotes the fund's redemption notice period (in days). Lockup is the period (in months) over which investors cannot withdraw their investment. Persncapid is an indicator variable set to 1 when fund managers invest personal capital in the fund. Meanreturn12 is the average of the fund's returns in the past 12 months. Meanreturn3 is the average of the fund's returns in the past 3 months. Autocorr is first order autocorrelation in the past 3 months. Autocorr is first order autocorrelation in the past 12 months. Stdret is the standard deviation of the fund's returns in the past 12 months. Flow3 is the capital flow in the past 3 months. Age is defined as the number of months between a fund's observation date and its inception date. All independent variables except Meanreturn and Stdret are divided by 100. Statistical significance of 1, 5, and 10% is indicated by ***, **, and *, respectively.

Table 30. Robustness Check: Determinants of Return Revision Direction

Panel A: Different Governance Measure

	$X_{Return\ Month}$				$X_{Revison\ Month-1}$				$X_{Revison\ Month-1} - X_{Return\ Month}$			
	Increase		Decrease		Increase		Decrease		Increase		Decrease	
Governance2	2.41		1.94		8.60	***	7.73	***	21.19	***	14.63	***
Mfee	-3.39	*	-0.34		-2.47		-1.26		-24.39	***	-23.88	***
Ifee	-0.336	*	-0.63	***	-0.52	***	-0.70	***	0.24		0.63	***
Waterid	4.17		6.91	**	9.59	***	11.41	***	26.10	***	13.67	**
levid	0.59		-1.72		-4.39	**	-2.39		-8.70		15.05	*
Notice	0.01		0.08	*	0.04		0.11	***	-0.22		-0.10	
Lockup	0.60	***	-0.22		0.51	***	-0.22		0.12		0.35	
Personalcapid	11.91	***	1.88		5.98	***	-1.80		-26.10	***	-8.47	
Meanreturn12	1.11		3.84	***	3.20	***	6.16	***				
Meanreturn3									0.01		-0.06	
Autocorr	0.14	***	8.53		0.30		-0.15	***	-0.19	***	-0.24	***
Stdret	0.95	**	2.31	***	1.70	***	1.76	***	1.74	***	1.27	***
Flow3	0.32		-0.40		0.32		-0.40		-0.30		0.27	
Age	0.05	**	0.06	**	0.04	**	0.06	***	0.12	**	0.23	***
R square	0.0063		0.0079		0.013		0.0158		0.0149		0.012	

Panel B. Excluding Funds of Funds

	$X_{Return\ Month}$		$X_{Revison\ Month-1}$		$X_{Revison\ Month-1} - X_{Return\ Month}$	
	Increase	Decrease	Increase	Decrease	Increase	Decrease
Governance1	1.91	4.79 ***	4.3 ***	9.24 ***	18.28 ***	13.37 ***
Mfee	0.99	2.87	2.59	2.40	-19.80 ***	-13.13 **
Ifee	1.04 ***	0.77 ***	0.70 ***	0.38	-1.40 ***	-1.04 ***
levid	-1.73	-5.83 **	-5.58 **	-7.52 ***	5.31	18.73 **
Notice	-0.01	0.11 **	0.07 *	0.18 ****	-0.04	0.09
Lockup	0.16	-0.51 **	0.16	-0.50 ***	0.16	0.19
Personalcapid	16.81 ***	2.29	9.49 ***	-2.23	-36.30 ***	-13.27
Meanreturn12	1.65 **	5.19 ***	3.15 ***	6.53 ***		
Meanreturn3					-0.05	-0.14
Autocorr	0.24 ***	0.14 **	-0.05	-0.21 ***	-0.26 ***	-0.34 ***
Stdret	1.01 **	2.05 ***	1.93 ***	1.84 ***	1.87 ***	1.67 ***
Flow3	0.33	-0.40	0.33	-10.00	-0.30	157.00
Age	0.07 ***	0.07 ***	0.03	0.05 **	0.06	0.14 **
R square	0.0114	0.0143	0.0122	0.0215	0.0183	0.0141

This table reports the results of logistic regression of direction dummy of return revision on fund characteristics in monthly level. We match each hedge fund with size data which revised its return at month s to the return of month t to the hedge fund which has the same strategy and the nearest asset size in the same return month and same month as the fund revised its return but did not revise its return at month s to the return of month t. In the columns of "Increase", the dependent variable is a dummy variable equal to 1 if a fund reported its return at month s to the return of month t is greater than what it previous reported, and 0 for the matched fund. In the columns of "Decrease", the dependent variable is a dummy variable equal to 1 if a fund reported its return at month s to the return of month t is smaller than what it previous reported, and 0 for the matched fund. In the first two columns, the independent variables are defined by the funds' characteristics at return month t. In the third and fourth columns, the independent variables are defined by the funds' characteristics at return revision month s. In last two columns, the independent variables are differences between the variables corresponding variables defined by the funds' characteristics at return month t and return revision month s. Governance is calculated as the sum of four individual governance variables: auditing, high-water mark, country of domicile, and SEC. The variable auditing is equal to one if a fund reports a completed financial audit in the past 6 months or in the next 6 months. High-water mark variable is equal to 1 when there is a high-water mark provision for charging incentive fee. The variable representing country of domicile is an indicator variable equal to one if the fund is offshore. Sec is a variable equal to 1 if a fund is registered with the SEC. Mfee and Ifee give the magnitude of management and incentive fees, respectively. Levid is an indicator variable equal to 1 when the fund uses leverage. The variables Notice denotes the fund's redemption notice period (in days). Lockup is the period (in months) over which investors cannot withdraw their investment. Persncapid is an indicator variable set to 1 when fund managers invest personal capital in the fund. Meanreturn is the average of the fund's returns in the past 12 months. Autocorr is first order autocorrelation in the past 12 months. Meanreturn3 is the average of the fund's returns in the past 12 months. Autocorr is first order autocorrelation in the past 3 months. Stdret is the standard deviation of the fund's returns in the past 12 months. Flow3 is the capital flow in the past 3 months. Age is defined as the number of months between a fund's observation date and its inception date. All independent variables except Meanreturn and Stdret are divided by 100. Statistical significance of 1, 5, and 10% is indicated by ***, **, and *, respectively.

Table 31. Robustness Check: Determinants of Revision Magnitude

Panel A. Different Governance Measure

	$X_{Return\ Month}$		$X_{Revison\ Month-1}$		$X_{Revison\ Month-1} - X_{Return\ Month}$	
Governance2	36.58	***	14.49	***	30.03	*
Mfee	90.49	***		***		***
Ifee	-3.99	***	-8.06	***	1.63	**
Waterid	-12.96		58.08	***	354.51	***
levid	49.73	***	35.47	***	-90.70	***
Notice	-0.47	**	-0.54	***	2.26	***
Lockup	-2.18	**	-1.22	**	6.22	**
Personalcapid	15.45		30.83	***	-115.01	***
meanreturn12	3.10		4.84	**		
meanreturn3					0.67	**
Autocorr	-0.39	*	-0.62	***	-0.21	***
Stdret	17.66	***	6.44	***	0.87	***
Flow3	0.04		-33.00		0.06	
age	-0.32	***	0.13	**	0.97	**
R square	0.0286		0.0213		0.1135	

Panel B. Excluding Funds of Funds

	$X_{Return\ Month}$		$X_{Revison\ Month-1}$		$X_{Revison\ Month-1} - X_{Return\ Month}$	
Governance1	-7.27	*	-13.70	***	1.13	
Mfee	8.71	*	14.55	***	17.15	
Ifee	-3.81	***	-2.89	***	2.99	***
levid	23.66	***	-6.69		-20.83	
Notice	0.12		0.11		-0.71	
Lockup	-2.10	***	-0.72	**	3.68	***
Personalcapid	-3.02		12.98	***	8.93	
meanreturn12	-1.16		1.88			
meanreturn3					0.21	
Autocorr	-0.51	***	-0.49	***	-0.02	
Stdret	11.56	***	4.92	***	2.89	***
Flow3	-0.06		-2471.90	***	0.09	
age	-0.14	***	-0.10	**	0.36	**
R square	0.0251		0.0221		0.0079	

This table reports the results of OLS regression of magnitude of return revision on fund characteristics in monthly level. We match each hedge fund with size data which revised its return at month s to the return of month t to the hedge fund which has the same strategy and the nearest asset size in the same return month and same month as the fund revised its return but did not revise its return at month s to the return of month t. The dependent variable is the absolute value of the revision a fund made at month s to the return of month t. The dependent variable equals to 0 for the matched fund. In the first column, the independent variables are defined by the funds' characteristics at return month t. In the second column, the independent variables are defined by the funds' characteristics at return revision month s. In last column, the independent variables are differences between the variables corresponding variables defined by the funds' characteristics at return month t and return revision month s. Governance is calculated as the sum of four individual governance variables: auditing, high-water mark, country of domicile, and SEC. The variable auditing is equal to one if a fund reports a completed financial audit in the past 6 months or in the next 6 months. High-water mark variable is equal to 1 when there is a high-water mark provision for charging incentive fee. The variable representing country of domicile is an indicator variable equal to one if the fund is offshore. Sec is a variable equal to 1 if a fund is registered with the SEC. Mfee and Ifee give the magnitude of management and incentive fees, respectively. Levid is an indicator variable equal to 1 when the fund uses leverage. The variables Notice denotes the fund's redemption notice period (in days). Lockup is the period (in months) over which investors cannot withdraw their investment. Persncapid is an indicator variable set to 1 when fund managers invest personal capital in the fund. Meanreturn12 is the average of the fund's returns in the past 12 months. Autocorr is first order autocorrelation in the past 12 months. Meanreturn3 is the average of the fund's returns in the past 12 months. Autocorr is first order autocorrelation in the past 3 months. Stdret is the standard deviation of the fund's returns in the past 12 months. Flow3 is the capital flow in the past 3 months. Age is defined as the number of months between a fund's observation date and its inception date. All independent variables except Meanreturn and Stdret are divided by 100. Statistical significance of 1, 5, and 10% is indicated by ***, **, and *, respectively.

Table 32. Robustness Check: Fund Level Performance Comparisons

Panel A. Regressions on Median Return Differences of Portfolios Based on Actual Revision Points

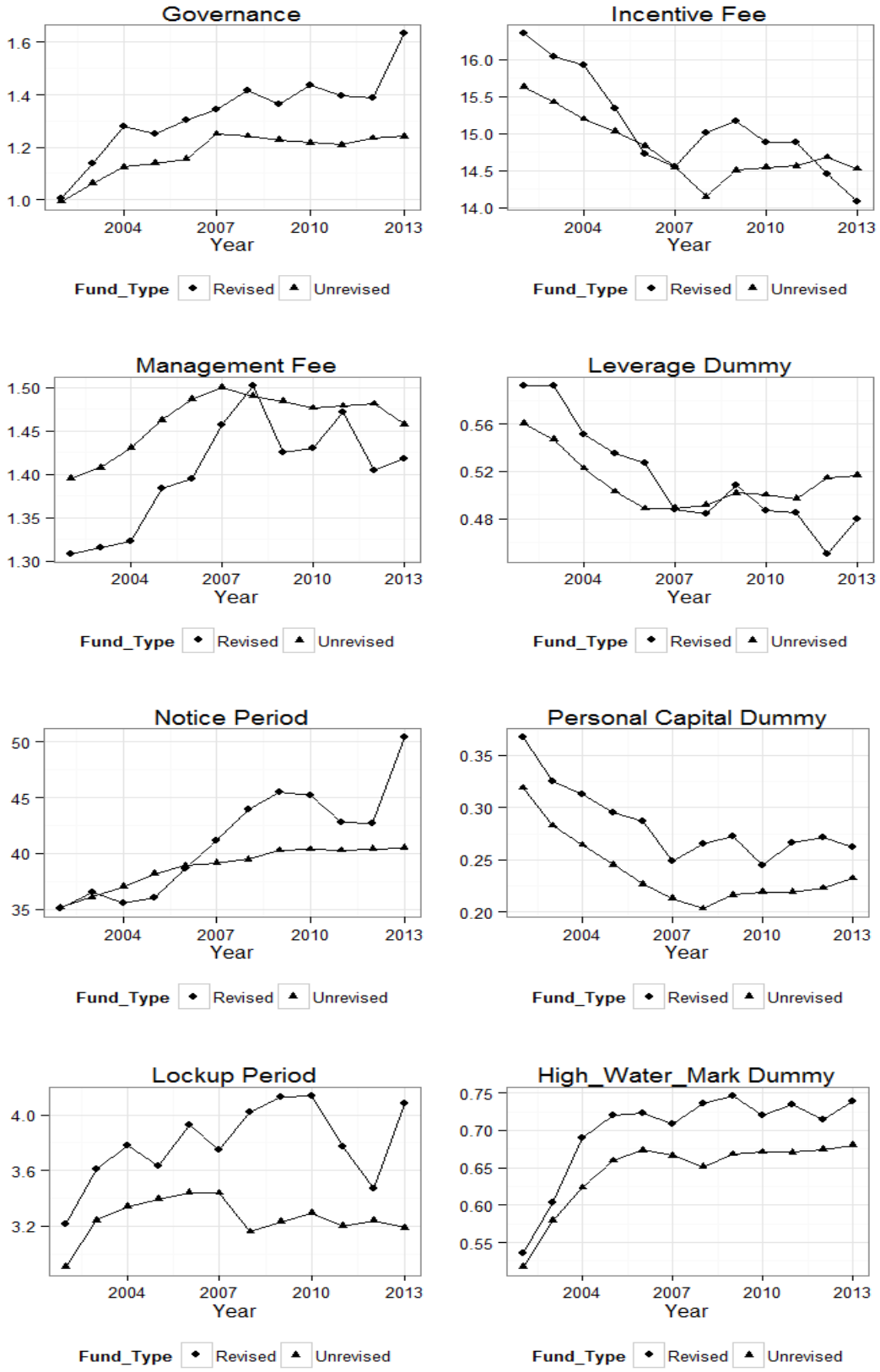
			Revised Funds 2		
			Rvised Funds 1	prior to First Revision	post First Revision
	Unrevised Funds 1	Alpha	-0.054 ***		
			(-2.96)		
	Unrevised Funds 2	Alpha			-0.041 *
					(-1.8)
	Unrevised Funds 3	Alpha		-0.254 ***	-0.080 ***
				(-14.38)	(-3.55)
Revised Funds 2	prior to First Revision	Alpha			0.055 **
					(2.07)

Panel B. Regressions on Median Return Differences of Portfolios Based on Average Revision Points

			Unrevised Funds 2	Revised Funds 2	
			post Average Revision Point	prior to Average Revision Point	post Average Revision Point
Unrevised Funds 3	prior to Average Revision Point	Alpha	0.094 **	-0.189 ***	
			(3.57)	(-2.64)	
	post Average Revision Point	Alpha			-0.183 ***
					(-8.51)
Revised Funds 2	prior to Average Revision Point	Alpha			0.100
					(-1.38)

This table reports the estimated alpha from regression of the difference in returns between the unrevised fund portfolio and revised fund portfolio from January 2002 December 2013 on Fung-Hsiech 7-factor model. The difference in returns is between the portfolio in the left column and the portfolio on the upper row. Unrevised funds 1 include all unrevised funds and all revised funds prior to first revisions. Unrevised funds 2 include all unrevised funds, revised funds with all revisions in 3 months after first reports, and other revised funds prior to first revisions. Unrevised funds 3 include all unrevised funds. Revised Funds 1 include all revised funds.
Revised Funds 2 include revised funds with revisions occurred more than 3 months after first reports. Average revision point is the average of the percentages of fund lifecycle over our sample period. Regression alphas are shown, with t-statistics in parentheses beneath them. Statistical significance of 1, 5, and 10% is indicated by ***, **, and *, respectively.

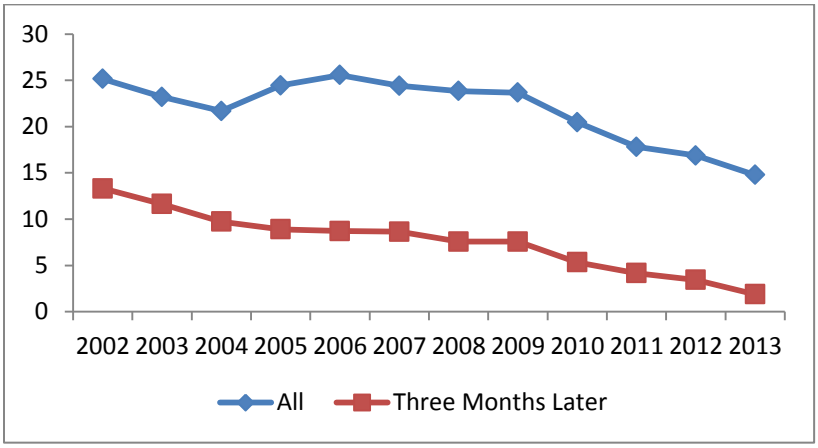
Figure 7. Average Monthly Characteristic of All Funds in Each Year



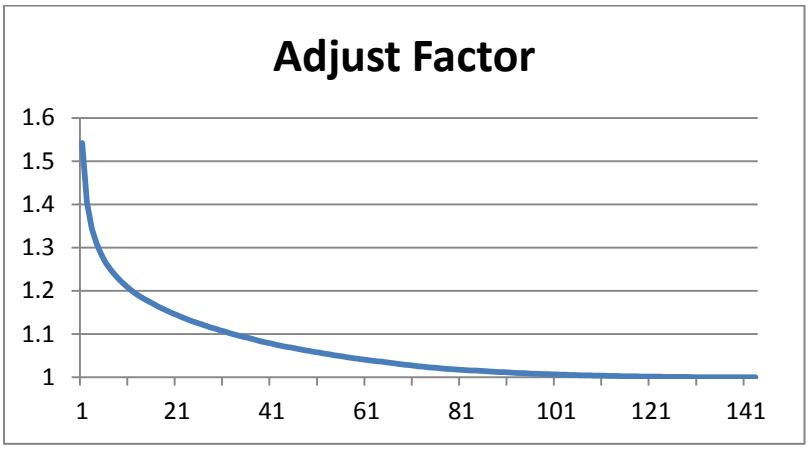
This figure shows average monthly characteristic of all funds in each year. The monthly characteristic is the average of the funds' characteristics in each month. The revised funds are funds whose returns are revised more than 3 months after they are first reported. Unrevised funds are the rest of the funds. Governance is calculated as the sum of four individual governance variables: auditing, high-water mark, country of domicile, and SEC. The variable auditing is equal to one if a fund reports a completed financial audit in the past 6 months or in the next 6 months. High-water mark variable is equal to 1 when there is a high-water mark provision for charging incentive fee. The variable representing country of domicile is an indicator variable equal to one if the fund is offshore. Sec is a variable equal to 1 if a fund is registered with the SEC. Management Fee and Incentive Fee give the magnitude of management and incentive fees, respectively. Leverage dummy is an indicator variable equal to 1 when the fund uses leverage. Notice period denotes the fund's redemption notice period (in days). Lockup is the period (in months) over which investors cannot withdraw their investment. Personal capital dummy is an indicator variable set to 1 when fund managers invest personal capital in the fund.

Figure 8. Average Monthly Revision Percentage in Each Year

Panel A. Original Average Monthly Revision Percentage in Each Year



Panel B. Adjust Factor for Performance Report Recency



Panel C. Adjusted Average Monthly Revision Percentage in Each Year

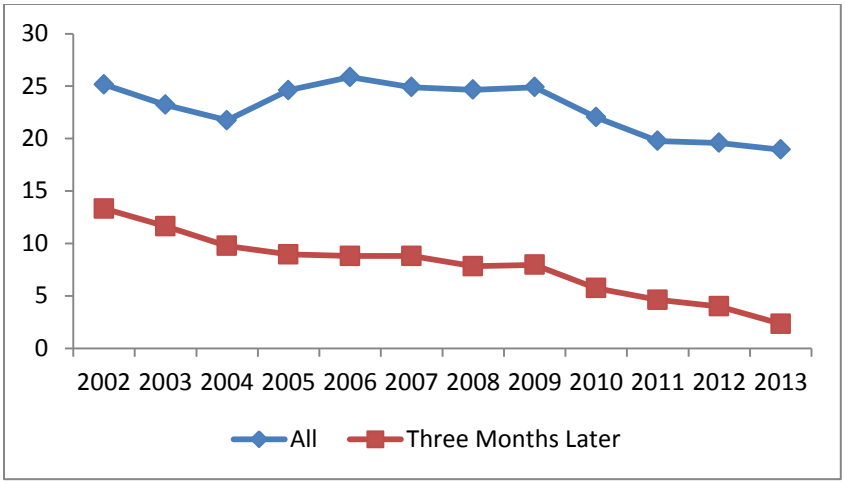
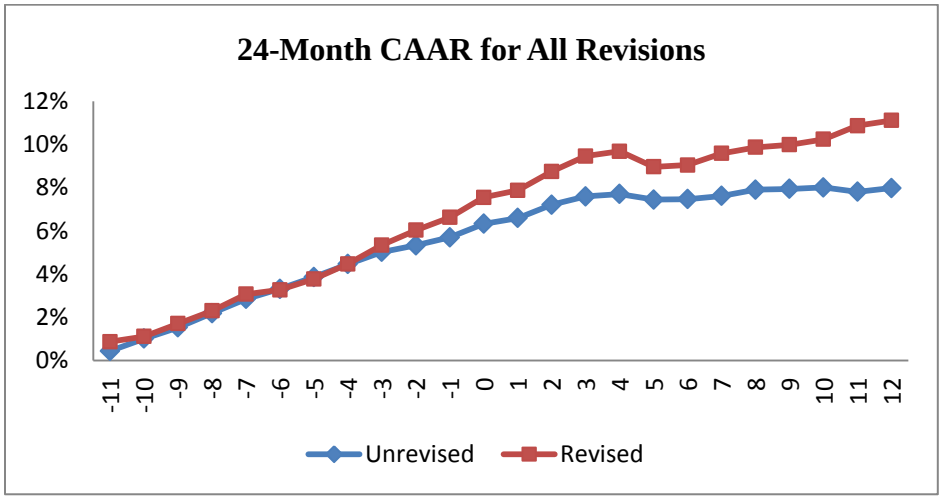
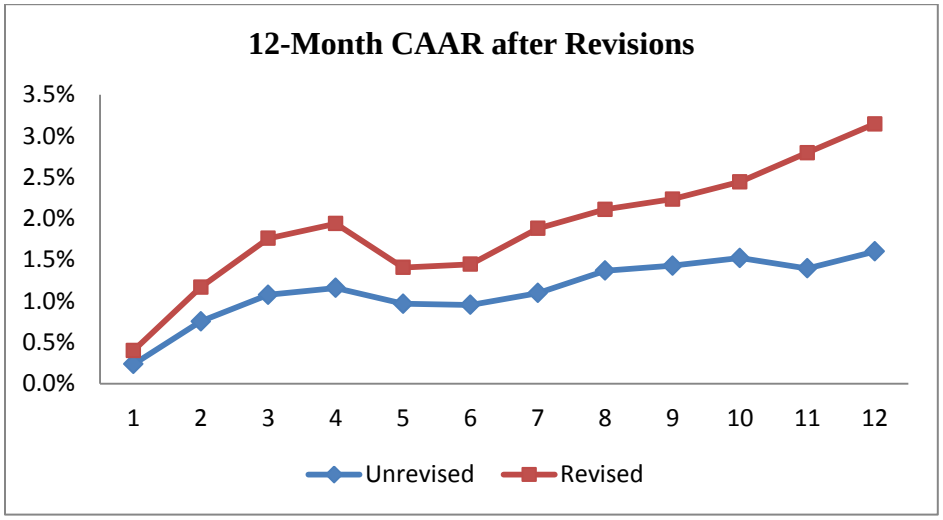
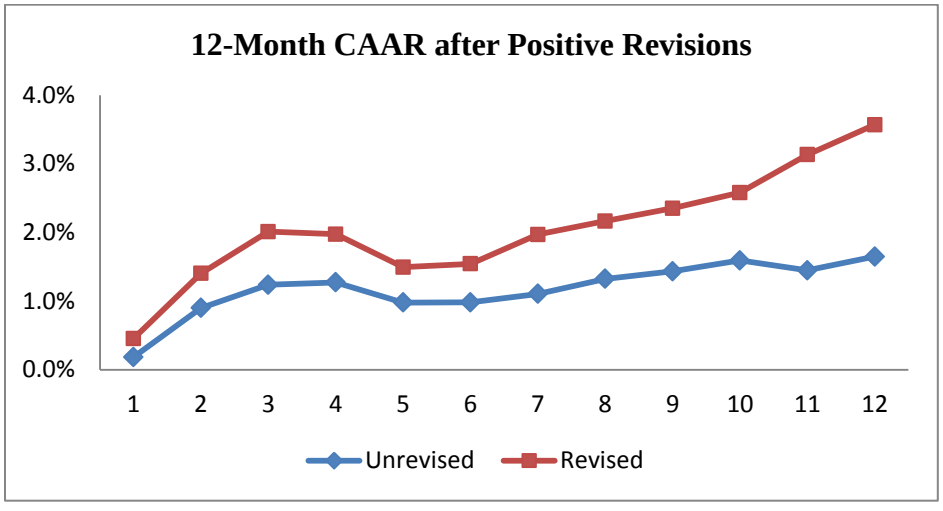


Figure 8 Panel A: This figure shows the average monthly proportion of all returns that have been revised after being first reported (upper line) and the returns that have been revised later than three months after the returns have been first reported (lower line) in each year during our sample period. The proportion of return revisions in each month is the number of revisions to the returns of that month as a percentage of the total number returns of that month. The average monthly proportion of return revision in each year is calculated as the mean of the 12 monthly proportions of return revisions in each year. Panel B: This figure shows the factor used to adjust for the return report recency. Revision Recency Adjust Factor=2-cumulative percentage of revision recency. X-Axis is the number of months between December 2013 and the return month. Panel C This figure shows the average monthly proportion of all returns that have been revised after being first reported (upper line) and the returns that have been revised later than three months after the returns have been first reported (lower line) in each year during our sample period. The proportion of return revisions in each month is the number of revisions to the returns of that month as a percentage of the total number returns of that month. The average monthly proportion of return revision in each year is calculated as the mean of the 12 monthly proportions of return revisions in each year.

Figure 9. Revision Level Performance Comparisons







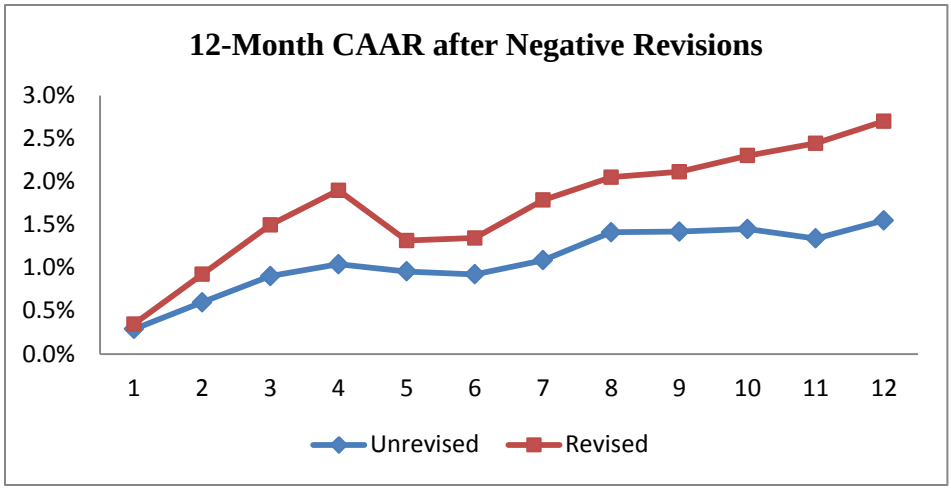
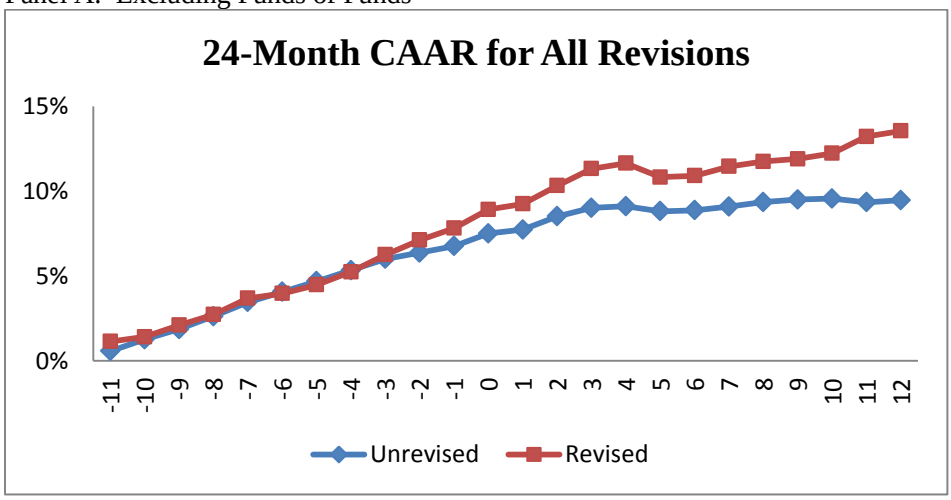
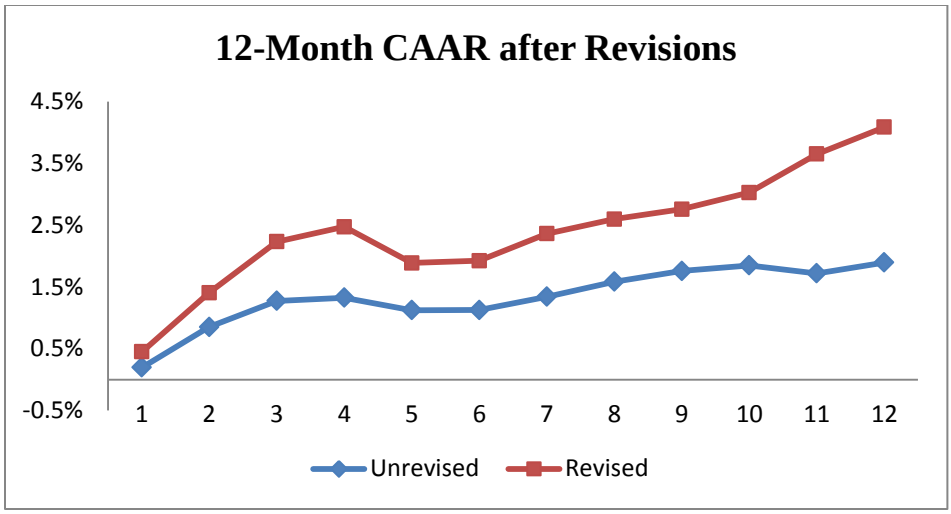


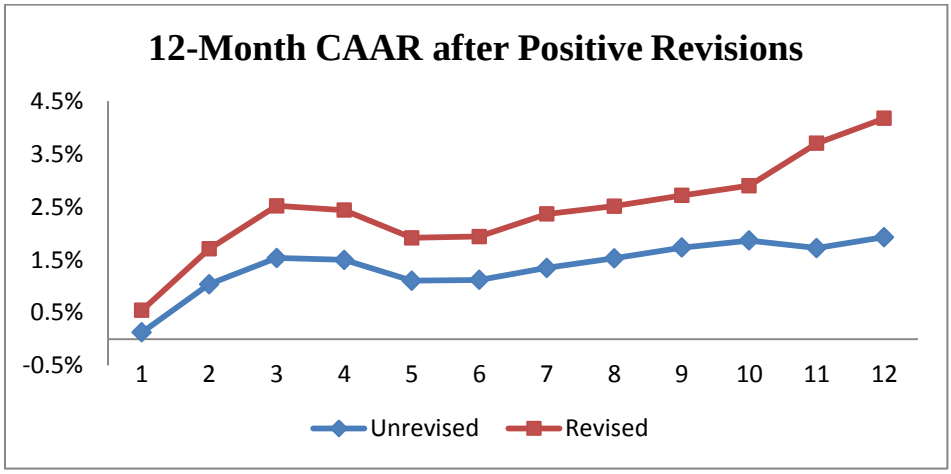
Figure 9 shows the CAAR (Cumulative Average Abnormal Return) in 12 months before and 12 months after the return revisions that occurred more than 3 months after first reports. A revised fund is a hedge fund with which revised its return at month s to the return of month t and s-t>3. An unrevised fund is a matched fund which has the same strategy and the nearest asset size in the same return month and same month as the fund revised its return but did not revise its return at month s to the return of month t.

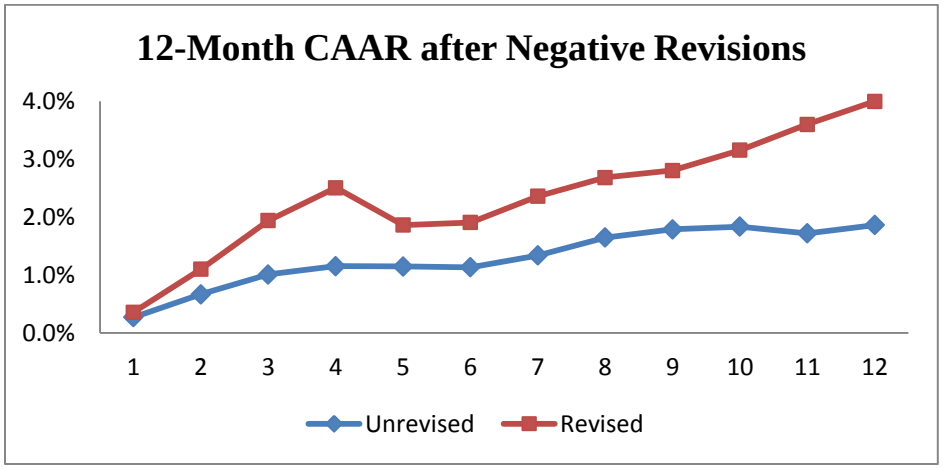
Figure 10. Robustness Check: Revision Level Performance Comparisons

Panel A. Excluding Funds of Funds

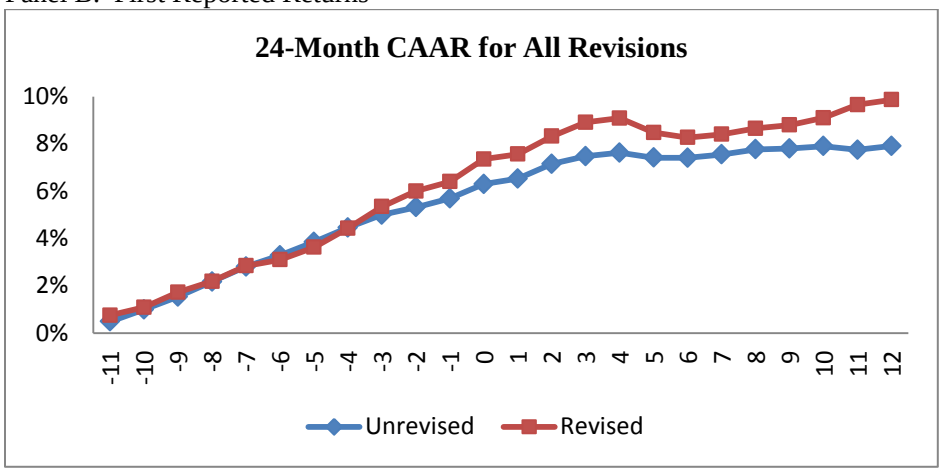


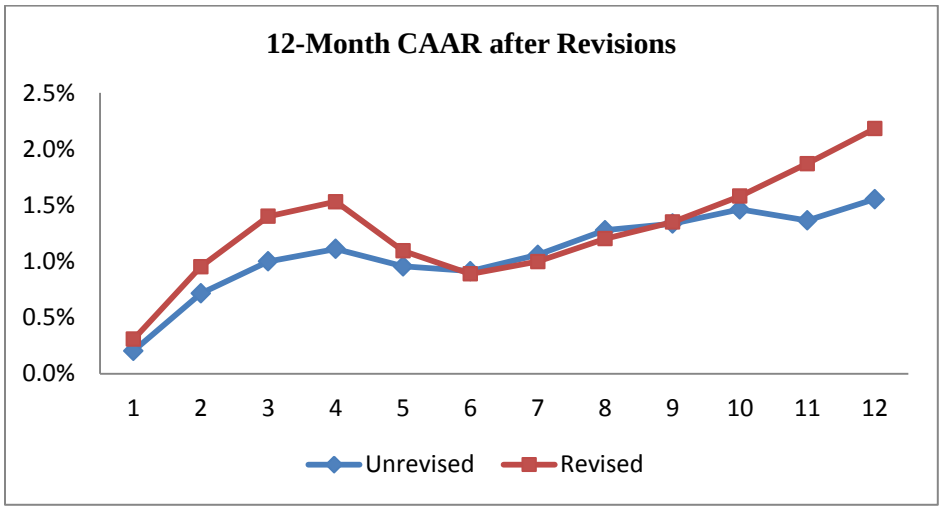

12-Month CAAR after Revisions
4.5%
3.5%
2.5%
1.5%
0.5%
-0.5%
1 2 3 4 5 6 7 8 9 10 11 12
Unrevised
Revised

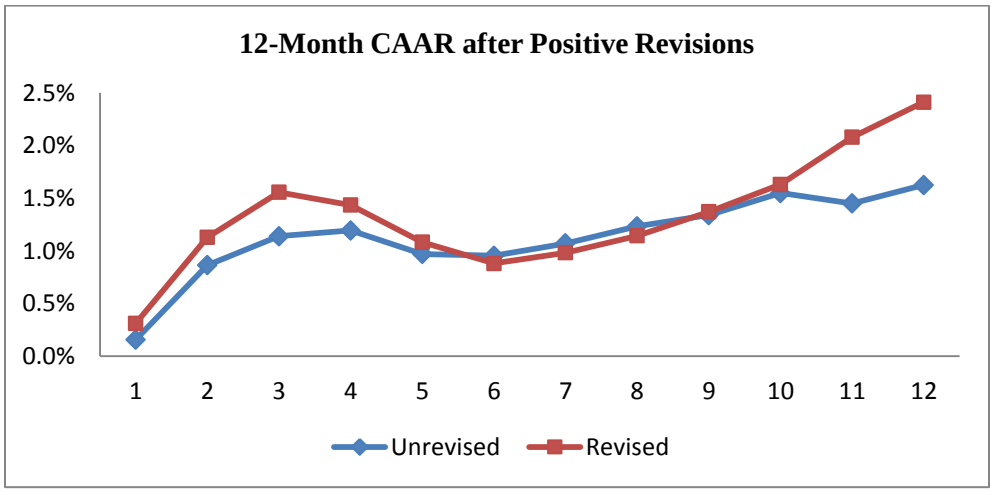

12-Month CAAR after Positive Revisions
4.5%
3.5%
2.5%
1.5%
0.5%
-0.5%
1 2 3 4 5 6 7 8 9 10 11 12
Unrevised
Revised

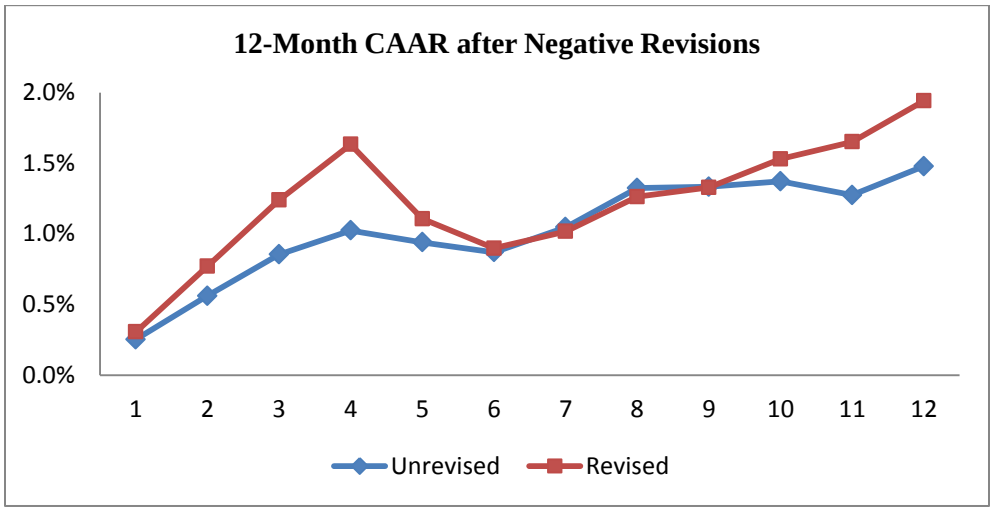

12-Month CAAR after Negative Revisions
4.0%
3.0%
2.0%
1.0%
0.0%
1 2 3 4 5 6 7 8 9 10 11 12
Unrevised
Revised

Panel B. First Reported Returns









Figures show the CAAR (Cumulative Average Abnormal Return) in 12 months before and 12 months after the return revisions that occurred more than 3 months after first reports. A revised fund is a hedge fund with which revised its return at month s to the return of month t and s-t>3. An unrevised fund is a matched fund which has the same strategy and the nearest asset size in the same return month and same month as the fund revised its return but did not revise its return at month s to the return of month t.

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