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HEDGE FUNDS AND MANAGED FUTURES FUNDS:

A PERFORMANCE ANALYSIS

by

MUSTAFA ONUR CAGLAYAN

A dissertation submitted to the Graduate Faculty in Economics in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York

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Abstract

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A PERFORMANCE ANALYSIS

by

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This study provides a comprehensive analysis of the performance of hedge funds and managed futures funds both as "stand-alone investments" and as "portfolio assets". First, hedge funds and managed futures funds, and their alternative investment styles, are examined by forming equally-weighted (EW) and value-weighted (VW) portfolios of these funds. Based on an analysis using Sharpe ratios as the performance measure, certain hedge fund and managed futures fund investment styles consistently produce higher Sharpe ratios than the S&P 500 Index in all time periods analyzed. Portfolios of Private Pools, Financial Commodity Trading Advisors (CTAs), Agriculture CTAs (among managed futures fund investment styles), and portfolios of Market-Neutral funds, Event-Driven funds, and Global Macro funds (among hedge fund investment styles) appear to be the highest ranking portfolios when they are analyzed as stand-alone investments. These specific hedge fund and managed futures fund investment styles also receive the largest allocations in the diversified portfolios of stocks and bonds, and significantly enhance the performance of those portfolios. In addition, the aforementioned hedge fund and managed futures fund investment styles seem to produce very attractive returns in both bull and bear markets. In the second part, a multi-factor risk model is employed for

the first time to estimate the risk-adjusted excess returns (Jensen alphas) of individual hedge funds and managed futures funds. By employing time-series cross-section pooled regressions on monthly returns data, hedge funds and managed futures funds, and their alternative investment styles, are found to produce significantly positive annualized risk-adjusted excess returns (α's). Moreover, in a cross-section regression of individual fund alphas on three fund characteristics (size, age, and incentive fee), the strongest explanatory factor appears to be the level of incentive fee. Finally, persistence in fund performance is examined using two different methods: a non-parametric test of quintile analysis, and a parametric test of cross-section regressions. A reasonable degree of persistence is found to exist in hedge fund and managed futures fund performance, especially when performance is measured over a longer period.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDIX TABLES

I. INTRODUCTION

Hedge funds and Managed Futures funds have witnessed a dramatic increase in number and in total dollar under management since the early 1980's. Although they have been in existence in financial markets for almost half a century, they have gained tremendous popularity especially after the early 1990's, as a result of flexible investment strategies, limited Securities and Exchange Commission (SEC) regulations, and better manager-investor alignment with a unique incentive fee structure. Since 1990, the number of hedge funds has risen, on average, by 26% per year. Managed Account Reports (MAR) include 1265 hedge funds and 932 managed futures funds on its listings at the beginning of 1998. The total dollar under management in the hedge fund and managed futures fund industry has gone up from $0.4 billion in 1980 to $20 billion by the end of 1990 and has increased further to over $200 billion by mid 1998, an almost tenfold increase since 1990.

There is no common definition of a hedge fund. Most often, they are described rather simply as unregulated limited liability partnerships established to invest and raise capital for their partners. A more accurate definition, however, would include the number of specific features that distinguish them from mutual funds and other institutional investors. Hedge funds, as opposed to mutual funds, are exempt from the regulation of SEC under the Investment Company Act of 1940. Being exempt from regulations makes hedge funds extremely flexible in the investment strategy they choose: they can make extensive use of leverage, take short as well as long positions in any market, hold concentrated positions in a single firm, industry, or sector, and move quickly among different markets to take advantage of market inefficiencies. Furthermore, hedge funds can invest both in domestic

and international equity and bond markets as well as in derivatives markets. This provides a direct exposure to risk and return characteristics that are not easily accessible by investments in traditional U.S. stock and bond markets.

In general, hedge funds are available only to "accredited investors". Accredited investors are individuals with a net worth of at least $1 million and/or a $200,000 annual income for the last two consecutive years. For institutions, the required net worth is at least $5 million. Hedge funds also have minimum-investment requirements. Typically, the minimum-investment requirement ranges from $250,000 to $1 million. Thus, the intent of the legal framework surrounding hedge funds is clearly to limit them to wealthy and sophisticated investors. In addition, there are restrictions on withdrawing funds once investors put money in hedge funds: yearly redemption for initial investors and quarterly redemption for existing investors. This gives hedge funds greater freedom to invest in illiquid assets. Also, to qualify for exclusion from regulations by the SEC, hedge funds have to limit the number of investors to 99. This, in return, prompts hedge funds to avoid advertising their returns and asset holdings publicly.

Another important aspect of hedge funds is their incentive fee structure. The hedge fund manager's compensation package typically includes a management fee of 1% to 2% of fund's size (total net asset value of the fund), and an incentive fee of 5% to 20% of annual profits. These are accompanied with "high-water mark provisions", which make fund managers unable to receive their incentive fees until the fund recovers past losses and surpasses a specified hurdle rate. In addition, hedge fund managers are required to invest a substantial amount in the fund in an attempt to reduce the excessive risk-taking behavior by fund managers.

All these characteristics put hedge funds in an advantageous place over mutual funds and other institutional investors because they have the opportunity to exploit mispricing of securities in any market through the use of less commonly employed financial instruments only available to hedge funds.

The other category of alternative investments that has brought attention among investors during the 1990's is Managed Futures funds. The term "managed futures" refers to various investment vehicles that provide professional money management to investors who wish to participate in "commodity" markets. By investing with managed futures funds, investors have access to commodity markets through use of futures, forward, and option contracts on both physical commodities and financial instruments. There are three main categories of managed futures funds: Public Funds, Private Pools, and Commodity Trading Advisors (CTAs). Investing in public funds is similar to investing in conventional stock or bond mutual funds, except that public funds buy and sell commodity futures, forward, and option contracts rather than stocks and bonds. Public funds have the lowest minimum-investment requirement of all three main categories of managed futures funds. This makes public funds accessible to small investors, whereas Private pools and CTAs primarily serve high net worth individuals and institutional investors. Public funds must register with the Commodity Futures Trading Commission (CFTC) and Securities and Exchange Commission (SEC), and they are advertised and sold like any other registered security.

Private pools are the second category of managed futures funds. They are private investment partnerships organized and operated by a commodity pool operator (CPO). The CPO forms the portfolio by collecting and pooling investors' funds and employs one

or more CTAs (commodity trading advisors) to manage the pooled portfolio. Private pools typically have higher minimum-investment requirements than do public funds, and therefore are available only to high net worth individuals and institutional investors. Private pools are also required to register with CFTC and SEC, if they have more than 499 investors in the pool.

The third and the last category of managed futures funds include investments made directly with Commodity Trading Advisors (CTAs). Investors can choose a particular CTA with an investment strategy that suits their risk preferences and have their funds managed by that CTA on an individual basis. This avenue is open only to investors with substantial net worth, since CTAs typically set very high minimum-investment requirements. All CTAs must register with the CFTC and are subject to its regulations.

The fees charged by managed futures funds are generally quite high. Similar to hedge funds, the managers of managed futures funds are paid both a management fee and an incentive fee. The management fees are based on 2% to 3% of total assets under management and incentive fees are based on 5% to 20% of annual profits. There may also be one-time front-load and back-load fees as well as significant brokerage and trading expenses.

This study provides a comprehensive analysis of the performance of hedge funds and managed futures funds both as "stand-alone investments" and as "portfolio assets". Different measures of risk-adjusted returns are used to measure performance. I provide a thorough analysis of the portfolio allocations that would be given to hedge funds and managed futures funds in diversified stock and bond portfolios. The performance of hedge funds and managed futures funds is also analyzed in bull and bear markets to see

how well they perform in different states of the market. Using a multi-factor risk model, I estimate risk-adjusted excess returns of individual funds as well as portfolios of hedge funds and managed futures funds. In search for skill among professional fund managers, the tests for persistence in performance are conducted using both raw and risk-adjusted excess returns. Hedge funds and CTAs have various self-declared investment strategies. Thus, in all of the analyses carried throughout the study, the tests are performed for alternative investment styles of hedge funds and CTAs, as well as all hedge funds and all CTAs taken together as separate groups.

II. DATA AND VARIABLES

The data on asset under management and monthly returns for individual hedge funds and managed futures funds are provided by Managed Account Reports (MAR), which is one of the leading data vendors in the hedge fund and managed futures fund industry. In this study, the longest time period analyzed for hedge funds is 1990:01 – 1998:08, and for managed futures funds is 1985:01 – 1998:08. The data encompass 1665 hedge funds that exist at some time during the period January 1990 through August 1998. Similarly, the data set includes 704 Public Funds, 466 Private Pools, and 1219 CTAs, which all exist at some point during the period January 1985 through August 1998.[1] In total, there are 71,911 monthly return observations for hedge funds and 133,763 monthly return observations for managed futures funds. The data include surviving as well as non-

[1] Since hedge funds and managed futures funds report on a voluntary basis, MAR data may not include all hedge funds and managed futures funds. For marketing benefits, however, most funds tend to report their returns.

surviving (defunct) funds. Information on managerial and incentive fees is only available for the year 1998.

The returns of hedge funds and managed futures funds are also compared to the returns of standard benchmark asset classes: S&P 500 index, US small stock index, intermediate- and long-term government bonds, and long-term corporate bonds. The monthly returns on these benchmark indices are taken from Ibbotson Database, 1999.

Hedge funds and CTAs also declare their investment strategies to MAR. The data set includes the broad type of investment style that is chosen by each hedge fund and each CTA. MAR distinguishes eight self-declared styles for hedge funds and six self-declared styles for CTAs. Hedge fund styles include (1) Funds of Funds (2) Event-Driven, (3) Global Macro, (4) Global, (5) Long-only, (6) Market-Neutral, (7) Sector, and (8) Short-Sell. The MAR definition of each style is provided in Appendix 1. Similarly, CTA styles include (1) Currency, (2) Agriculture, (3) Financial, (4) Stock, (5) Energy, and (6) Diversified. While all these CTA styles trade futures, forward, and option contracts, mostly in the area they specify, Diversified CTAs trade in all of those markets.

There are differences among alternative investment styles of hedge funds and managed futures funds in terms of their risk, return, size, age and incentive fees. Table 1A shows basic descriptive statistics on these variables for managed futures funds and alternative CTA styles. The average monthly return and the average standard deviation of returns vary significantly by investment style. For the period 1985:01 – 1998:08, the average monthly returns range from a low of 0.76% (Public Funds) to a high of 2.74% (Currency CTAs). In the same way, the average standard deviations of returns range from a low of 5.59% (Public Funds) to a high of 10.62% (Currency CTAs).

In addition, the results on variable "size" (total asset under management) indicate that the managed futures fund industry is heavily concentrated: a few funds account for a large proportion of the industry assets. The size discrepancy can be seen in large differences that exist between the mean and the median size of CTAs. For all CTAs taken together, while the mean size is $20.62 million, the median size is just $2.44 million. Significant large differences are also observed in other categories of managed futures funds and alternative investment styles of CTAs.

The age of a fund is measured as the number of months in existence since its inception. The mean and the median age, for all CTAs taken together as a group, are 55 and 45, respectively. The age figures for other categories of managed futures funds and alternative CTA investment styles are no different than the category "all CTAs".

Analyzing incentive fees show some significant differences across investment styles. The median annual incentive fees range from a low of 4.00% for Public funds to a high of 20% for Private Pools, Agriculture CTAs, Stock CTAs, and Energy CTAs.

The same kind of analysis is also conducted for hedge funds. Table 1B presents the basic descriptive statistics on return, standard deviation of return, size, age, and incentive fee for alternative investment styles of hedge funds as well as for all hedge funds taken together as a separate group. The results show that the average monthly return and the average standard deviation of returns change significantly by investment style. For the period 1990:01 – 1998:08, the average monthly returns range from a low of 0.58% (Short-sell Funds) to a high of 1.83% (Long-only Funds). Similarly, the average standard deviations of returns range from a low of 2.72% (Market-Neutral Funds) to a high of 7.53% (Long-only Funds).

In terms of size of funds, similar to the results obtained for managed futures funds, there appears to be large significant differences between the mean and the median size of hedge funds. This indicates that a large proportion of the industry assets is concentrated amongst a few of the largest funds: by December 1997, the largest 64 hedge funds (or the largest five percent) account for 53% of the total capital managed by all hedge funds. This, of course, is reflected in the mean and the median size statistics for size. For all hedge funds taken together, while the mean size is $59.19 million, the median size is just $15.23 million. Significant large differences are also observed in other categories of hedge funds. There is also significant size disparity among hedge fund styles. On average, over the period 1990:01 through 1998:08, 94% of the capital under management by hedge funds are concentrated in the following five investment styles: Global (nearly 29 percent), Global Macro (28 percent), Market-Neutral (16 percent), Funds of Funds (14 percent), and Event-Driven (7 percent). Further, almost 90% of all new hedge funds formed since 1990 are concentrated in these five investment styles.

Another characteristic of the hedge fund industry is its high attrition rate. This is consistent with my finding that the median life (age) of a hedge fund is quite short: 37 months. Also, the median age of hedge funds varies by investment style: from a low of 25 months for Sector funds to a high of 60 months for Short-sell funds.

Lastly, comparing incentive fees among alternative hedge fund investments styles show that incentive fees vary from one style to the other. All hedge funds taken together, the median annual incentive fee is 15.25%. Among alternative investment styles, however, the median annual incentive fees range from a low of 8.50% for Sector funds to a high of 20% for Event-Driven and Short-sell funds.

III. POSSIBLE DATA BIASES

There may be two biases in the MAR data: a "survivorship bias" and a "self-selection bias". A survivorship bias exists when the data does not include all non-surviving funds. If non-surviving funds have lower returns than surviving funds (which is likely), omitting non-surviving funds from the data will result in an upward bias in reported returns. My data, however, does contain both surviving and non-surviving funds, and therefore should be free of survivorship bias.[2] In particular, the entry and exit tables (see tables 2A and 2B) provide information on the number of hedge funds and CTAs existing by August 1998, as well as on the number of funds and CTAs that ceased operation at some point prior to August 1998. The results indicate that the attrition rates are very high in both industries, especially for managed futures funds.[3] Specifically, for the period 1985:01 through 1998:08, sixty-seven percent of all CTAs that existed at some time during this period were not in existence by 1998:08. The attrition rates for other categories of managed futures funds and alternative CTA investment styles are no different from the category "all CTAs" (see table 2A, last column). Having the same analysis for hedge funds for the period 1990:01 through 1998:08 shows that almost thirty percent of all hedge funds that existed at some point during this period were not in existence by August 1998. Also, the attrition rate varies significantly by hedge fund investment style: from a

[2] Non-survivors are defined as funds that began operation at any time after January 1980, but ceased operation at some time prior to August 1998. Survivors are defined as funds still in operation by August 1998.

[3] The attrition rate is computed as the proportion of funds that existed at some point during the analysis period that no longer exist by August 1998. Hedge funds and managed futures funds may cease to exist because of poor performance or because they voluntarily dissolve and go out of business. However, it is probable that most cease to exist because of poor performance.

high of 46 percent for global macro funds to a low of 12 percent for sector-specific funds (see table 2B, last column).

Although it is difficult to calculate the exact magnitude of survivorship bias, my estimates show that the observed return differences between survivors and non-survivors are quite large. In particular, if the data were to contain only surviving funds, the annual returns would be substantially higher than what they are reported in the data: 3.30 percentage points for CTAs, 4.01 percentage points for private pools, 1.65 percentage points for public funds, and 1.05 percentage points for hedge funds.[4] Since my data includes a large number of non-surviving funds as well as surviving funds, the magnitude of survivorship bias should be much less than these suggested figures.

The data may also have a self-selection bias. A self-selection bias occurs when the performance histories of funds, prior to the date that performance is first reported to the data vendor, are included in the database. Since only funds with successful track records will be inclined to report their performance, this results in upwardly biased observed returns. In fact, the results from my MAR data indicate that including pre-reporting performance histories put a significant upward bias on CTA returns.[5] There is no evidence of a self-selection bias in the returns of hedge funds, private pools and public funds.

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[4] Other studies find similar results. Edwards and Liew [1999] report an annual survivorship bias of 5.17% for CTAs, 6.74% for private pools, 3.05% for public funds and 1.91% for hedge funds. Fung and Hsieh [1997b] find that reported annual CTA returns could be inflated by 3.48 percentage points when non-surviving CTAs are not included in the data. Schneeweis, Spurgin, and McCarthy find that including non-surviving CTAs in the data would reduce annual returns by approximately 1.0 – 2.5 percentage points. For a discussion of survivorship bias in hedge fund returns, see Ackermann, McEnally, and Ravenscraft [1999].

[5] The reported performance histories of CTAs may even include returns prior to registering with the CFTC. Data vendors commonly acknowledge the existence of self-selection bias in CTA data. For example, Barclays attempts to correct for this bias by eliminating the first 48 months of CTA performance data.

A possible procedure to correct for the self-selection bias in CTA data is to compute CTA returns only after omitting the early performance histories. To do this, Edwards and Liew (1999) calculate the median number of months that CTAs provide returns prior to their first-reporting dates to determine how much of a fund's earlier performance history should be excluded from the data. Using the same procedure followed by Edwards and Liew, the first twelve months of data for all CTAs are excluded from the database. Excluding the first-twelve month returns, as expected, results in lower annual CTA returns: 3.37 percentage points for the equally-weighted, and 0.99 percentage points for the value-weighted portfolios of all CTAs. However, omitting the early performance histories of CTAs could also eliminate a large number of small CTAs from the data. Since small CTAs generally have higher returns than large CTAs, omitting the early performance histories could also result in downward bias in CTA returns. In addition, omitting the first-twelve month returns reduces the number of CTAs in each investment style considerably, and does not allow us to analyze alternative CTA investment styles separately. Thus, given these offsetting considerations, the first twelve-month returns are omitted only for the category "all CTAs", but no data are omitted in analyses of alternative categories of CTA investment styles. Since there is no evidence of self-selection bias in returns of hedge funds, private pools and public funds, no data are omitted from the database for these alternative investment categories.

IV. HEDGE FUNDS AND MANAGED FUTURES AS STAND-ALONE ASSET CLASSES

One reason to invest in hedge funds and managed futures funds is that they provide very attractive risk-adjusted returns. In all time periods analyzed, portfolios of hedge funds and managed futures funds, especially certain hedge fund investment styles, produce very large returns while they maintain the volatility in returns relatively at low levels.

A. PERFORMANCE MEASURES

Monthly returns, returns volatility, and risk-adjusted returns for hedge funds and managed futures funds are examined as performance measures over the period January 1985 through August 1998. Monthly returns are calculated assuming all cash distributions are reinvested during the month in which they are received. That is, monthly returns are defined as the sum of the change in unit value over a month plus any cash distributions made per unit during the month divided by the unit value at the end of the preceding month. All returns are net of fees and expenses.[6] Returns volatility is measured by the standard deviation of monthly returns for a specific time period and risk-adjusted return is measured as the excess return per unit of returns volatility.

Two stylized portfolios of hedge funds and managed futures funds are formed to evaluate the performance: 1) Equally-weighted (EW) portfolios of hedge funds and managed futures funds where an identical amount is invested in all funds in existence in a

[6] In reporting monthly returns net of fees, it is necessary to adopt a uniform accounting convention for fees. In some cases, funds themselves accrue the fees over the relevant months, and the data reported to MAR

month; 2) Value-weighted (VW) portfolios of hedge funds and managed futures funds where a proportional amount is invested in each fund in existence in a month according to the amount of money that fund has under management relative to the total amount of money managed by all funds in that month.

Thus, EW monthly returns are calculated as the simple arithmetic average of the monthly returns of all funds in the portfolio and VW monthly returns are calculated as the weighted average of the monthly returns of all funds in the portfolio. Therefore, EW and VW portfolios have to be rebalanced at the end of every month to maintain the assumed portfolio weights: equal for EW and dollar-weighted for VW.[7]

For a detailed analysis of investment strategies conducted by different managed futures and hedge funds, separate EW and VW portfolios of CTAs and hedge funds are formed for each CTA and hedge fund "investment style" in addition to EW and VW portfolios of All CTAs and All Hedge Funds.

Average returns, volatility of returns, and risk-adjusted returns are examined on these EW and VW portfolios for each investment style.[8] Sharpe Ratio (SR) is used as a measure of risk-adjusted return and calculated as:

$$\frac{R_i - R_f}{\sigma_i} \qquad (1)$$

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reflect those fee accruals. In other cases, MAR spreads the incentive fees over the relevant months to determine monthly returns net of fees.

[7] In an EW portfolio, each month money is implicitly taken from last month's winners and given to last month's losers to maintain an equally weighted portfolio. In a VW portfolio, winners receive larger portfolio weights each month.

[8] New entrants and non-surviving funds during the year are included in calculating the standard deviation and the risk-adjusted returns.

where

R_i = the average monthly rate of return on the i-th investment (or asset class) during a specified investment period;

R_f = the average monthly risk-free rate of return (T-Bill return) during the investment period; and

σ_i = the standard deviation of monthly rates of return on the i-th investment (or asset class) during the investment period.

It is important to note that each EW and VW hedge fund and managed futures fund portfolio has a different risk-return combination. Therefore, each of them can be represented as a single point on the risk-return space, and a separate Capital Allocation Line (CAL) can be drawn for each EW and VW portfolio, starting from the risk-free rate and passing through the labeled point for the portfolio. The slope of the CAL is a measure of extra return per extra risk, which is the measure for Sharpe ratio. For this reason, a steeper CAL implies a higher Sharpe ratio for the portfolio, which means a higher return per risk.

Average returns, returns volatility, and Sharpe ratios of the EW and VW portfolios of alternative hedge fund and managed futures fund investment styles are also compared to the performance measures of the benchmark asset classes. Table 3 provides the annualized average returns as well as the returns volatility for the benchmark asset classes: S&P 500 Index, US Small Stock Index, Intermediate-Term Government Bonds, Long-Term Government Bonds, Long-Term Corporate Bonds, and US Treasury Bills. Sharpe ratios of the benchmark asset classes are provided in tables 6A and 6B to compare

to the Sharpe ratios of alternative hedge fund and managed futures fund investment styles.

B. MANAGED FUTURES FUNDS

EW and VW portfolios of managed futures funds and alternative CTA investment styles, in general, produce risk-adjusted returns comparable to benchmark asset classes. In fact, certain managed futures and CTA investment styles produce larger Sharpe ratios than the benchmark asset classes for most of the time periods analyzed.

1. Returns and Standard Deviation of Returns

Table 4 provides the returns and returns volatility (standard deviation of returns) for EW and VW portfolios of Public Funds, Private Pools, All CTAs, and different CTA investment styles for the analysis periods 1985-98, 1990-98 and two sub-periods 1990-93 and 1994-98.

For all managed futures and CTA styles, the results indicate that returns on both EW and VW portfolios have been falling over time.[9] When 1985-98 period annual returns are compared to 1990-98 and 1994-98 period annual returns, we see that 1985-98 returns are much higher than 1990-98 and 1994-98 returns in all categories of managed futures funds. Moreover, this trend in returns continues over the last five year period, 1994-98. 1990-98 EW and VW annual portfolio returns are considerably higher than the 1994-98 portfolio annual returns in almost every category with one exception: EW and VW Agriculture CTA portfolios. For example, an EW portfolio of All CTAs produces an

[9] This finding is consistent with the earlier study by Edwards and Liew "Managed Commodity Funds" [1999]. They find that 1982-1988 annual returns for an EW CTA portfolio is much higher than 1989-96 annual returns.

annual return of 18.49% in the period 1985-98, while this figure drops to 11.16% in 1990-98 period, and further to 8.73% in 1994-98 period. The same pattern can be observed in annual returns of a VW portfolio of Private Pools: 17.39% in 1985-98 period, 14.72% in 1990-98 period, and 12.86% in the last five-year period. A possible "data" explanation for the fall in returns is that the data set does not include all defunct funds prior to 1990.[10] This survivorship artificially increases the returns in the period 1985-89. The elimination of the bias in 1990-98 makes it appear that the returns fell in 1990-98. It is also possible that market conditions in 1990-98 are not favorable to commodity traders. That is, most of the commodity traders are "trend followers" and too much volatility in commodity prices, especially in 1990-98, made them unable to identify price trends and capitalize on such trends. Also, in 1994-98, as a result of increased capital and competition among traders, commodity markets become more efficient which may result in lower returns compared to earlier periods.

Furthermore, for both EW and VW portfolios of Public Funds, Private Pools, All CTAs, and for most of the CTA investment styles (with some exceptions in EW Agriculture, VW Stock and EW and VW Energy CTAs), the results show that the annualized standard deviation of returns are much lower in 1994-98 period compared to earlier periods.[11] For example, an EW Financial CTAs portfolio has an annualized standard deviation of returns 12.80% in period 1985-98, and this decreases to 7.76% in

[10] MAR changed ownership in 1990. Before 1990, the database consisted of only the largest twenty-five CTAs. Smaller CTAs as well as CTAs who went out of business, were not included in the data. MAR back-filled the database by collecting the unpublished performance records of both surviving and non-surviving CTAs from previous owners. In back-filling the data, however, it is possible that some non-surviving CTAs were inadvertently excluded.

[11] Edwards and Liew "Managed Commodity Funds" [1999] also find that returns volatility, both for EW and VW portfolios, is considerably lower in 1993-96 than in earlier years.

period 1994-98. The same figures for a VW Currency CTAs portfolio are 19.85% and 6.17% respectively.

Lastly, comparing EW and VW portfolios of Public Funds to EW and VW portfolios of Private Pools and All CTAs, we see that the standard deviation of returns are more or less the same across these three main categories of managed futures funds for different periods of time. However, returns on EW and VW portfolios of Private Pools and All CTAs are always higher than the EW and VW portfolios of Public Funds in all time periods analyzed. In particular, comparing VW portfolio of Public Funds to VW portfolios of Private Pools and All CTAs for the 1990-98 period, we see that Public Funds have the highest annualized standard deviation of returns (9.69% vs. 8.12% and 9.55%) and the lowest annual return (10.27% vs. 14.72% and 12.38%). Similar patterns exist in different time periods both for EW and VW portfolios of Public Funds. This suggests that Public Funds are inferior stand-alone asset classes compared to Private Pools and All CTAs as well as to other benchmark asset classes.[12]

2. Sharpe Ratios

Managed futures funds, in general, provide very attractive risk-adjusted returns compared to other benchmark asset classes. Table 6A provides performance statistics for alternative managed futures funds and other benchmark asset classes over various time periods. As a measure of risk-adjusted return, Sharpe ratios are used to rank alternative managed futures fund investment styles against each other, as well as against the benchmark asset classes.

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[12] This finding is consistent with earlier studies. Elton, Gruber, and Rentzler [1987, 1990] find that public funds perform poorly compared to stocks and bonds during the 1979-1988 period. Irwin, Krukemyer, and

Randomly-selected (RS) single fund portfolios of managed futures are formed in addition to EW and VW portfolios of managed futures funds. Although RS single fund portfolios have the same annual returns as EW portfolios, their returns volatility are almost twice as high as the EW portfolios (See table 6A). This is because single fund portfolios are not as diversified as EW portfolios. Thus, single fund portfolios are inferior stand-alone investments compared to EW portfolios in terms of risk-adjusted returns. That is, Sharpe ratios of RS single fund portfolios are always lower than the Sharpe ratios of the corresponding EW portfolios, giving single fund portfolios low-rankings in all time periods.

Analyzing the Sharpe ratios further, an EW Financial CTAs portfolio and a VW Private Pools portfolio produce the highest two Sharpe ratios in 1985-98 period, 1.29 and 1.15 respectively, while S&P 500 Index has a Sharpe ratio of 0.77 during the same time period. In the following periods, 1990-98 and 1990-93, these two managed futures fund portfolios continue to have the highest Sharpe ratios among other CTA investment styles and other benchmark asset classes. EW Financial CTAs portfolio produces a Sharpe ratio of 1.19 in 1990-98 and 1.90 in 1990-93. The figures for the VW Private Pools portfolio are 1.21 and 1.45 for the respective time periods. In the period 1994-98, VW Private Pools portfolio produces the third highest Sharpe ratio (1.00) after EW Agriculture CTAs portfolio (1.18) and the S&P 500 Index (1.02). However, EW Financial CTAs portfolio generates a Sharpe ratio of 0.53 in this period, which is much lower than the other three, but higher than the other benchmark asset classes. We see that the VW Financial CTAs

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Zulauf [1992] conclude that the Sharpe ratio of a public fund investment does never exceed the Sharpe ratio of a stock or bond investment during the 1979-1989 period.

portfolio replaces the EW Financial CTAs portfolio in this period 1994-98, and produces the fifth highest Sharpe ratio (0.70) among all other categories. It should also be noted that the VW Financial CTAs portfolio did produce higher Sharpe ratios than the S&P 500 Index and the US Small Stock Index in earlier periods, even though these Sharpe ratios are relatively low compared to the Sharpe ratios of other CTA investment styles.

In sum, given sensational and historically abnormal high returns in common stocks in 1990-98 period, VW Private Pools, EW and VW Financial CTAs, and to some extent, EW Stock and Agriculture CTAs do generate very attractive risk-adjusted returns in all time periods analyzed.

C. HEDGE FUNDS

EW and VW portfolios of hedge funds and alternative hedge fund investment styles produce very attractive risk-adjusted returns in all analyzed time periods. The high returns and the low returns volatility of these EW and VW portfolios, especially for some certain investment styles, produce Sharpe ratios significantly larger than the Sharpe ratios of the benchmark asset classes.

1. Returns and Standard Deviation of Returns

Table 5 provides returns and returns volatility (standard deviation of returns) for EW and VW portfolios of all Hedge Funds and different hedge fund investment styles over the analysis periods 1985-98, 1990-98 and two sub-periods 1990-93 and 1994-98. Since the number of funds from each investment style is not enough to form well-diversified EW and VW portfolios prior to 1990, 1985-98 performance measures have to be

analyzed with caution, and more emphasis should be given to 1990-98 performance measures when different hedge fund investment styles are examined.[13]

In all periods analyzed, the results indicate that EW and VW portfolios of alternative hedge fund investment styles produce very large attractive returns in addition to their low returns volatility.[14] Specifically, a VW All Hedge Funds portfolio has an annual return of 19.61% in 1985-98 period and 17.91% in 1990-98 period. These figures are a little lower for an EW All Hedge Funds portfolio: 16.64% and 13.75% for the respective time periods. During the same periods of time, S&P 500 Index produces an annual return of 17.02% in 1985-98 and 15.11% in 1990-98. While the returns on these two portfolios do not significantly differ from the returns on S&P 500 Index, the volatility of EW and VW hedge fund portfolio returns are much lower than the volatility of S&P 500 Index returns. The annualized standard deviations of returns for the EW All Hedge Funds portfolio are 7.39% in 1985-98 and 5.93% in 1990-98, and these figures are less than half of the annualized standard deviations of S&P 500 returns: 15.02% in 1985-98, and 13.30% in 1990-98. Similarly, the annualized standard deviations of returns for the VW All Hedge Funds portfolio are 9.25% in 1985-98 and 8.40% in 1990-98, which are significantly lower than those of S&P 500 Index.

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[13] The hedge fund industry has grown very fast after 1990. While there were only 157 funds in existence before 1990, the number of funds that existed at some time during 1990:01 – 1998:08 increased to 1665 (see table 2B).

[14] A study on "Offshore Hedge Funds" by Brown, Goetzmann, and Ibbotson [1999] find that EW and VW indices of Hedge Funds have Sharpe ratios exceeding that of the S&P 500 over the period 1989-1995. In a recent study by Schneeweis and Spurgin, "The Benefits of Hedge Funds" [1999] they find that EACM 100 Hedge Fund Index has a higher Sharpe ratio than any of the other assets during the period 1990-1998. Similarly, Liang in a study "On the Performance of Hedge Funds" [1998] finds that an EW portfolio of Hedge Funds produces a higher return than the S&P 500 Index while the standard deviation of monthly returns is lower for the Hedge Fund portfolio during the period 1990-96.

These characteristics of high returns and very low returns volatility are relevant across different hedge fund investment styles, except for Short-sell funds. Among all time periods analyzed, 1990-93 is the period when all hedge funds with different investment styles have the highest return and the lowest returns volatility. This is the period when all hedge fund investment styles produce the highest excess return per unit of risk. Particularly, a VW Event-Driven Funds portfolio has an annual return of 17.09% in 1990-93 period, while the annualized standard deviation of returns is only 3.59%. During the same time period, an EW Global Macro Funds portfolio generates a 21.45% annual return while the annualized standard deviation of returns is just 5.58%.

Having analyzed eight different hedge fund investment styles, EW and VW Market-Neutral Funds portfolios have the lowest annualized standard deviation of returns among all other investment styles in all periods of time. The returns on these Market-Neutral funds portfolios are not as high as the other investment styles, however, the volatility of returns are sometimes almost three times as low as the volatility of returns of any other investment style. In particular, EW and VW Market-Neutral Funds portfolios have annualized standard deviation of returns 2.54% and 2.20% respectively for the period 1994-98, while this figure ranges between 6.39% (EW Funds of Funds) and 18.30% (VW Long-only Funds) for other investment styles during the same time period. In addition, the annual returns on these Market-Neutral funds portfolios are not drastically lower than the returns on other hedge fund investment styles. In the period 1994-98, EW and VW Market-Neutral Funds portfolios have annual returns of 11.78% and 10.10% respectively, which are on average 2 - 3% below the portfolio returns on other investment styles. Similar characteristics exist also in earlier time periods both for EW and VW Market-

Neutral Funds portfolios. This suggests that Market-Neutral Funds portfolios provide very attractive risk-adjusted returns compared to both benchmark asset classes and other hedge fund investment styles.

2. Sharpe Ratios

Hedge funds, especially certain investment styles provide very large and attractive risk-adjusted returns compared to other benchmark asset classes in all time periods analyzed. Table 6B provides performance statistics for hedge funds and other benchmark asset classes over various time periods. Sharpe ratios are used to rank alternative hedge fund investment styles against each other, as well as against the benchmark asset classes.

Randomly-selected (RS) single fund portfolios of hedge funds are formed in addition to EW and VW portfolios of hedge funds. Comparing RS single hedge fund portfolios to EW hedge fund portfolios, RS single hedge fund portfolios have returns volatility almost three times as high as the returns volatility of EW hedge fund portfolios, although the returns on these two stylized portfolios are the same.[15] This makes EW hedge fund portfolios superior stand-alone investments compared to RS single hedge fund portfolios. However, it should also be noted that RS single Market-Neutral hedge fund portfolio produces higher risk-adjusted returns than the S&P 500 Index in 1990-98 (0.81 vs. 0.77) and in 1990-93 (1.28 vs.0.47) periods. Thus, while RS single hedge fund portfolios are inferior in comparison to EW hedge fund portfolios, they are able to beat a number of benchmark asset classes in terms of risk-adjusted returns.

In 1990-98 period, excluding short-sell funds, all other EW and VW hedge fund portfolios with different investment styles have higher Sharpe ratios than the benchmark

[15] This is because there is diversification among individual hedge funds in EW portfolios.

asset classes, including the S&P 500 Index. Among all different hedge fund investment styles, EW Market-Neutral Funds portfolio has the highest Sharpe ratio in all analyzed periods. It produces a Sharpe ratio of 3.06 in 1990-98, while the rest of the portfolios with other hedge fund investment styles produce Sharpe ratios ranging from 0.84 (VW Long-only Funds) to 1.83 (VW Market-Neutral Funds). S&P 500 Index, on the other hand, produces a Sharpe ratio of only 0.77 during the same time period 1990-98, which is significantly lower than that of any hedge fund investment style. EW Market-Neutral Funds portfolio continues to be the first ranking in the sub-periods by producing Sharpe ratios of 3.48 in 1990-93 and 2.71 in 1994-98 period. Together with EW Market-Neutral Funds, portfolios of VW Market-Neutral Funds, EW and VW Event Driven Funds, EW and VW Global Macro Funds, and EW Sector Funds receive the highest rankings in all time periods analyzed. These portfolios seem to be superior hedge fund investment styles in comparison to other styles of hedge funds. Other styles, EW and VW Funds of Funds have lower returns, and EW and VW Global Funds and Long-only Funds have larger standard deviation of returns, which make them lower-ranking hedge fund portfolios in terms of their Sharpe ratios. However, even these lower-ranking hedge fund portfolios have Sharpe ratios higher than the benchmark asset classes, except for the 1994-98 period. Only in 1994-98, did the S&P 500 Index produce the sixth highest Sharpe ratio (1.02) by surpassing a number of hedge fund investment styles.

Finally, comparing the Sharpe ratios of managed futures funds in table 6A to the Sharpe ratios of hedge funds in table 6B, we see that the highest ranking managed futures fund portfolios (VW Private Pools and EW Financial CTAs) rank just after the highest ranking hedge fund portfolios (EW and VW Market-Neutral Funds, Event Driven Funds

and Global Macro Funds). In addition, both alternative asset classes beat all other benchmark asset classes.[16]

In conclusion, given the exceptionally high returns in the stock market since 1990, hedge funds and managed futures funds generate very attractive risk-adjusted returns compared to other financial assets in all time periods analyzed.

D. ALTERNATIVE PERFORMANCE MEASURES

1. Safety First Criteria

The Sharpe ratio analysis is based on the assumption that investors are utility maximizers, risk averse and prefer more to less. However, it is possible that some investors do not fit into those assumptions of the expected utility theorem, and thus use simpler decision rules that concentrate on bad outcomes. The term "safety first" comes from the concept of minimizing the risk of bad outcomes. Since safety first criteria and the Sharpe ratio as performance measures originate from different objective functions, it is possible that the safety first criteria rankings of EW and VW portfolios of hedge funds and managed futures funds are different from the Sharpe ratio rankings of those portfolios.

1.a. Roy's Criterion

Roy's criterion suggests that the best portfolio is the one that has the smallest probability of producing a level of return below which the investor does not want to fall.[17] In other words, Roy's criterion can be identified as:

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[16] This result is consistent with the previous study by Edwards and Liew, "Hedge Funds versus Managed Futures as Asset Classes" [1999]. They find that EW and VW portfolios of Hedge Funds and Funds of

$$\text{Minimize Prob.}\ (R_p < R_s) \tag{2}$$

where

R_p = return on the portfolio; and

R_s = specified level of return below which the investor does not want to fall.

Assuming that R_s lies below the mean return of the portfolio $E(R_p)$, this criterion implies that the best portfolio is the one where R_s is the maximum number of standard deviations away from the mean return of the portfolio. Algebraically, this can be represented as:

$$E(R_p) = R_s + k^* \sigma_p \tag{3}$$

where

σ_p = standard deviation of returns on the portfolio; and

k = the number of standard deviations that R_s lies below the mean return of the portfolio.

Then, the objective function for this criterion simply reduces to maximizing k:

$$k = \frac{E(R_p) - R_s}{\sigma_p} \tag{3'}$$

Thus, the larger the k, the more desirable the portfolio is.

1.b. Kataoka's Criterion

Kataoka's Criterion suggests maximizing the lower limit subject to the constraint that the probability of obtaining a return less than the lower limit is not greater than some

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Funds as well as VW portfolios of Private Pools win over the benchmark asset classes in terms of risk-adjusted returns over the period 1989-96.

[17] Elton and Gruber, *Modern Portfolio Theory and Investment Analysis*, Chapter 11: Other Portfolio Selection Models, p. 235-236

predetermined percentage value.[18] For example, maximize the lower limit R_L subject to the constraint that the probability of obtaining a return less than R_L is not greater than 5%. This can be algebraically represented as:

$$\text{Maximize } R_L$$

$$\text{Subject to Prob. } (R_p < R_L) \leq \chi \tag{4}$$

where

R_p = return on the portfolio

R_L = lower limit: and

χ = the predetermined probability value (in the example 5%).

The probability of obtaining portfolio returns below some specified percentage value depends on the number of standard deviations that the lower limit lies below the mean return of the portfolio. Then with predetermined probability value being χ = 5%, the lower limit for each portfolio lies 1.645 standard deviations below the mean return of the portfolio. Thus, maximizing the lower limit R_L is equivalent to maximizing:

$$E(R_p) - 1.645^* \sigma_p \tag{5}$$

where

$E(R_p)$ = mean return of the portfolio; and

σ_p = standard deviation of returns on the portfolio.

Thus, the higher the mean return and the lower the standard deviation, the higher the lower return will be and therefore, the more desirable the portfolio becomes.

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[18] Elton and Gruber, *Modern Portfolio Theory and Investment Analysis*, Chapter 11: Other Portfolio Selection Models, p. 237-238

2. Results

Table 7A provides the Roy's criterion and Kataoka's criterion values as well as the Sharpe ratio values for EW and VW portfolios of alternative managed futures fund and hedge fund investment styles for the period 1985-98. Roy's criterion values are derived for a 10% minimum annual return. In other words, 10% annual return is assumed to be the level of return below which the investors do not want to fall. That is, any managed futures fund or hedge fund portfolio that has an annual return below 10% is omitted from the analysis.[19] In addition, Kataoka's criterion values are derived according to the predetermined probability value of $\chi = 5\%$.

The two safety first criteria rankings for EW and VW portfolios of alternative managed futures and hedge funds are also provided in the same table, in addition to the Sharpe ratio rankings of those portfolios. Comparing the Sharpe ratio rankings to Roy's criterion rankings or to Kataoka's criterion rankings over the period 1985-98, we observe that portfolio rankings on average do not change significantly from one criterion to the other, with some exceptions. For example, the EW Global Macro Funds portfolio has the highest ranking according to Roy's criterion and has the second highest rankings according to Sharpe ratio and Kataoka's criterion. The Spearman rank correlation coefficient test is used to test the significance of the differences in rankings under different criteria.[20] For the period 1985-98, the Spearman rank correlation coefficient between Sharpe ratio and Roy's criterion is 0.80, and between Sharpe ratio and Kataoka's

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[19] To calculate the Roy's criterion, R_s should lie below the mean return of the portfolio $E(R_p)$.

[20] See G. Udny Yule and M. G. Kendall, *An Introduction to the Theory of Statistics,* Charles Griffin & Company, London, 1953, p. 455

criterion is 0.92. Both correlation coefficients are close to 1.0 and statistically significant, which suggests that rankings of hedge funds and managed futures funds as stand-alone asset classes are independent of the performance measure criteria used.

Table 7B provides exactly the same analysis for the safety first criteria, but for the period 1990-98. Again, portfolio rankings do not depend on the criteria used. In particular, the EW Market-Neutral Funds portfolio has the first ranking according to Sharpe ratio and Kataoka's criterion and has the second ranking according to Roy's criterion over the 1990-98 period. Moreover, the Spearman rank correlation coefficient between Sharpe ratio and Roy's criterion is 0.86 and between Sharpe ratio and Kataoka's criterion is 0.89 in this period.

The statistical significance of the Spearman rank correlation coefficients in both periods is indicative of how strong and reliable the Sharpe ratio rankings are in analyzing hedge funds and managed futures funds as stand-alone asset classes. Thus, high Sharpe ratio rankings of EW and VW portfolios of alternative hedge fund and managed futures fund investment styles relative to benchmark asset classes suggest that both hedge funds and managed futures funds are powerful asset classes. Therefore, investors should seriously consider including them as alternative asset classes in their diversified portfolios.

V. HEDGE FUNDS AND MANAGED FUTURES AS PORTFOLIO ASSETS

A. HEDGE FUNDS AND MANAGED FUTURES AS DIVERSIFYING ASSET CLASSES

One reason to include hedge funds and managed futures funds in a diversified asset portfolio is that they typically provide significant diversification benefits. That is, the returns earned by these funds, especially managed futures, have low correlation with the returns on most of the traditional asset classes.

Tables 8A, 8B and 8C provide the simple correlation coefficients between the returns on traditional benchmark asset classes and the returns on EW and VW portfolios of alternative managed futures and hedge fund investment styles, for the periods 1990-98 and two sub-periods 1990-93 and 1994-98 respectively. Except for the Short-sell funds, simple correlation coefficients between alternative hedge fund investment styles and the S&P 500 Index are quite low in the 1990-98 period, ranging between 0.267 and 0.791. We also see similar characteristics for hedge funds in correlation coefficients in the two sub-periods.

On the other hand, the correlation coefficients between alternative managed futures fund investment styles and the S&P 500 Index are negative and close to zero in almost all time periods analyzed, except for an EW Stock CTA portfolio. Specifically, returns on an EW portfolio of Diversified CTAs as well as returns on VW portfolios of Private Pools, All CTAs, Diversified CTAs and Agriculture CTAs are all negatively correlated with the returns on S&P 500 Index in all time periods, although none of the correlation coefficients are statistically different from zero.

This clearly indicates a desirable correlation coefficient structure, especially for managed futures funds, for the use of alternative managed futures and hedge fund investment styles as portfolio assets in diversified portfolios.[21] Thus, by including managed futures and hedge funds into a diversified portfolio, one can enhance the performance of the portfolio through diversification benefits.

B. HEDGE FUNDS AND MANAGED FUTURES AS DISTINCT ASSET CLASSES

A reasonable motive to include both hedge funds and managed futures in diversified asset portfolios is that they constitute distinct asset classes. A careful analysis of the correlation coefficients between the returns on alternative hedge fund investment styles and the returns on alternative managed futures fund investment styles reveals that hedge funds and managed future funds are two distinct asset classes.

Table 9A provides the simple correlation coefficients of returns between alternative hedge fund investment styles and managed futures fund investment styles for the EW portfolios for the 1990-98 period. The correlation coefficients between EW hedge fund returns and EW managed futures fund returns are generally negative and not statistically different from zero, except for EW Global Macro funds, EW Short-sell funds and EW Stock CTAs portfolios. For example, the correlation coefficients between the EW Market-Neutral funds portfolio and EW portfolios of alternative managed futures fund investment styles are generally negative and range between negative 0.14 and positive

[21] Edwards and Liew "Hedge Funds versus Managed Futures as Asset Classes" [1999] find that the correlation between hedge fund returns and stock returns range between 0.37 and 0.71 in the 1989-96 period, while the correlation between managed futures returns and stocks are close to zero.

0.15, and not statistically different from zero. Table 9B provides the same correlation coefficients, but this time for VW portfolios, for the same time period 1990-98. Like EW portfolios, most of the correlation coefficients between VW alternative hedge fund returns and VW alternative managed futures fund returns are negative and not statistically different from zero (an exception is VW Global Macro funds portfolio). In particular, the correlation coefficients between the VW Sector funds portfolio and VW portfolios of alternative managed futures fund investment styles are usually negative and range between negative 0.15 and positive 0.14, and not statistically different from zero.

Thus, low correlation coefficients between the returns on hedge funds and the returns on managed futures funds suggest that they are distinct asset classes, and by including them together in a diversified portfolio, investors can enhance the performance of the portfolio.

C. DOES THE INCLUSION OF HEDGE FUNDS AND MANAGED FUTURES ENHANCE PORTFOLIO PERFORMANCE?

1. Break-even Analysis

The break-even returns are the minimum required returns that each asset or asset class should produce in order to be included as an asset in a diversified portfolio, thereby enhancing the performance of the portfolio. Including a particular asset or asset class into a diversified portfolio will enhance the portfolio performance if the inclusion of that asset or asset class increases the Sharpe ratio of the portfolio. This will be true for any asset or asset class as long as the following condition is satisfied:

[Sharpe Ratio of the Candidate Asset] $\geq \rho_{cp}$ * [Sharpe Ratio of Portfolio] (6)

where ρ_{cp} is the correlation coefficient between the returns on the asset or asset class in question and the returns on the existing portfolio.[22] This criterion suggests that high returns and/or low returns volatility is not simply enough for an asset or asset class to be included in a diversified portfolio. The correlation of these returns with the returns on the portfolio is also important. In the case in which the correlation coefficient between the asset's returns and portfolio's returns is zero, as is the case for many alternative managed futures fund investment styles, the condition simply reduces to:

[Sharpe Ratio of the Candidate Asset] ≥ 0 (7)

and this condition will be satisfied as long as the expected return on the asset is greater than the risk-free rate of return.[23]

This criterion in equation (6) is used to compute the break-even (or minimum) returns for each alternative hedge fund and each managed futures fund investment style. Rewriting this criterion algebraically and solving for the minimum required rate of return R_c:

$$\left[\frac{R_c - R_f}{\sigma_c}\right] \geq \rho_{cp} * \left[\frac{R_p - R_f}{\sigma_p}\right] \quad (6')$$

[22] It has been shown that every risk-averse investor, regardless of the degree of risk aversion, will become better off by adding a new asset to the portfolio if the efficient frontier of the existing investments shifts upward and/or to the left.

[23] See Elton, Gruber, and Rentzler [1987].

where

R_c = the average monthly rate of return on investment c;

$$R_c \geq R_f + (R_p - R_f) * \rho_{cp} * \left[\frac{\sigma_c}{\sigma_p}\right] \qquad (6'')$$

R_p = the average monthly rate of return on portfolio p;

R_f = the average monthly risk-free rate of return;

σ_c = the standard deviation of monthly rates of return on investment c;

σ_p = the standard deviation of monthly rates of return on portfolio p; and

ρ_{cp} = the simple correlation coefficient between monthly returns on investment c and the monthly returns on portfolio p.

Thus, for given R_f, R_p, σ_p, σ_c, and ρ_{cp}, the break-even (minimum required) returns (R_c) are calculated for each alternative hedge fund and each managed futures fund investment style.

2. Results

Table 10 reports the break-even returns as well as the actual average returns both for EW and VW portfolios of alternative hedge fund and managed futures fund investment styles.[24] The decision to include EW and VW portfolios of alternative hedge funds and managed futures funds into a diversified portfolio of stocks and bonds is tested on two hypothetical (benchmark) portfolios: 1) 100% invested in the S&P 500 common stock index, and 2) a portfolio consisting of 60% S&P 500 stocks and 40% long-term corporate

[24] Break-even returns for randomly selected hedge fund and managed futures fund portfolios are not calculated, because there is no obviously correct way to compute the relevant correlation coefficients between the returns on those investments and the other financial assets.

bonds. In other words, the break-even returns are calculated for these two hypothetical portfolios for the analysis periods 1985-98 (for managed futures only), 1990-98, and two sub-periods 1990-93 and 1994-98, and they are compared to the actual average returns for the same time periods. If the actual return on a particular hedge fund or managed future fund investment exceeds the break-even return for that investment, including that particular investment will increase the Sharpe ratio of the portfolio, implying an enhancement of the portfolio performance.

For the 1985-98 period, all three main categories of managed futures funds (Public Funds, Private Pools, and All CTAs) as well as all CTA investment styles satisfy the criterion for inclusion in both benchmark portfolios.[25] Since the number of hedge funds from each investment style is not enough to form well-diversified EW and VW portfolios prior to 1990, break-even returns are not computed for hedge funds and alternative hedge fund investment styles for the period 1985-98.

Over the period 1990-98, as well as the sub-period 1990-93, all EW and VW portfolios of hedge funds and alternative hedge fund investment styles satisfy this criterion.[26] Also, during the same time periods, except for VW Energy CTAs portfolio, all EW and VW portfolios of managed futures as well as all CTAs with alternative investment styles satisfy the criterion for inclusion in both benchmark portfolios. That is,

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[25] Schneeweis "The Benefits of Managed Futures" [1999] calculates excess annual break-even returns for MARSCTA index as the difference between actual returns and minimum required returns to improve the portfolio's Sharpe ratio over the period 1985-98. He finds that CTAs do have positive excess annual break-even returns, which suggests including CTAs into diversified portfolios for better performance.

[26] Schneeweis and Spurgin "The Benefits of Hedge Funds" [1999] calculate excess annual break-even returns for EACM 100 Hedge Fund index as the difference between actual returns and minimum required returns to improve portfolio's Sharpe ratio over the period 1990-98. They find positive excess annual break-even returns for the Hedge Fund Index, which suggests including hedge funds into diversified portfolios will increase portfolio performance.

hedge funds and managed futures funds with alternative investment styles produce returns greater than their corresponding break-even returns in the periods 1990-98 and 1990-93.

In 1994-98, however, the return on EW portfolio of Public Funds as well as the returns on EW and VW portfolios of Stock CTAs and Energy CTAs fall short of their corresponding break-even returns and therefore, fail for inclusion in either benchmark portfolios.[27] Similarly, when all hedge funds and their investment styles are analyzed for the same time period 1994-98, we see that both EW and VW portfolios for Funds of Funds, Global Funds and Long-only Funds fail to satisfy the criterion for inclusion in either of the benchmark portfolios. It should also be remembered that these hedge fund and managed futures fund portfolios that fail to satisfy the criterion are also low-ranking portfolios in terms of their Sharpe ratios when they are analyzed as stand-alone investments.

Thus, the break-even analysis indicates that including EW and VW portfolios of specific hedge fund and managed futures fund investment styles into diversified portfolios of stocks and bonds enhances the performance of those portfolios.

[27] Edwards and Liew "Managed Commodity Funds" [1999] also find that EW Public Funds portfolio fails to satisfy the criterion for inclusion into diversified portfolios, while VW portfolio barely satisfies it. Elton, Gruber, and Rentzler [1987, 1990] and Irwin, Krukemyer, and Zulauf [1992] use the same methodology to analyze the performance of public funds and find that adding public funds to a diversified portfolio does not enhance the portfolio performance.

D. OPTIMAL PORTFOLIO ALLOCATIONS

1. Methodology

While the break-even analysis in the previous section suggests that the performance of the portfolio can be improved by including managed futures and hedge fund investments into the portfolio, it does not specify the allocations that should be devoted to alternative hedge fund and managed futures fund investment styles to maximize the portfolio performance. This raises the issue of optimal portfolio allocations given to hedge funds and managed futures funds in a diversified portfolio. When the objective is to maximize the portfolio's Sharpe ratio, Elton and Gruber (1987) show that optimal portfolio allocations can be obtained by solving the following:[28]

$$\text{Max. } SR_p = \frac{R_p - R_f}{\sigma_p} \tag{8}$$

subject to

$$R_p = \sum_{i=1}^{N} \omega_i R_i \,, \qquad \sum_{i=1}^{N} \omega_i = 1 \,, \quad \omega_i \geq 0 \text{ for all } i$$

where

SR_p = Sharpe ratio of the portfolio p;

R_p = the expected rate of return on portfolio p;

R_f = the risk-free rate of return;

σ_p = the standard deviation of monthly rates of return on portfolio p;

ω_i = the proportion of asset i in portfolio p; and

R_i = the expected rate of return on asset i.

[28] Implicit assumptions are that short sales of the funds are impossible and there can be riskless borrowing and lending at the same rate.

Optimal portfolio allocations are estimated for two different perspective portfolios: 1) portfolios in which there is no upper or lower boundary on the weights of the assets included: Unconstrained portfolios; 2) portfolios in which there are both upper and lower boundaries on the weights of the assets included: Constrained portfolios.[29] Irwin, Krukemyer and Zulauf (1992) argue that constraining the portfolio allocations reduces the estimation error when solving for the optimal portfolio. In constrained portfolios, the minimum and maximum portfolio allocations for stocks and bonds are set according to the minimum and maximum U.S. capital-market-value-weights for those asset classes in the 1970-1984 period. In particular, the minimum allocations are 45% for large capitalization stocks (S&P 500), 4% for small-capitalization stocks (U.S. Small Stock), 8% for intermediate-term government bonds, 7% for long-term government bonds, and 9% for long-term corporate bonds.[30] Taken together, these figures suggest that at least 73% of the portfolio's assets should be invested in traditional stock and bond investments. This implies that at most, only 27% of the portfolio can be allocated to alternative asset classes such as hedge funds and managed futures funds.

2. Results

2.a. 1985-98 Optimal Portfolio Allocations

Managed futures and alternative CTA investment styles receive substantial portfolio allocations in diversified portfolios in the period 1985-98. The optimum portfolio

[29] Optimization solutions must be obtained using a numerical algorithm because the objective function that maximizes the Sharpe ratio of the portfolio is non-linear. Although both optimizations are constrained in the sense that the weights must sum to one and be non-negative, unconstrained optimization is referred for the portfolios where the weights are not bound by any other constraint.

[30] See Ibbotson, Siegel, and Love [1985]. The ranges are 45% to 65% for large-cap common stocks; 4% to 8% for small stocks; 8% to 20% for intermediate-term government bonds; 7% to 19% for long-term government bonds; and 9% to 17% for long-term corporate bonds.

allocations given to alternative managed futures fund investment styles for EW and VW portfolios are given in tables 11A and 11B, respectively. Since the data on hedge funds is relatively sparse prior to 1990, optimum portfolio allocations for hedge funds and alternative hedge fund investment styles are only estimated for the period 1990-98 and two sub-periods 1990-93 and 1994-98 (see tables 12, 13, and 14).

A benchmark optimal portfolio that does not include either hedge funds or managed futures funds is created both for constrained and unconstrained allocations to analyze the benefits of including hedge funds and managed futures funds into those diversified portfolios of stocks and bonds. For example, for the period 1985-98, the benchmark unconstrained optimal portfolio consists of 26% common stocks, 42% intermediate-term government bonds, and 32% long-term corporate bonds. It has an annual return of 11.9%, an annualized standard deviation of returns 6.59%, and a Sharpe ratio of 0.97 (see the column labeled w/o in tables 11A and 11B for Unconstrained allocations).

In table 11A, both for unconstrained and constrained portfolios, optimum portfolio allocations are presented in columns 1 through 9, when each EW alternative managed futures fund investment style is included separately in the portfolio. Column 10 provides the optimal allocations for unconstrained and constrained portfolios, when three main categories of EW managed futures (Public Funds, Private Pools and All CTAs) are included together in the portfolio. Similarly, column 11 provides the optimal allocations for unconstrained and constrained portfolios, when all alternative EW CTA investment styles are allowed to enter the portfolio simultaneously. Table 11B reports the identical analysis, but for VW portfolios of managed futures and alternative CTA investment styles, for the same time period 1985-98.

2.a.i. Unconstrained Portfolios

Attractive returns by EW and VW portfolios of managed futures and alternative CTA investment styles generate very large allocations for these alternative asset classes in the period 1985-98, when there is no boundary on the weights of the assets included to the portfolio.

Specifically, when EW portfolios of alternative managed futures fund investment styles are included separately in the benchmark portfolio, they receive portfolio allocations between 4% (EW Public Funds portfolio) and 43% (EW Financial CTAs portfolio). Consequently, the Sharpe ratio of the benchmark optimal portfolio increases by a percentage within the range of 0.39 percent to 49.5 percent (see table 11A columns 1 through 9 for unconstrained allocations). Following suit, when VW portfolios of alternative managed futures fund investment styles are included separately in the benchmark portfolio, they receive portfolio allocations between 6% (VW Energy CTAs portfolio) and 45% (VW Private Pools portfolio), raising the Sharpe ratio of the benchmark optimal portfolio by a percentage which falls between 1.24 percent and 48.0 percent (see table 11B columns 1 through 9 for unconstrained allocations).

In addition, when three main categories of managed futures (Public Funds, Private Pools and All CTAs) are included together in the portfolio, we see that the dominant managed futures investments are All CTAs in EW portfolios and Private Pools in VW portfolios (see column 10 for unconstrained allocations in tables 11A & 11B).[31] Among EW portfolios, the EW All CTAs portfolio receives 30% allocation while the other two

[31] Edwards and Liew "Managed Commodity Funds" [1999], also find that EW CTAs and VW Private Pools portfolio are the dominant investments among commodity funds during the period 1982-96.

managed futures categories receive zero allocations, increasing the Sharpe ratio of the benchmark optimal portfolio from 0.97 to 1.27 (see column 10 for unconstrained allocations in table 11A). Similarly, among VW unconstrained portfolios, the VW Private Pools portfolio receives a 45% allocation knocking down all allocations for the other two managed futures to zero and increasing the Sharpe ratio of the benchmark optimal portfolio from 0.97 to 1.43 (see column 10 for unconstrained allocations in table 11B).

Finally, when all alternative CTA investment styles are allowed to enter the portfolio simultaneously, we see that there is no dominant CTA investment style that receives all of the allocations and knocks down all allocations for other styles to zero. This is relevant both for EW and VW portfolios (see column 11 for unconstrained allocations in tables 11A & 11B). In terms of EW portfolios, when alternative CTA investment styles are added simultaneously to the benchmark portfolio, all styles other than EW Diversified CTAs receive positive allocations and increase the Sharpe ratio of the benchmark optimal portfolio by 108 percent from 0.97 to 2.01 (see column 11 for unconstrained allocations in table 11A). The same analysis for VW portfolios gives the same result: all styles other than VW Diversified CTAs receive positive allocations and increase the Sharpe ratio by 76.7 percent from 0.97 to 1.71 (see column 11 for unconstrained allocations in table 11B). Thus, the fact that different CTA styles receive positive weights when they are included simultaneously in the benchmark portfolio, suggests that alternative investment styles of CTAs are complementary, rather than substitute investment products both in EW and VW portfolio analysis.

2.a.ii. Constrained Portfolios

As in unconstrained portfolios, managed futures and alternative CTA investment styles receive large allocations, usually the maximum permissible amount, in constrained portfolios in the period 1985-98.

In particular, for EW portfolios, except for the EW Public Funds portfolio, all EW portfolios of alternative managed futures fund investment styles receive the maximum permissible portfolio allocation of 27% when they are incorporated separately to the benchmark portfolio (see table 11A columns 1 through 9 for constrained allocations).[32] Also, the same analysis for VW portfolios show that majority of managed futures and alternative CTA investment styles receive the 27% allocation in constrained portfolios (see table 11B columns 1 through 9 for constrained allocations).

When three main categories of managed futures (Public Funds, Private Pools and All CTAs) are together added to the portfolio, we see that EW All CTAs and VW Private Pool portfolios are the dominant managed futures investments. Both of them receive the highest 27% permissible allocation leaving no room for the other two managed futures categories in the portfolio (see column 10 for constrained allocations in tables 11A & 11B).

Furthermore, when all alternative CTA investment styles are allowed to enter the portfolio simultaneously, certain CTA styles receive positive weights both in EW and VW portfolios and their sum adds up to 27% allocation in the diversified portfolios.

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[32] An EW Public Funds portfolio receives very small allocations - 4% in unconstrained portfolios and 1% in constrained portfolios - which is significantly smaller than the allocations that other commodity funds receive in diversified portfolios. Elton, Gruber, and Rentzler [1987, 1990] and Irwin, Krukemyer, and Zulauf [1992] also find that adding public funds into diversified portfolio does not enhance performance. See also Oberuc [1990], Peters [1989], Orr [1987], Baratz and Eresian [1986, 1990], and Lintner [1983].

Particularly, in EW portfolio analysis, EW Currency CTAs receive 10%, EW Agriculture CTAs receive 3%, and EW Stock CTAs receive 14% allocations. This in return increases the Sharpe ratio of the benchmark constrained optimal portfolio by 51.5 percent from 0.90 to 1.37 (see column 11 for constrained allocations in table 11A). In the same analysis for VW portfolios, the Sharpe ratio of the benchmark constrained optimal portfolio increases by 48.4 percent in response to similar optimum portfolio allocations for VW alternative CTA styles (see column 11 for constrained allocations in table 11B).

2.b. 1990-98 Optimal Portfolio Allocations

Hedge funds and managed futures funds with different alternative investment styles receive excessive portfolio allocations in the period 1990-98. Tables 12A, 12B, 12C, and 12D provide an identical analysis for this period 1990-98, when all hedge funds and alternative hedge fund investment styles are also included in the benchmark portfolio together with the managed futures funds. The unconstrained portfolio allocations for the EW and the VW portfolios are given in tables 12A and 12B, respectively. Likewise, the constrained allocations for the EW and the VW portfolios are given in tables 12C and 12D. In each table, optimum portfolio allocations for managed futures and alternative CTA investment styles are presented in columns 1 through 11, and optimum portfolio allocations for hedge funds and different investment styles are presented in columns 12 through 21. Column 22 gives the optimum portfolio allocations for alternative CTA styles and alternative hedge fund styles when they are both simultaneously included in the portfolio.

2.b.i. Unconstrained Portfolios

Both managed futures and hedge funds, especially certain hedge fund investment styles, receive substantial portfolio allocations in unconstrained portfolios in the 1990-98 period.

In terms of EW portfolios, when EW alternative managed futures and CTA investment styles are included separately in the benchmark portfolio, they receive portfolio allocations between 8% (EW Public Funds portfolio) and 58% (EW Financial CTAs portfolio; see columns 1 through 9 in table 12A). Similarly, when EW portfolios of alternative hedge fund investment styles are separately included in the benchmark portfolio, they receive portfolio allocations between 36% (EW Long-only Funds portfolio) and 96% (EW Market-Neutral Funds portfolio; see columns 12 through 20 in table 12A). Thus, the optimum portfolio allocations devoted to certain EW hedge fund investment styles are considerably large. For example, EW Event Driven Funds, EW Global Macro Funds, and EW Market-Neutral Funds receive 72%, 74%, and 96% portfolio allocations in 1990-98 period, increasing the Sharpe ratio of the benchmark optimal portfolio from 0.92 to 1.85, 1.73, and 3.08, respectively (see columns 14, 15, 18 in table 12A).

In the same way, when VW portfolios of alternative managed futures fund and hedge fund investment styles are included separately in the benchmark portfolio, managed futures receive allocations up to 57% (VW Private Pools portfolio), and hedge funds receive allocations between 26% (VW Short-sell Funds portfolio) and 83% (VW Market-Neutral Funds portfolio; see columns 1 through 9 and 12 through 20 in table 12B). For instance, the portfolio allocations applied to VW Event Driven Funds and VW Market-

Neutral Funds portfolios are very large: 73% and 83% respectively. This increases the Sharpe ratio of the benchmark optimal portfolio from 0.92 to 1.79 and 2.01 for the aforementioned portfolios (see columns 14 and 18 in table 12B).

As in the 1985-98 results, EW All CTAs portfolio and VW Private Pools portfolio are the dominant investments among the three main categories of managed futures in the 1990-98 period. When these three main categories of managed futures (Public Funds, Private Pools and All CTAs) are included together in the portfolio, EW All CTAs portfolio receives a 38% allocation leaving no room for other EW managed futures, and VW Private Pools portfolio receives a 57% allocation leaving no room for other VW managed futures (see column 10 in tables 12A and 12B).

In addition, when all alternative CTA investment styles are allowed to enter the portfolio simultaneously, almost all styles receive portfolio allocations and the sum of the weights on those styles add up to 76% for EW portfolios, and 54% for VW portfolios (see column 11 in tables 12A, and 12B). As a result, the Sharpe ratio of the benchmark unconstrained optimal portfolio increases significantly from 0.92 to 1.80 and 1.55 for the respective EW and VW portfolios.

Moreover, when eight alternative hedge fund investment styles are added simultaneously to the benchmark portfolio, except for certain investment styles, all different hedge fund investment styles receive positive portfolio allocations. For EW portfolios, the EW Market-Neutral Funds portfolio receives the highest allocation 74%, and the sum of the weights devoted to alternative hedge fund investment styles adds up to 99%, leaving only 1% allocation to alternative benchmark asset classes. Consequently, the Sharpe ratio of the benchmark optimal portfolio increases by 295.3 percent from 0.92

to 3.64 (see column 21 in table 12A). Having the same analysis for VW portfolios, the VW Market-Neutral Funds portfolio receives the largest component: 62%, and the other alternative VW hedge fund investment styles receive 27% altogether adding up to a 89% allocation in the overall portfolio, raising the Sharpe ratio of the benchmark optimal portfolio from 0.92 to 2.46 (see column 21 in table 12B). It should be noticed that both in EW and VW portfolios, low Sharpe ratio ranking hedge fund investment styles (Funds of Funds, Global Funds, and Long-only Funds) are also the only three styles that do not receive any allocation when they are added to the portfolio together with other styles. This is consistent with previous results of hedge funds analyzing them as stand-alone investments.

Finally, when all six alternative CTA investment styles and eight alternative hedge fund investment styles are permitted to enter the portfolio together, both hedge funds and managed futures funds receive substantial portfolio allocations, leaving little room for benchmark asset classes in the portfolio.[33] In terms of EW portfolios, alternative hedge fund investment styles receive a total of 84% and alternative CTA investment styles receive a total of 14% allocation, forcing benchmark asset classes to a 2% allocation in the overall portfolio. As a result, the Sharpe ratio of the benchmark optimal portfolio increases significantly from 0.92 to 3.98 (see column 22 in table 12A). Likewise, for VW portfolios, alternative hedge fund investment styles obtain a total of 73% and alternative CTA investment styles obtain a total of 15% allocation in the overall portfolio, increasing the Sharpe ratio of the portfolio to 2.71 from 0.92 (see column 22 in table 12B).

[33] Edwards and Liew "Hedge Funds versus Managed Futures as Asset Classes" [1999] find that Hedge funds receive a total of 68% and Private Pools receive a total of 28% allocation in the overall unconstrained portfolios during the period 1989-96.

Thus, the introduction of managed futures and hedge funds efficiently replaces the portfolio allocations formally given to stocks and bonds.[34] Most importantly, both alternative hedge fund investment styles and alternative CTA investment styles together receive positive allocations in EW and VW unconstrained portfolios. Therefore, these findings imply that managed futures and hedge funds are complementary rather than substitute investment products.

2.b.ii. Constrained Portfolios

Hedge funds and managed futures generally receive the maximum permissible allocation of 27%, in constrained portfolios in the period 1990-98.[35]

In particular, in terms of EW portfolios, except for EW Public Funds, EW Energy CTAs and EW Global Funds, all EW portfolios of alternative hedge fund and managed futures fund investment styles receive the 27% allocation, when they are incorporated separately into the benchmark portfolio (see columns 1 through 9 and 12 through 20 in table 12C). These results are very similar for VW portfolios. Most of the VW hedge fund and managed futures fund investment styles receive the maximum weight that can be allocated to alternative asset classes in the overall diversified portfolio (see columns 1 through 9 and 12 through 20 in table 12D).

Furthermore, when six alternative CTA investment styles are entered together into the portfolio, the sum of optimal portfolio weights for alternative CTA styles, both in EW

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[34] Schneeweis and Spurgin "Alternative Investments in the Institutional Portfolio" [1998] find that 1991-96 optimal portfolio has 74% allocation to EACM 100 Hedge Fund Index and no allocation to either U.S. stocks or bonds in unconstrained portfolios.

[35] Schneeweis and Spurgin "Alternative Investments in the Institutional Portfolio" [1998] find that 1991-96 optimal portfolio has 19% allocation to EACM 100 Hedge Fund Index and 1% allocation to Goldman Sachs Commodity Index (GSCI) when the maximum permissible allocation to alternative asset classes is 20% in the constrained diversified portfolios.

and VW portfolios, is always the maximum permissible amount for alternative investments: 27%. (see column 11 in tables 12C and 12D). The results are also the same, in the case of adding eight alternative hedge fund investment styles together into the portfolio. Both EW and VW portfolios of alternative hedge funds receive a total of 27% allocation in the overall portfolio (see column 21 in tables 12C and 12D).

Finally, putting six alternative CTA investment styles and eight alternative hedge fund investment styles altogether into the same portfolio, again brings a total of 27% allocation for hedge funds and managed futures funds. Consequently, this in turn increases the Sharpe ratio of the benchmark optimal portfolio by 47.6 percent for EW portfolios and 41.67 percent for VW portfolios (see column 22 in tables 12C and 12D).

2.c. Optimal Portfolio Allocations in the Sub-periods 1990-93 and 1994-98

An analysis of the sub-periods 1990-93 and 1994-98 gives similar results. For both unconstrained and constrained portfolios, alternative investment styles of managed futures and hedge funds receive substantial allocations in both periods.

For EW unconstrained portfolios, when all hedge fund and managed futures fund investment styles are allowed to enter the portfolio simultaneously, alternative hedge fund investment styles receive total allocations of 80% in 1990-93 and 83% in 1994-98, and alternative CTA investment styles together receive total allocations of 16% and 12% in respective time periods (see column 22 in tables 13A and 14A). EW Market-Neutral Funds portfolio obtains the largest weights in these diversified portfolios in both sub-periods.

The same analysis for VW unconstrained portfolios produces similar results. Alternative hedge fund investment styles receive total allocations of 69% in 1990-93 and

80% in 1994-98, and alternative CTA investment styles together receive total allocations of 20% and 16% in respective time periods (see column 22 in tables 13B and 14B). Among VW unconstrained portfolios, VW Event Driven Funds portfolio is the dominant asset class in the optimal portfolio in period 1990-93, just as VW Market-Neutral Funds portfolio is dominant in 1994-98.

Similarly, for both EW and VW constrained portfolios, when all hedge fund and managed futures fund investment styles are added to the portfolio simultaneously, together they always receive the maximum permissible allocation of 27% in both periods (see column 22 in tables 13C, 13D, 14C, and 14D).

In conclusion, throughout the analyzed periods, both hedge funds and managed futures funds have attractive return and correlation coefficient structures, which makes it optimal to include them in substantial amounts in diversified portfolios of stocks and bonds to enhance the performance of those portfolios.

E. HEDGE FUNDS AND MANAGED FUTURES IN UP AND DOWN MARKETS

1. Return Characteristics of Hedge Funds and Managed Futures Funds

Hedge funds and managed futures funds as distinct asset classes do have very different return characteristics in different states of the market. One possible way to analyze the return characteristics of hedge funds and managed futures funds in different states of the market is to break the sample into two segments and analyze the returns; first, when S&P 500 is up more than 1% in a month and second, when S&P 500 is down more than –1% in a month. For the 1985-98 period, while there are 99 months of observations when S&P 500 is up more than 1% in a month, there are 38 months of

observations when S&P 500 is down more than –1% in a month. Likewise, for the 1990-98 period, the numbers of observations are 62 and 25 for the aforementioned states of markets.[36]

For both the up and down states of the market, table 15 provides the average monthly returns for EW and VW portfolios of alternative managed futures and hedge fund investment styles, as well as the correlation coefficients of these returns with the S&P 500 Index. Since the number of hedge funds from each investment style is not enough to form well-diversified EW and VW portfolios prior to 1990, the average returns and correlation coefficients with the S&P 500 Index are not computed for alternative hedge fund investment styles for the period 1985-98.

1.a. 1985-98 Up and Down Market Return Characteristics

EW and VW portfolios of managed futures and alternative CTA investment styles do have returns, which are remarkable both in the up and down states of the market during the 1985-98 period.

1.a.i. Up Markets

In the up markets, the correlation coefficients of returns between alternative managed futures investments and the S&P 500 Index are mostly positive and significant. This results in, on average, 1.50% monthly returns for alternative managed futures portfolios during the 1985-98 up markets. In particular, the average monthly returns for alternative managed futures range between 0.803% (VW Energy CTAs) and 2.490% (EW Agriculture CTAs) when the S&P 500 monthly returns are up more than 1% in a month.

[36] Schneeweis and Spurgin "Benefits of Hedge Funds" [1999] take the best and worst 30 S&P 500 months during the period 1990-98, and analyze the EACM Sub-indices returns in those periods.

1.a.ii. Down Markets

In the down markets, however, the correlation coefficients of alternative managed futures returns with the S&P 500 Index returns are negative for almost all investment styles during the same time period 1985-98. This generates positive EW and VW portfolio returns for alternative managed futures, ranging between –0.003% (VW Public Funds) and 2.454% (VW Stock CTAs), even though the S&P 500 monthly returns are down –1% or more in a month.

These findings clearly indicate a desirable return structure for managed futures and alternative CTA investment styles both in the up and down markets during the period 1985-98.[37]

1.b. 1990-98 Up and Down Market Return Characteristics

Hedge funds and managed futures funds do have very different return characteristics in both the up and down states of the market. Hedge funds and their alternative investment styles produce attractive returns in the up markets, whereas managed futures and alternative CTA investment styles produce attractive returns in the down markets.

1.b.i. Up Markets

Hedge funds produce very large and attractive returns compared to managed futures, making them welcome in diversified portfolios of stocks and bonds in the up markets.

During the 1990-98 period, the correlation coefficients of returns between alternative managed futures investments and the S&P 500 Index, for the most part, are positive but

[37] Schneeweis "The Benefits of Managed Futures" [1999] show that managed futures are negatively correlated (-0.23) with the S&P 500 when S&P 500 posted its twelve worst months and yet are positively correlated (0.38) when the S&P 500 reported its best twelve months. When S&P 500 returns are ranked from low to high and divided into fourteen twelve month sub-periods over the period 1985-98, managed futures provide positive returns in months in which the S&P 500 provided negative returns as well as in months in which the S&P 500 reported positive returns.

not strongly significant. Also, the returns for managed futures in the up markets are not as high as they are in the 1985-98 period. Average monthly returns for alternative managed futures fall from an average 1.50% in the 1985-98 period to an average 0.75% in the 1990-98 period.

Furthermore, analyzing hedge funds together with managed futures funds during 1990-98, show that hedge funds and their alternative investment strategies are better assets classes compared to managed futures in the up markets. While the correlation coefficients of these two alternative investments are positive with the S&P 500 Index, except for Short-sell Funds, hedge funds are more positively and significantly correlated with the market returns when S&P 500 monthly returns are up more than 1% in a month. These high positive correlation coefficients in the up markets, especially for hedge funds, produce very large returns for EW and VW alternative hedge fund investment styles. During 1990-98 up markets, except for Short-sell funds, the average monthly returns for alternative hedge fund portfolios range between 0.799% (VW Market-Neutral Funds) and 3.357% (EW Sector Specific Funds), while the average monthly returns for alternative managed futures fund portfolios range between -0.480% (VW Energy CTAs) and 1.597% (EW Agriculture CTAs). Thus, during 1990-98 up markets, alternative hedge fund portfolios, on average, produce a monthly return of 2.18% (excluding Short-sell funds), whereas alternative managed futures portfolios, on average, produce a monthly return of only 0.75%.

This clearly shows that hedge funds do have return characteristics that make them more desirable compared to managed futures in the up markets. Therefore, one should

predict larger portfolio allocations for hedge funds in the diversified portfolios in the up markets.

1.b.ii. Down Markets

Managed futures and hedge funds do have totally different return characteristics in the down markets in comparison to their returns in the up markets. While managed futures are negatively correlated with the S&P 500 Index and produce positive attractive returns in the down markets, hedge funds are positively and significantly correlated with the S&P 500 Index and produce negative returns, except for certain hedge fund investment styles.

In general, almost all EW and VW alternative managed futures investments have returns negatively correlated with the S&P 500 Index in the down markets. This, in return, generates very large attractive positive returns for alternative managed futures and CTA investment styles. In particular, the average monthly returns for alternative managed futures range between –0.189% (EW Stock CTAs) and 1.803% (VW Financial CTAs), even though the returns on the S&P 500 Index are down more than –1% in a month.

In contrast to managed futures, except for Short-sell funds, almost all EW and VW alternative hedge fund investment styles do have returns positively and significantly correlated with the S&P 500 Index. With some exceptions, this certainly creates negative returns for most of the hedge fund styles in the down markets. However, there are some hedge fund investment styles that produce positive returns in the down markets as opposed to their peer groups. These styles are EW and VW Market-Neutral Funds, VW Event Driven Funds, VW Global Macro Funds and EW and VW Short-sell Funds. The

styles outlined above, except for Short-sell funds, are also the only four hedge fund portfolios that produce positive returns in both states of the market. Particularly, EW Market-Neutral Funds portfolio has an average monthly return of 1.185% in the up markets and 0.538% (the highest return among hedge fund styles) in the down markets.

These findings indicate that managed futures and alternative CTA investment styles do have positive and attractive returns in the down markets.[38] Thus, one should predict larger portfolio allocations for managed futures in the down markets. Also, certain hedge fund investment styles like Market-Neutral Funds, Event Driven Funds and Global Macro Funds produce positive returns in the down markets in addition to their very large attractive returns in the up markets.[39] This suggests heavy weights on these specific hedge fund investment styles in diversified portfolios in both states of the market.

2. Optimal Portfolio Allocations in Up and Down Markets

Different return characteristics of hedge funds and managed futures funds in different states of the market suggest that managed futures should receive large allocations in diversified portfolios in the down markets, while hedge funds receive extensive allocations in the up markets. There are also some certain hedge fund styles that should receive positive portfolio allocations in both states of the market.

Tables 16A and 16B provide the optimal portfolio allocations for EW and VW alternative hedge fund and managed futures fund investment styles in the up markets,

[38] This result is consistent with Schneeweis, Spurgin, and Potter [1996] and Potter [1998] who show that CTAs have the lowest correlation with the S&P 500 when the S&P 500 experiences its largest losses.

[39] In addition to these specific hedge fund investment styles, Schneeweis and Spurgin "Alternative Investments in the Institutional Portfolio" [1998] show that EACM 100 Hedge Fund Index offers a beneficial correlation coefficient pattern in the sense that its correlation is twice as high during the best months of the market (0.54) as during the worst months of the market (0.23).

when S&P 500 returns are up more than 1% in a month. Likewise, tables 16C and 16D report the optimal portfolio allocations for EW and VW portfolios of hedge funds and managed futures funds in the down markets, when S&P 500 returns are down more than −1% in a month. In each table, optimum portfolio allocations for managed futures and alternative CTA investment styles are presented in columns 1 through 11, and optimum portfolio allocations for hedge funds and alternative investment styles are presented in columns 12 through 21. Column 22 gives the optimum portfolio allocations both for alternative CTA styles and alternative hedge fund styles when they are all included simultaneously in the portfolio.

2.a. Up Markets Optimal Portfolio Allocations

While alternative hedge fund investment styles receive very large allocations in the diversified portfolios of stocks and bonds, except for certain CTA investment styles. managed futures most of the time receive "zero" allocations in the up markets.

2.a.i. Optimal Portfolio Allocations for Managed Futures in the Up Markets

Generally, both EW and VW portfolios of managed futures and alternative CTA investment styles receive zero allocations in diversified portfolios of stocks and bonds when S&P 500 returns are up more than 1% in a month.

When EW portfolios of managed futures and alternative CTA investment styles are included separately in the benchmark portfolio of stocks and bonds, only EW Agriculture and EW Stock CTAs receive positive allocations --14% and 19% respectively, while the rest of the managed futures and CTA styles do not receive any allocations at all (see columns 1 through 9 in table 16A). Similarly, when VW portfolios of managed futures and alternative CTA investment styles are included separately in the portfolio, except for

VW Private Pools and VW Agriculture CTAs -- 3% and 9% respectively, all other managed futures receive zero allocations in the overall portfolios (see columns 1 through 9 in table 16B).

Furthermore, including the three main categories of managed futures simultaneously (column 10 in tables 16A and 16B) or putting six alternative CTA investment styles together (column 11 in tables 16A and 16B) into the portfolio does not increase the portfolio weights allocated to managed futures and CTAs in the up markets. When three main categories of managed futures are allowed to enter the portfolio simultaneously, none of the three main categories of managed futures receive positive allocations in EW portfolios, and only Private Pools receive a 3% allocation in VW portfolios (see column 10 in tables 16A and 16B). In a similar analysis, when all CTA investment styles are added to the portfolio, only Agriculture and Stock CTAs in EW portfolios, and only Agriculture CTAs in VW portfolios receive positive but small allocations in diversified portfolios of stocks and bonds (see column 11 in tables 16A and 16B). These small allocations for managed futures suggest that they are not good asset classes for diversified portfolios in the up markets.

2.a.ii. Optimal Portfolio Allocations for Hedge Funds in the Up Markets

In contrast to managed futures, hedge funds and their alternative investment styles receive substantial portfolio allocations in the up markets.

An EW All Hedge Funds portfolio, for example, receives a 43% allocation, and a VW All Hedge Funds portfolio receives a 25% allocation when the market is producing on average a monthly return of 1% or more (see column 12 in tables 16A and 16B). Specifically, when EW portfolios of alternative hedge fund investment styles are included

separately in the portfolio, they receive portfolio allocations between 8% (EW Long-only Funds) and 58% (EW Market-Neutral Funds) in the up markets (see columns 13 through 20 in table 16A). Similarly, when VW portfolios of alternative hedge fund investment styles are included separately in the portfolio, except for VW Long-only Funds and VW Sector Funds, all other styles receive positive portfolio allocations between 12% (VW Short-sell Funds) and 49% (VW Event Driven Funds; see columns 13 through 20 in table 16B).

Moreover, when eight alternative hedge fund investment styles are added simultaneously to the benchmark portfolio, EW hedge fund portfolios receive a total of 67% and VW hedge fund portfolios receive a total of 51% allocation in diversified portfolios, despite the fact that the stock market is doing extremely well in those periods (see column 21 in tables 16A and 16B).

Finally, when all six alternative CTA investment styles and eight alternative hedge fund investment styles are allowed to enter the portfolio together in the up markets, hedge funds dominate the managed futures in portfolio allocations. In terms of EW portfolios, alternative hedge fund investment styles receive a total of 57% allocation while alternative CTA investment styles receive only a total of 14% allocation. For VW portfolios, the sum of weights for alternative hedge funds and alternative CTAs are 48% and 3% respectively (see column 22 in tables 16A and 16B).

These findings clearly indicate that hedge funds do have return characteristics that make them optimal to put into diversified portfolios to enhance the performance of those portfolios in the up markets.

2.b. Down Markets Optimal Portfolio Allocations

In the down markets, both hedge funds and managed futures funds receive totally different portfolio allocations than their allocations in the up markets. While managed futures and alternative CTA styles receive very large allocations in the diversified portfolios of stocks and bonds, except for certain investment styles, hedge funds most often receive "zero" allocations in the overall portfolios.

2.b.i. Optimal Portfolio Allocations for Managed Futures in the Down Markets

Both EW and VW portfolios of managed futures and alternative CTA investment styles receive very large portfolio allocations in the down markets, in contrast to their small allocations in the up markets.

When EW and VW portfolios of managed futures and alternative CTA investment styles are included separately in the portfolio, all managed futures receive 100% of the allocations in the overall portfolios, knocking down all other benchmark asset classes to zero allocations (see columns 1 through 9 in tables 16C and 16D). This result is consistent with the down market return characteristics of managed futures that was analyzed in the previous section.

In the down markets, when three main categories of managed futures (Public Funds, Private Pools and All CTAs) are included together in the portfolio, we see that the dominant managed futures investments are All CTAs in EW portfolios and Private Pools in VW portfolios.[40] Both EW All CTAs and VW Private Pools portfolios receive 100%

[40] This is the same result as before when I compute the optimal portfolio allocations for managed futures for all markets during the 1990-98 period.

of the allocations, leaving no room for the other two managed futures and other benchmark asset classes in the portfolio (see column 10 in tables 16C and 16D).

Lastly, when all six alternative CTA investment styles are allowed to enter the portfolio simultaneously, almost all CTA styles receive positive allocations and their sum of weights add up to 100%, again knocking down the other benchmark asset classes to zero allocations. This is true both for EW and VW portfolios in the down markets (see column 11 in tables 16C and 16D).

In conclusion, these extraordinary large allocations for managed futures and alternative CTA investment styles point out that managed futures produce very attractive positive returns in the down markets, which makes them very good asset classes for diversified portfolios during those periods.

2.b.ii. Optimal Portfolio Allocations for Hedge Funds in the Down Markets

While managed futures receive large allocations in diversified portfolios in the down markets, except for some certain investment styles, hedge funds usually receive zero allocations in the overall portfolios during those periods.

When EW hedge funds and their alternative investment styles are separately included in the portfolio, only EW Event Driven Funds, EW Market-Neutral Funds and EW Short-sell Funds receive positive allocations and the rest of the styles can not even get into the portfolio. Besides, two out of the three EW portfolios (Event Driven and Market-Neutral Funds) that manage to get into the diversified portfolio, beat all the assets in the benchmark portfolio and receive 100% of the allocations in the overall portfolios (see columns 12 through 20 in table 16C). Similarly, when VW hedge funds and their investment styles are included in the portfolio separately, only VW Event Driven Funds,

VW Global Macro Funds and VW Short-sell Funds get into the portfolio and receive 100% of the allocations, while the rest of hedge funds receive zero allocations in the overall portfolios (see columns 12 through 20 in table 16D).

Moreover, both for EW and VW portfolios, when eight alternative hedge fund investment styles are added simultaneously to the portfolio in the down markets, only Event Driven Funds, Market-Neutral Funds and Short-sell Funds receive positive weights and the sum of those three weights adds up to 100% in the overall portfolios. Particularly, Market-Neutral is the largest component in both portfolios, receiving 71% allocation in EW portfolios and 63% allocation in VW portfolios (see column 21 in tables 16C and 16D).

Finally, when all six alternative CTA investment styles and eight alternative hedge fund investment styles are entered together to the portfolio in the down markets, both hedge funds and managed futures receive substantial allocations by knocking down the benchmark asset allocations to zero percent. In terms of EW portfolios, alternative hedge fund investment styles receive a total of 77% allocation and alternative CTA investment styles receive a total of 23% allocation adding up to 100% allocation in the overall portfolio. Likewise, for VW portfolios, the sum of allocations for hedge funds is 74% and the sum of allocations for CTAs is 26%. Specifically, Market-Neutral Funds portfolio dominates both the other hedge fund investment styles and the CTA investment styles in those portfolio allocations by receiving a 63% allocation both in EW and VW portfolios (see column 22 in tables 16C and 16D).

All in all, even managed futures and alternative CTA investment styles receive excessive allocations in the down markets, certain hedge fund investment styles like

Market-Neutral Funds. Event Driven Funds continue to receive large allocations in those periods in addition to their large allocations in diversified portfolios in the up markets. Particularly, Market-Neutral Funds portfolio is the dominant investment style among hedge funds as well as managed futures funds both in EW and VW portfolios by producing positive returns and receiving large portfolio allocations in both states of the market.

3. Summary of Results

The analysis of optimal portfolio allocations indicates that hedge funds and managed futures funds receive excessive weights in diversified portfolios of stocks and bonds in all time periods analyzed. Certain hedge fund and managed futures fund investment styles receive very large allocations not only in 1990-98 – a sample of *all markets*, but also in the *up* and *down markets* when these periods are examined separately. Regardless of whether these certain styles are included in the portfolio separately or combined with all of the investment styles, they enhance the portfolio performance considerably in all time periods and in all states of the market.

Table 17A reports the best three hedge fund investment styles for EW and VW portfolios in *all markets* as well as in the *up* and the *down markets*. In each market, the best three EW and VW hedge fund investment styles are determined according to their weights in the portfolio and their effects on the enhancement of the portfolio performance when they are included separately into the diversified portfolio of stocks and bonds. In addition, a benchmark portfolio consisting of only stocks and bonds (50% S&P 500 Index, 10% US Small Stock Index, 10% Intermediate-term government bonds, 15% Long-term government bonds, and 15% Long-term corporate bonds) is created to

compare the performance of this benchmark portfolio to the performances of the portfolios that include a single hedge fund investment style. The annualized raw returns and risk-adjusted returns are used as performance measures. In terms of risk-adjusted returns, two different measures are utilized: 1) Sharpe ratio of the portfolio and 2) the risk-adjusted return of the portfolio where the raw return is adjusted to the same risk level of the benchmark portfolio.[41] Table 17B reports exactly the same analysis but for managed future funds.

The first result that can be derived from this analysis is that in terms of risk-adjusted returns, all the portfolios with hedge funds and managed futures funds win over the benchmark portfolio in all states of the market. For example, while the benchmark portfolio produces a Sharpe ratio of 0.85 in the *all markets* (including the sample from 1990:01 through 1998:08), portfolios including the best EW and VW hedge fund styles produce a Sharpe ratio between 1.53 (VW Global Macro Funds) and 3.08 (EW Market Neutral Funds). Similarly, when the portfolio returns are adjusted to the same risk level of the benchmark portfolio, the portfolios with the best EW and VW hedge fund styles produce an annual return between 18.98% and 33.42% while the benchmark portfolio produces only a 12.75% annual return in the *all markets*. The results are also similar in the *up* and the *down markets* for both hedge funds and managed futures funds. For instance, in the *up markets*, even though the benchmark portfolio produces a Sharpe ratio of 5.01, the portfolios that include the best EW and VW hedge fund styles produce higher Sharpe ratios: between 5.49 (VW Market Neutral Funds) and 6.27 (EW Market Neutral

[41] For a discussion of adjusting portfolio returns to the same risk level of the market portfolio, see Z. Bodie, A. Kane, and A. J. Marcus, *Investments*, Irwin McGraw-Hill, USA, 1999, p.755 – 757.

funds; see table 17A). In the same way, the best EW and VW managed futures styles produce Sharpe ratios between 5.32 (VW Private Pools) and 5.73 (EW Agriculture CTAs; see table 17B).

In terms of hedge fund styles, for both EW and VW portfolios, Market-Neutral Funds, Event Driven Funds, and Global Macro Funds all consistently take place in the first three rankings in almost all different states of the market. For instance, a portfolio including EW Market-Neutral Funds receives the first ranking in the *all markets* and the second ranking both in the *up* and the *down markets*. Similarly, a portfolio including VW Event Driven funds receives the second ranking in the *all markets*, the first ranking in the *up markets*, and again the second ranking in the *down markets*. The only other two styles that appear in the rankings other than the three aforementioned hedge fund styles are EW and VW Short-sell funds in the *down markets* and EW Sector funds in the *up markets*.

The results for managed futures funds are not as consistent as the results for hedge funds. Due to distinct return characteristics of managed futures funds in the *up* and the *down markets*, all EW and VW styles receive 100% allocation in the *down markets*, whereas only two styles from each of the EW and VW portfolios are able to receive positive allocations in the *up markets*. The only style that takes place in the rankings in all three markets is the VW Private Pools. A portfolio including VW Private Pools receives the first ranking in the *all markets* as well as in the *down markets* and a second ranking in the *up markets*. Also, a portfolio including EW Financial CTAs receives the first ranking in the *all markets* and the second ranking in the *down markets*, however, the EW Financial CTAs portfolio does not receive any allocation in an optimal portfolio in the *up markets*. In addition, portfolios with EW Agriculture CTAs and VW Agriculture

CTAs receive the second rankings in the *all markets* and the first rankings in the *up markets*, while they do not rank among the best three managed futures in the *down markets*.

In conclusion, particular hedge fund and managed futures fund investment styles receive excessive allocations and enhance the risk-adjusted returns of the portfolios in significant amounts in all different states of the market. Among hedge funds, EW and VW portfolios of Market-Neutral Funds, Event Driven Funds, and Global Macro Funds are definitely the best hedge fund investment styles in all states of the market when they are analyzed as part of a diversified portfolio. Similarly, VW Private Pools, EW Financial CTAs, and EW and VW Agriculture CTAs can be considered as the best managed futures fund investment styles among the other styles of CTAs when they are examined within the context of a diversified portfolio.

VI. DO HEDGE FUNDS AND MANAGED FUTURES FUNDS HAVE EXCESS RETURNS?

The Capital Asset Pricing Model (CAPM) is a single-factor risk model which predicts that an asset's return should be equal the risk-free rate plus an adjustment for the relative riskiness of the asset. The model uses a time-series regression to compute the beta, which measures the sensitivity of the asset's return to changes in the market return. The beta is considered to be a measure of the asset's systematic risk. The CAPM predicts that the expected excess return of an asset is proportional to the beta of that asset. Multi-factor risk models extend the CAPM in a straightforward way. They use a time-series multiple regression to measure an asset's beta with respect to multiple risk factors. The model

predicts that the expected excess return is proportional to the betas of different risk factors. The alpha estimated in the multiple regression is a measure of the asset's risk-adjusted excess return. Basically, it is the difference between the asset's actual return and the return what the multi-factor model predicts. This section estimates alphas for hedge funds and managed futures funds using multi-factor risk models. I find that both hedge funds and managed futures funds have significantly positive excess returns.

1. Literature Review

The CAPM is used extensively to estimate the risk-adjusted excess returns for mutual funds. Most of the early studies on this topic concluded that mutual funds did not display positive excess returns (see Appendix 2 for a detailed description of prior literature on mutual funds' and hedge funds' excess returns). Jensen (1968), by employing the CAPM, finds that mutual funds perform poorly relative to randomly selected portfolios of equal risk over the period 1945-1964. Treynor (1965) and Sharpe (1966) provide similar results.

A more recent study, Ippolito (1989), using the single-factor CAPM, finds that mutual funds, on average, produce positive excess returns net of expense fees, except for load charges. On the contrary, Hendricks, Patel, and Zeckhauser (1993) analyze the effect of "hot hands" in short-term performance persistence of mutual funds by employing the single-factor CAPM for different market indices and find that most of the estimated individual α's (excess returns) are not significantly different from zero. The annualized mean (median) fund alpha is found to be -1.12% (-0.80%) for the period 1975 – 1988. However, they find an evidence of short-term performance persistence in risk-adjusted returns. That is, mutual funds that do well in the past continue to do so in the near future.

Similarly, Elton, Gruber, Das, and Hlavka (1993), employ a single-factor CAPM, and find that the annualized average alpha is 0.61% per year, which is statistically not different from zero. Likewise, Malkiel (1995) utilizes the single-factor CAPM in estimation of mutual fund alphas and finds that annualized average fund α during the period 1971-1991 is –0.24 percent, which is indistinguishable from zero. For the period 1982-1991, however, he finds that mutual funds underperform the S&P 500 Index and produce an annualized average alpha of –3.20% per year, which is statistically significant at the 1% level.

In the academic literature, the use of multi-factor models in the return equations is becoming widely accepted, dominating the traditional one-factor CAPM in performance attribution and in explanation of average returns.

In terms of stock-market factors, Fama and French (1993) identify two stock-market risk factors in addition to the market index which proxies for the common market risk-factor: SMB and HML, where SMB is the difference between the returns on small-stock and large-stock portfolios with the same weighted-average book-to-market equity, and HML is the difference between the returns on high book-to-market stock portfolios and low book-to-market stock portfolios with the same weighted-average size. "Small cap" (large cap) stocks have small (large) market values (stock price times shares outstanding). "High book-to-market", or "value", stocks have market values that are relatively small compared to the book values. Both small cap stocks and value stocks have had historically high average returns compared to "large cap" stocks and "low book-to-market" or "growth" stocks. Thus, portfolios constructed to mimic risk factors related to size and book-to-market ratios are found to explain a significant amount of variation in

stock returns, suggesting that size and book-to-market proxy for common risk factors in stock returns.

Fama and French, based on these results, suggest the use of a 3-factor model for stock returns. Brown and Goetzmann (1995) also employ a 3-index model, where the total return on the S&P 500 Index, the Ibbotson Small Firm Index, and the government bond index are used in the regression analyses to compute the α's of mutual funds. In the study, the annualized average alpha is found to be 0.36%, which is not statistically different from zero. Carhart (1997) uses a four-factor model where he adds a risk factor related to "momentum" to the three-factor model of Fama and French, and concludes that a "momentum factor" explains stock returns.[42] Carhart concludes that 4-factor model significantly improves over the three-factor model of Fama and French, reducing the mean absolute errors from 0.31 percent to 0.14 percent per month. However, the study finds no significantly positive risk-adjusted returns for mutual funds. Similarly, Gruber (1996), and Elton, Gruber, and Blake (1996) use a different version of a 4-factor model to explain the risk-adjusted returns of mutual funds. They use the same three factors used by Fama and French and add the excess return on a bond index as the fourth factor in their regression analyses. Both articles conclude that using 4-factor models do a very good job in forecasting the future risk-adjusted performance, both in the short-run and in the long-run. However, both studies conclude that average fund performance is negative. Gruber (1996) finds that mutual funds underperform the benchmark portfolio during the period 1985-1994 by 65 basis points per year (i.e., They earn negative excess returns). Elton,

[42] For momentum effects see Jegadeesh and Titman [1993], Grinblatt, Titman, and Wermers [1995], and Wermers [1996]. They conclude that funds following momentum strategies realize better performance in the short-run before management fees and transaction expenses.

Gruber, and Blake (1996) find that 3-year annualized average four-factor alpha is –0.91% per year and statistically significant at the 1% level.

In terms of bond-market factors, Fama and French (1993) introduce two factors related to maturity and default risk. They define maturity risk premium (TERM) as the difference between the monthly return on long-term government bonds and one month Treasury bill rate measured at the end of the previous month. Thus, the term premium proxies for predicted changes in interest rates. The default risk premium (DEF) is defined as the difference between the returns on long-term corporate bond portfolio and long-term government bond portfolio. They find that factor mimicking portfolios for the two interest rate factors – term premium and default risk premium – capture most of the variation in the returns on government and corporate bond portfolios.

In contrast to mutual funds and other asset returns, the literature on risk-adjusted excess returns of hedge funds is very new. Brown, Goetzmann, and Ibbotson (1999), using the CAPM, compute the Jensen alphas for offshore hedge funds. They find that the Jensen alphas are positive for all categories of hedge funds except for short-sellers. However, this study uses only annual returns data for seven years to estimate the risk-adjusted excess returns of hedge funds. The use of annual data limits the power of statistical tests and prevents the authors using a multi-factor risk model.

Ackermann, McEnally, and Ravenscraft (1999) use Sharpe ratios as well as Jensen alphas as measures of risk-adjusted returns in a performance study of hedge funds covering the period 1988-1995. Their results indicate that, using S&P 500 as the market index, Jensen alphas are significantly positive for hedge funds in all samples except for the 1994-95 period, and typically range from 6 to 8% per year. Ackermann et. al.,

however, put much more emphasis on Sharpe ratios as a measure of risk-adjusted return for hedge funds.

This study differs from past studies in many ways. First, it uses a longer time period and a larger sample of hedge funds and managed futures funds. Second, it employs multi-factor risk models, rather than the single-factor model. Third, it estimates pooled time-series cross-section regressions to obtain Jensen alphas for individual funds, allowing for fund-specific slope coefficients for all risk factors. In addition, it estimates individual fund alphas when the slope coefficients for individual funds are permitted to vary from year-to-year. Finally, it estimates fund alphas by different investment styles and provides a statistical description of high-alpha funds versus low-alpha funds by investment style.

A. THE PERFORMANCE OF HEDGE FUNDS

1. Measuring Performance as Excess Returns

The complexity of hedge fund returns suggests that it is best to use a multi-factor model rather than a single-factor model to capture most of the returns generated by these funds. The fact that hedge funds operate both in the stock and the bond markets, and use a variety of trading strategies dictates the use of a multi-factor risk model. I employ a six-factor model to capture the variation in hedge fund returns due to common risk factors where the risk factors are represented by various zero-investment, dynamic index trading strategies that have been identified in the academic literature [43] The six-factor model employed here is:

$$R_i - R_f = \alpha + b*(S\&P500 - R_f) + h*(HML) + s*(SMB) + w*(WML) + g*(TERM) + k*(DEF) + e_i \quad (9)$$

[43] See Fama and French [1993, 1996, 1997] and Carhart [1997].

where

R_i is monthly hedge fund returns; R_f is 30 day T-bill rate; HML is the monthly returns on a portfolio of high book-to-market stocks minus the monthly returns on a portfolio of low book-to-market stocks;[44] SMB is the monthly returns on a portfolio of small stocks minus the monthly returns on a portfolio of large stocks;[45] WML is the monthly returns on a stock portfolio of past year's winners minus the monthly returns on a stock portfolio of past year's losers;[46] TERM is the monthly returns on long-term government bond portfolio minus the one month lag return on 30-day Treasury bills;[47] DEF is the monthly returns on a portfolio of long-term corporate bonds minus the monthly returns on a portfolio of long-term government bonds;[48] and e_i is the usual error term (or residual return). Using pooled cross-section data on returns, this equation is estimated separately for each of the eight hedge fund investment styles as well as for all hedge funds that exist

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[44] See Rosenberg, Reid, and Lanstein [1985]. Book-to-market values are defined as book value per share divided by the market price per share. The index is created by using equity information obtained from Datastream. Only the stocks that report book-to-market values, market capitalization, and monthly returns for the prior year are used in the formation of the index. The HML portfolio is value-weighted, re-balanced quarterly, and "size" and "momentum" neutral. See Liew and Vassalou [1998] for a more detailed explanation.

[45] See Banz [1981] for the size effect in U.S. equities. Market capitalization is calculated by multiplying the number of shares outstanding by the market price of the stock. The SMB index is value-weighted, re-balanced quarterly, and "value" and "momentum" neutral.

[46] See Jegadesh and Titman [1993], Asness [1995], and Carhart [1997] for a discussion of stock momentum. Winners are defined as stocks that have had high monthly returns during the past year, excluding the most recent month; and losers are those that have had low monthly returns during the past year, excluding the most recent month. Excluding the last month returns reduces the problems related to bid/ask bounce. The WML index is value-weighted, re-balanced quarterly, and "value" and "size" neutral.

[47] See Fama and French [1993]. TERM is the risk premium in bond returns arising from unexpected changes in interest rates. The T-bill rate is meant to proxy for the general level of expected returns on bonds, thus TERM proxies for the deviation of long-term bond returns from expected returns due to shifts in interest rates.

[48] See Fama and French [1993]. DEF is the risk premium in bond returns arising from shifts in economic conditions that change the likelihood of default.

within the sample for the nine-year period 1990:01 through 1998:08. All hedge funds with a minimum twelve months of existence are included in the pooled regressions.[49] The advantage of a time-series cross-section pooled regression over an individual time-series regression for each hedge fund is that pooled regressions take into account the correlation of returns between funds, whereas individual time-series regressions do not. This is an important weakness in past studies that use individual time-series regressions to derive the risk-adjusted excess returns. This paper is the first study to use pooled time-series cross-section regressions to estimate the risk-adjusted excess returns. The estimates for the six-factor pooled time-series cross-section equations are presented in table 18.[50]

I also estimate a single pooled time-series cross-section six-factor regression for all hedge funds using *hedge fund style dummies*. This method allows us to estimate separate intercept and slope coefficients for each hedge fund style while pooling over all funds and investment styles. For comparison, this technique is also applied to CAPM, and the four-factor model of Carhart, where only the stock-market factors ({S&P 500 – T-bill}, HML, SMB, and WML) are included in the regression.

Finally, I add time dummies to the six-factor model for specific months to account fixed-effects associated with the extreme hedge fund returns during these months. A time

[49] Fifty-four hedge funds have fewer than twelve monthly observations and are therefore excluded from the data.

[50] Because some hedge funds trade in international markets, such as Global and Global Macro funds, I also tried, as alternative additional explanatory variables, both an international equity index (the MSCI World Index) and a foreign equity index (the MSCI EAFE Index). These variables are significant only for two investment styles, Funds of Funds, and Global funds, and do not increase the adjusted R^2's of the equation or change estimates of fund alphas. In addition, I tried three currency variables as additional explanatory variables, the monthly returns on the Deutsche Mark, British Pound, and Japanese Yen. While these variables were significant for some investment styles, particularly for Funds of Funds, Global funds, and Short-sell funds, their inclusion did not change the estimated alphas, and did not appreciably increase the adjusted R^2's (see Appendix 3).

dummy is added for each month for which the EW monthly return of all hedge funds is 1.645 standard deviations below or above the mean return of the EW portfolio over all months in the sample. The estimates for these large pooled time-series cross-section regressions for one-factor, four-factor, six-factor and six-factor with time dummies models are reported in table 19.

2. Excess Returns by Investment Style

Table 18 reports the estimates from six-factor time-series cross-section pooled regressions when this equation is estimated separately for each of the eight hedge fund investment styles as well as for all hedge funds taken together for the nine-year period 1990:01 through 1998:08. The results indicate that all indices chosen to proxy for separate risk factors in the stock and the bond markets work very well to explain hedge fund returns. In particular, all factors except for HML are statistically significant in the pooled regression that includes all hedge funds in the sample. Although HML is not significant in the equation for all hedge funds, it is a significant risk factor in the return equations of Global Macro funds, Global funds, and Short-sell funds.

In addition, the significance of different risk factors for different styles tells more about the activities of hedge fund investment styles. For example, it is clear from the regression results that Global Macro funds are more involved in equity markets, whereas Market-Neutral funds trade more in bond markets (see table 18).

In terms of the signs of coefficients, we see a particular pattern among hedge fund investment styles for certain risk factors. For instance, the market risk factor (S&P 500 – T-bill) have positive and significant betas in all hedge fund investment styles, except for the Short-sell funds; and SMB has negative and significant slope coefficients in all styles,

again except for Short-sell funds. However, there are also some cases where a risk factor is positive and significant for one style, but negative and significant for the other style. For example, Global Macro funds have a positive and significant coefficient for the risk factor HML, whereas Global funds have a statistically negative coefficient for the same risk factor. Similarly, Event Driven funds have a statistically positive coefficient for the DEF variable, but Sector funds have a negative and significant coefficient for the same risk factor. These results indicate that different trading styles involve different types of risks, which point out the importance of distinguishing among the different hedge fund investment styles.

Analyzing the alphas from the six-factor time-series cross-section pooled regressions of hedge fund returns reveal that all hedge fund investment styles, except for Long-only funds, produce positive and significant risk-adjusted excess returns. In particular, all hedge funds produce a monthly average excess return of 0.383%, and the monthly average risk-adjusted excess returns among different hedge fund investment styles range between 0.179% (Funds of Funds) and 0.763% (Sector funds) (see table 18).

Table 19 reports the estimation results of the pooled time-series cross-section regressions of all hedge funds when investment *style dummies* are added in order to estimate separate intercept and slope coefficients for each style. This technique is applied to the single-factor CAPM, the four-factor model of Carhart, my six-factor model, and a six-factor model, which includes time dummies. The estimates for all four regressions appear in columns of table 19. Column 1 reports the pooled regression results for the CAPM. Column 2 provides the estimates for the four-factor model, where only stock-market factors are included in the pooled regression. Column 3 gives the results for the

six-factor model, where bond-market factors (DEF and TERM) are included in addition to the stock-market factors. And, finally, column 4 presents the pooled results from a six-factor model, which includes time dummies.

When the single-factor CAPM is used in the pooled regression, all styles have positive and significant beta coefficients, except for Short-sell funds; and all styles, except for Long-only funds, have positive and significant risk-adjusted excess returns. Long-only funds have a monthly average alpha of –0.096% which is not statistically different from zero (see column 1 in table 19). However, the CAPM explains only 11.2% of the variation in the returns of hedge funds.

When Carhart's four-factor model is estimated, the risk factors HML, SMB, and WML are generally statistically significant (see column 2 in table 19). Similar to the CAPM results, except for Long-only funds, all styles have significantly positive risk-adjusted excess returns and the monthly average alphas among different hedge fund investment styles range between 0.141% (Funds of Funds) and 0.890% (Sector funds).

The six-factor pooled regression result presented in column 3 in table 19 exactly matches to the results reported in table 18, where separate six-factor pooled regressions are estimated for each of the styles. For example, the intercept style dummies (alphas) given in column 3 are similar to the alphas computed separately in style regressions in table 18. Thus, the results obtained in table 18 continue to hold when I pool across all hedge fund styles. The six-factor model shown in column 3 of table 19 explains 14.9% of the variation in all hedge fund returns, compared to 11.2% for the CAPM. The bond-market risk factors – TERM and DEF – used in the six-factor model are statistically significant for most of the hedge fund styles. TERM has five and DEF has six significant

slope coefficients, out of the eight slope coefficients for hedge fund investment styles. The F-test rejects the null-hypothesis that the coefficients on variables TERM and DEF are jointly not different from zero. Thus, both bond-market factors and stock-market factors appear to explain hedge fund returns.

Adding time dummies to the six-factor model to account for the extreme hedge fund returns improves the results: the adjusted R-square of the regression increases from 14.9% to 15.8%. In addition, WML, which had statistically significant coefficients only for two hedge fund styles in the four and six-factor models, is now statistically significant for six out of the eight hedge fund investment styles. Further, all hedge funds, including the Long-only funds, now exhibit positive and significant monthly risk-adjusted excess returns, ranging from 0.274% for Funds of Funds to 0.936% for Sector funds, after holding every possible risk and time factor constant.

3. The Excess Returns of Individual Hedge Funds: Descriptive Statistics

The six-factor time-series cross-section pooled regression, including the hedge fund style and time dummies, produces a monthly average risk-adjusted return (alpha) for each of the hedge fund investment styles. The alpha measure computed for a style, however, is roughly the average of the all funds' alphas in that particular style. It does not give any information about the number of hedge funds that have positive and significant alphas in that particular style. To find more about alphas and estimate the individual alphas for all funds in a style, I employ a six-factor time-series cross-section pooled regression for each of the hedge fund investment styles by adding fund and time dummies to the equation. In other words, within each style, I run six-factor pooled regressions where I add one fund dummy for each of the funds in a style and one time (month) dummy for each of the

months with extreme returns to the regression equation. This technique produces a separate alpha for each fund in a given hedge fund style.[51]

Table 20 reports the descriptive statistics on fund alphas (risk-adjusted excess returns), which are computed with the six-factor regression technique explained above for the period 1990:01 – 1998:08. The results indicate that the number of funds that have positive and significant alphas is very low compared to the total fund numbers. For example, there are only 42 Fund of Funds that have positive significant alphas at a 10% significance level out of the 349 funds in that category. That means only 12% of the Fund of funds have positive and significant alphas. The percent of funds with positive and significant alphas ranges between 10% and 30% among alternative hedge fund investment styles. These results show that choosing funds that produce positive and significant alphas is a very difficult task. Only Market-Neutral funds have a large percent of funds with positive significant alphas: out of the 300 Market-Neutral funds, 85 of them have positive and significant alphas, which is relatively a large number in comparison to other styles of hedge funds.

Comparing the average of positive significant alphas – winners – to the average alphas of all other funds – losers – show a considerable gap between the two groups for

[51] As alternative measures of excess returns, in addition to six-factor individual fund alphas, Sharpe ratios and absolute excess returns over the risk-free rate are also computed for each individual hedge fund over the period 1990-1998. The averages of these measures by hedge fund investment style as well as the correlation coefficients between these alternative measures are reported in the Appendix 4A. The simple correlations between six-factor alphas and absolute excess returns and Sharpe ratios are, respectively, 0.88 and 0.53. However, despite the high correlation that exists between alphas and both absolute excess returns and Sharpe ratios, there are substantial differences in the magnitude of the alternative estimates of excess returns. The annualized average six-factor alpha ranges from a low of 2.15% for Funds of Funds to a high of 8.16% for Sector funds. On the other hand, the annualized average absolute excess returns range from a low of 2.04% for Short-sell funds to a high of 17.05% for Long-only funds. The annualized average Sharpe ratios between alternative hedge fund investment styles range between 0.15 for Short-sell funds and 1.38 for Market-Neutral funds (see Appendix 4A).

each of the hedge fund investment styles. For instance, Global Macro funds with positive and significant alphas produce an average excess return of 2.29% in a month, while all other Global Macro funds have a monthly average alpha of 0.05%. This is a 2.24 percentage points difference in monthly excess returns between winners and losers. The figures for the other hedge fund investment styles are very much the same.

The results are similar, when monthly raw returns are compared between the two groups, winners and losers. Funds that have positive significant alphas also have very large raw returns compared to raw returns of all other funds in that category. For instance, Sector funds that have positive and significant alphas produce an average monthly raw return of 3.07%, whereas all other funds in this style can only produce an average monthly raw return of 0.68%. The discrepancy between the raw returns of winners and losers is clearly visible in other styles of hedge funds as well.

In terms of market size, funds with positive significant alphas, most often, have a larger size than funds with non-positive significant alphas. The largest average fund size difference between the winners and the losers is observed among Global Macro funds. That is, funds with positive significant alphas have an average size of $997.28 million, and in contrast, all other funds in this style have only an average size of $77.64 million. Although the differences are not as large as in Global Macro funds, we see a similar pattern in average fund sizes in other styles of hedge funds, except for Long-only and Short-sell funds.

The age of the fund does not reveal anything about the excess return (alpha) of the fund. Thus, across all hedge fund styles, the average number of months in existence for funds with positive significant alphas is no different from the other funds.

Finally, analyzing the incentive fee structure between funds with positive significant alphas and the other funds show that incentive fees are considerably larger for funds that have significantly positive alphas. Especially, for Global Macro, Market-Neutral, and Sector funds, the differences in median incentive fees between winners and losers are significant. In particular, while Market-Neutral funds with positive significant alphas pay managers a median annual incentive fee of 20.00% on profits, the other funds in the same style just pay a 5.00% median annual incentive fee on the profits.

All in all, alternative hedge fund investment styles do have positive and significant average risk-adjusted excess returns. However, positive significant alphas are heavily concentrated within a small number of funds in each style. Therefore, it is very important to select the funds that produce positive and significant alphas, because funds with positive significant alphas considerably differ from the peer funds in terms of average alphas, average raw returns, average size, and median annual incentive fees.[52]

B. THE PERFORMANCE OF MANAGED FUTURES FUNDS

1. Measuring Performance as Excess Returns

Managed futures funds most often concentrate their investment activities in futures and derivatives markets. The majority employ trend-following or "market momentum" technical trading methodologies to identify upward or downward price trends, and take either long or short futures positions to capitalize on rising or falling prices (Fung and

[52] The individual hedge fund alphas are also computed for a seven-factor model, where the seventh factor is the MSCI World Index. Adding the seventh factor did not significantly change the values of individual hedge fund alphas. Thus, the number of hedge funds with positive significant alphas remained same in each style.

Hsieh, 1997). Therefore, their returns depend on the incidence and magnitude of upward and downward price trends in the commodity markets.

I use the MLM (Mount Lucas Management) index to represent the potential returns that can be capitalized from price trends in commodity markets. The MLM index is a dynamically constructed, passive commodity index that permits long as well as short positions, and includes both financial and commodity futures. The index employs a simple moving-average technical trading rule to identify the upward and downward price trends in each of the major twenty-five commodity markets, and depending on the trading signal, the index simulates taking a long or a short position in each of these markets.[53] Thus, the total return on the MLM index is the average of the returns on the long and short positions that are taken in each of the twenty-five futures markets, plus the T-bill return. Therefore, when there are significant upward or downward price trends in commodity markets, the MLM index generates positive returns (Edwards and Liew 1999).

Since the MLM index is basically replicating the activities of CTAs (Commodity Trading Advisors), it can be considered as a substitute for holding managed futures funds. Therefore, a skilled CTA should outperform the MLM index by either timing the market better, successfully changing the respective positions with impending price trends, or even trading in more profitable commodity markets than those in the MLM index. For this reason, I add the MLM index to the right hand side of the return equations together

[53] The MLM index consists of futures prices on the following commodities: Australian dollar, British pound, Canadian dollar, coffee, copper, corn, cotton, crude oil, German mark, gold, heating oil, Japanese yen, live cattle, natural gas, silver, soybean, soybean meal, soybean oil, sugar, Swiss franc, T-note 5 year, T-note 10 year, Treasury bonds, unleaded gas, and wheat. In addition, the MLM index return includes the Treasury bill return.

with my six factors to capture the variation in managed futures fund returns. That is, I employ a seven-factor model to derive the risk-adjusted excess returns (alphas) of managed futures funds. The seven-factor model used in the return equations is the following:

$$R_i - R_f = \alpha + m*(MLM - R_f) + b*(S\&P500 - R_f) + h*(HML) + s*(SMB) + w*(WML) + g*(TERM) + k*(DEF) + e_i \quad (10)$$

where

MLM is the Mount Lucas Management index; and the other variables are the same factor mimicking portfolios used in the hedge fund return equations to proxy for the common risk factors. Using pooled cross-section data on returns, this equation is estimated separately for each of the six CTA investment styles as well as for all CTAs, Public Funds, and Private Pools for the fourteen-year period 1985:01 through 1998:08. All CTAs, Public Funds, and Private Pools with a minimum twelve months of existence are included in the pooled regressions. To account for the correlation of returns between the individual funds, the pooled regressions are preferred over the individual time-series regressions. In addition, the specific MLM sub-indices are used in the regressions when pooled regressions are estimated separately for each of the CTA investment styles.[54] The estimates for the seven-factor pooled time-series cross-section equations for managed futures fund returns are reported in table 21.

[54] The MLM-Agriculture Sub-index is used in the regressions for Agriculture CTAs; the MLM-Currency Sub-index is used in the regressions for Currency CTAs; the MLM-Financial Sub-index is used in the regressions for Financial CTAs; and MLM-Energy Sub-index is used in the regressions for Energy CTAs. The aggregate MLM index is used in the regressions of Public Funds, Private Pools, All CTAs, Diversified CTAs, and Stock CTAs.

I also estimate a single pooled time-series cross-section seven-factor regression for all CTAs using *CTA style dummies*. This method allows us to estimate separate intercept and slope coefficients for each CTA style while pooling over all CTAs and CTA investment styles. This method also uses the aggregate MLM index in the pooled regression, as opposed to using separate MLM sub-indices for the specific CTA investment styles. For comparison, this technique is applied to a single-factor CAPM, where MLM index is considered to be the market index for managed futures funds. It is also applied to the six-factor model used for hedge funds, which does not include the MLM index.

Finally, I add time dummies to the seven-factor model – including the MLM index – for specific months to account fixed-effects associated with the extreme CTA returns during these months. A time dummy is added for each month for which the EW monthly return of all CTAs is 1.645 standard deviations below or above the mean return of the EW portfolio over all months of the sample. The estimates for these large pooled time-series cross-section regressions for one-factor, six-factor, seven-factor and seven-factor with time dummies models are provided in table 22.

2. Excess Returns by Investment Style

The estimates from the seven-factor time-series cross-section pooled regressions of managed futures fund returns are reported in table 21. The same equation is estimated separately for each of the six CTA investment styles as well as for all CTAs, Public Funds, and Private Pools for the fourteen-year period 1985:01 through 1998:08. The results show that all the variables on the right-hand side of the equation successfully explain the returns on managed futures funds. In particular, all the variables have statistically significant coefficients in the pooled regression of Public Funds. All factors,

except for HML and WML, are also significant in the pooled regression including all CTAs in the sample. Although some variables do not seem to work well in the return equation for Private Pools, most of them are statistically significant in separate pooled regressions of CTA investment styles.

The results also indicate that different CTA styles concentrate in different sectors. For example, Currency and Financial CTAs have significant slope coefficients for the bond-market factors TERM and DEF, suggesting that their returns are related to fluctuations in the interest rates. However, the same bond-market factors are not statistically significant in pooled regressions of Agriculture and Stock CTAs. This is because Agriculture and Stock CTAs are involved in commodity and equity markets rather than in bond markets.

Different signs of coefficients for the same variable among different CTA styles show that different trading styles involve different types of risks. For example, Financial CTAs have a positive and significant coefficient for the risk factor WML, whereas Energy CTAs have a statistically negative coefficient for the same risk factor. The results are similar for the other risk factors and CTA investment styles. The only exception is the market risk factor measured by the excess return on the MLM index (MLM - T-bill). More specifically, all managed futures funds have positive and significant slope coefficients on the market risk factor. This suggests that most CTAs employ a simple moving-average technical trading rule similar to that of MLM in order to identify the upward and downward price trends in the commodity markets. Thus, the returns on the managed futures funds go in the same direction as MLM.

Analyzing the alphas from the seven-factor time-series cross-section pooled regressions of managed futures fund returns reveal that managed futures funds, except for

Public Funds, produce positive and significant average risk-adjusted excess returns (see table 21). Public Funds produce a negative and significant monthly average risk-adjusted excess return of 0.386%.[55] On the other hand, monthly average risk-adjusted excess returns for the other styles range between positive 0.172% (Private Pools) and 1.472% (Agriculture CTAs).

Table 22 reports the estimation results of the pooled time-series cross-section regressions of all CTAs when investment *style dummies* are added to estimate separate intercept and slope coefficients for each CTA style. This technique is applied to the single-factor CAPM, the six-factor model used for hedge funds, the seven-factor model, and the seven-factor model that includes time dummies. The estimates for all four regressions are reported in columns of table 22. Column 1 gives the pooled regression results for the single factor model where MLM index is used as the market index for managed futures funds. Column 2 reports the estimates for the six-factor model that was previously used in the hedge fund return equations. Column 3 presents the results of the seven-factor model where both MLM and other six market risk factors are considered together in the equation. And, finally, column 4 provides the pooled regression results from a seven-factor model, which includes time dummies.

In a single-factor pooled regression of CTA returns, all CTA styles have positive and significant beta coefficients, except for Stock CTAs. The monthly average alphas estimated for each style are positive and significant and range between 0.659% and

[55] Edwards and Liew [1999], Elton, Gruber, and Rentzler [1987, 1990], and Irwin, Krukemyer, and Zulauf [1992] also find poor performance for public funds.

1.364% (see column 1 in table 22). However, the percent of variation in CTA returns explained by this single-factor model is very low.

When the six-factor model is used for CTA returns, the factor mimicking portfolios that proxy for the stock and bond-market factors do, in fact, explain the CTA returns (see column 2 in table 22). That is, most often, the coefficients are statistically significant among different CTA styles, suggesting that the stock and bond market factors should also be included in CTA return equations. In addition, the alphas estimated from the six-factor model show that all of the six CTA investment styles produce a positive and significant monthly average risk-adjusted excess return.

The seven-factor pooled regression result presented in column 3 in table 22 is very similar to the results reported in table 21, where separate seven-factor pooled regressions are estimated for each of the CTA styles. It is important to note, however, that small discrepancies in the estimates are present due to the fact that MLM sub-indices are being used for style regressions, while the aggregate MLM index is being used for the pooled regression with style dummies. Despite this change, neither the signs of the coefficients, nor the significance of the variables are altered. Thus, the results obtained in table 21 continue to hold when I pool across all CTA styles. For example, the estimates reported in column 3 in table 22 show that all CTA styles earn a positive and significant average risk-adjusted excess return, and these returns range between a monthly average of 0.495% (Stock CTAs) and 1.397% (Agriculture CTAs).

Finally, adding time dummies to the seven-factor model to account for extreme CTA returns improves the results: the adjusted R-square of the regression increases to 6.0%. In addition, the monthly average risk-adjusted excess returns estimated for CTA styles, on

average, decrease, but are still positive and significant, ranging between 0.430% and 1.195% (see column 4 in table 22).

3. The Excess Returns of Individual Managed Futures Funds: Descriptive Statistics

The alpha measure derived for a CTA style in seven-factor pooled regressions, including style and time dummies, is roughly the average of the all CTAs' alphas in that particular style. To compute the individual alphas for all funds in a given CTA style, I employ a seven-factor time-series cross-section pooled regression for each CTA investment style, by adding fund and time dummies to the equation. This technique generates a separate alpha for each fund in a CTA style.[56]

Table 23 provides the descriptive statistics on CTA fund alphas (excess returns), which are computed with the seven-factor regression technique explained above for the period 1985:01 – 1998:08. The results show that CTAs with positive significant alphas are very few compared to total CTA numbers within each style. The percent of CTAs with positive and significant alpha ranges between 2% and 19% among different managed futures and alternative CTA investment styles.[57] For example, out of the 704

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[56] As alternative measures of excess returns, in addition to seven-factor individual CTA alphas, Sharpe ratios and absolute excess returns over the risk-free rate are also computed for each individual CTA over the period 1985-1998. The averages of these measures by CTA investment style as well as the correlation coefficients between these alternative measures are reported in the Appendix 4B. The simple correlations between seven-factor alphas and absolute excess returns and Sharpe ratios are, respectively, 0.92 and 0.63. However, despite the high correlation that exists between alphas and both absolute excess returns and Sharpe ratios, there are substantial differences in the magnitude of the alternative estimates of excess returns. The annualized average seven-factor alphas range from a low of 5.94% for Stock CTAs to a high of 16.31% Agriculture CTAs. On the other hand, the annualized average absolute excess returns range from a low of 14.62% for Energy CTAs to a high of 27.22% for Currency CTAs. The annualized average Sharpe ratios between alternative CTA investment styles range between 0.06 for Stock CTAs and 0.29 for Diversified CTAs (see Appendix 4B).

[57] These figures for managed futures funds are even smaller than the figures for hedge funds. The percent of hedge funds with positive and significant alphas ranges between 10% and 30%.

Public funds, there are only 15 (or 2%) that have positive significant alphas at a 10% significance level. Even for Financial, Agriculture, and Energy CTA styles, the percent of CTAs with positive and significant alphas barely exceed 10%.

Comparing the average of positive significant alphas – winners – to the average alphas of all other funds – losers – point out a sizeable alpha difference between the two groups for each of the managed futures fund styles. For instance, Financial CTAs with positive and significant alphas produce an average excess return of 3.38% in a month, while all other Financial CTAs have a monthly average alpha of 0.30%. This is a 3.08 percentage points difference in monthly excess returns between winners and losers. The figures for the other managed futures and CTA investment styles are very similar.

When average raw returns of funds with positive significant alphas are compared to the average raw returns of all other funds in that category, the results are much the same. Funds that have positive significant alphas also have very large raw returns. For example, Private Pools that have positive and significant alphas produce an average monthly raw return of 4.01%, whereas all other Private Pools can only produce an average monthly raw return of 0.44%. The large differences in raw returns between the winners and the losers also appear in other styles of managed futures funds.

Analyzing the average size of funds does not indicate a significant difference between the winners and the losers. Thus, across all managed futures and alternative CTA styles, the average size of funds with positive significant alphas is no different from the other funds in that style.

In terms of age, funds with positive significant alphas are, most often, older than funds with non-positive significant alphas. That means age (number of months in

existence) and experience add positive value to CTA alphas. For example, while the average number of months in existence is 92 both for successful Public Funds and Private Pools, it is only 56 months for the others. This is a three-year experience difference between the two groups. The results are similar for the other CTA styles, except for Agriculture and Energy CTAs.

Finally, looking at the incentive fee structure of managed futures funds show that incentive fees are larger for funds that have positive and significant alphas. For instance, Agriculture CTAs with positive significant alphas charge a median annual incentive fee of 20.00% on profits, while all other CTAs in the same style charge a median 13.00% annual incentive fee. The differences in the incentive fees between the winners and the losers are also apparent for most of the other managed futures and CTA investment styles.

In conclusion, CTAs with positive significant alphas significantly differ from their peers in terms of average alphas, average raw returns, age (average number of months in existence), and median annual incentive fees. They produce larger raw and risk-adjusted returns, exist in the market longer, and charge larger fees on the profits.

VII. INCENTIVE FEES AND FUND PERFORMANCE

The finding that hedge funds and managed futures funds provide very attractive positive risk-adjusted excess returns raises the question of what the sources of those returns are. This section provides a potential explanation for the superior performance by linking incentive fees to risk-adjusted fund performance.

Both hedge funds and managed futures funds are characterized by strong performance incentive fees. While mutual fund managers' fees are largely based on fund size (total net asset value of the fund), hedge funds and managed futures funds typically provide an asymmetrical incentive fee structure on annual profits, which rewards managers for superior performance. On average, hedge fund managers are paid a median incentive fee of 15.25% on the annual profits. This figure is 15% for CTAs, 20% for Private Pools, and 4% for Public Funds. These high incentive fees are also accompanied with "high-water mark provisions", which make fund managers unable to receive their incentive fees until the fund recovers past losses and surpasses a specified hurdle rate. Based on this, one can definitely argue that incentive fees and high-water mark provisions could make fund managers take excessive risk, however, this is dampened by requiring fund managers to invest a substantial amount of their wealth in the fund. Thus, the incentive fee structure combined with the managerial investment should enhance the fund performance without excessive risk.

1. Literature Review

The relationship between fund performance and fees is investigated in some of the mutual fund studies. Mutual fund managers claim that expenses do not reduce performance, because investors are paying for the manager's superior ability to pick

stocks. However, past studies show contrary results. Expenses have a direct negative effect on mutual fund performance. Malkiel (1995), by employing a cross-section regression using 10-year average returns and expense ratios, finds an extremely strong and apparently significant negative relationship between a fund's total expense ratio and its net performance. In the study, he finds that even when the total expenses are divided between investment advisory and non-advisory expenses, an increase in investment advisory expenses fail to increase the fund's performance significantly. These results suggest that investors do not get their money's worth even from expenditures on investment advice. Similarly, Carhart (1997) employs a cross-section regression of mutual fund alphas (from a 4-factor model) on fund characteristics. The results indicate a strong and significant negative relation between performance and expense ratios: for every 100-basis-point increase in expense ratio, annual risk-adjusted excess return drops by about 154 basis points.

The fact that fee structure in hedge funds and managed futures funds is very different than the fee structure in mutual funds could result in conclusions that differ from mutual funds. Ackermann, McEnally, and Ravenscraft (1999) analyze the relationship between hedge fund performance and incentive fees. In a cross-section regression of risk-adjusted performance (Sharpe ratio) on four characteristics of hedge funds and six dummy variables for hedge fund styles, the study finds a strong positive impact of incentive fees on risk-adjusted performance. Moving from a fund with no incentive fee to a fund with the median incentive fee (20%) increases the Sharpe ratio by an average of 0.15 (or 66% of the average Sharpe ratio).

A. HEDGE FUND CHARACTERISTICS AND PERFORMANCE

Similar to the analyses conducted in previous studies, the effect of incentive fees on hedge fund performance is tested in cross-section regressions of six-factor hedge fund alphas on three fund characteristics (size, age, and incentive fee) for the period 1990-98.[58] Although there is a wide range of incentive fees from 1% to 50%, most of the distribution is concentrated on two points: 1% and 20%. Thus, instead of using the incentive fee as a continuous variable in the regression, I use two dummy variables for different levels of incentive fees: *High-fee funds*, with incentive fees 20% or more, and *Medium-fee funds*, with fees higher than 5% and smaller than 20%. *Low-fee funds*, with fees less than 5%, is the omitted category in the regressions.[59] The coefficients on the "High-fee funds" and "Medium-fee funds" therefore represent the risk-adjusted performance of these categories relative to the category "Low-fee funds". The regressions are employed separately for alternative hedge fund investment styles as well as for all hedge funds taken together.[60]

Table 24 provides the estimates on cross-section regressions of six-factor hedge fund alphas on size, age, and incentive fee. For all hedge funds taken together, the results indicate that size and incentive fee have a strong positive impact on the risk-adjusted performance. More specifically, the risk-adjusted excess return increases as we move from a low-fee fund to a high-fee fund. While low-fee funds produce a monthly average

[58] Of the 1611 total hedge funds in the sample, 934 hedge funds report incentive fees. Since I do not have any further information regarding unreported fees by the other funds, I only include the funds that report their incentive fees in the cross-section regressions.

[59] The number of funds in each incentive fee category points out a unique distribution of incentive fees: out of the 934 hedge funds that report incentive fees in the sample, there are 346 high-fee funds, 501 low-fee funds, and there are only 87 medium-fee funds. The average (median) incentive fees in each category are 20.78% (20%) for high-fee funds, 13.07% (15%) for medium-fee funds, and 1.35 (1.5%) for low-fee funds.

alpha of 0.13%, medium-fee funds produce an average of 0.31% and high-fee funds produce an average of 0.46% in a month. The 0.18 percentage point difference between the low-fee funds and medium-fee funds is not statistically significant at the 10% level. This is because the number of funds in the medium-fee category (87) is very small compared to number of funds in the low-fee category (501), which limits the power of the statistical test. On the other hand, the number of funds in the high-fee category (346) is comparable to the number of funds in the low-fee category, and the 0.33 percentage point difference between the alphas of these two categories is statistically significant at the 5% level. Thus, the results suggest that investors get their money's worth by investing with funds that pay larger incentive fees to its managers, because larger incentive fees enhance the manager's performance.

The effect of incentive fees on performance is also quite powerful among certain hedge fund investment styles: Funds of funds, Global funds and Market-Neutral funds. For Market-Neutral funds, after controlling for size and age, high-fee funds produce an average alpha 0.33 percentage point above the average alpha of low-fee funds. The same figures for Funds of funds and Global funds are 0.30 percentage points and 0.41 percentage points, respectively. All these alpha differences are statistically significant at the 5% level. For the rest of the hedge fund styles, the corresponding alpha differences between low-fee and high-fee funds are all positive, but they are not statistically significant at the 10% level. Thus, moving from a low-fee fund to a high fee fund increases the monthly average alphas across all hedge fund styles, however, the increase

[60] For the hedge fund styles "Long-only funds, Sector funds, and Short-sell funds", we do not have sufficient number of funds that report their incentive fees. Therefore, I did not run cross-section regressions for these styles.

in the alphas is statistically significant only in Funds of funds, Global funds, and Market-Neutral funds.

Analyzing the other fund characteristics show that size is positively and significantly related with the risk-adjusted performance only for Global Macro funds, while age (number of months in existence) of the fund is positive and significant only for Funds of funds. Size and age do not have an explanatory power over the risk-adjusted excess returns among other hedge fund investment styles.

B. MANAGED FUTURES FUND CHARACTERISTICS AND PERFORMANCE

The effect of incentive fees on CTA's performance is tested in a similar way through the cross-section regressions of seven-factor CTA alphas on three CTA characteristics (size, age, and incentive fee) for the period 1985-98.[61] The dummy variables for high-fee funds and medium-fee funds are added to the regressions in the same manner to compare the performance of those categories of CTAs to the performance of the omitted category, low-fee funds.[62] The CTA alphas derived form the seven-factor model are used in the cross-section regressions as the dependent variable to measure performance differences between those categories. The regressions are employed separately for alternative CTA investment styles as well as for all CTAs taken together as a separate group.[63]

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[61] Of the 1175 CTAs that exist at some point during the period 1985-98 in the sample, 939 CTAs report incentive fees. Only CTAs that report incentive fees are included in the regressions.

[62] The number of CTAs in each incentive fee category points out a unique distribution of incentive fees: out of the 939 CTAs that report incentive fees in the sample, there are 407 high-fee CTAs, 387 low-fee CTAs, and there are only 145 medium-fee CTAs. The average (median) incentive fees in each category are 21.58% (20%) for high-fee CTAs, 11.24% (12.5%) for medium-fee CTAs, and 2.65 (2.40%) for low-fee CTAs.

[63] For the style "Energy CTAs" there are not enough number of CTAs that report incentive fees. Thus, I did not run cross-section regression for this particular CTA style.

The estimates from the cross-section regressions are reported in table 25. For all CTAs taken together, the results show that age and incentive fee increase the risk-adjusted performance of CTAs in a significant way. In particular, moving from a CTA with low incentive fee to a CTA with high incentive fee increases the monthly average alpha from -0.11% to 0.17%. This is a 0.28 percentage point difference in monthly average alphas between the two categories, which is statistically significant at the 10% level. Interestingly, although the medium-fee CTA category produces a monthly average alpha 0.31 percentage point above the low-fee CTA category, the difference is not statistically significant at the 10% level. This is again because the number of CTAs in the medium-fee category (145) is very small compared to the number of CTAs in the low-fee category (387), which limits the power of the statistical test. Thus, based on a comparison between high-fee and low-fee CTAs, the results indicate that higher incentive fees, on average, enhance the performance of CTAs.

Analyzing the effect of incentive fees on the risk-adjusted performance among alternative CTA investment styles show that the monthly average alphas increase as we move from a CTA with low incentive fee to a CTA with high incentive fee. However, the increase in the alphas is not significant in most of the CTA styles. In fact, we see statistically significant improvements only in Agriculture and Diversified CTAs as we move from low-fee CTAs to medium-fee and high-fee CTAs. For Diversified CTAs, after controlling for size and age, high-fee CTAs produce a monthly average alpha 0.33 percentage point above the average alpha of low-fee CTAs, which is statistically significant at the 10% level. The difference between high-fee and low-fee CTAs among Agriculture CTAs is 0.75 percentage points, again statistically significant at the 10%

level. For the other CTA styles, the alpha differences between low-fee and high-fee CTAs are all the time positive, but they are not statistically significant.

The other variable (CTA characteristic) that is positive and significant in the cross-section regressions is the variable "age" (number of months in existence). Age has a positive and significant slope coefficient in the regressions for Currency CTAs, Diversified CTAs, and Financial CTAs, as well as for all CTAs taken together as a separate group. This implies that age brings experience and in return experience adds positive value to CTA alphas.

In conclusion, my results are in line with Ackermann, McEnally, and Ravenscraft (1999). The existence of the attractive incentive fee structure in the hedge fund and managed futures fund industry, which does not exist in the mutual fund industry, enhances the risk-adjusted performance of hedge funds and managed futures funds in a significant way.

VIII. PERFORMANCE PERSISTENCE

The Efficient Market Hypothesis states that any information that can be used to predict stock performance is already reflected in the current stock prices. That is, the past history is fully reflected in the present price, which does not provide any further information. The market responds only to new information, which is unpredictable; if new information could be predictable, then the prediction would be a part of today's information and that would be reflected in today's prices. Thus, the hypothesis concludes that stock prices should follow a random walk.

The proponents of the efficient market hypothesis believe that active portfolio management is unable to cover the expenses incurred and thus can not perform better than a passive portfolio, which can be characterized as a buy-and-hold strategy. Given all available information, the hypothesis indicates that assets are fairly priced, and buying and selling securities frequently simply increases the brokerage fees without increasing the performance of the portfolio. Thus, those who believe in efficient markets argue that investors should consider having investments in index funds, which are designed to replicate the performance of broad-based indices rather than investing in actively managed funds.

Not surprisingly, the efficient market hypothesis has not been widely embraced by professional portfolio managers. They believe that skilled managers are able to make consistent abnormal profits. If such skill does exist, professional portfolio managers should be able to outperform the passive strategies over an extended period of time. Further, to the extent that some managers possess superior skills, we would expect to observe "persistence" in their performance relative to both passive portfolio strategies and to unskilled portfolio managers. Indeed, we would expect their past performance to be a predictor of their future performance.

1. Literature Review

Persistence in mutual fund performance is investigated in many studies. Hendricks, Patel, and Zeckhauser (1993) find evidence of persistence in mutual fund risk-adjusted returns in the short-run and relate this finding to a "hot hands" phenomenon. The study uses quarterly data, and sorts funds according to the last one, two, four, and eight-quarter returns, and groups them into octiles. Jensen α's are computed for the equally weighted

portfolios in each octile for the following quarters, and risk-adjusted returns (α's) are compared between the best and worst octile performers. The difference in risk-adjusted performance between the top and bottom octile portfolios is found to be statistically significant – six to eight percent per year – which signifies the existence of persistence in performance.

In another study, Goetzmann and Ibbotson (1994) examine the performance of mutual funds in a winner and loser two-way test by dividing the funds into two groups each year and categorizing them as winners and losers according to whether or not they are above or below the median performance. Their results show that 62% of the initial top-half performers (winners) fall in the top-half of the sample in the following period, while 63% of initial bottom-half performers (losers) fall in the bottom-half in the following periods. This is consistent with performance persistence, which suggests that at least some part of a fund's performance is a function of skill, as opposed to luck.

Following Goetzmann and Ibbotson (1994), Malkiel (1995) analyzes the predictability of mutual fund performance by constructing winner and loser two-way tables and finds that while initial-year performance predicts subsequent-year performance during the 1970's, the pattern in performance persistence fades away in the 1980's.

Similarly, Brown and Goetzmann (1995) study performance persistence in mutual funds using absolute and relative benchmarks in two-way tables of winners and losers. They find that there is persistence in risk-adjusted returns of mutual funds. However, most of the persistence phenomenon is due to repeat-losers rather than to repeat-winners. They also conduct an octile analysis where each year funds are sorted according to past one-year raw returns and grouped in octiles to analyze the performance of equally

weighted portfolio (CAPM alpha) in each octile in the following year. They find statistically significant differences in risk-adjusted returns between the top and bottom octile portfolios, which again indicates evidence on performance persistence.

Both Gruber (1996) and Elton, Gruber, and Blake (1996) use the same 4-index model to analyze the persistence in risk-adjusted returns (α's) of mutual funds. The 4-index model they employ include the excess return on market index, the returns on factor mimicking portfolios for size and book-to-market equity and excess return on a bond index. They group funds into deciles according to past one-year and three-year alpha measures. Both studies use individual fund alphas to rank funds, and find that past performance is predictive of future risk-adjusted performance in the short-run as well as in the long-run, indicating a longer persistence in performance than noted in the "hot hands" literature. It is also concluded that using 4-index model to rank alphas, instead of a single-factor model, does a better job of forecasting both future raw and risk-adjusted excess returns.

In another study, Carhart (1997) uses a different 4-factor model to compute the risk-adjusted excess returns of mutual funds. The four-factors used in the equations are the excess return on market index and the returns on factor mimicking portfolios for size, book-to-market equity, and one-year momentum in stock returns. To test for persistence, each year the funds are sorted according to past one-year raw returns and grouped into ten deciles. Equally weighted portfolios are formed within each decile at the beginning of each year and held for one full year. Then, 4-factor alphas on those portfolios are computed in the performance period. The statistical significance of the differences in risk-adjusted returns (α's) between the top and bottom decile portfolios show that there is

persistence in mutual fund performance. However, most of the persistence is explained by common factors in stock returns and investment expenses. Thus, the results do not support the existence of skilled mutual fund portfolio managers.

The only study on hedge fund performance persistence is by Brown, Goetzmann, and Ibbotson (1999) and finds, by relying on annual data, no evidence of persistence: past performance is not predictive of future performance. In contrast to mounting evidence of managerial skill in the mutual fund industry, it would be surprising if there was no persistence in risk-adjusted returns in hedge funds, since many of the best mutual fund managers have quit the mutual fund industry in order to start hedge funds. The use of annual data by Brown et. al., however, may limit the power of statistical tests. Thus, a study using monthly returns and a multi-factor model such as used in the mutual fund studies may provide a better picture of persistence in the returns of hedge funds.

A. PERSISTENCE IN PERFORMANCE OF HEDGE FUNDS

This section uses the standard methodology employed in past mutual fund studies to analyze the performance persistence in hedge funds. Persistence in performance is examined in terms of simple raw returns as well as risk-adjusted excess returns, where individual fund alphas are derived from a six-factor model and are estimated with time-series cross-section pooled regressions of hedge fund returns. If hedge fund managers possess skill, there should be persistence in performance: either past returns or past alphas should be a predictor of future returns or future alphas.

1. Persistence in Raw Returns

1.a. Methodology

Following the standard analysis in the performance persistence literature, hedge funds are sorted into five quintiles according to the past twelve month average raw returns, and the performance of each quintile is analyzed in the subsequent month in order to assess the quintiles' performance. In other words, funds are sorted into quintiles each month based on their past twelve-month average raw returns. Then, by holding the funds in the same quintile, the subsequent month's mean hedge fund returns in each quintile are calculated and compared between the best and worst performing quintiles of the past twelve months. This procedure is repeated every month from January 1990 through August 1998, creating a rolling cross-sectional, time-series monthly returns for each quintile portfolio from 1990 to 1998. If there is any persistence in raw returns, the winners of the past twelve-months should continue to be the winners in the subsequent month. In other words, the average returns of the best performing quintiles should be significantly greater than the average returns of the worst performing quintiles in the subsequent performance period.

1.b. Results

The results on performance persistence for hedge funds using raw returns are presented in table 26. Quintile (1) contains the top 20% of funds (best performers), whereas quintile (5) contains the bottom 20% of funds (worst performers).[64] For each of the quintile portfolios, the average monthly raw returns of the past twelve months as well

[64] Quintile portfolios are created only if there are at least 20 funds in the cross-section and each portfolio contains at least four different funds. For inclusion in the quintile analysis a fund needs only 13 consecutive months of past returns. If a fund becomes defunct, it is no longer used in the subsequent months.

as the average monthly raw returns in the subsequent month are presented on the left-hand side of the table. The right-hand side of the table 26 shows the differences in the "subsequent month" mean returns for quintiles (1) and (5); (1) and (4); (2) and (5); and (2) and (4). If there is persistence in raw returns, the difference between the returns in quintiles (1) and (5) should be positive and significant. If return differences between quintiles (1) and (4), and quintiles (2) and (5) are also positive and significant, this suggests a clearer and stronger evidence of persistence in performance. This analysis is applied for all eight hedge fund investment styles separately as well as for all hedge funds taken together. To test for differences in mean returns between the quintiles, a *t*-test is performed to determine whether the return differences are significantly greater than zero. The results of the *t*-test are given in the parentheses.

The results indicate that the subsequent month average returns decrease monotonically as we move from past year's best performers to past year's worst performers. All hedge funds taken together, the best performers (quintile (1)) produce an average monthly return of 1.576% in the subsequent month, whereas the worst performers (quintile (5)) produce an average monthly return of only 0.572%. The 1.003 percentage point difference between the two groups is statistically significant at the 5% significance level, suggesting the existence of performance persistence in hedge fund raw returns. The differences in the subsequent month raw returns among other quintiles are also significant, increasing the power of the findings in performance persistence. For example, the average monthly return differences between quintile (1) and (4) is 0.671% and between (2) and (5) is 0.565%, and they are both statistically significant at the 5% significance level. This shows that performance persistence in simple raw returns exists

because there are both repeat-winners and repeat-losers in the sample including all hedge funds.

Analyzing hedge fund investment styles separately for performance persistence provides similar results for some of the styles. The results indicate that Fund of Funds, Global funds, Market-Neutral funds, and to some extent, Event Driven and Sector funds show persistence in their raw return performance. That is, the future returns of last year's winners are significantly higher than those of last year's losers: 1.124% vs. 0.516% for Fund of funds, 1.526% vs. 0.533% for Global funds, and 1.470% vs. 0.424% for Market-Neutral funds. Especially, for Market-Neutral funds, the subsequent month mean return differences between the quintiles are positive and significant at very high confidence intervals. On the other hand, among Global Macro funds, there is evidence of performance persistence between only quintiles (1) and (5) at the 10% significance level. There is even less evidence of performance persistence for Long-only funds and Short-sell funds. In some cases, the returns of last year's losers are higher than last year's winners, implying reversal in the returns of those hedge fund styles.

Thus, except for Long-only and Short-sell funds, there is an evidence of performance persistence in raw returns of hedge funds. Therefore, past returns have some ability to predict future returns of hedge funds.

2. Persistence in Risk-adjusted Excess Returns: A Quintile Analysis

2.a. Methodology

Following the performance persistence analysis conducted for raw returns, a similar analysis is employed for risk-adjusted excess returns of hedge funds.[65] For one-year and two-year holding periods, risk-adjusted excess returns for each fund in a particular style are computed by employing the six-factor time-series cross-section pooled regressions where fund and time dummies are added into the equations. In other words, for each of the hedge fund investment styles, the risk-adjusted performance (α) of each individual fund is estimated over a one and two-year holding period by using fund and time dummies in the six-factor pooled regressions of hedge fund equations.[66]

To measure how effective the past risk-adjusted returns are in forecasting the future risk-adjusted returns, the funds are ranked and placed into quintiles based on alphas in the *selection period*, and the future alphas in each quintile are analyzed in the subsequent *performance period*. Both in the selection and performance periods, the alphas for each quintile are computed by treating the quintile alpha as an equally-weighted portfolio of fund alphas.[67] Ranking funds based on alphas and taking the average of the fund alphas to compute the quintile alpha, which is the methodology used here, is very different than ranking funds based on raw returns and computing the quintile alpha from a time-series regression of raw returns. Both methodologies are used in some of the mutual fund

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[65] Carhart [1997] argues that ranking mutual funds based on alphas rather than on raw returns should measure the stock-picking talent more accurately.

[66] For one-year holding periods, only funds with a full year of monthly returns are included in the six-factor pooled regressions. Similarly, for two-year holding periods, only funds with two full years of monthly returns are included in the six-factor pooled regressions.

performance studies in the literature. Following Gruber (1996), and Elton, Gruber, and Blake (1996), I apply the former methodology to compute the quintile alphas. This methodology is superior, because ranking funds and forming quintiles based on raw returns and computing a single alpha for each quintile from a time-series regression, by definition, assumes fixed alpha and beta coefficients for each of the funds in the quintile throughout the analysis period. However, funds in the same quintile may have different alphas and betas, and both the alpha values and the betas can very well change from year to year.

2.b. Results

For different selection and performance periods, tables 27A, 27B, and 27C present the results on the quintile analysis for the risk-adjusted performance persistence tests of hedge funds. This analysis is applied to all eight hedge fund investment styles separately as well as for all hedge funds taken together. In each table, quintile (1) includes the funds with the highest alpha values (best performers), and quintile (5) includes the funds with the lowest alpha values (worst performers) in the selection period. For each of the quintile portfolios, the monthly average alphas in the selection period as well as the monthly average alphas in the performance period are presented on the left-hand side of the tables. The right-hand side of the tables 27A, 27B, and 27C provide the differences between the average monthly alphas for quintiles (1) and (5); (1) and (4); (2) and (5); and (2) and (4) in the subsequent performance period. To see if differences in the average alphas between quintiles are statistically significant in the performance period, a *t*-test is

[67] Quintile alphas are computed only if there are at least 20 funds in the cross-section and each quintile contains at least four different funds. For inclusion in the quintile analysis a fund needs at least a year of past and future annual risk-adjusted excess returns.

performed. If the differences in alphas between the best performers and worst performers are positive and significant, this signifies the existence of persistence in risk-adjusted returns (α's).

Table 27A presents the results when funds are ranked and placed into quintiles based on past one-year alphas in the selection period and observed in the subsequent one-year performance period. All hedge funds taken together, the best performers (quintile (1)) produce a monthly average alpha of 0.522% in the subsequent year, whereas the worst performers (quintile (5)) produce a monthly average alpha of only 0.159%. The alpha values decrease monotonically as we move from past year's winners to past year's losers. The statistical significance of the differences in alphas between the winners and losers in the performance period suggests the existence of performance persistence in risk-adjusted excess returns.

Looking at the investment styles separately, there is evidence of performance persistence in one-year risk-adjusted returns of certain hedge fund investment styles: Market-Neutral, Global, Sector, and Global Macro funds. For Market-Neutral funds the evidence of one-year performance persistence is much stronger compared to other hedge fund investment styles. For example, the following one-year mean alpha differences between quintiles (1) and (5) is 0.661%, between quintiles (1) and (4) is 0.577%, and between (2) and (5) is 0.330%. All differences are statistically significant at the 5% level.

Table 27B presents the results on persistence tests of hedge funds when funds are ranked into quintiles based on two-year alpha values in the selection period, and subsequent one-year alpha values are analyzed in the performance period. Clearly, increasing the selection period from one year to two years increases the evidence of

performance persistence in risk-adjusted returns. Past two-year winners continue to be the winners in the following year. Comparing the average quintile alphas between the winners and the losers in the performance period shows that the differences in the mean alphas are dramatically large and significant. For all hedge funds taken together, while the past two-year best performers produce a monthly average alpha of 0.644% in the subsequent year, the worst performers are only able to produce a monthly average alpha of 0.147%. The same pattern is observed between the mean α's of quintiles (1) and (4), (2) and (5), and (2) and (4). This signifies how strong the persistence in performance is when funds are ranked on the basis of two-year alphas instead of one-year alphas.

The same type of strong performance persistence is clearly visible in certain hedge fund investment styles. For Market-Neutral and Global Macro funds, the results suggest that past two-year alpha values are good predictors of subsequent one-year alpha values. For these two styles, the differences in the one-year performance period alphas are positive and significant between all top-ranking and bottom-ranking quintiles. In addition to Market-Neutral and Global Macro funds, there is also evidence of performance persistence among Short-sell funds, Sector funds, and Fund of funds. For Fund of funds, however, the fact that performance differences are significant between only quintiles (1) and (5), and (2) and (5), and that alpha measures between quintiles (1) through (4) are very similar in the performance period clearly suggests that most of the performance persistence is due to repeat-losers.

As a last analysis, when funds are ranked into quintiles based on their past two-year alpha values and their subsequent two-year alpha values are analyzed in the performance period, we still see persistence in risk-adjusted excess returns of hedge funds. The results

are given in table 27C. Increasing both the selection and the performance period to two years increases the power of persistence in risk-adjusted excess returns. That is, the past two-year winners continue to be the winners in the subsequent two years. The differences in the two-year mean alpha values between the winners and the losers in the performance period are statistically significant among Market-Neutral, Global Macro, Short-sell, Event Driven, and Long-only funds as well as among all hedge funds taken together as a separate group. Comparing the alpha values between quintiles (1) and (5) highlights the large discrepancies: 0.522% vs. 0.171% for all hedge funds, 0.761% vs. 0.163% for Market-Neutral funds, and 0.434% vs. –0.017% for Global Macro funds.

In conclusion, hedge funds do have persistence in their risk-adjusted returns as well as in their raw returns.[68] Using six-factor alphas to rank funds does a very good job in forecasting future risk-adjusted returns. Also the predictability power of future alphas by past alphas increases when performance is measured over a longer period. These results point out the existence of a longer period persistence in risk-adjusted returns of hedge funds than noted in the "hot hands" literature.[69]

3. Persistence in Risk-adjusted Excess Returns: A Cross-section Regression Analysis

An alternative way to examine the performance persistence in risk-adjusted returns of hedge funds is to employ standard cross-section regressions between past and future alphas. More specifically, cross-section regressions are estimated each year to determine

[68] These conclusions are supported by the regression analyses of risk-adjusted excess returns in Tables 28A, 28B, and 28C.

[69] Elton, Gruber, and Blake [1996] find similar results on performance persistence of mutual funds when fund alphas are ranked based on 3-year alphas from a 4-index model. They conclude that when ranking is done on a risk-adjusted basis, the predictability increases over longer periods of performance measurement.

whether past risk-adjusted excess returns are predictors of future risk-adjusted excess returns. If there is persistence in performance, the estimated slope coefficients in these regressions should be positive and statistically significant. Cross-section regressions to test the persistence in performance are employed by Grinblatt and Titman (1992), Hendricks, Patel, and Zeckhauser (1993), and Goetzmann and Ibbotson (1994) in studies of mutual funds, and by Brown, Goetzmann, and Ibbotson (1999) in a study of offshore hedge funds.

Following these studies, one-year and two-year individual hedge fund alphas that are estimated from the six-factor model are used in the cross-section regressions of future alphas on past alphas to test the degree of persistence in risk-adjusted excess returns.[70]

For different holding periods – one and two years – the estimates from the cross-section regressions are provided in tables 28A, 28B, and 28C. This analysis is applied for all eight hedge fund investment styles separately as well as for all hedge funds taken together as a separate group.

Table 28A reports the results on cross-section regressions when future one-year six-factor alphas are regressed on past one-year six-factor alphas. All hedge funds taken together, of the eight one-year on one-year regression analyses, five have positive and significant slope coefficients at the 5% level. Only two regressions have negative slope coefficients at the 10% level. In fact, the last three regressions, spanning the period 1995-1998, have significantly positive coefficients. The fact that those years also have more cross-sectional observations than prior years increases the evidence of performance persistence in one-year risk-adjusted returns of hedge funds. Analyzing different styles of

[70] Equations are estimated only for years in which there are at least ten funds in the cross-section.

hedge funds reveals the existence of performance persistence especially in Market-Neutral funds. Of the eight regression analyses for Market-Neutral funds, six of them have significantly positive slope coefficients. Only one regression has a negative slope coefficient at the 10% level. The last three regressions have positive and significant slope coefficients at the 5% level.[71] The evidence of performance persistence in other styles is not as strong as it is in Market-Neutral funds. Global Macro and Global funds are the other hedge fund styles where we see some degree of persistence in performance. Of the eight one-year on one-year regression analyses, both Global Macro and Global funds have four positive and significant slope coefficients. While there are no significantly negative slope coefficients for Global funds, there is only one for Global Macro funds. The signs of slope coefficients for the other hedge fund investment styles are mixed; therefore, it is hard to see evidence of performance persistence for other styles of hedge funds.

The results provide stronger support for the existence of performance persistence when future one-year six-factor alphas are regressed on past two-year six-factor alphas. The cross-section regression estimates are provided in table 28B. All hedge funds taken together, of the seven one-year on two-year regression analyses, five of them have significantly positive slope coefficients. There is only one regression with a significantly negative slope coefficient. Positive and significant slope coefficients – especially in the last three regressions – point out the increasing evidence of performance persistence in hedge fund returns in the most recent years. Similarly, the evidence for performance

[71] This result for Market Neutral funds is in the same line with the prior findings of persistence in risk-adjusted returns employing a quintile analysis.

persistence can be seen in certain hedge fund investment styles like Market-Neutral funds, Global Macro funds, Sector funds, and Short-sell funds.[72] For example, out of the seven regression analyses, there are five positive and significant slope coefficients for Market-Neutral funds, four for Global Macro funds, and three for Sector funds and Short-sell funds. While there is only one negative and significant slope coefficient for Market-Neutral and Global Macro funds, there is no significantly negative coefficient for Sector and Short-sell funds. Other than the four aforementioned hedge fund investment styles, the signs of the slope coefficients for other hedge fund investment styles are mixed, and do not provide any evidence of performance persistence.

In the last analysis of cross-section regressions, table 28C provides the estimates on the regressions of future two-year six-factor alphas on past two-year six-factor alphas. The results suggest that past two-year alphas are good predictors of subsequent two-year alphas. The persistence in two-year risk-adjusted returns are clearly visible in Market-Neutral, Global Macro, Event Driven, Short-sell and Fund of funds as well as in all hedge funds taken together. Out of the six two-year on two-year regression analyses, there are four positive and significant slope coefficients for Market-Neutral funds, Global Macro funds, and Fund of funds. There are three positive and significant slope coefficients for Event Driven and Short-sell funds. While there is only one significantly negative slope coefficient for Event Driven funds, there are not any for Market-Neutral, Global Macro, Short-sell and Fund of funds. The positive and significant slope coefficients for these hedge fund investment styles indicate the existence of performance persistence over a

[72] These results are consistent with the prior findings of persistence in risk-adjusted returns when quintiles are formed on the basis of past two-year alphas and analyzed in the subsequent one-year performance period.

longer period of time. Thus, the results are in line with the prior findings of quintile analysis.

B. PERSISTENCE IN PERFORMANCE OF MANAGED FUTURES FUNDS

Similar to the analyses conducted for hedge funds, persistence in performance of managed futures funds is analyzed in terms of simple raw returns as well as risk-adjusted excess returns. For risk-adjusted excess returns, individual fund alphas are derived from the seven-factor time-series cross-section pooled regressions of managed futures funds with dummy variables added for all individual funds in the equation. Any finding of performance persistence in managed futures funds should imply that managed futures fund managers possess skill and past performance is predictive of future performance.

1. Persistence in Raw Returns

1.a. Methodology

Following the quintile analysis employed for hedge funds, managed futures funds are ranked and grouped into five quintiles each month according to the past twelve-month average raw returns.[73] Next, holding the funds in the same quintile, the subsequent month's mean managed futures fund returns in each quintile are calculated and compared between the best and worst performing quintiles of last twelve months. Repeating this procedure every month starting from January 1990 through August 1998 creates rolling cross-sectional time-series monthly returns on each quintile portfolio. If there is any persistence in raw returns, the winners of the past twelve months should continue to be

[73] Quintile portfolios for managed futures funds are created in the same way they are created for hedge funds. There should be at least 20 funds in the cross-section and each portfolio should contain at least four different funds.

the winners in the subsequent month. That is, the average raw returns of the quintile (1) (best performers) should be significantly greater than the average raw returns of the quintile (5) (worst performers) in the subsequent performance period.

1.b. Results

Using the simple raw returns to rank funds, Table 29 presents the results on the quintile analysis for the performance persistence tests of managed futures funds. Each quintile consists of the same number of funds: while quintile (1) includes the top 20% of funds, quintile (5) includes the bottom 20% of funds. For each of the quintile portfolios, the average monthly raw returns of the past twelve months as well as the average monthly raw returns in the subsequent month are presented on the left-hand side of the table 29. The right-hand side of the table presents the monthly average return differences between the quintiles of best performers and quintiles of worst performers in the subsequent month. The statistical differences of the mean returns between the quintiles are tested using a *t*-test and results are provided in the parentheses. This analysis is conducted for Public Funds, Private Pools and for all of the six CTA investment styles separately as well as for all CTAs taken together as a separate group.

The results indicate an existence of performance persistence in raw returns of Public Funds and Private Pools. Both for Public Funds and Private Pools, past twelve-month best performing funds continue to perform better than the peer funds in the subsequent month. The differences in the average raw returns between the best performing quintiles and worst performing quintiles are positive and statistically significant at the 5% level. However, the same results can not be obtained in raw returns of CTAs. Neither all CTAs taken together, nor alternative CTA investment styles analyzed separately show an

indication of performance persistence in raw returns. That is, the subsequent month returns of last year's winners (quintile (1)) are not significantly higher than those of last year's losers (quintile (5)): 1.042% vs. 0.918% for all CTAs, 1.437% vs. 1.036% for Currency CTAs, and 1.040% vs.0.848% for Diversified CTAs. There is even evidence of reversal in raw returns of certain CTA investment styles. That is, for certain CTA styles, the subsequent month returns of last year's losers are higher than last year's winners. For example, while the best performers of Stock CTAs (quintile (1)) produce an average monthly return of 0.686% in the subsequent month, the worst performers (quintile (5)) win over the best performers in the subsequent month and produce an average monthly return of 0.942%. However, the difference between the two is not statistically significant.

Thus, except for Public Funds and Private Pools, there is a no evidence of performance persistence in raw returns of managed futures funds. Therefore, past raw returns are poor predictors for the future raw returns of CTAs. However, past raw returns of Public funds and Private pools can forecast the future raw returns to a certain extent.

2. Persistence in Risk-adjusted Excess Returns: A Quintile Analysis

2.a. Methodology

Since risk-adjusted returns are better indicators of performance, a similar quintile analysis is conducted for the performance persistence tests of managed futures funds by using the risk-adjusted excess returns (alphas). For one-year and two-year holding periods, the risk-adjusted excess returns of each fund in a particular managed futures fund style is computed by employing the seven-factor time-series cross-section pooled regression, in which fund and time dummies are added to the equation. That is, the risk-adjusted return (α) of each individual fund is estimated over a one and two-year holding

period by using fund and time dummies in the seven-factor pooled regressions of managed futures funds.[74] After computing the fund alphas for one and two-year holding periods, the funds are ranked and placed into quintiles based on past alphas in the *selection period*, and the future alphas in each quintile are analyzed in the subsequent *performance period*. Both in selection and performance periods, quintile alphas are computed from the averages of alphas of all funds in that particular quintile.[75]

2.b. Results

The predictability of past one and two-year alphas in the selection period on future one and two-year alphas in the performance period are tested for Public funds, Private pools, alternative CTA investment styles as well as for all CTAs taken together as a separate group. The results are reported in tables 30A, 30B, and 30C. In each table, quintile (1) includes the funds with the highest alpha values (best performers), and quintile (5) includes the funds with the lowest alpha values (worst performers) in the selection period. For each of the quintile portfolios, the monthly average alphas in the selection period as well as the monthly average alphas in the performance period are presented on the left-hand side of the tables. The right-hand side of the tables 30A, 30B, and 30C provide the monthly average alpha differences between the quintiles in the subsequent performance period. If the differences in alphas between the best performers

[74] For one-year holding periods, only funds with a full year of monthly returns are included in the seven-factor pooled regressions to compute the individual one-year fund alphas. Similarly, for two-year holding periods, only funds with two full years of monthly returns are included in the seven-factor pooled regressions to estimate the individual two-year fund alphas.

[75] Quintile alphas are computed only if there are at least 20 funds in the cross-section and each quintile contains at least four different funds. For inclusion in the quintile analysis a fund should have at least two years of performance.

and worst performers are significantly positive, this suggests that managed futures funds do have persistence in their risk-adjusted excess returns.

Table 30A provides the results on persistence tests of managed futures funds when funds are ranked into quintiles based on their one-year alpha values in the selection period, and their subsequent one-year alpha values are analyzed in the performance period. The results show that there is persistence in risk-adjusted excess returns of Public funds, Private pools, and all CTAs taken together as a separate group. That is, the past year winners continue to be the winners in the subsequent year. However, similar to the results derived earlier, Public funds continue to produce negative risk-adjusted excess returns for one-year holding periods and be inferior investments compared to other categories of managed futures funds. Even though we see a significant alpha difference between quintiles (1) and (5), the best performers of Public funds (quintile (1)) produce a monthly average alpha of –0.165% in the subsequent one-year performance period. Therefore, the persistence in risk-adjusted returns of Public funds does not indicate any skill among Public fund portfolio managers. However, the results for Private Pools and all CTAs are different: there is evidence of performance persistence in one-year alphas and average risk-adjusted excess returns of best performers in the subsequent performance period are positive and significant.

Analyzing the six alternative CTA investment styles separately provide a big evidence of performance persistence among Diversified CTAs and Financial CTAs. In terms of number of CTAs, Diversified and Financial CTAs constitute the largest component among all CTA investment styles. Therefore, persistence in their risk-adjusted returns is reflected in performance persistence of all CTAs, when they are analyzed

altogether as a separate group. For these two styles, the differences in the one-year performance period alphas are positive and significant between all top-ranking and bottom-ranking quintiles. For example, while the best performers of Financial CTAs produce a monthly average alpha of 0.844% in the subsequent one-year performance period, the worst performers in the same category produce a monthly average alpha of –0.109%. The large difference between the two quintiles is statistically significant at the 5% level. Similar results are also obtained in the analysis of Diversified CTAs. However, for the remaining CTA styles, the results do not show any evidence of persistence in one-year risk-adjusted excess returns.

Table 30B presents the results on performance persistence when funds are ranked and placed into quintiles based on past two-year alpha values in the selection period and their subsequent one-year alpha values are observed in the performance period. Increasing the selection period to two years increases the power of persistence in risk-adjusted excess returns among alternative CTA investment styles. In addition to Diversified and Financial CTAs, we see evidence of performance persistence among Agriculture and Energy CTAs. For Agriculture and Energy CTAs, the finding that performance differences are positive and significant between only quintiles (1) and (5), and (1) and (4), but negative for the rest, suggests that most of the persistence in performance is due to repeat-winners in those categories.

Also, for Public funds, Private pools, and all CTAs, past two-year winners continue to be the winners in the following year. In other words, performance persistence continues among three main categories of managed futures funds when selection period is increased to two years. The comparison of alphas between quintiles (1) and (5) in the subsequent

one-year performance period indicates large and significant differences: 0.837% vs. –0.070% for Private pools, 1.080% vs. 0.346% for all CTAs. In terms of Public funds, however, almost all quintiles produce negative alphas in the performance period. Only quintile (1) produces a monthly average alpha slightly above zero percent. Therefore, the findings of performance persistence among Public funds do not indicate any skilled performance among Public fund portfolio managers.

The same type of strong performance persistence in managed futures funds is clearly visible when funds are ranked into quintiles based on their past two-year alpha values and their subsequent two-year alpha values are analyzed in the performance period. The results are given table 30C. Looking at the two-year performance period alpha differences between the best performers and worst performers suggests that the past two-year winners continue to be the winners in the subsequent two years. The mean alpha differences between top-ranking quintiles and bottom-ranking quintiles are significantly positive among Public funds, Private pools, Diversified CTAs, Financial CTAs, Agriculture CTAs, Energy CTAs, as well as among all CTAs taken together as a separate group. For example, the two-year performance period monthly average alpha differences between quintiles (1) and (5) are 0.923% for Private pools, 0.858% for all CTAs, 1.748% for Agriculture CTAs, 0.908% for Diversified CTAs, 1.080% for Financial CTAs, and 1.841% for Energy CTAs. All differences are statistically significant at the 5% level. The only two CTA styles that do not provide any evidence of performance persistence in two-year alphas are Currency and Stock CTAs.

All in all, Public funds and Private pools do have persistence in their risk-adjusted excess returns as well as in their raw returns. However, for CTAs, performance

persistence can only be found after adjusting for risk. Thus, using seven-factor alphas to rank funds does a better job of forecasting future risk-adjusted excess returns of managed futures funds than it does by using raw returns. Also, the predictability power of future alphas by past alphas increases when performance is measured over a longer period.[76] That is, increasing the selection and performance periods from one year to two years definitely increases the power of persistence in risk-adjusted excess returns of managed futures funds.[77]

3. Persistence in Risk-adjusted Excess Returns: A Cross-section Regression Analysis

Similar to the cross-section regressions analyses conducted for hedge funds, the persistence in risk-adjusted excess returns of managed futures funds are also tested by regressing future seven-factor alphas on past seven-factor alphas.[78] In other words, cross-section regressions are estimated each year to determine whether past risk-adjusted excess returns are predictors of future risk-adjusted excess returns. Positive and statistically significant slope coefficients estimated from these cross-section regressions should indicate performance persistence in managed futures funds.

For different holding periods – one and two years –, Tables 31A, 31B, and 31C provide the estimates from the cross-section regressions for seven-factor managed futures

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[76] These results are supported by the regression analyses of risk-adjusted excess returns in Tables 31A, 31B, and 31C.

[77] The results are in line with performance persistence in hedge funds. The persistence in risk-adjusted excess returns of hedge funds also became stronger due to the fact that performance is measured over a longer period.

[78] The seven-factor alphas used in the cross-section regressions are the individual managed futures fund alphas, which are estimated by using fund and time dummies in the seven-factor pooled time-series cross-section regressions.

fund alphas. Cross-section regressions are estimated each year from 1985 through 1998 for all different categories of managed futures funds including Public funds, Private pools, all CTAs, and six alternative CTA investment styles.

Table 31A reports the results on cross-section regressions when future one-year seven-factor alphas are regressed on past one-year seven-factor alphas. The estimated slope coefficients from the regressions indicate a big evidence of performance persistence in Public funds, Private pools, Diversified CTAs, Financial CTAs, as well as all CTAs taken together as a separate group. Of the thirteen one-year on one-year regression analyses, while there are eight positive and significant slope coefficients for Public funds, seven for Private pools, and nine for all CTAs, there is only one regression with a significantly negative slope coefficient in each of those three categories. The cross-section regressions across alternative CTA styles suggest performance persistence among Diversified CTAs and Financial CTAs. Of the thirteen regression analyses, Diversified CTAs have nine and Financial CTAs have eight significantly positive slope coefficients. In fact, in all categories of managed futures funds, in which performance persistence is found to exist, the last three regressions, spanning the period 1995-1998, have significantly positive slope coefficients. This suggests an increasing evidence of performance persistence especially in the most recent years.

Similarly, regressing future one-year alphas on past two-year alphas does not change the results in a significant way. Table 31B provides the estimates on the regressions of future one-year seven-factor alphas on past two-year seven-factor alphas. As the regression results indicate, past two-year alphas are good predictors of subsequent one-year alphas for all three main categories of managed futures funds. All CTAs taken

together, of the twelve one-year on two-year regression analyses, eight of them have significantly positive slope coefficients. In the same way, the number of positive and significant slope coefficients for Public funds and Private pools are eight and seven, respectively. While there are no significantly negative slope coefficients for Private pools and all CTAs, there is only one for Public funds. Similarly, the evidence on performance persistence can easily be seen among certain CTA investment styles. For example, out of the twelve regression analyses, there are nine positive and significant slope coefficients for Diversified CTAs, and eight for Financial CTAs. The signs of slope coefficients for the other four CTA investment styles are mixed; thus, it is hard to see an evidence of performance persistence in other CTA styles.

The results provide stronger support for performance persistence when future two-year seven-factor alphas are regressed on past two-year seven-factor alphas. The cross-section regression estimates are provided in table 31C. Analyzing the three main categories of managed futures funds (Public funds, Private pools, and all CTAs) show that past two-year alphas are good predictors of subsequent two-year alphas. Of the eleven two-year on two-year regressions, all CTAs have seven, Private pools and Public funds have eight positive and significant slope coefficients. There are no significantly negative slope coefficients in any of the three main categories. This indicates that past alphas predict future alphas strongly when performance is measured over a longer period. Using two-year alphas in the cross-section regressions increases the power of persistence in risk-adjusted excess returns among alternative CTA investment styles as well. In addition to Diversified and Financial CTAs, we see evidence of performance persistence

among Agriculture and Energy CTAs.[79] Out of the eleven two-year on two-year regression analyses, there are nine positive and significant slope coefficients for Diversified CTAs, seven for Financial CTAs, and six for both Agriculture and Energy CTAs. While there are no significantly negative slope coefficients for Diversified, Agriculture, and Energy CTAs, there is only one negative and significant slope coefficient for Financial CTAs. The only two CTA styles that do not provide any evidence of performance persistence in two-year alphas are Currency and Stock CTAs. The estimated slope coefficients for these two CTA styles do not support any performance persistence in risk-adjusted excess returns.

In conclusion, for most of the time, past alphas of managed future funds explain future alphas at a considerable amount. In addition, the predictability power of future alphas by past alphas increases when performance is measured over a longer period.

IX. CONCLUSION

This study provides a comprehensive analysis of the performance of hedge funds and managed futures funds, both as stand-alone investments and as assets in diversified portfolios of stocks and bonds. Hedge funds and managed futures funds and their alternative investment styles are examined within a context of equally-weighted (EW) and value-weighted (VW) portfolios.

As stand-alone investments, VW Private Pools, EW and VW Financial CTAs, and EW Agriculture CTAs, among managed futures fund investment styles, produce very

[79] These results are consistent with the prior findings of persistence in risk-adjusted returns when quintiles are formed on the basis of past two-year alphas and analyzed in the subsequent two-year performance period.

high Sharpe ratios compared to the S&P 500 index. In terms of hedge fund investment styles, EW and VW Market-Neutral Funds, Event Driven Funds and Global Macro Funds produce even higher Sharpe ratios in all time periods analyzed.

As portfolio assets, the inclusion of managed futures funds and hedge funds in diversified stock and bond portfolios appears to enhance the performance of those portfolios. In particular, for *unconstrained portfolios*, an analysis of the optimal portfolio allocations for hedge funds and managed futures funds in diversified portfolios shows that hedge funds and managed futures funds together replace the traditional investments in stocks and bonds and form almost the entire optimal portfolio. Thus, the addition of hedge funds and managed futures funds significantly increases the Sharpe ratio of the unconstrained benchmark portfolio: from 0.92 to 3.98 for EW portfolios and to 2.71 for VW portfolios. Even for *constrained portfolios*, managed futures and hedge funds together receive the maximum permissible allocation (27%) given to alternative asset classes in diversified portfolios. In return, the Sharpe ratio of the constrained benchmark portfolio increases from 0.89 to 1.31 for EW portfolios and to 1.26 for VW portfolios. Most importantly, both alternative hedge fund investment styles and alternative CTA investment styles together receive positive allocations in EW and VW portfolios, suggesting that managed futures and hedge funds are complementary rather than substitute investment products.

The performance of hedge funds and managed futures funds is also analyzed in bull and bear markets to see how well they perform in different states of the market. I find that certain hedge fund investment styles like Market-Neutral Funds, Event Driven Funds and Global Macro Funds produce positive returns in the down markets in addition to their

very large attractive returns in the up markets. This generates heavy weights on these specific hedge fund investment styles in diversified portfolios in both states of the market. Particularly, the Market-Neutral Funds portfolio is the dominant investment style among hedge funds as well as managed futures funds both in EW and VW portfolios by producing positive returns and receiving large portfolio allocations in both states of the market.

This study is also the first to estimate the risk-adjusted excess returns (α's) of hedge funds and managed futures funds in a context of multi-factor risk models. Using pooled cross-section time-series data on the monthly returns of individual hedge funds, separate six-factor Jensen alphas and separate slope coefficients for the risk factors are estimated for each hedge fund investment style. A similar analysis is also conducted for managed futures funds but by using a seven-factor model as opposed to the six-factor risk model used for hedge funds. I find that all hedge fund investment styles produce positive and significant annualized risk-adjusted excess returns, ranging from 3.29% for Funds of Funds to 11.23% for Sector funds. Similarly, analyzing the alphas from the seven-factor model for managed futures funds, I find that managed futures funds, except for Public Funds, produce positive and significant annualized average risk-adjusted excess returns, ranging from 2.06% for Private Pools to 14.34% for Agriculture CTAs.

The same six-factor model for hedge funds and the same seven-factor model for managed futures funds are also employed to obtain separate alphas and separate slope coefficients for each fund in a given investment style by adding fund and time dummies to the regression equations. Both for hedge funds and managed futures funds, I find that positive significant alphas are heavily concentrated within a small number of funds in

each style. I also find that funds with positive significant alphas, "successful funds", differ considerably from their peer funds in terms of average alphas, average raw returns, and median annual incentive fees.

The relationship between fund performance and fund characteristics is also analyzed in a regression context. In a cross-section regression of risk-adjusted performance (six-factor alpha) on three characteristics of hedge funds (size, age, and incentive fee), I find that size and incentive fees are positively and significantly related to risk-adjusted excess returns of hedge funds. On average, hedge funds which pay high incentive fees (20 percent or more) appear to earn annualized excess returns of about four to five percentage points higher than funds which pay lower incentive fees (5 percent or less). In a similar analysis for managed futures funds, using seven-factor alphas as the dependent variable in the cross-section regressions, I find that age and incentive fee increase the risk-adjusted performance of CTAs in a significant way.

In the last section of this study, I explore whether investors can use a fund's past returns to select successful (or skillful) fund managers. Using simple raw returns as well as risk-adjusted excess returns (alphas), I conduct two different tests, and find a reasonable amount of persistence in the risk-adjusted excess returns of various hedge fund and CTA investment styles. In addition, for both hedge funds and managed futures funds, I conclude that the predictability power of future alphas by past alphas increases when performance is measured over a longer period. These results point out the existence of a longer period persistence in risk-adjusted excess returns of hedge funds and CTAs, in comparison to the short-term persistence for mutual funds, suggested by the "hot hands" literature.

Table 1A
Descriptive Statistics of Managed Futures Funds
Period: 1985:01 - 1998:08

	Public Funds	Private Pools	All CTAs*	Currency CTAs	Agriculture CTAs	Diversified CTAs	Financial CTAs	Stock CTAs	Energy CTAs
# of Funds	704	466	1219	175	49	599	226	90	36
Average Monthly Return (%)	0.76	1.19	1.82	2.74	1.89	1.74	1.83	1.98	1.69
Average Std. Dev. of Returns (%)	5.59	7.28	8.15	10.62	10.58	9.06	6.65	6.72	9.66
Average Size of Funds (million $s)	22.32	8.99	20.62	27.05	8.82	23.12	23.19	4.97	5.73
Median Size of Funds (million $s)	4.61	1.96	2.44	5.48	2.17	2.25	3.57	1.00	1.82
Average # of Months in Existence	57	58	55	52	55	60	51	43	56
Median # of Months in Existence	47	46	45	44	47	48	42	41	55
Average Annual Incentive Fee (%)	9.30	18.30	12.13	9.46	14.06	12.01	11.04	16.54	19.86
Median Annual Incentive Fee (%)	4.00	20.00	15.00	4.50	20.00	13.50	7.23	20.00	20.00

All CTAs include 44 CTAs that do not disclose a specific investment style

Table 1B
Descriptive Statistics of HedgeFunds
Period: 1990:01 – 1998:08

	All Hedge Funds*	Funds of Funds	Event-Driven Funds	Global Macro Funds	Global Funds	Long-only Funds	Mkt. Neutral Funds	Sector-Specific Funds	Short-sell Funds
# of Funds	1665	349	149	125	586	22	300	60	20
Average Monthly Return (%)	1.15	0.90	1.34	1.33	1.22	1.83	1.05	1.77	0.58
Average Std. Dev. of Returns (%)	4.54	3.15	4.13	4.72	5.96	7.53	2.72	6.47	6.96
Average Size of Funds (million $s)	59.19	41.14	46.63	218.56	48.02	18.58	53.41	27.17	23.55
Median Size of Funds (million $s)	15.23	11.86	17.59	21.55	15.23	7.49	18.53	10.90	5.20
Average # of Months in Existence	44	45	46	46	44	37	40	32	61
Median # of Months in Existence	37	42	38	40	38	27	32	25	60
Average Annual Incentive Fee (%)	9.73	7.75	14.83	8.65	8.21	12.18	12.32	10.59	13.30
Median Annual Incentive Fee (%)	15.25	10.00	20.00	10.00	10.00	15.00	15.00	8.50	20.00

* All Hedge Funds include 54 funds that do not disclose a specific investment style

Table 2A
Managed Futures Funds: Entry and Exit
Period 1985:01 – 1998:08

	Funds Existing at the beg. of 1985	New Entrants during 1985-1998	Total Funds in Existence during 1985-1998	Funds Existing at the end of 08/1998	Defunct Funds during 1985-1998	Attrition Rates (%)
Public Funds	71	633	704	276	428	60.80
Private Pools	37	429	466	153	313	67.17
All CTAs*	131	1088	1219	399	820	67.27
CTAs- Currency	2	173	175	53	122	69.71
CTAs- Agriculture	5	44	49	20	29	59.18
CTAs- Diversified	95	504	599	218	381	63.61
CTAs- Financial	8	218	226	74	152	67.26
CTAs- Stocks	1	89	90	30	60	66.67
CTAs- Energy	2	34	36	5	31	86.11

* All CTAs include 44 CTAs that do not disclose a specific investment style

Table 2B
Hedge Funds: Entry and Exit
Period 1990:01 – 1998:08

	Funds Existing at the beg. of 1990	New Entrants during 1990-1998	Total Funds in Existence during 1990-1998	Funds Existing at the end of 08/1998	Defunct Funds during 1990-1998	Attrition Rates (%)
All Hedge Funds*	157	1508	1665	1169	496	29.79
Funds of Funds	27	322	349	260	89	25.50
Event Driven	19	130	149	122	27	18.12
Global Macro	18	107	125	67	58	46.40
Global	55	531	586	405	181	30.89
Long-only	0	22	22	18	4	18.18
Market Neutral	22	278	300	231	69	23.00
Sector Specific	1	59	60	53	7	11.67
Short-sell	5	15	20	13	7	35.00

* All Hedge Funds include 54 funds that do not disclose a specific investment style

Table 3
Returns and Standard Deviation of Returns for Alternative Benchmark Investments

	S&P 500 Index (Large-cap)		U.S. Small Stock (Small-cap)		Intermediate-Term Government Bonds		Long-Term Government Bonds		Long-term Corporate Bonds		Treasury Bills	
	Annual Return (%)	Annual Std. Dev. (%)	Annual Return (%)	Annual Std. Dev. (%)	Annual Return (%)	Annual Std. Dev. (%)	Annual Return (%)	Annual Std. Dev. (%)	Annual Return (%)	Annual Std. Dev. (%)	Annual Return (%)	Annual Std. Dev. (%)
1980	29.96	18.31	37.76	27.84	4.95	15.93	-2.03	21.33	-1.00	20.12	10.72	0.89
1981	-4.26	12.89	14.64	18.56	9.58	10.82	4.01	22.16	0.53	19.93	13.81	0.45
1982	21.16	19.14	26.24	17.21	26.04	7.03	34.87	10.48	36.72	12.73	10.06	0.72
1983	20.92	9.92	35.01	15.83	7.30	5.35	1.23	11.27	6.56	10.20	8.46	0.17
1984	6.96	14.01	-5.83	15.29	13.38	6.35	15.10	11.58	16.25	11.15	9.42	0.31
1985	28.87	12.17	23.20	14.59	18.80	5.64	27.96	12.21	27.08	10.37	7.46	0.17
1986	18.55	17.94	7.60	14.38	14.32	5.73	23.47	17.32	18.54	8.19	5.99	0.19
1987	9.72	30.50	-3.27	34.53	2.96	4.80	-2.27	10.28	0.16	9.64	5.34	0.22
1988	16.10	10.07	21.56	13.17	6.04	4.73	9.72	10.07	10.52	8.26	6.18	0.34
1989	28.37	12.35	10.25	10.58	12.66	5.41	17.05	8.15	15.31	6.20	8.07	0.22
1990	-1.67	18.39	-22.05	20.45	9.41	4.36	6.40	9.32	6.81	7.08	7.57	0.16
1991	28.07	15.80	38.59	15.80	14.50	3.06	17.92	6.22	18.36	4.29	5.46	0.16
1992	7.66	7.37	22.53	17.47	7.11	5.46	8.00	7.08	9.14	5.30	3.45	0.13
1993	9.73	6.12	19.61	9.54	10.77	4.02	17.10	7.17	12.56	4.93	2.86	0.05
1994	1.81	10.54	3.52	10.03	-5.15	4.72	-7.72	8.70	-5.69	7.06	3.84	0.23
1995	32.34	5.18	30.40	9.59	15.69	3.42	28.07	7.51	24.46	5.90	5.46	0.13
1996	21.48	10.91	17.81	17.78	2.14	3.81	-0.52	9.37	1.65	7.50	5.08	0.09
1997	30.30	15.94	22.14	17.97	8.14	3.81	15.19	9.07	12.47	7.14	5.13	0.12
1998	1.91	23.05	-32.18	28.95	10.13	3.38	15.21	6.15	8.04	2.60	4.92	0.06
1980-98	16.46	15.02	14.91	18.27	9.93	6.47	11.98	11.79	11.56	10.10	6.84	0.85
1985-98	17.02	15.02	12.47	17.85	9.08	4.72	12.48	9.78	11.47	7.30	5.50	0.46
1990-98	15.11	13.30	12.82	17.24	8.00	4.31	10.91	8.25	9.82	6.32	4.86	0.41
1990-93	10.95	13.00	14.67	17.08	10.45	4.24	12.36	7.44	11.72	5.47	4.84	0.56
1994-98	18.69	13.58	11.23	17.51	5.91	4.31	9.68	8.93	8.20	6.97	4.88	0.22

Annual Return: Arithmetic average of monthly returns during the investment period multiplied by 12
Annual Standard Deviation: Standard deviation of monthly returns during the investment period multiplied by $\sqrt{12}$

Table 4
Returns and Standard Deviation of Returns for EW & VW Portfolios of Managed Futures Funds

	EW Public Funds		VW Public Funds			EW Private Pools		VW Private Pools			EW All CTAs*		VW All CTAs*	
Year	# of Funds	Annual Return	Annual St. Dev.	Annual Return	Annual St. Dev.	# of Funds	Annual Return	Annual St. Dev.	Annual Return	Annual St. Dev.	# of Funds	Annual Return	Annual St. Dev.	Annual Return	Annual St. Dev.
1980	16	25.43	17.19	14.24	22.21	10	55.86	24.46	38.56	17.79	NA				
1981	26	10.76	19.73	14.13	17.55	12	24.83	26.00	35.98	21.54	49	30.66	23.18	19.00	17.41
1982	36	5.76	16.88	8.60	14.89	19	22.29	19.30	32.21	12.64	57	29.10	18.89	11.89	22.27
1983	53	-4.87	21.02	-10.06	16.88	27	26.70	24.19	12.82	12.08	68	20.68	19.03	0.46	19.04
1984	67	14.60	21.20	8.57	20.02	34	22.86	28.66	14.40	10.96	97	24.00	21.85	25.20	26.82
1985	79	18.65	16.17	19.92	18.98	51	26.52	18.48	23.49	18.52	136	32.39	17.75	24.85	18.21
1986	102	-1.55	18.66	-0.86	21.34	75	28.04	15.86	18.93	14.74	177	25.59	20.07	5.53	19.09
1987	126	36.49	17.01	31.04	17.43	111	43.61	13.97	39.24	12.69	212	54.58	19.62	40.76	18.03
1988	150	7.99	20.58	7.80	17.86	140	13.85	19.87	13.31	10.16	260	28.55	25.69	18.65	20.41
1989	206	4.43	16.15	10.48	13.04	176	5.55	12.71	15.17	9.38	325	14.85	14.03	5.03	15.16
1990	245	18.84	9.66	17.97	10.36	208	21.37	7.46	32.11	9.15	398	25.63	9.53	22.31	10.02
1991	279	5.91	14.38	14.34	17.00	229	4.07	12.54	10.28	9.94	495	12.45	11.88	15.38	15.04
1992	328	-2.21	10.52	2.09	12.19	249	0.89	8.20	9.74	7.10	586	6.55	9.17	8.35	11.72
1993	370	10.72	7.16	17.06	7.10	255	10.97	8.21	15.47	5.74	634	11.32	6.94	17.47	7.57
1994	431	-5.88	6.23	-3.60	6.02	243	-1.91	7.21	7.17	7.19	684	4.01	6.43	-1.86	7.07
1995	419	9.24	6.52	9.43	6.62	230	12.07	8.43	13.48	6.80	681	12.94	6.91	12.50	7.43
1996	411	7.87	9.89	13.00	9.06	224	11.99	12.60	15.23	9.27	636	10.63	9.17	13.99	8.32
1997	377	7.47	8.16	11.30	7.62	210	10.42	10.08	14.37	7.76	562	9.54	7.70	11.55	7.64
1998	322	9.26	10.13	11.19	6.55	184	12.22	12.66	14.63	10.45	457	5.38	8.64	11.47	10.34
1985-98		9.08	12.96	11.52	13.10		14.31	12.60	17.39	10.34		18.49	13.81	14.79	13.28
1990-98		6.71	9.31	10.27	9.69		9.00	9.63	14.72	8.12		11.16	8.47	12.38	9.55
1990-93		8.31	10.63	12.87	11.95		9.32	9.30	16.90	8.32		13.99	9.46	15.88	11.14
1994-98		5.33	8.07	8.05	7.26		8.73	9.98	12.86	7.97		8.73	7.54	9.39	7.95

Table 4
Continued

		EW Currency CTAs		VW Currency CTAs			EW Agriculture CTAs		VW Agriculture CTAs			EW Diversified CTAs		VW Diversified CTAs	
Year	# of Funds	Annual Return	Annual St. Dev	Annual Return	Annual St. Dev	# of Funds	Annual Return	Annual St. Dev	Annual Return	Annual St. Dev	# of Funds	Annual Return	Annual St. Dev	Annual Return	Annual St. Dev
1980	NA					2	-1.04	23.86	1.45	18.03	33	80.37	37.73	43.92	25.69
1981	1	56.77	23.14	56.77	23.14	2	-33.53	35.02	29.25	21.70	43	34.79	23.66	21.23	19.56
1982	1	30.19	24.85	30.19	24.85	3	59.89	40.40	8.08	10.13	51	46.92	24.84	12.94	24.07
1983	2	57.38	18.31	32.79	20.99	3	62.10	24.01	45.11	23.44	59	17.33	20.58	-0.93	18.71
1984	2	107.50	30.57	103.93	33.82	5	8.85	16.02	7.38	19.70	81	34.35	23.66	26.41	27.03
1985	3	102.74	42.80	94.83	29.30	5	6.13	15.93	4.40	8.63	110	43.08	25.01	26.31	20.30
1986	10	124.67	72.16	61.60	33.68	6	47.31	18.75	3.92	18.31	139	33.27	19.66	2.23	20.35
1987	14	58.72	22.81	69.27	30.95	7	21.96	20.59	11.37	12.18	156	55.79	20.59	42.52	17.02
1988	22	23.79	22.05	56.51	22.42	9	91.79	39.91	66.69	43.37	180	30.31	29.66	17.42	23.89
1989	30	25.20	20.60	1.52	18.02	10	12.43	9.04	4.93	12.32	211	12.13	15.30	3.62	15.70
1990	50	36.22	13.74	27.46	14.52	12	10.57	5.15	20.57	8.81	230	25.47	9.53	22.87	10.70
1991	72	22.24	16.48	16.08	17.81	16	10.14	4.29	-2.46	7.59	270	11.73	14.58	16.56	15.85
1992	92	16.05	12.33	16.52	11.89	25	5.09	7.51	-1.03	7.23	293	6.66	10.35	10.06	11.90
1993	103	4.14	8.47	-0.98	9.98	29	6.75	7.20	19.60	8.15	301	17.97	8.79	23.19	8.16
1994	118	-1.48	5.50	-7.26	4.85	35	38.53	18.43	10.68	8.48	327	6.33	9.28	-0.64	9.22
1995	111	15.51	9.73	12.50	8.26	31	15.67	10.83	7.43	6.51	330	15.31	9.26	13.34	8.69
1996	100	9.91	7.12	10.62	5.44	25	33.69	12.43	15.24	6.85	314	12.50	12.27	14.67	9.03
1997	88	7.48	6.75	7.14	5.05	27	-5.04	11.53	13.30	4.60	278	12.25	9.75	10.17	8.99
1998	67	5.65	8.19	9.28	5.71	23	21.24	9.09	5.53	3.87	239	4.89	11.90	12.67	13.48
1985-98		32.85	27.37	27.22	19.85		22.62	17.16	13.05	15.09		20.93	16.03	15.42	14.45
1990-98		13.14	10.53	10.19	10.39		14.95	10.79	10.04	7.27		12.86	10.46	13.69	10.59
1990-93		19.66	13.09	14.77	13.74		8.14	6.02	9.17	8.35		15.46	10.88	18.17	11.70
1994-98		7.54	7.45	6.25	6.17		20.78	13.44	10.79	6.28		10.64	10.14	9.85	9.51

Table 4
Continued

		EW Financial CTAs		VW Financial CTAs			EW Stock CTAs		VW Stock CTAs			EW Energy CTAs		VW Energy CTAs	
Year	# of Funds	Annual Return	Annual St Dev	Annual Return	Annual St Dev	# of Funds	Annual Return	Annual St Dev	Annual Return	Annual St Dev	# of Funds	Annual Return	Annual St Dev	Annual Return	Annual St Dev
1980	1	13.63	21.62	13.63	21.62	NA					NA				
1981	1	-8.29	24.32	-8.29	24.32	NA					NA				
1982	1	13.73	15.88	13.73	15.88	NA					NA				
1983	3	8.69	11.43	20.15	12.41	1	136.40	59.75	136.40	59.75	NA				
1984	8	27.48	11.85	27.91	20.79	1	52.30	72.52	52.30	72.52	NA				
1985	13	38.43	21.14	4.98	24.92	2	28.40	33.22	14.00	26.59	3	55.49	32.16	54.78	19.49
1986	17	25.20	15.37	27.34	18.49	2	36.25	33.44	39.59	34.92	3	53.67	16.92	24.76	18.47
1987	24	57.82	21.07	45.24	11.80	5	116.27	40.27	118.18	33.67	6	28.35	14.13	14.40	13.14
1988	29	18.64	15.09	12.36	11.00	8	14.41	4.77	4.91	6.73	12	50.93	29.89	18.73	11.46
1989	44	30.36	14.29	24.31	21.06	11	35.34	10.53	24.73	8.94	19	53.33	13.86	29.90	13.95
1990	65	30.96	8.56	30.21	12.14	18	28.16	7.58	19.96	10.03	23	40.01	18.46	9.66	12.00
1991	89	30.83	11.18	25.59	21.06	24	11.48	5.20	8.73	5.03	24	9.36	9.29	0.71	5.04
1992	117	10.97	9.49	0.94	15.49	36	2.82	3.85	11.12	4.25	23	6.48	4.99	-11.30	4.15
1993	130	15.07	5.34	21.79	8.34	46	13.50	5.37	4.18	7.54	25	3.08	4.72	3.61	4.21
1994	136	-1.32	5.24	-2.51	6.90	51	13.49	6.35	18.07	10.69	17	7.70	5.80	9.46	8.14
1995	140	13.82	6.93	15.99	9.67	54	1.95	4.31	-16.46	7.60	15	9.19	7.27	9.76	6.09
1996	128	11.64	8.65	18.60	12.26	55	11.32	5.64	-3.84	9.69	14	-12.40	11.22	-19.90	10.13
1997	114	10.84	8.38	18.88	12.15	48	10.85	8.28	11.60	6.47	7	16.36	14.43	16.67	21.55
1998	85	10.61	10.31	10.49	13.42	38	0.78	5.51	11.38	3.94	5	-65.63	10.64	-62.35	42.15
1985-98		21.98	12.80	18.34	14.94		23.76	18.87	19.20	18.12		20.33	17.69	8.76	16.27
1990-98		14.99	8.53	15.75	12.82		10.86	6.15	7.03	8.08		4.15	12.33	-2.64	15.79
1990-93		21.96	9.01	19.63	14.88		13.99	6.09	11.00	7.06		14.73	11.38	0.67	7.26
1994-98		9.01	7.76	12.42	10.79		8.17	6.16	3.63	8.81		-4.91	12.61	-5.48	20.50

EW Equally-Weighted Market Portfolio , VW Value-Weighted Market Portfolio
Annual Return: Arithmetic average of monthly returns during the investment period multiplied by 12
Annual Standard Deviation: Standard deviation of monthly returns during the investment period multiplied by $\sqrt{12}$
* For the category "All CTAs", first twelve-month returns of CTAs are excluded

Table 5
Returns and Standard Deviation of Returns for EW & VW Portfolios of Hedge Funds

		EW All Hedge Funds		VW All Hedge Funds			EW Funds of Funds		VW Funds of Funds			EW Event-Driven Funds		VW Event-Driven Funds	
Year	# of Funds	Annual Return	Annual St. Dev	Annual Return	Annual St. Dev	# of Funds	Annual Return	Annual St. Dev	Annual Return	Annual St. Dev	# of Funds	Annual Return	Annual St. Dev	Annual Return	Annual St. Dev
1980	3	47.54	10.14	38.05	24.25	1	83.45	9.02	83.45	9.30	1	20.63	3.20	20.63	3.20
1981	5	26.62	11.48	-3.28	21.94	2	49.76	12.46	88.83	15.58	1	22.84	3.60	22.84	3.60
1982	9	5.89	26.29	25.02	18.17	3	-21.82	54.28	-69.69	102.50	1	16.65	2.90	16.65	2.90
1983	15	21.23	8.42	15.88	9.47	3	24.11	9.15	19.95	8.70	1	20.43	1.45	20.43	1.61
1984	26	11.47	7.46	7.24	7.56	5	-0.69	9.64	3.12	13.03	2	15.28	5.98	15.53	3.10
1985	40	31.12	5.79	33.49	6.11	5	28.25	8.51	44.48	13.22	3	24.40	4.39	21.80	1.86
1986	55	21.10	9.06	17.90	8.46	6	17.73	10.04	22.90	14.65	5	18.70	13.94	12.43	3.53
1987	81	18.28	17.19	28.74	14.87	8	11.28	19.96	12.18	27.45	7	9.32	27.46	4.38	12.09
1988	104	19.02	5.02	10.96	8.39	15	15.70	3.21	12.85	4.56	9	40.14	9.74	19.86	2.92
1989	134	18.73	3.77	21.72	13.14	19	16.25	3.55	18.69	5.41	13	18.13	5.81	17.88	3.60
1990	198	7.22	4.81	12.79	9.37	38	10.18	3.15	9.17	4.80	21	8.62	6.82	13.25	3.59
1991	275	22.80	4.71	31.71	5.30	53	12.27	3.23	18.27	3.77	30	22.69	4.18	12.70	2.49
1992	390	14.62	3.61	23.33	11.68	79	11.08	2.63	15.29	4.14	31	15.08	4.56	16.20	3.61
1993	571	23.58	3.01	29.37	5.91	113	23.27	3.86	25.10	5.18	49	29.52	4.26	26.22	3.47
1994	844	0.75	4.52	-2.80	6.02	182	-4.94	4.89	-8.84	6.26	62	2.16	4.94	1.43	4.16
1995	1058	16.90	3.28	19.34	6.11	237	10.54	3.64	15.40	4.22	90	24.32	3.53	17.08	2.97
1996	1188	19.17	4.87	20.73	8.29	258	15.68	4.52	15.73	6.30	113	20.43	5.06	18.61	4.34
1997	1375	18.11	7.01	20.34	7.33	294	16.66	6.50	19.20	6.72	139	18.94	6.45	19.50	4.61
1998	1307	-5.95	12.11	0.61	11.55	289	-2.13	10.49	-0.41	10.77	129	-3.04	12.43	-4.34	14.29
1985-98		16.64	7.39	19.61	9.25		13.36	7.74	16.11	10.57		18.32	10.17	14.52	5.79
1990-98		13.75	5.93	17.91	8.40		10.77	5.31	12.58	6.32		16.12	6.36	14.09	5.61
1990-93		17.05	4.42	24.30	8.47		14.20	3.50	16.96	4.67		18.98	5.42	17.09	3.59
1994-98		10.92	6.90	12.43	8.08		7.83	6.39	8.83	7.31		13.68	7.05	11.51	6.84

Table 5
Continued

		EW Global Macro Funds		VW Global Macro Funds			EW Global Funds		VW Global Funds			EW Long-only Funds		VW Long-only Funds	
Year	# of Funds	Annual Return	Annual St. Dev.	Annual Return	Annual St. Dev.	# of Funds	Annual Return	Annual St. Dev.	Annual Return	Annual St. Dev.	# of Funds	Annual Return	Annual St. Dev.	Annual Return	Annual St. Dev.
1980	NA					1	38.54	26.01	38.54	26.01	NA				
1981	NA					1	-9.35	24.62	-9.35	24.62	NA				
1982	NA					2	26.27	15.28	32.85	17.87	NA				
1983	1	25.85	22.60	25.85	22.60	8	17.63	7.26	12.62	13.31	NA				
1984	2	9.06	9.01	3.02	14.32	12	16.39	10.86	3.11	11.78	NA				
1985	4	56.78	11.23	27.89	11.19	20	31.02	6.39	38.64	6.41	NA				
1986	10	18.67	13.22	15.49	12.03	24	25.03	11.10	18.24	11.35	NA				
1987	13	26.28	19.35	64.65	21.72	34	16.96	22.95	14.19	18.14	NA				
1988	14	17.37	9.52	8.71	11.82	39	22.33	6.24	16.54	4.79	NA				
1989	17	26.70	6.63	26.50	20.11	49	22.21	6.74	10.81	6.29	NA				
1990	23	17.57	3.73	18.12	16.12	72	0.16	10.27	-1.76	9.96	1	-39.04	37.15	-39.04	37.15
1991	29	24.64	6.40	37.54	7.45	102	31.90	8.20	36.11	7.83	2	38.67	12.27	37.86	12.40
1992	42	15.05	6.27	30.72	20.99	142	16.65	5.53	19.48	7.56	3	32.84	8.06	16.09	6.81
1993	67	28.54	5.30	35.54	10.31	192	26.95	4.71	28.90	4.99	6	38.16	10.58	28.63	9.54
1994	84	-3.90	4.81	-4.04	7.80	289	2.67	7.12	-0.54	8.72	7	0.96	15.29	-3.97	11.67
1995	93	20.74	5.43	24.61	10.47	365	18.45	4.76	17.73	6.60	10	37.78	10.33	42.06	10.28
1996	79	14.02	8.36	26.44	15.51	461	22.99	7.17	19.89	7.45	14	28.52	11.67	33.11	13.89
1997	76	18.59	7.75	23.52	12.23	517	18.37	10.14	21.04	9.84	22	26.91	15.59	29.77	17.88
1998	75	3.81	6.46	21.68	14.76	466	-16.61	18.96	-11.98	18.11	19	-30.28	25.45	-38.21	30.71
1985-98		20.75	9.56	25.62	14.54		17.90	10.49	16.92	10.03					
1990-98		15.90	6.54	23.87	13.36		14.66	9.38	15.33	9.70		21.97	15.64	18.73	16.54
1990-93		21.45	5.58	30.48	14.38		18.92	8.08	20.68	8.60		30.74	14.24	21.85	13.79
1994-98		11.14	7.03	18.21	12.31		11.01	10.31	10.74	10.44		15.85	16.44	16.18	18.30

Table 5
Continued

	EW Mkt. Neutral Funds		VW Mkt. Neutral Funds		EW Sector-Specific Funds			VW Sector-Specific Funds		EW Short-sell Funds			VW Short-sell Funds	
Year	# of Funds	Annual Return	Annual St. Dev	Annual Return	Annual St. Dev	# of Funds	Annual Return	Annual St. Dev	Annual Return	Annual St. Dev.	# of Funds	Annual Return	Annual St. Dev	Annual Return	Annual St. Dev
1980	NA					NA					NA				
1981	NA					NA					NA				
1982	NA					NA					NA				
1983	1	23.95	4.55	23.95	4.55	NA					NA				
1984	3	15.55	2.95	13.22	3.62	NA					NA				
1985	6	16.87	4.22	12.72	7.44	NA					NA				
1986	7	17.39	5.11	27.67	5.38	NA					NA				
1987	13	16.29	3.30	7.56	4.78	NA					NA				
1988	16	8.33	2.79	7.26	4.28	NA					5	11.36	2.76	13.09	5.59
1989	21	9.83	2.20	8.02	2.62	NA					5	10.20	8.01	24.14	4.47
1990	24	8.43	1.43	3.59	1.82	2	5.47	13.19	7.35	13.80	8	31.03	19.83	22.25	12.58
1991	32	17.24	3.48	7.99	2.60	2	37.71	16.00	26.30	17.13	9	-11.49	14.86	-13.36	12.78
1992	58	12.53	2.53	6.41	1.38	5	25.23	8.35	17.76	8.13	10	7.45	13.87	7.98	10.49
1993	93	15.98	1.38	10.26	1.04	9	21.85	6.89	15.52	5.54	14	-8.85	12.58	7.51	9.79
1994	144	4.48	1.91	4.59	1.39	15	6.01	7.98	2.78	10.19	18	13.35	15.75	17.70	11.61
1995	174	15.86	1.38	11.93	2.06	22	38.71	6.49	41.64	6.61	18	-6.44	11.60	-1.14	14.94
1996	202	16.07	0.79	15.84	0.71	33	30.14	8.82	24.94	10.37	13	1.29	19.89	-6.88	19.29
1997	260	15.42	1.90	12.76	1.25	53	31.54	13.68	34.75	22.39	14	10.80	13.48	13.02	10.82
1998	254	4.74	4.03	3.03	3.12	60	-18.31	14.36	-33.18	16.14	15	34.43	25.75	20.95	19.17
1985-98		13.01	3.01	10.14	3.72										
1990-98		12.59	2.52	8.70	2.10		21.28	11.59	17.18	13.79		6.96	16.42	7.04	13.54
1990-93		13.54	2.50	7.06	1.88		22.57	11.81	16.73	11.82		4.54	15.82	6.09	11.71
1994-98		11.78	2.54	10.10	2.20		20.18	11.51	17.57	15.38		9.04	17.03	7.86	15.03

EW: Equally-Weighted Market Portfolio , VW: Value-Weighted Market Portfolio
Annual Return: Arithmetic average of monthly returns during the investment period multiplied by 12
Annual Standard Deviation: Standard deviation of monthly returns during the investment period multiplied by $\sqrt{12}$

Table 6A
Annual Returns, Standard Deviation of Returns and Sharpe Ratios
For Alternative Managed Futures Fund Investment Styles

	1985:01 – 1998:08			1990:01 – 1998:08			1990:01 – 1993:12			1994:01 – 1998:08		
	Annual Return	Annual Std. Dev.	Sharpe Ratio	Annual Return	Annual Std. Dev.	Sharpe Ratio	Annual Return	Annual Std. Dev.	Sharpe Ratio	Annual Return	Annual Std. Dev.	Sharpe Ratio
	(%)	(%)		(%)	(%)		(%)	(%)		(%)	(%)	
RS Public Funds	9.08	19.37	0.18	6.71	17.10	0.11	8.32	17.27	0.20	5.33	16.37	0.03
RS Private Pools	14.31	25.22	0.35	9.00	21.18	0.20	9.32	20.58	0.22	8.72	19.67	0.20
RS All CTAs*	18.49	28.23	0.46	11.16	21.96	0.29	13.99	22.02	0.42	8.74	20.68	0.19
RS Currency CTAs	32.85	36.79	0.74	13.14	18.99	0.44	19.67	22.94	0.65	7.54	15.78	0.17
RS Agriculture CTAs	22.62	36.64	0.47	14.95	31.91	0.32	8.14	26.29	0.13	20.78	33.84	0.47
RS Diversified CTAs	20.93	31.38	0.49	12.86	24.55	0.33	15.46	25.96	0.41	10.64	22.99	0.25
RS Financial CTAs	21.98	23.03	0.72	14.99	21.07	0.48	21.96	21.96	0.78	9.01	17.94	0.23
RS Stock CTAs	23.76	23.29	0.78	10.86	22.09	0.27	13.99	18.42	0.50	8.17	22.11	0.15
RS Energy CTAs	20.33	33.48	0.44	4.15	26.47	-0.03	14.74	24.74	0.40	-4.91	20.30	-0.48
EW Public Funds	9.08	12.96	0.28	6.71	9.31	0.20	8.31	10.63	0.33	5.33	8.07	0.06
EW Private Pools	14.31	12.6	0.70	9.00	9.63	0.43	9.32	9.30	0.48	8.73	9.98	0.38
EW All CTAs*	18.49	13.81	0.94	11.16	8.47	0.74	13.99	9.46	0.97	8.73	7.54	0.51
EW Currency CTAs	32.85	27.37	1.00	13.14	10.53	0.79	19.66	13.09	1.13	7.54	7.45	0.36
EW Agriculture CTAs	22.62	17.16	1.00	14.95	10.79	0.93	8.14	6.02	0.55	20.78	13.44	1.18
EW Diversified CTAs	20.93	16.03	0.96	12.86	10.46	0.77	15.46	10.88	0.98	10.64	10.14	0.57
EW Financial CTAs	21.98	12.8	1.29	14.99	8.53	1.19	21.96	9.01	1.90	9.01	7.76	0.53
EW Stock CTAs	23.76	18.87	0.97	10.86	6.15	0.97	13.99	6.09	1.50	8.17	6.16	0.53
EW Energy CTAs	20.33	17.69	0.84	4.15	12.33	-0.06	14.73	11.38	0.87	-4.91	12.61	-0.78
VW Public Funds	11.52	13.1	0.46	10.27	9.69	0.56	12.87	11.95	0.67	8.05	7.26	0.44
VW Private Pools	17.39	10.34	1.15	14.72	8.12	1.21	16.90	8.32	1.45	12.86	7.97	1.00
VW All CTAs*	14.79	13.28	0.70	12.38	9.55	0.79	15.88	11.14	0.99	9.39	7.95	0.57
VW Currency CTAs	27.22	19.85	1.09	10.19	10.39	0.51	14.77	13.74	0.72	6.25	6.17	0.22
VW Agriculture CTAs	13.05	15.09	0.50	10.04	7.27	0.71	9.17	8.35	0.52	10.79	6.28	0.94
VW Diversified CTAs	15.42	14.45	0.69	13.69	10.59	0.83	18.17	11.70	1.14	9.85	9.51	0.52
VW Financial CTAs	18.34	14.94	0.86	15.75	12.82	0.85	19.63	14.88	0.99	12.42	10.79	0.70
VW Stock CTAs	19.2	18.12	0.76	7.03	8.08	0.27	11.00	7.06	0.87	3.63	8.81	-0.14
VW Energy CTAs	8.76	16.27	0.20	-2.64	15.79	-0.48	0.67	7.26	-0.57	-5.48	20.50	-0.51
S&P 500	17.02	15.02	0.77	15.11	13.30	0.77	10.95	13.00	0.47	18.69	13.58	1.02
US Small Stock	12.47	17.85	0.39	12.82	17.24	0.46	14.67	17.08	0.58	11.23	17.51	0.36
Int.-Term Govt. Bonds	9.08	4.72	0.76	8.00	4.31	0.73	10.45	4.24	1.32	5.91	4.31	0.24
Long-Term Govt. Bonds	12.48	9.78	0.71	10.91	8.25	0.73	12.36	7.44	1.01	9.68	8.93	0.54
Long-Term Corp. Bonds	11.47	7.30	0.82	9.82	6.32	0.79	11.72	5.47	1.26	8.20	6.97	0.48

RS: Randomly Selected Single CTA, Pool or Fund Portfolio, EW: Equally-Weighted Market Portfolio, VW: Value-Weighted Market Portfolio
* For the category "All CTAs", first twelve-month returns of CTAs are excluded

Table 6B
Annual Returns, Standard Deviation of Returns and Sharpe Ratios
For Alternative Hedge Fund Investment Styles

	1990:01 – 1998:08			1990:01 – 1993:12			1994:01 – 1998:08		
	Annual Return	Annual Std. Dev.	Sharpe Ratio	Annual Return	Annual Std. Dev.	Sharpe Ratio	Annual Return	Annual Std. Dev.	Sharpe Ratio
	(%)	(%)		(%)	(%)		(%)	(%)	
RS All Hedge Funds	13.75	15.90	0.56	17.05	12.64	0.97	10.92	15.80	0.38
RS Funds of Funds	10.76	10.94	0.54	14.20	9.04	1.04	7.82	10.85	0.27
RS Event Driven Funds	16.13	15.02	0.75	18.97	11.67	1.21	13.68	14.77	0.60
RS Global Macro Funds	15.90	16.05	0.69	21.46	14.04	1.18	11.14	15.80	0.40
RS Global Funds	14.66	21.06	0.47	18.91	15.92	0.88	11.02	20.96	0.29
RS Long-only Funds	21.96	26.09	0.66	30.74	23.38	1.11	15.85	25.97	0.42
RS Mkt. Neutral Funds	12.60	9.52	0.81	13.55	6.79	1.28	11.78	9.55	0.72
RS Sector Specific Funds	21.29	23.02	0.71	22.56	17.67	1.00	20.18	22.96	0.67
RS Short-sell Funds	6.96	22.45	0.09	4.54	18.12	-0.02	9.04	23.85	0.17
EW All Hedge Funds	13.75	5.93	1.50	17.05	4.42	2.76	10.92	6.90	0.87
EW Funds of Funds	10.77	5.31	1.11	14.20	3.50	2.68	7.83	6.39	0.46
EW Event Driven Funds	16.12	6.36	1.77	18.98	5.42	2.61	13.68	7.05	1.25
EW Global Macro Funds	15.90	6.54	1.69	21.45	5.58	2.98	11.14	7.03	0.89
EW Global Funds	14.66	9.38	1.05	18.92	8.08	1.74	11.01	10.31	0.59
EW Long-only Funds	21.97	15.64	1.09	30.74	14.24	1.82	15.85	16.44	0.67
EW Mkt. Neutral Funds	12.59	2.52	3.06	13.54	2.50	3.48	11.78	2.54	2.71
EW Sector Specific Funds	21.28	11.59	1.42	22.57	11.81	1.50	20.18	11.51	1.33
EW Short-sell Funds	6.96	16.42	0.13	4.54	15.82	-0.02	9.04	17.03	0.24
VW All Hedge Funds	17.91	8.40	1.55	24.30	8.47	2.30	12.43	8.08	0.93
VW Funds of Funds	12.58	6.32	1.22	16.96	4.67	2.59	8.83	7.31	0.54
VW Event Driven Funds	14.09	5.61	1.64	17.09	3.59	3.42	11.51	6.84	0.97
VW Global Macro Funds	23.87	13.36	1.42	30.48	14.38	1.78	18.21	12.31	1.08
VW Global Funds	15.33	9.70	1.08	20.68	8.60	1.84	10.74	10.44	0.56
VW Long-only Funds	18.73	16.54	0.84	21.85	13.65	1.25	16.18	18.30	0.62
VW Mkt. Neutral Funds	8.70	2.10	1.83	7.06	1.88	1.18	10.10	2.20	2.37
VW Sector Specific Funds	17.18	13.79	0.89	16.73	11.82	1.01	17.57	15.38	0.82
VW Short-sell Funds	7.04	13.54	0.16	6.09	11.71	0.11	7.86	15.03	0.20
S&P 500	15.11	13.30	0.77	10.95	13.00	0.47	18.69	13.58	1.02
US Small Stock	12.82	17.24	0.46	14.67	17.08	0.58	11.23	17.51	0.36
Int.-Term Govt. Bonds	8.00	4.31	0.73	10.45	4.24	1.32	5.91	4.31	0.24
Long-Term Govt. Bonds	10.91	8.25	0.73	12.36	7.44	1.01	9.68	8.93	0.54
Long-Term Corp. Bonds	9.82	6.32	0.79	11.72	5.47	1.26	8.20	6.97	0.48

RS: Randomly Selected Single Fund Portfolio , EW Equally-Weighted Market Portfolio , VW Value-Weighted Market Portfolio

Table 7A
Rankings of EW and VW Portfolios of Managed Futures and Hedge Funds
According to Different Safety First Criteria
Period: 1985:01 - 1998:08

	Annual Return (%)	Annual Std. Dev. (%)	Sharpe Ratio	Roy's Criteria with 10% Minimum Annual Return	Kataoka's Criteria with χ= 0.05 (%)	Ranking by Sharpe Ratio	Ranking by Roy's Criteria	Ranking by Kataoka's Criteria
EW Private Pools	14.31	12.60	0.70	0.34	-6.41	24	25	20
EW All CTAs*	18.49	13.81	0.94	0.61	-4.23	20	17	15
EW Currency CTAs	32.85	27.37	1.00	0.83	-12.17	16	8	28
EW Agriculture CTAs	22.62	17.16	1.00	0.74	-5.61	17	12	18
EW Diversified CTAs	20.93	16.03	0.96	0.68	-5.44	19	16	17
EW Financial CTAs	21.98	12.80	1.29	0.94	0.92	7	5	9
EW Stock CTAs	23.76	18.87	0.97	0.73	-7.28	18	13	22
EW Energy CTAs	20.33	17.69	0.84	0.58	-8.78	22	18	24
VW Public Funds	11.52	13.10	0.46	0.12	-10.04	28	27	25
VW Private Pools	17.39	10.34	1.15	0.72	0.39	11	14	13
VW All CTAs*	14.79	13.28	0.70	0.36	-7.06	25	24	21
VW Currency CTAs	27.22	19.85	1.09	0.87	-5.44	13	7	16
VW Agriculture CTAs	13.05	15.09	0.50	0.20	-11.78	27	26	27
VW Diversified CTAs	15.42	14.45	0.69	0.38	-8.34	26	23	23
VW Financial CTAs	18.34	14.94	0.86	0.56	-6.23	21	20	19
VW Stock CTAs	19.20	18.12	0.76	0.51	-10.61	23	21	26
EW All Hedge Funds	16.64	7.39	1.51	0.90	4.49	5	6	4
EW Funds of Funds	13.36	7.74	1.02	0.43	0.62	14	22	11
EW Event Driven Funds	18.32	10.17	1.26	0.82	1.59	8	9	8
EW Global Macro Funds	20.75	9.56	1.60	1.12	5.02	2	1	2
EW Global Funds	17.90	10.49	1.18	0.75	0.64	10	11	10
EW Mkt. Neutral Funds	13.01	3.01	2.50	1.00	8.06	1	4	1
VW All Hedge Funds	19.61	9.25	1.53	1.04	4.39	4	3	5
VW Funds of Funds	16.11	10.57	1.00	0.58	-1.29	15	19	14
VW Event Driven Funds	14.52	5.79	1.56	0.78	5.00	3	10	3
VW Global Macro Funds	25.62	14.54	1.38	1.07	1.70	6	2	7
VW Global Funds	16.92	10.03	1.14	0.69	0.42	12	15	12
VW Mkt. Neutral Funds	10.14	3.72	1.25	0.04	4.02	9	28	6

* For the category "All CTAs", first twelve-month returns of CTAs are excluded

$r_s = 1 - 6*\{\Sigma d_i^2/[n*(n^2-1)]\}$, $t = \{(r_s*\sqrt{n-2})/\sqrt{1-r_s^2}\}$

	Sharpe Ratio and Roy's Criteria Rankings	Sharpe Ratio and Kataoka's Criteria Rankings
Spearman Correlation Coefficient (r_s)	0.80	0.92
T-statistic	6.71	11.89

Table 7B
Rankings of EW and VW Portfolios of Managed Futures and Hedge Funds
According to Different Safety First Criteria
Period: 1990:01 – 1998:08

	Annual Return (%)	Annual Std. Dev. (%)	Sharpe Ratio	Roy's Criteria with 10% Minimum Annual Return	Kataoka's Criteria with χ= 0.05 (%)	Ranking by Sharpe Ratio	Ranking by Roy's Criteria	Ranking by Kataoka's Criteria
EW All CTAs*	11.16	8.47	0.74	0.14	-2.78	25	25	17
EW Currency CTAs	13.14	10.53	0.79	0.30	-4.19	23	20	22
EW Agriculture CTAs	14.95	10.79	0.93	0.46	-2.80	17	16	18
EW Diversified CTAs	12.86	10.46	0.77	0.27	-4.34	24	21	23
EW Financial CTAs	14.99	8.53	1.19	0.58	0.96	11	10	12
EW Stock CTAs	10.86	6.15	0.97	0.14	0.73	16	24	13
VW Public Funds	10.27	9.69	0.56	0.03	-5.66	27	26	26
VW Private Pools	14.72	8.12	1.21	0.58	1.37	10	11	11
VW All CTAs*	12.38	9.55	0.79	0.25	-3.33	22	22	19
VW Currency CTAs	10.19	10.39	0.51	0.02	-6.91	28	27	27
VW Agriculture CTAs	10.04	7.27	0.71	0.01	-1.92	26	28	16
VW Diversified CTAs	13.69	10.59	0.83	0.35	-3.73	21	19	20
VW Financial CTAs	15.75	12.82	0.85	0.45	-5.34	19	17	24
EW All Hedge Funds	13.75	5.93	1.50	0.63	4.00	6	9	6
EW Funds of Funds	10.77	5.31	1.11	0.14	2.03	12	23	9
EW Event Driven Funds	16.12	6.36	1.77	0.96	5.66	2	4	2
EW Global Macro Funds	15.90	6.54	1.69	0.90	5.14	3	6	3
EW Global Funds	14.66	9.38	1.05	0.50	-0.76	15	15	15
EW Long-only Funds	21.97	15.64	1.09	0.77	-3.76	13	7	21
EW Mkt. Neutral Funds	12.59	2.52	3.06	1.03	8.44	1	2	1
EW Sector Specific Funds	21.28	11.59	1.42	0.97	2.21	8	3	7
VW All Hedge Funds	17.91	8.40	1.55	0.94	4.09	5	5	5
VW Funds of Funds	12.58	6.32	1.22	0.41	2.19	9	18	8
VW Event Driven Funds	14.09	5.61	1.64	0.73	4.86	4	8	4
VW Global Macro Funds	23.87	13.36	1.42	1.04	1.91	7	1	10
VW Global Funds	15.33	9.70	1.08	0.55	-0.63	14	12	14
VW Long-only Funds	18.73	16.54	0.84	0.53	-8.48	20	13	28
VW Sector Specific Funds	17.18	13.79	0.89	0.52	-5.50	18	14	25

* For the category "All CTAs", first twelve-month returns of CTAs are excluded
$r_s = 1 - 6*(\Sigma d_i^2/[n*(n^2-1)])$, $t = (r_s*\sqrt{n-2})/\sqrt{1-r_s^2}$

	Sharpe Ratio and Roy's Criteria Rankings	Sharpe Ratio and Kataoka's Criteria Rankings
Spearman Correlation Coefficient (r_s)	0.86	0.89
T-statistic	8.65	9.80

Table 8A
Correlation Coefficients Between Managed Futures and Hedge Fund Returns and Returns on the Standard Asset Class Investments
Period: 1990:01 – 1998:08

	S&P 500	US Small Stock	Int.-Term Government Bonds	Long-Term Government Bonds	Long-Term Corporate Bonds	T-Bills
EW Public Funds	-0.040	-0.282**	0.245**	0.286**	0.231**	0.122
EW Private Pools	-0.064	-0.304**	0.228**	0.274**	0.216**	0.129
EW All CTAs	-0.066	-0.290**	0.189*	0.205**	0.169*	0.154
EW Currency CTAs	-0.026	-0.202**	0.135	0.115	0.126	0.208**
EW Agriculture CTAs	0.008	0.060	-0.128	-0.185*	-0.185*	0.002
EW Diversified CTAs	-0.101	-0.306**	0.155	0.196**	0.143	0.086
EW Financial CTAs	0.022	-0.200**	0.333**	0.328**	0.310**	0.184
EW Stock CTAs	0.444**	0.225**	0.162*	0.168*	0.208**	0.233**
EW Energy CTAs	-0.145	-0.106	-0.065	-0.070	-0.048	0.167*
VW Public Funds	0.014	-0.234**	0.260**	0.285**	0.243**	0.061
VW Private Pools	-0.113	-0.345**	0.228**	0.260**	0.194**	0.162
VW All CTAs	-0.084	-0.307**	0.248**	0.269**	0.214**	0.082
VW Currency CTAs	-0.052	-0.236**	0.113	0.098	0.098	0.169*
VW Agriculture CTAs	-0.061	0.023	-0.199**	-0.150	-0.146	0.106
VW Diversified CTAs	-0.106	-0.288**	0.233**	0.264**	0.198**	0.037
VW Financial CTAs	-0.005	-0.247**	0.307**	0.341**	0.294**	0.082
VW Stock CTAs	-0.217**	-0.141	-0.246**	-0.269**	-0.261**	0.036
VW Energy CTAs	0.033	0.214**	-0.181*	-0.197**	-0.120	0.024
EW All Hedge Funds	0.742**	0.848**	0.133	0.150	0.283**	-0.054
EW Funds of Funds	0.544**	0.570**	0.158	0.165*	0.262**	-0.015
EW Event Driven Funds	0.650**	0.822**	0.120	0.131	0.251**	-0.076
EW Global Macro Funds	0.557**	0.530**	0.218**	0.277**	0.342**	0.027
EW Global Funds	0.791**	0.891**	0.104	0.125	0.261**	-0.092
EW Long-only Funds	0.699**	0.806**	0.106	0.075	0.213**	-0.127
EW Mkt. Neutral Funds	0.501**	0.613**	0.131	0.123	0.252**	-0.003
EW Sector Specific Funds	0.719**	0.825**	0.169*	0.197**	0.299**	-0.009
EW Short-sell Funds	-0.729**	-0.838**	-0.031	-0.083	-0.177*	0.090
VW All Hedge Funds	0.452**	0.368**	0.221**	0.244**	0.297**	-0.048
VW Funds of Funds	0.655**	0.643**	0.248**	0.280**	0.370**	-0.012
VW Event Driven Funds	0.499**	0.584**	0.040	0.025	0.158	-0.041
VW Global Macro Funds	0.267**	0.080	0.228**	0.266**	0.272**	-0.039
VW Global Funds	0.750**	0.813**	0.121	0.161	0.290**	-0.102
VW Long-only Funds	0.725**	0.780**	0.110	0.104	0.244**	-0.016
VW Mkt. Neutral Funds	0.336**	0.362**	-0.050	-0.025	0.063	-0.090
VW Sector Specific Funds	0.545**	0.701**	0.190*	0.207**	0.280**	0.040
VW Short-sell Funds	-0.577**	-0.652**	-0.002	-0.020	-0.092	0.035

EW Equally-Weighted Market Portfolio , VW Value-Weighted Market Portfolio
Test statistic $t(n-2) = r / [(1 - r^2)/(n-2)]^{(0.5)}$
T critical values at 5% and 10% level are 1.984 and 1.660 respectively
* Significant at the 10% level
** Significant at the 5% level

Table 8B
Correlation Coefficients Between Managed Futures and Hedge Fund Returns and Returns on the Standard Asset Class Investments
Period: 1990:01 – 1993:12

	S&P 500	US Small Stock	Int.-Term Government Bonds	Long-Term Government Bonds	Long-Term Corporate Bonds	T-Bills
EW Public Funds	-0.131	-0.381**	0.100	0.126	0.066	0.075
EW Private Pools	-0.164	-0.427**	0.081	0.088	0.034	0.095
EW All CTAs	-0.158	-0.429**	0.084	0.064	0.025	0.158
EW Currency CTAs	-0.114	-0.344**	0.133	0.099	0.094	0.230
EW Agriculture CTAs	0.066	0.058	-0.090	-0.151	-0.118	0.078
EW Diversified CTAs	-0.179	-0.416**	0.027	0.035	-0.021	0.054
EW Financial CTAs	0.038	-0.258*	0.282*	0.250*	0.253*	0.214
EW Stock CTAs	0.320**	0.007	0.138	0.112	0.110	0.352**
EW Energy CTAs	-0.357**	-0.469**	-0.136	-0.249*	-0.273*	0.365**
VW Public Funds	-0.057	-0.334**	0.209	0.227	0.170	0.005
VW Private Pools	-0.192	-0.483**	0.095	0.095	0.021	0.173
VW All CTAs	-0.131	-0.374**	0.152	0.163	0.106	0.043
VW Currency CTAs	-0.136	-0.345**	0.098	0.085	0.077	0.155
VW Agriculture CTAs	-0.108	-0.011	-0.352**	-0.284*	-0.273	0.094
VW Diversified CTAs	-0.138	-0.337**	0.091	0.125	0.057	-0.032
VW Financial CTAs	-0.001	-0.270*	0.271*	0.305**	0.266*	0.063
VW Stock CTAs	-0.533**	-0.401**	-0.265*	-0.447**	-0.436**	0.255*
VW Energy CTAs	-0.228	-0.332**	0.002	-0.068	-0.115	0.227
EW All Hedge Funds	0.719**	0.849**	0.181	0.393**	0.439**	-0.276*
EW Funds of Funds	0.229	0.208	0.147	0.318**	0.266*	-0.287**
EW Event Driven Funds	0.523**	0.716**	0.134	0.308**	0.319**	-0.255*
EW Global Macro Funds	0.428**	0.487**	0.012	0.240	0.224	-0.144
EW Global Funds	0.819**	0.903**	0.204	0.402**	0.467**	-0.262*
EW Long-only Funds	0.514**	0.643**	0.058	0.156	0.227	-0.329**
EW Mkt. Neutral Funds	0.345**	0.528**	0.079	0.157	0.224	-0.133
EW Sector Specific Funds	0.737**	0.754**	0.201	0.353**	0.408**	-0.114
EW Short-sell Funds	-0.774**	-0.856**	-0.061	-0.294**	-0.326**	0.220
VW All Hedge Funds	0.189	0.099	0.182	0.287**	0.218	-0.208
VW Funds of Funds	0.563**	0.543**	0.248*	0.466**	0.442**	-0.297**
VW Event Driven Funds	-0.063	0.196	-0.035	0.013	-0.003	-0.262*
VW Global Macro Funds	0.033	-0.103	0.152	0.216	0.131	-0.163
VW Global Funds	0.737**	0.882**	0.112	0.304**	0.367**	-0.281*
VW Long-only Funds	0.576**	0.674**	0.080	0.194	0.287**	-0.210
VW Mkt. Neutral Funds	0.084	0.245*	-0.026	0.047	0.051	-0.285**
VW Sector Specific Funds	0.689**	0.734**	0.168	0.308**	0.369**	-0.050
VW Short-sell Funds	-0.640**	-0.672**	-0.028	-0.216	-0.259*	0.121

EW Equally-Weighted Market Portfolio , VW Value-Weighted Market Portfolio
Test statistic $t(n-2) = r / [(1-r^2)/(n-2)]^{(0.5)}$
T critical values at 5% and 10% level are 2.014 and 1.680 respectively
* Significant at the 10% level
** Significant at the 5% level

Table 8C
Correlation Coefficients Between Managed Futures and Hedge Fund Returns and Returns on the Standard Asset Class Investments
Period: 1994:01 – 1998:08

	S&P 500	US Small Stock	Int.-Term Government Bonds	Long-Term Government Bonds	Long-Term Corporate Bonds	T-Bills
EW Public Funds	0.065	-0.184	0.403**	0.447**	0.385**	0.280**
EW Private Pools	0.013	-0.209	0.345**	0.397**	0.331**	0.247*
EW All CTAs	0.045	-0.162	0.270**	0.329**	0.281**	0.188
EW Currency CTAs	0.134	-0.033	0.094	0.139	0.160	0.164
EW Agriculture CTAs	-0.033	0.074	-0.119	-0.197	-0.198	-0.078
EW Diversified CTAs	-0.023	-0.213	0.254*	0.317**	0.255*	0.189
EW Financial CTAs	0.046	-0.168	0.341**	0.396**	0.348**	0.181
EW Stock CTAs	0.577**	0.402**	0.150	0.200	0.262*	0.065
EW Energy CTAs	0.038	0.150	-0.080	0.024	0.055	-0.133
VW Public Funds	0.127	-0.123	0.335**	0.383**	0.348**	0.275**
VW Private Pools	-0.036	-0.232*	0.330**	0.382**	0.310**	0.190
VW All CTAs	-0.014	-0.252*	0.343**	0.389**	0.321**	0.228*
VW Currency CTAs	0.119	-0.101	0.117	0.135	0.139	0.261*
VW Agriculture CTAs	-0.019	0.062	-0.027	-0.029	-0.038	0.157
VW Diversified CTAs	-0.059	-0.253*	0.354**	0.389**	0.310**	0.238*
VW Financial CTAs	0.005	-0.235	0.342**	0.393**	0.333**	0.157
VW Stock CTAs	0.003	0.024	-0.278**	-0.181	-0.189	-0.324**
VW Energy CTAs	0.120	0.399**	-0.274**	-0.249*	-0.135	-0.109
EW All Hedge Funds	0.812**	0.882**	0.079	0.033	0.206	0.233*
EW Funds of Funds	0.750**	0.771**	0.138	0.101	0.252*	0.309**
EW Event Driven Funds	0.765**	0.904**	0.085	0.027	0.206	0.195
EW Global Macro Funds	0.705**	0.576**	0.311**	0.293**	0.392**	0.354**
EW Global Funds	0.810**	0.897**	0.010	-0.037	0.142	0.161
EW Long-only Funds	0.802**	0.883**	0.098	0.020	0.187	0.174
EW Mkt. Neutral Funds	0.651**	0.683**	0.149	0.094	0.264**	0.283**
EW Sector Specific Funds	0.714**	0.886**	0.137	0.082	0.227*	0.226*
EW Short-sell Funds	-0.706**	-0.824**	0.003	0.059	-0.081	-0.145
VW All Hedge Funds	0.731**	0.608**	0.210	0.208	0.342**	0.316**
VW Funds of Funds	0.768**	0.725**	0.222	0.193	0.330**	0.388**
VW Event Driven Funds	0.797**	0.791**	0.044	0.021	0.205	0.192
VW Global Macro Funds	0.522**	0.252*	0.273**	0.307**	0.378**	0.278**
VW Global Funds	0.803**	0.780**	0.093	0.069	0.235*	0.183
VW Long-only Funds	0.789**	0.827**	0.114	0.061	0.222*	0.218
VW Mkt. Neutral Funds	0.498**	0.472**	-0.014	-0.055	0.100	0.221
VW Sector Specific Funds	0.461**	0.689**	0.213	0.153	0.236*	0.212
VW Short-sell Funds	-0.548**	-0.645**	0.019	0.091	-0.004	-0.099

EW Equally-Weighted Market Portfolio ; VW Value-Weighted Market Portfolio
Test statistic $t(n-2) = r / [(1-r^2)/(n-2)]^{0.5}$
T critical values at 5% and 10% level are 2.005 and 1.674 respectively
* Significant at the 10% level
** Significant at the 5% level

Table 9A
Correlation Coefficients between EW Managed Futures Fund Returns and EW Hedge Fund Returns
Period: 1990:01 - 1998:08

	Public Funds	Private Pools	All CTAs	CUR	AG	DIV	FIN	STX	EN	All HFs	Funds of Funds	Ev. Driv.	Gl. Macro	Global	Long-only	Mkt. Neut.	Sector	Short-sell
Public Funds	1.00																	
Private Pools	0.96*	1.00																
All CTAs	0.95*	0.94*	1.00															
CUR	0.64*	0.59*	0.75*	1.00														
AG	0.05	0.07	0.07	-0.10	1.00													
DIV	0.94*	0.95*	0.97*	0.61*	0.05	1.00												
FIN	0.85*	0.81*	0.87*	0.67*	-0.04	0.80*	1.00											
STX	0.20*	0.22*	0.24*	0.20*	0.11	0.18	0.20*	1.00										
EN	0.19	0.15	0.26*	0.13	-0.12	0.24*	0.13	0.06	1.00									
All HFs	-0.04	-0.07	-0.04	0.02	0.00	-0.08	0.02	0.35*	0.01	1.00								
Fund of Funds	0.18	0.14	0.16	0.18	-0.02	0.13	0.13	0.36*	0.10	0.89*	1.00							
Ev. Driv.	-0.11	-0.16	-0.15	-0.07	-0.02	-0.18	-0.08	0.24*	0.02	0.90*	0.76*	1.00						
Gl. Macro	0.27*	0.24*	0.25*	0.18	-0.03	0.22*	0.29*	0.36*	0.04	0.78*	0.81*	0.63*	1.00					
Global	-0.13	-0.16	-0.13	-0.04	0.02	-0.16	-0.05	0.34*	-0.07	0.97*	0.78*	0.86*	0.68*	1.00				
Long-only	-0.03	-0.10	-0.04	-0.11	0.05	-0.06	0.03	0.27*	0.06	0.82*	0.64*	0.77*	0.61*	0.84*	1.00			
Mkt. Neut.	-0.11	-0.14	-0.10	0.00	-0.05	-0.14	-0.04	0.14	0.15	0.75*	0.65*	0.72*	0.54*	0.69*	0.62*	1.00		
Sector	-0.17	-0.19	-0.17	-0.16	0.04	-0.19	-0.04	0.31*	-0.06	0.78*	0.52*	0.71*	0.58*	0.80*	0.78*	0.60*	1.00	
Short-sell	0.25*	0.27*	0.26*	0.17	-0.08	0.28*	0.20*	-0.25*	0.19	-0.74*	-0.47*	-0.71*	-0.50*	-0.81*	-0.73*	-0.46*	-0.73*	1.00

Test statistic $t(n-2) = r / [(1 - r^2)/(n-2)]^{(0.5)}$
t critical value at 5% level is 1.984
* Significant at the 5% level

Table 9B
Correlation Coefficients between VW Managed Futures Fund Returns and VW Hedge Fund Returns
Period: 1990:01 – 1998:08

	Public Funds	Private Pools	All CTAs	CUR	AG	DIV	FIN	STX	EN	All HFs	Funds of Funds	Ev. Driv.	Gl. Macro	Global	Long-only	Mkt. Neut.	Sector	Short-sell
Public Funds	1.00																	
Private Pools	0.81*	1.00																
All CTAs	0.96*	0.86*	1.00															
CUR	0.72*	0.58*	0.74*	1.00														
AG	-0.01	0.01	-0.01	-0.07	1.00													
DIV	0.92*	0.87*	0.97*	0.62*	0.00	1.00												
FIN	0.90*	0.78*	0.92*	0.62*	0.02	0.86*	1.00											
STX	0.12	0.19	0.12	0.12	0.08	0.11	0.04	1.00										
EN	0.03	-0.04	-0.05	-0.01	-0.08	-0.05	-0.07	0.13	1.00									
All HFs	0.27*	0.21*	0.21*	0.20*	0.02	0.18	0.19	-0.05	0.12	1.00								
Funds of Funds	0.20*	0.07	0.10	0.10	0.08	0.10	0.08	-0.13	0.19	0.79*	1.00							
Ev. Driv.	0.01	-0.10	-0.06	0.03	0.08	-0.08	-0.08	-0.02	0.34*	0.56*	0.76*	1.00						
Gl. Macro	0.36*	0.34*	0.32*	0.29*	0.01	0.28*	0.30*	0.00	-0.04	0.92*	0.59*	0.33*	1.00					
Global	-0.06	-0.20*	-0.15	-0.09	0.06	-0.15	-0.10	-0.17	0.15	0.64*	0.85*	0.74*	0.36*	1.00				
Long-only	0.06	-0.16	-0.04	-0.12	0.11	-0.05	0.04	-0.17	0.29*	0.50*	0.68*	0.68*	0.23*	0.81*	1.00			
Mkt. Neut.	-0.01	-0.10	-0.05	0.03	-0.10	-0.08	-0.01	-0.12	0.25*	0.35*	0.46*	0.54*	0.18	0.53*	0.51*	1.00		
Sector	-0.07	-0.12	-0.11	-0.15	0.14	-0.12	0.00	-0.13	0.06	0.36*	0.52*	0.35*	0.17	0.58*	0.63*	0.32*	1.00	
Short-sell	0.15	0.27*	0.20*	0.08	-0.05	0.21	0.16	0.18	0.00	-0.21*	-0.41*	-0.38*	0.00	-0.59*	-0.60*	-0.30*	-0.43*	1.00

Test statistic $t(n-2) = r / [(1-r^2)/(n-2)]^{1/2}$
t critical value at 5% level is 1.984
* Significant at the 5% level

Table 10
Break-even Analysis for Managed Futures and Hedge Fund Investments

	1985:01 – 1998:08			1990:01 – 1998:08			1990:01 – 1993:12			1994:01 – 1998:08		
	100% Stocks	60% Stocks 40% Bonds	Average Return	100% Stocks	60% Stocks 40% Bonds	Average Return	100% Stocks	60% Stocks 40% Bonds	Average Return	100% Stocks	60% Stocks 40% Bonds	Average Return
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
EW Public Funds	7.15	7.69	9.08	4.57	5.08	6.71	4.18	4.14	8.31	5.42	6.20	5.33
VW Public Funds	7.50	8.13	11.52	4.97	5.50	10.27	4.50	4.75	12.87	5.87	6.40	8.05
EW Private Pools	6.18	6.81	14.31	4.39	4.89	9.00	4.12	4.01	9.32	5.01	5.93	8.73
VW Private Pools	5.53	6.08	17.39	4.15	4.56	14.72	4.09	3.94	16.90	4.59	5.35	12.86
EW All CTAs*	6.12	6.71	18.49	4.27	4.59	11.16	3.95	3.73	13.99	5.12	5.66	8.73
VW All CTAs*	7.11	7.75	14.79	4.24	4.74	12.38	4.21	4.24	15.88	4.64	5.40	9.39
EW Currency CTAs	7.63	9.01	32.85	4.65	4.97	13.14	4.13	4.17	19.66	5.90	6.05	7.54
VW Currency CTAs	5.99	6.91	27.22	4.45	4.71	10.19	3.95	3.93	14.77	5.63	5.74	6.25
EW Agriculture CTAs	7.62	7.95	22.62	4.93	4.47	14.95	5.02	4.95	8.14	4.43	3.76	20.78
VW Agriculture CTAs	6.21	6.18	13.05	4.52	4.30	10.04	4.41	3.95	9.17	4.76	4.72	10.79
EW Diversified CTAs	5.82	6.46	20.93	4.05	4.44	12.86	3.92	3.68	15.46	4.65	5.43	10.64
VW Diversified CTAs	7.04	7.69	15.42	3.99	4.53	13.69	4.08	4.01	18.17	4.31	5.25	9.85
EW Financial CTAs	7.27	8.16	21.98	5.01	5.60	14.99	5.00	5.40	21.96	5.24	5.94	9.01
VW Financial CTAs	8.03	9.22	18.34	4.81	5.67	15.75	4.83	5.47	19.63	4.94	5.95	12.42
EW Stock CTAs	5.06	4.90	23.76	6.97	7.12	10.86	5.75	6.07	13.99	8.49	8.28	8.17
VW Stok CTAs	3.42	2.60	19.20	3.51	3.12	7.03	3.07	2.17	11.00	4.91	4.43	3.63
EW Energy CTAs	5.85	6.33	20.33	3.48	3.44	4.15	2.92	1.99	14.73	5.37	5.47	-4.91
VW Energy CTAs	6.48	6.57	8.76	5.27	4.81	-2.64	4.06	3.75	0.67	7.38	6.13	-5.48
EW All Hedge Funds				8.25	8.41	13.75	6.33	6.98	17.05	10.58	9.93	10.92
VW All Hedge Funds				7.79	8.16	17.91	5.59	6.06	24.30	10.89	10.56	12.43
EW Funds of Funds				7.09	7.26	10.77	5.21	5.45	14.20	9.75	9.31	7.83
VW Funds of Funds				8.05	8.37	12.58	6.07	6.69	16.96	10.59	10.22	8.83
EW Event Driven Funds				8.05	8.20	16.12	6.17	6.75	18.98	10.36	9.76	13.68
VW Event Driven Funds				7.02	7.08	14.09	4.73	4.70	17.09	10.42	9.79	11.51
EW Global Macro Funds				7.67	7.99	15.90	5.96	6.42	21.45	9.92	9.77	11.14
VW Global Macro Funds				7.61	8.25	23.87	5.06	5.41	30.48	11.41	11.52	18.21
EW Global Funds				10.58	10.75	14.66	7.95	9.27	18.92	13.38	12.22	11.01
VW Global Funds				10.47	10.73	15.33	7.82	9.01	20.68	13.40	12.52	10.74
EW Long-only Funds				13.29	13.54	21.97	8.27	9.71	30.74	18.28	16.67	15.85
VW Long-only Funds				14.10	14.48	18.73	8.57	10.21	21.85	19.57	18.00	16.18
EW Mkt. Neutral Funds				5.84	5.92	12.59	5.24	5.42	13.54	6.57	6.44	11.78
VW Mkt. Neutral Funds				5.40	5.40	8.70	4.91	4.94	7.06	6.00	5.85	10.10
EW Sector Specific Funds				11.29	11.64	21.28	8.92	10.63	22.57	13.23	12.43	20.18
VW Sector Specific Funds				10.66	11.14	17.18	8.67	10.24	16.73	12.09	11.79	17.57
EW Short-sell Funds				-4.36	-4.40	6.96	-0.92	-3.06	4.54	-7.34	-5.46	9.04
VW Short-sell Funds				-1.16	-1.04	7.04	1.31	0.02	6.09	-3.48	-1.95	7.86

* For the category "All CTAs", first twelve-month returns of CTAs are excluded
Stocks S&P 500 (large-cap), Bonds Long-term corporate bonds (All returns are expressed in annualized form)

Table 11A
Optimal Portfolio Allocations for EW Managed Futures Fund Investment Styles
Period: 1985:01 – 1998:08

	Unconstrained												Constrained**											
	w/o	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	w/o	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
Managed Futures																								
EW Public Funds		0.04									0.00			0.01									0.00	
EW Private Pools			0.24								0.00				0.27								0.00	
EW All CTAs*				0.30							0.30					0.27							0.27	
EW Currency CTAs					0.19							0.05					0.27							0.10
EW Agriculture CTAs						0.28						0.15						0.27						0.03
EW Diversified CTAs							0.28					0.00							0.27					0.00
EW Financial CTAs								0.43				0.20								0.27				0.00
EW Stock CTAs									0.27			0.16									0.27			0.14
EW Energy CTAs										0.23		0.08										0.27		0.00
Standard Assets																								
S&P 500	0.26	0.24	0.20	0.19	0.21	0.15	0.20	0.13	0.19	0.20	0.19	0.07	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
US Small Stock	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.02	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Int.-Term Govt. Bonds	0.42	0.41	0.50	0.49	0.58	0.34	0.50	0.42	0.26	0.45	0.49	0.27	0.15	0.14	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Long-Term Govt. Bonds	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.19	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Long-Term Corp. Bonds	0.32	0.31	0.06	0.02	0.02	0.23	0.02	0.00	0.28	0.12	0.02	0.00	0.17	0.17	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Annual Return (%)	11.9	11.7	12.1	13.5	15.3	14.6	14.1	15.7	15.2	13.6	13.5	18.9	13.8	13.8	14.7	15.8	19.7	16.9	16.4	16.7	17.2	16.3	15.8	18.1
Annual Std. Dev. (%)	6.59	6.42	5.86	6.26	7.62	6.97	6.57	7.09	6.94	6.56	6.26	6.67	9.23	9.23	9.01	9.12	11.6	9.90	9.30	9.37	9.33	9.51	9.12	9.18
Sharpe Ratio	0.97	0.97	1.12	1.27	1.29	1.30	1.30	1.45	1.39	1.24	1.27	2.01	0.90	0.90	1.02	1.13	1.22	1.15	1.18	1.20	1.25	1.13	1.13	1.37
Change (%)		0.39	15.9	31.7	33.1	34.8	34.8	49.5	44.1	27.8	31.7	108		0.01	12.3	24.7	34.9	27.3	30.1	32.5	38.8	25.4	24.7	51.5

EW: Equally-Weighted Market Portfolio
* For the category "All CTAs", first twelve-month returns of CTAs are excluded
** Constrained optimizations have the following restrictions on the weights: S&P 500: 45 to 65%; US Small Stock: 4 to 8%; Int.-Term Govt. Bonds: 8 to 20%; Long-Term Govt. Bonds: 7 to 19%; Long-Term Corporate Bonds: 9 to 17%. See Ibbotson, Siegel, and Love (1995)

Table 11B
Optimal Portfolio Allocations for VW Managed Futures Fund Investment Styles
Period: 1985:01 – 1998:08

	Unconstrained												Constrained**											
	w/o	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	w/o	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
Managed Futures																								
VW Public Funds		0.11									0.00			0.12									0.00	
VW Private Pools			0.45								0.45				0.27								0.27	
VW All CTAs*				0.23							0.00					0.27							0.00	
VW Currency CTAs					0.28							0.12					0.27							0.15
VW Agriculture CTAs						0.17						0.09						0.19						0.00
VW Diversified CTAs							0.21					0.00							0.26					0.00
VW Financial CTAs								0.26				0.09								0.27				0.00
VW Stock CTAs									0.24			0.17									0.27			0.12
VW Energy CTAs										0.06		0.03										0.04		0.00
Standard Assets																								
S&P 500	0.26	0.23	0.18	0.19	0.23	0.19	0.20	0.20	0.19	0.23	0.18	0.12	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
US Small Stock	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Int.-Term Govt. Bonds	0.42	0.38	0.36	0.40	0.43	0.46	0.40	0.39	0.25	0.43	0.36	0.33	0.15	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.11	0.08	0.08
Long-Term Govt. Bonds	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.14	0.07	0.07	0.07	0.15	0.07	0.07	0.07	0.19	0.07	0.07
Long-Term Corp. Bonds	0.32	0.28	0.00	0.18	0.06	0.18	0.19	0.15	0.32	0.28	0.00	0.04	0.17	0.17	0.09	0.09	0.09	0.09	0.10	0.09	0.09	0.17	0.09	0.09
Annual Return (%)	11.9	11.9	14.2	12.3	16.2	11.7	12.5	13.4	13.8	11.6	14.2	15.2	13.8	14.0	15.5	14.8	18.1	14.3	14.9	15.7	16.0	13.8	15.5	17.1
Annual Std. Dev. (%)	6.59	6.38	6.10	6.25	7.73	5.70	6.36	7.04	6.08	6.20	6.10	5.69	9.23	9.27	8.60	9.36	9.91	9.04	9.44	9.87	8.62	9.18	8.60	8.69
Sharpe Ratio	0.97	1.00	1.43	1.09	1.38	1.08	1.09	1.13	1.37	0.98	1.43	1.71	0.90	0.92	1.16	0.99	1.27	0.97	1.00	1.04	1.21	0.91	1.16	1.34
Change (%)		3.12	48.0	13.1	42.6	12.0	13.2	16.5	41.5	1.24	48.0	76.7		1.78	28.4	9.75	41.0	7.28	10.4	14.8	34.4	0.29	28.4	48.4

VW: Value-Weighted Market Portfolio
* For the category "All CTAs", first twelve-month returns of CTAs are excluded
** Constrained optimizations have the following restrictions on the weights: S&P 500: 45 to 65%, US Small Stock: 4 to 8%, Int.-Term Govt. Bonds: 8 to 20%, Long-Term Govt. Bonds: 7 to 19%, Long-Term Corporate Bonds: 9 to 17%. See Ibbotson, Siegel, and Love (1995)

Table 12A
Unconstrained Optimal Portfolio Allocations for EW Managed Futures and Hedge Fund Investment Styles
Period: 1990:01 - 1998:08

		Unconstrained																				
	w/o	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]
Managed Futures																							
EW Public Funds		0.08									0.00												
EW Private Pools			0.22								0.00												
EW All CTAs*				0.38							0.38												
EW Currency CTAs					0.33							0.06											0.00
EW Agriculture CTAs						0.38						0.24											0.06
EW Diversified CTAs							0.34					0.00											0.00
EW Financial CTAs								0.58				0.28											0.04
EW Stock CTAs									0.50			0.18											0.04
EW Energy CTAs										0.03		0.00											0.00
Hedge Funds																							
EW All Hedge Funds													0.68										
EW Funds of Funds														0.64								0.00	0.00
EW Event Driven Funds															0.72							0.05	0.07
EW Global Macro Funds																0.74						0.05	0.00
EW Global Funds																	0.45					0.00	0.00
EW Long-only Funds																		0.36				0.00	0.00
EW Mkt. Neutral Funds																			0.96			0.74	0.65
EW Sector Specific Funds																				0.51		0.05	0.03
EW Short-sell Funds																					0.35	0.10	0.09
Standard Assets																							
S&P 500	0.23	0.20	0.16	0.10	0.12	0.10	0.11	0.11	0.00	0.22	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.23	0.00	0.00
US Small Stock	0.03	0.05	0.08	0.10	0.09	0.01	0.11	0.11	0.05	0.03	0.10	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00
Int.-Term Govt. Bonds	0.70	0.67	0.54	0.42	0.40	0.09	0.44	0.20	0.35	0.68	0.42	0.00	0.27	0.24	0.22	0.26	0.43	0.00	0.00	0.46	0.21	0.00	0.00
Long-Term Govt. Bonds	0.04	0.00	0.00	0.00	0.06	0.05	0.00	0.00	0.10	0.04	0.00	0.16	0.05	0.12	0.06	0.00	0.12	0.58	0.04	0.03	0.00	0.01	0.02
Long-Term Corp. Bonds	0.00	0.00	0.00	0.00	0.00	0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual Return (%)	9.91	9.57	9.73	10.43	11.13	12.24	10.97	13.36	9.98	9.74	10.43	13.31	12.08	10.11	14.00	13.81	11.37	16.03	12.54	14.81	10.31	12.72	12.78
Annual Std. Dev. (%)	5.48	5.07	4.86	4.61	5.22	5.32	4.97	5.92	4.38	5.29	4.61	4.70	4.53	4.20	4.95	5.18	5.33	8.16	2.49	6.62	3.64	2.16	1.99
Sharpe Ratio	0.92	0.93	1.00	1.21	1.20	1.39	1.23	1.43	1.17	0.92	1.21	1.80	1.59	1.25	1.85	1.73	1.22	1.37	3.08	1.50	1.50	3.64	3.98
Change (%)		0.80	8.90	31.08	30.48	50.55	33.42	55.81	26.88	0.25	31.08	95.16	73.01	35.74	100.5	87.60	32.55	48.75	234.9	63.04	62.62	295.3	332.6

EW: Equally-Weighted Market Portfolio
* For the category "All CTAs", first twelve-month returns of CTAs are excluded

Table 12B
Unconstrained Optimal Portfolio Allocations for VW Managed Futures and Hedge Fund Investment Styles
Period: 1990:01 – 1998:08

		Unconstrained																				
	w/o	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]
Managed Futures																							
VW Public Funds		0.25									0.00												
VW Private Pools			0.57								0.57												
VW All CTAs*				0.38							0.00												
VW Currency CTAs					0.24							0.02											0.00
VW Agriculture CTAs						0.37						0.25											0.09
VW Diversified CTAs							0.38					0.14											0.03
VW Financial CTAs								0.33				0.01											0.00
VW Stock CTAs									0.27			0.12											0.03
VW Energy CTAs										0.00		0.00											0.00
Hedge Funds																							
VW All Hedge Funds													0.66										
VW Funds of Funds														0.63								0.00	0.00
VW Event Driven Funds															0.73							0.14	0.09
VW Global Macro Funds																0.45						0.04	0.02
VW Global Funds																	0.44					0.00	0.00
VW Long-only Funds																		0.29				0.00	0.00
VW Mkt. Neutral Funds																			0.83			0.62	0.56
VW Sector Specific Funds																				0.28		0.02	0.01
VW Short-sell Funds																					0.26	0.07	0.05
Standard Assets																							
S&P 500	0.23	0.14	0.07	0.13	0.14	0.12	0.15	0.14	0.16	0.22	0.07	0.08	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.09	0.23	0.00	0.00
US Small Stock	0.03	0.09	0.14	0.11	0.08	0.01	0.10	0.12	0.03	0.03	0.14	0.05	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.11	0.00	0.00
Int.-Term Govt. Bonds	0.70	0.52	0.22	0.38	0.49	0.50	0.37	0.41	0.46	0.69	0.22	0.33	0.33	0.35	0.10	0.45	0.52	0.42	0.15	0.54	0.40	0.10	0.12
Long-Term Govt. Bonds	0.04	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.08	0.02	0.00	0.00	0.01	0.02	0.17	0.00	0.04	0.28	0.02	0.09	0.00	0.01	0.00
Long-Term Corp. Bonds	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual Return (%)	9.91	10.09	13.00	11.11	10.03	9.66	11.74	12.17	9.23	9.87	13.00	10.17	14.53	10.95	12.95	15.67	11.33	11.84	8.64	11.48	9.89	10.17	9.66
Annual Std. Dev. (%)	5.48	5.04	5.11	5.15	4.89	3.79	5.50	6.08	4.06	5.44	5.11	3.42	6.03	4.68	4.53	7.09	5.23	6.53	1.88	6.15	4.32	2.16	1.78
Sharpe Ratio	0.92	1.04	1.59	1.21	1.06	1.27	1.25	1.20	1.08	0.92	1.59	1.55	1.60	1.30	1.79	1.53	1.24	1.07	2.01	1.08	1.16	2.46	2.71
Change (%)		12.66	73.12	31.72	14.90	37.56	35.86	30.43	16.92	0.00	73.12	68.84	74.06	41.10	93.94	65.72	34.33	16.17	118.1	16.98	26.17	166.6	193.8

VW: Equally-Weighted Market Portfolio
* For the category "All CTAs", first twelve-month returns of CTAs are excluded

Table 12C
Constrained Optimal Portfolio Allocations for EW Managed Futures and Hedge Fund Investment Styles
Period: 1990:01 - 1998:08

		Constrained**																				
	w/o	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]
Managed Futures																							
EW Public Funds		0.07									0.00												
EW Private Pools			0.27								0.00												
EW All CTAs*				0.27							0.27												
EW Currency CTAs					0.27							0.00											0.01
EW Agriculture CTAs						0.27						0.13											0.07
EW Diversified CTAs							0.27					0.00											0.00
EW Financial CTAs								0.27				0.14											0.00
EW Stock CTAs									0.27			0.00											0.00
EW Energy CTAs										0.00		0.00											0.00
Hedge Funds																							
EW All Hedge Funds													0.27										
EW Funds of Funds														0.27								0.00	0.00
EW Event Driven Funds															0.27							0.00	0.00
EW Global Macro Funds																0.27						0.00	0.00
EW Global Funds																	0.24					0.00	0.00
EW Long-only Funds																		0.27				0.13	0.08
EW Mkt. Neutral Funds																			0.27			0.00	0.00
EW Sector Specific Funds																				0.27		0.00	0.00
EW Short-sell Funds																					0.27	0.14	0.11
Standard Assets																							
S&P 500	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
US Small Stock	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Int.-Term Govt. Bonds	0.20	0.16	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.20	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Long-Term Govt. Bonds	0.19	0.19	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.19	0.07	0.07	0.07	0.07	0.07	0.07	0.10	0.07	0.07	0.07	0.07	0.07	0.07
Long-Term Corp. Bonds	0.12	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.12	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Annual Return (%)	12.17	12.02	12.03	12.21	13.15	13.64	13.08	13.65	12.53	12.15	12.21	13.64	13.32	12.51	13.96	13.90	13.44	15.30	13.00	15.35	11.48	12.81	12.78
Annual Std. Dev. (%)	8.24	8.04	7.59	6.63	7.72	7.72	7.54	7.72	8.07	8.21	6.63	7.48	8.47	8.09	8.44	8.35	9.18	10.24	7.59	9.72	5.15	6.13	6.05
Sharpe Ratio	0.89	0.89	0.94	1.11	1.07	1.14	1.09	1.14	0.95	0.89	1.11	1.17	1.00	0.95	1.08	1.08	0.93	1.02	1.07	1.08	1.29	1.30	1.31
Change (%)		0.34	6.51	24.95	21.07	28.18	22.81	28.37	7.21	0.00	24.95	32.29	12.58	6.57	21.47	21.93	5.32	14.97	20.98	21.63	44.86	46.12	47.60

EW: Equally-Weighted Market Portfolio

* For the category "All CTAs", first twelve-month returns of CTAs are excluded

** Constrained optimizations have the following restrictions on the weights: S&P 500: 45 to 65%; US Small Stock: 4 to 8%; Int.-Term Govt. Bonds: 8 to 20%; Long-Term Govt. Bonds: 7 to 19%; Long-Term Corporate Bonds: 9 to 17%. See Ibbotson, Siegel, and Love (1995)

Table 12D
Constrained Optimal Portfolio Allocations for VW Managed Futures and Hedge Fund Investment Styles
Period: 1990:01 - 1998:08

		Constrained**																				
	w/o	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]
Managed Futures																							
VW Public Funds		0.27									0.00												
VW Private Pools			0.27								0.27												
VW All CTAs*				0.27							0.00												
VW Currency CTAs					0.27							0.00											0.00
VW Agriculture CTAs						0.27						0.03											0.00
VW Diversified CTAs							0.27					0.14											0.00
VW Financial CTAs								0.27				0.10											0.00
VW Stock CTAs									0.24			0.00											0.00
VW Energy CTAs										0.00		0.00											0.00
Hedge Funds																							
VW All Hedge Funds													0.27										
VW Funds of Funds														0.27								0.00	0.00
VW Event Driven Funds															0.27							0.00	0.00
VW Global Macro Funds																0.27						0.22	0.22
VW Global Funds																	0.27					0.00	0.00
VW Long-only Funds																		0.16				0.00	0.00
VW Mkt. Neutral Funds																			0.27			0.00	0.00
VW Sector Specific Funds																				0.24		0.00	0.00
VW Short-sell Funds																					0.27	0.05	0.05
Standard Assets																							
S&P 500	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
US Small Stock	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Int.-Term Govt. Bonds	0.20	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.20	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Long-Term Govt. Bonds	0.19	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.10	0.19	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.18	0.07	0.10	0.07	0.07	0.07
Long-Term Corp. Bonds	0.12	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.12	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Annual Return (%)	12.17	12.47	13.58	12.95	12.35	12.31	13.30	13.85	11.61	12.17	13.58	13.40	14.44	13.00	13.41	16.05	13.74	13.74	11.95	14.06	11.50	15.15	15.15
Annual Std. Dev. (%)	8.24	7.82	7.37	7.54	7.63	7.32	7.58	8.12	7.11	8.24	7.37	7.63	8.51	8.45	8.06	8.93	9.32	9.54	7.41	9.62	6.04	8.18	8.18
Sharpe Ratio	0.89	0.97	1.18	1.07	0.98	1.02	1.11	1.11	0.95	0.89	1.18	1.12	1.13	0.96	1.06	1.25	0.95	0.93	0.96	0.96	1.10	1.26	1.26
Change (%)		9.67	33.28	20.84	10.75	14.74	25.50	24.86	7.01	0.00	33.28	26.10	26.90	8.56	19.49	41.20	7.36	4.94	7.81	7.80	24.05	41.67	41.67

VW Equally-Weighted Market Portfolio
* For the category "All CTAs", first twelve-month returns of CTAs are excluded
** Constrained optimizations have the following restrictions on the weights: S&P 500: 45 to 65%; US Small Stock: 4 to 8%; Int.-Term Govt. Bonds: 8 to 20%; Long-Term Govt. Bonds: 7 to 19%; Long-Term Corporate Bonds: 9 to 17%. See Ibbotson, Siegel, and Love (1995)

Table 13A
Unconstrained Optimal Portfolio Allocations for EW Managed Futures and Hedge Fund Investment Styles
Period: 1990:01 – 1993:12

	Unconstrained																					
	w/o	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]
Managed Futures																							
EW Public Funds		0.12									0.00												
EW Private Pools			0.19								0.00												
EW All CTAs*				0.30							0.30												
EW Currency CTAs					0.24							0.00											0.02
EW Agriculture CTAs						0.24						0.02											0.00
EW Diversified CTAs							0.27					0.00											0.00
EW Financial CTAs								0.49				0.21											0.00
EW Stock CTAs									0.43			0.23											0.11
EW Energy CTAs										0.26		0.17											0.03
Hedge Funds																							
EW All Hedge Funds													0.75										
EW Funds of Funds														0.76								0.00	0.00
EW Event Driven Funds															0.66							0.12	0.14
EW Global Macro Funds																0.64						0.17	0.12
EW Global Funds																	0.44					0.03	0.04
EW Long-only Funds																		0.31				0.02	0.03
EW Mkt. Neutral Funds																			0.85			0.44	0.34
EW Sector Specific Funds																				0.30		0.03	0.03
EW Short-sell Funds																					0.21	0.11	0.10
Standard Assets																							
S&P 500	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
US Small Stock	0.09	0.11	0.12	0.14	0.14	0.06	0.13	0.14	0.06	0.13	0.14	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00
Int.-Term Govt. Bonds	0.91	0.77	0.69	0.56	0.62	0.70	0.60	0.37	0.51	0.61	0.56	0.25	0.25	0.24	0.34	0.36	0.56	0.69	0.15	0.70	0.57	0.08	0.04
Long-Term Govt. Bonds	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Long-Term Corp. Bonds	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual Return (%)	10.82	10.65	10.73	12.09	13.26	10.16	12.34	16.63	12.22	12.10	12.09	14.79	15.38	13.31	16.09	17.45	14.21	15.62	13.07	14.12	10.13	14.86	15.24
Annual Std. Dev. (%)	4.22	3.93	3.76	3.81	4.49	3.42	3.94	5.13	3.79	3.56	3.81	3.47	3.65	2.99	4.04	3.89	4.68	5.14	2.26	5.08	3.09	2.05	1.92
Sharpe Ratio	1.42	1.48	1.57	1.90	1.87	1.56	1.90	2.30	1.95	2.04	1.90	2.87	2.89	2.84	2.79	3.25	2.00	2.10	3.64	1.83	1.71	4.90	5.42
Change (%)		4.43	10.36	34.15	32.20	9.69	34.25	62.20	37.29	43.94	34.15	102.3	103.5	100.0	96.68	128.9	41.21	17.94	156.5	28.89	20.90	245.5	282.2

EW: Equally-Weighted Market Portfolio
* For the category "All CTAs", first twelve-month returns of CTAs are excluded

Table 13B
Unconstrained Optimal Portfolio Allocations for VW Managed Futures and Hedge Fund Investment Styles
Period: 1990:01 – 1993:12

		Unconstrained																				
	w/o	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]
Managed Futures																							
VW Public Funds		0.15									0.00												
VW Private Pools			0.43								0.43												
VW All CTAs*				0.25							0.00												
VW Currency CTAs					0.16							0.00											0.00
VW Agriculture CTAs						0.24						0.12											0.00
VW Diversified CTAs							0.26					0.11											0.00
VW Financial CTAs								0.18				0.00											0.05
VW Stock CTAs									0.37			0.24											0.15
VW Energy CTAs										0.00		0.00											0.00
Hedge Funds																							
VW All Hedge Funds													0.51										
VW Funds of Funds														0.75								0.01	0.07
VW Event Driven Funds															0.74							0.62	0.44
VW Global Macro Funds																0.30						0.08	0.04
VW Global Funds																	0.43					0.00	0.04
VW Long-only Funds																		0.24				0.04	0.02
VW Mkt. Neutral Funds																			0.65			0.00	0.00
VW Sector Specific Funds																				0.20		0.05	0.04
VW Short-sell Funds																					0.17	0.06	0.04
Standard Assets																							
S&P 500	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
US Small Stock	0.09	0.12	0.15	0.13	0.12	0.05	0.13	0.13	0.08	0.09	0.15	0.09	0.04	0.00	0.00	0.10	0.00	0.00	0.01	0.00	0.15	0.00	0.00
Int.-Term Govt. Bonds	0.91	0.73	0.42	0.62	0.72	0.71	0.61	0.69	0.37	0.91	0.42	0.44	0.45	0.25	0.25	0.60	0.57	0.76	0.34	0.80	0.68	0.14	0.10
Long-Term Govt. Bonds	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Long-Term Corp. Bonds	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual Return (%)	10.82	11.37	13.85	12.33	11.67	10.36	13.02	12.62	11.23	10.82	13.85	11.63	17.69	15.34	15.37	16.77	14.83	12.87	8.30	11.68	10.32	16.66	15.92
Annual Std. Dev. (%)	4.22	4.21	3.91	4.21	4.16	3.14	4.29	4.71	2.96	4.22	3.91	2.55	5.15	3.91	2.84	5.45	4.63	4.59	1.91	4.43	3.51	2.74	2.26
Sharpe Ratio	1.42	1.55	2.30	1.78	1.64	1.76	1.91	1.65	2.16	1.42	2.30	2.67	2.50	2.69	3.71	2.19	2.16	1.75	1.81	1.54	1.56	4.32	4.90
Change (%)		9.41	62.38	25.64	15.88	24.35	34.53	16.56	52.22	0.00	62.38	88.13	75.99	89.51	161.7	54.43	52.12	23.37	27.60	8.84	10.25	204.6	245.8

VW: Equally-Weighted Market Portfolio
* For the category "All CTAs", first twelve-month returns of CTAs are excluded

Table 13C
Constrained Optimal Portfolio Allocations for EW Managed Futures and Hedge Fund Investment Styles
Period: 1990:01 - 1993:12

		Constrained**																				
	w/o	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]
Managed Futures																							
EW Public Funds		0.08									0.00												
EW Private Pools			0.21								0.00												
EW All CTAs*				0.27							0.27												
EW Currency CTAs					0.27							0.00											0.05
EW Agriculture CTAs						0.04						0.00											0.00
EW Diversified CTAs							0.27					0.00											0.00
EW Financial CTAs								0.27				0.23											0.13
EW Stock CTAs									0.27			0.00											0.00
EW Energy CTAs										0.27		0.04											0.01
Hedge Funds																							
EW All Hedge Funds													0.27										
EW Funds of Funds														0.27								0.00	0.00
EW Event Driven Funds															0.27							0.00	0.00
EW Global Macro Funds																0.27						0.07	0.00
EW Global Funds																	0.27					0.00	0.00
EW Long-only Funds																		0.27				0.13	0.08
EW Mkt. Neutral Funds																			0.27			0.00	0.00
EW Sector Specific Funds																				0.27		0.00	0.00
EW Short-sell Funds																					0.27	0.07	0.00
Standard Assets																							
S&P 500	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
US Small Stock	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Int.-Term Govt. Bonds	0.20	0.20	0.14	0.08	0.08	0.20	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Long-Term Govt. Bonds	0.14	0.07	0.07	0.07	0.07	0.10	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Long-Term Corp. Bonds	0.17	0.16	0.09	0.09	0.09	0.17	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Annual Return (%)	11.32	11.01	10.85	12.04	13.58	11.14	12.44	14.20	12.05	12.25	12.04	13.88	12.87	12.10	13.39	14.06	13.38	15.62	11.93	14.36	9.54	13.62	14.42
Annual Std. Dev. (%)	8.19	7.70	7.27	7.12	7.66	7.95	7.24	7.71	7.81	6.65	7.12	7.43	8.10	7.48	8.07	7.94	9.06	9.23	7.45	9.76	4.87	7.39	7.80
Sharpe Ratio	0.79	0.80	0.83	1.01	1.14	0.79	1.05	1.21	0.92	1.11	1.01	1.22	0.99	0.97	1.06	1.16	0.94	1.17	0.95	0.98	0.97	1.19	1.23
Change (%)		1.07	4.44	27.77	44.04	0.10	32.54	53.32	16.57	40.56	27.77	53.67	25.29	22.67	33.82	46.60	18.93	47.42	20.11	23.12	21.93	49.99	55.11

EW: Equally-Weighted Market Portfolio
* For the category "All CTAs", first twelve-month returns of CTAs are excluded
** Constrained optimizations have the following restrictions on the weights: S&P 500: 45 to 65%; US Small Stock: 4 to 8%; Int.-Term Govt. Bonds: 8 to 20%; Long-Term Govt. Bonds: 7 to 19%; Long-Term Corporate Bonds: 9 to 17%. See Ibbotson, Siegel, and Love (1995)

Table 13D
Constrained Optimal Portfolio Allocations for VW Managed Futures and Hedge Fund Investment Styles
Period: 1990:01 – 1993:12

		Constrained**																				
	w/o	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]
Managed Futures																							
VW Public Funds		0.27									0.00												
VW Private Pools			0.27								0.27												
VW All CTAs*				0.27							0.00												
VW Currency CTAs					0.27							0.00											0.00
VW Agriculture CTAs						0.19						0.00											0.00
VW Diversified CTAs							0.27					0.24											0.00
VW Financial CTAs								0.27				0.00											0.00
VW Stock CTAs									0.27			0.03											0.00
VW Energy CTAs										0.00		0.00											0.00
Hedge Funds																							
VW All Hedge Funds													0.27										
VW Funds of Funds														0.27								0.00	0.00
VW Event Driven Funds															0.27							0.00	0.00
VW Global Macro Funds																0.27						0.27	0.27
VW Global Funds																	0.27					0.00	0.00
VW Long-only Funds																		0.27				0.00	0.00
VW Mkt. Neutral Funds																			0.00			0.00	0.00
VW Sector Specific Funds																				0.22		0.00	0.00
VW Short-sell Funds																					0.27	0.00	0.00
Standard Assets																							
S&P 500	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
US Small Stock	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Int.-Term Govt. Bonds	0.20	0.08	0.08	0.08	0.08	0.16	0.08	0.08	0.08	0.20	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.20	0.13	0.08	0.08	0.08
Long-Term Govt. Bonds	0.14	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.14	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.14	0.07	0.07	0.07	0.07
Long-Term Corp. Bonds	0.17	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.17	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.17	0.09	0.09	0.09	0.09
Annual Return (%)	11.32	11.84	12.83	12.56	12.26	10.84	13.17	13.57	11.24	11.32	12.83	12.98	14.83	12.85	12.88	16.50	13.85	13.79	11.32	12.45	9.91	16.50	16.50
Annual Std. Dev. (%)	8.19	7.80	7.11	7.48	7.65	7.28	7.47	8.32	6.34	8.19	7.11	7.29	7.98	7.98	7.21	8.33	9.03	9.21	8.19	9.24	5.78	8.33	8.33
Sharpe Ratio	0.79	0.90	1.13	1.03	0.97	0.83	1.12	1.05	1.01	0.79	1.13	1.12	1.25	1.00	1.12	1.40	1.00	0.97	0.79	0.82	0.88	1.40	1.40
Change (%)		13.37	42.03	30.22	22.47	4.18	40.95	32.49	27.43	0.00	42.03	41.07	58.16	26.64	40.83	76.79	26.05	22.74	0.00	4.06	10.92	76.79	76.79

VW: Equally-Weighted Market Portfolio
* For the category "All CTAs", first twelve-month returns of CTAs are excluded
** Constrained optimizations have the following restrictions on the weights: S&P 500: 45 to 65%; US Small Stock: 4 to 8%; Int.-Term Govt. Bonds: 8 to 20%; Long-Term Govt. Bonds: 7 to 19%; Long-Term Corporate Bonds: 9 to 17%. See Ibbotson, Siegel, and Love (1995)

Table 14A
Unconstrained Optimal Portfolio Allocations for EW Managed Futures and Hedge Fund Investment Styles
Period: 1994:01 - 1998:08

	Unconstrained																					
	w/o	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]
Managed Futures																							
EW Public Funds		0.00									0.00												
EW Private Pools			0.27								0.00												
EW All CTAs*				0.41							0.41												
EW Currency CTAs					0.22							0.11											0.00
EW Agriculture CTAs						0.44						0.37											0.12
EW Diversified CTAs							0.41					0.09											0.00
EW Financial CTAs								0.43				0.01											0.00
EW Stock CTAs									0.00			0.00											0.00
EW Energy CTAs										0.00		0.00											0.00
Hedge Funds																							
EW All Hedge Funds													0.37										
EW Funds of Funds														0.00								0.00	0.00
EW Event Driven Funds															0.76							0.00	0.03
EW Global Macro Funds																0.35						0.00	0.00
EW Global Funds																	0.00					0.00	0.00
EW Long-only Funds																		0.00				0.00	0.00
EW Mkt. Neutral Funds																			0.97			0.88	0.70
EW Sector Specific Funds																				0.70		0.03	0.02
EW Short-sell Funds																					0.41	0.09	0.08
Standard Assets																							
S&P 500	0.70	0.70	0.61	0.50	0.56	0.30	0.54	0.52	0.70	0.70	0.50	0.25	0.35	0.70	0.00	0.44	0.70	0.70	0.00	0.00	0.44	0.00	0.05
US Small Stock	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00
Int.-Term Govt. Bonds	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Long-Term Govt. Bonds	0.30	0.30	0.12	0.09	0.22	0.26	0.05	0.05	0.30	0.30	0.09	0.17	0.28	0.30	0.24	0.21	0.30	0.30	0.03	0.30	0.00	0.00	0.00
Long-Term Corp. Bonds	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual Return (%)	16.00	16.00	14.90	13.80	14.23	17.21	14.95	14.05	16.00	16.00	13.80	15.87	13.25	16.00	12.70	14.13	16.00	16.00	11.72	17.03	13.61	11.79	16.68
Annual Std. Dev. (%)	10.62	10.62	9.21	7.91	8.77	7.41	8.55	8.12	10.62	10.62	7.91	6.42	7.86	10.62	5.81	8.65	10.62	10.62	2.51	8.70	4.94	2.10	3.48
Sharpe Ratio	1.05	1.05	1.09	1.13	1.07	1.66	1.18	1.13	1.05	1.05	1.13	1.71	1.06	1.05	1.35	1.07	1.05	1.05	2.73	1.40	1.77	3.29	3.40
Change (%)		0.00	3.89	7.71	1.76	58.79	12.42	7.77	0.00	0.00	7.71	63.34	1.62	0.00	28.52	2.07	0.00	0.00	160.4	33.44	68.68	214.0	223.8

EW: Equally-Weighted Market Portfolio
* For the category "All CTAs", first twelve-month returns of CTAs are excluded

Table 14B
Unconstrained Optimal Portfolio Allocations for VW Managed Futures and Hedge Fund Investment Styles
Period: 1994:01 - 1998:08

		Unconstrained																				
	w/o	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]
Managed Futures																							
VW Public Funds		0.30									0.00												
VW Private Pools			0.63								0.63												
VW All CTAs*				0.50							0.00												
VW Currency CTAs					0.11							0.00											0.00
VW Agriculture CTAs						0.60						0.52											0.15
VW Diversified CTAs							0.44					0.00											0.00
VW Financial CTAs								0.46				0.23											0.00
VW Stock CTAs									0.00			0.00											0.01
VW Energy CTAs										0.00		0.00											0.00
Hedge Funds																							
VW All Hedge Funds													0.40										
VW Funds of Funds														0.00								0.00	0.00
VW Event Driven Funds															0.58							0.00	0.00
VW Global Macro Funds																0.50						0.00	0.00
VW Global Funds																	0.00					0.00	0.00
VW Long-only Funds																		0.00				0.00	0.00
VW Mkt. Neutral Funds																			0.94			0.89	0.75
VW Sector Specific Funds																				0.26		0.01	0.00
VW Short-sell Funds																					0.38	0.05	0.05
Standard Assets																							
S&P 500	0.70	0.56	0.37	0.50	0.63	0.27	0.56	0.54	0.70	0.70	0.37	0.25	0.37	0.70	0.15	0.37	0.70	0.70	0.00	0.49	0.62	0.00	0.01
US Small Stock	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Int.-Term Govt. Bonds	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Long-Term Govt. Bonds	0.30	0.14	0.00	0.00	0.26	0.13	0.00	0.00	0.30	0.30	0.00	0.00	0.23	0.30	0.27	0.13	0.30	0.30	0.06	0.25	0.00	0.05	0.03
Long-Term Corp. Bonds	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual Return (%)	16.00	14.28	15.03	14.06	14.94	12.81	14.77	15.79	16.00	16.00	15.03	13.15	14.09	16.00	12.09	17.26	16.00	16.00	10.08	16.10	14.60	10.04	10.06
Annual Std. Dev. (%)	10.62	8.70	6.99	7.79	9.58	5.56	8.43	8.86	10.62	10.62	6.99	5.25	8.49	10.62	6.46	10.21	10.62	10.62	2.10	10.02	7.15	1.96	1.66
Sharpe Ratio	1.05	1.08	1.45	1.18	1.05	1.42	1.17	1.23	1.05	1.05	1.45	1.58	1.08	1.05	1.12	1.21	1.05	1.05	2.47	1.12	1.36	2.63	3.12
Change (%)		3.13	38.72	12.62	0.26	36.05	11.95	17.48	0.00	0.00	38.72	50.47	3.56	0.00	6.49	15.78	0.00	0.00	135.6	6.92	29.77	151.2	198.3

VW: Equally-Weighted Market Portfolio
* For the category "All CTAs", first twelve-month returns of CTAs are excluded

Table 14C
Constrained Optimal Portfolio Allocations for EW Managed Futures and Hedge Fund Investment Styles
Period: 1994:01 - 1998:08

		Constrained**																				
	w/o	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]
Managed Futures																							
EW Public Funds		0.00									0.00												
EW Private Pools			0.22								0.00												
EW All CTAs*				0.27							0.27												
EW Currency CTAs					0.17							0.00											0.00
EW Agriculture CTAs						0.27						0.27											0.09
EW Diversified CTAs							0.27					0.00											0.00
EW Financial CTAs								0.27				0.00											0.00
EW Stock CTAs									0.00			0.00											0.00
EW Energy CTAs										0.00		0.00											0.00
Hedge Funds																							
EW All Hedge Funds													0.12										
EW Funds of Funds														0.00								0.00	0.00
EW Event Driven Funds															0.27							0.00	0.00
EW Global Macro Funds																0.23						0.00	0.00
EW Global Funds																	0.00					0.00	0.00
EW Long-only Funds																		0.00				0.00	0.00
EW Mkt. Neutral Funds																			0.27			0.00	0.00
EW Sector Specific Funds																				0.27		0.02	0.00
EW Short-sell Funds																					0.27	0.25	0.18
Standard Assets																							
S&P 500	0.63	0.63	0.50	0.45	0.51	0.45	0.45	0.45	0.63	0.63	0.45	0.45	0.51	0.63	0.45	0.45	0.63	0.63	0.45	0.45	0.45	0.45	0.45
US Small Stock	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Int.-Term Govt. Bonds	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Long-Term Govt. Bonds	0.16	0.16	0.07	0.07	0.11	0.07	0.07	0.07	0.16	0.16	0.07	0.07	0.16	0.16	0.07	0.11	0.16	0.16	0.07	0.07	0.07	0.07	0.07
Long-Term Corp. Bonds	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Annual Return (%)	14.94	14.94	13.63	13.10	13.50	16.36	13.62	13.18	14.94	14.94	13.10	16.36	14.02	14.94	14.44	13.70	14.94	14.94	13.93	16.20	13.19	13.40	14.27
Annual Std. Dev. (%)	10.02	10.02	8.43	7.72	8.50	7.95	7.85	7.79	10.02	10.02	7.72	7.95	9.09	10.02	8.82	8.70	10.02	10.02	7.76	9.76	5.41	5.53	5.67
Sharpe Ratio	1.00	1.00	1.04	1.06	1.01	1.44	1.11	1.06	1.00	1.00	1.06	1.44	1.00	1.00	1.08	1.01	1.00	1.00	1.17	1.16	1.53	1.54	1.66
Change (%)		0.00	3.48	6.17	1.10	43.87	10.96	6.11	0.00	0.00	6.17	43.87	0.15	0.00	8.06	1.02	0.00	0.00	16.20	15.50	52.94	53.57	65.16

EW: Equally-Weighted Market Portfolio
* For the category "All CTAs", first twelve-month returns of CTAs are excluded
** Constrained optimizations have the following restrictions on the weights: S&P 500: 45 to 65%, US Small Stock: 4 to 8%, Int.-Term Govt. Bonds: 8 to 20%, Long-Term Govt. Bonds: 7 to 19%, Long-Term Corporate Bonds: 9 to 17%. See Ibbotson, Siegel, and Love (1995)

Table 14D
Constrained Optimal Portfolio Allocations for VW Managed Futures and Hedge Fund Investment Styles
Period: 1994:01 - 1998:08

		Constrained**																				
	w/o	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]
Managed Futures																							
VW Public Funds		0.24									0.00												
VW Private Pools			0.27								0.27												
VW All CTAs*				0.27							0.00												
VW Currency CTAs					0.03							0.00											0.00
VW Agriculture CTAs						0.27						0.17											0.08
VW Diversified CTAs							0.27					0.00											0.00
VW Financial CTAs								0.27				0.10											0.00
VW Stock CTAs									0.00			0.00											0.00
VW Energy CTAs										0.00		0.00											0.00
Hedge Funds																							
VW All Hedge Funds													0.24										
VW Funds of Funds														0.00								0.00	0.00
VW Event Driven Funds															0.23							0.00	0.00
VW Global Macro Funds																0.27						0.00	0.00
VW Global Funds																	0.00					0.00	0.00
VW Long-only Funds																		0.00				0.00	0.00
VW Mkt. Neutral Funds																			0.27			0.00	0.00
VW Sector Specific Funds																				0.22		0.04	0.00
VW Short-sell Funds																					0.27	0.23	0.19
Standard Assets																							
S&P 500	0.63	0.48	0.45	0.45	0.60	0.45	0.45	0.45	0.63	0.63	0.45	0.45	0.45	0.63	0.45	0.45	0.63	0.63	0.45	0.45	0.45	0.45	0.45
US Small Stock	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Int.-Term Govt. Bonds	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Long-Term Govt. Bonds	0.16	0.07	0.07	0.07	0.16	0.07	0.07	0.07	0.16	0.16	0.07	0.07	0.10	0.16	0.11	0.07	0.16	0.16	0.07	0.12	0.07	0.07	0.07
Long-Term Corp. Bonds	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Annual Return (%)	14.94	13.29	14.22	13.28	14.68	13.66	13.41	14.10	14.94	14.94	14.22	13.82	14.02	14.94	13.77	15.66	14.94	14.94	13.47	15.12	12.87	13.23	13.11
Annual Std. Dev. (%)	10.02	8.18	7.65	7.66	9.76	7.46	7.74	8.02	10.02	10.02	7.65	7.49	8.93	10.02	8.69	9.49	10.02	10.02	7.59	9.66	6.27	6.49	6.30
Sharpe Ratio	1.00	1.03	1.22	1.10	1.00	1.18	1.10	1.15	1.00	1.00	1.22	1.19	1.02	1.00	1.02	1.14	1.00	1.00	1.13	1.06	1.27	1.29	1.31
Change (%)		2.51	21.58	9.29	0.01	17.22	9.75	14.58	0.00	0.00	21.58	18.92	2.07	0.00	1.93	13.20	0.00	0.00	12.82	5.71	26.84	28.21	30.24

VW: Equally-Weighted Market Portfolio
* For the category "All CTAs", first twelve-month returns of CTAs are excluded
** Constrained optimizations have the following restrictions on the weights: S&P 500: 45 to 65%; US Small Stock: 4 to 8%; Int.-Term Govt. Bonds: 8 to 20%; Long-Term Govt. Bonds: 7 to 19%; Long-Term Corporate Bonds: 9 to 17%. See Ibbotson, Siegel, and Love (1995).

Table 15
Descriptive Statistics of Managed Futures and Hedge Fund Monthly Returns in Different States of the Market

	1985:01 – 1998:08				1990:01 – 1998:08			
	When S&P 500 is up more than 1% in a month		When S&P 500 is down more than -1% in a month		When S&P 500 is up more than 1% in a month		When S&P 500 is down more than -1% in a month	
	Average Monthly Return(%)	*Correlation with S&P 500*	*Average Monthly Return(%)*	*Correlation with S&P 500*	*Average Monthly Return(%)*	*Correlation with S&P 500*	*Average Monthly Return(%)*	*Correlation with S&P 500*
Managed Futures Funds								
EW Public Funds	1.024	0.373**	0.011	-0.194	0.510	0.245*	0.803	-0.446**
VW Public Funds	1.269	0.402**	-0.003	-0.157	0.828	0.282**	1.075	-0.318
EW Private Pools	1.348	0.333**	0.882	-0.461**	0.742	0.188	1.012	-0.514**
VW Private Pools	1.530	0.342**	1.307	-0.566**	1.119	0.194	1.680	-0.521**
EW All CTAs	1.925	0.338**	1.385	-0.534**	0.981	0.231*	1.432	-0.390*
VW All CTAs	1.557	0.372**	0.643	-0.223	0.886	0.227*	1.638	-0.443**
EW Currency CTAs	2.471	0.325**	1.460	-0.160	0.690	0.227*	1.637	0.183
VW Currency CTAs	1.861	0.389**	2.130	-0.288*	0.453	0.189	1.280	0.004
EW Agriculture CTAs	2.490	0.045	0.619	0.148	1.597	-0.137	0.787	-0.333
VW Agriculture CTAs	1.163	0.100	1.159	0.119	0.701	0.007	0.901	-0.067
EW Diversified CTAs	1.819	0.279**	1.378	-0.570**	0.942	0.161	1.575	-0.438**
VW Diversified CTAs	1.550	0.333**	0.548	-0.254	0.951	0.180	1.632	-0.491**
EW Financial CTAs	2.072	0.523**	1.455	-0.405**	1.241	0.383**	1.438	-0.435**
VW Financial CTAs	2.098	0.460**	1.051	-0.238	1.206	0.330**	1.803	-0.409**
EW Stock CTAs	2.352	-0.015	1.555	-0.351**	1.414	0.304**	-0.189	0.266
VW Stok CTAs	1.205	0.016	2.454	-0.328**	0.101	-0.037	1.285	-0.032
EW Energy CTAs	1.561	0.142	1.525	-0.101	-0.263	0.173	0.972	-0.261
VW Energy CTAs	0.803	0.095	0.392	0.097	-0.480	0.066	-0.064	0.248
Hedge Funds								
EW All Hedge Funds					1.838	0.406**	-0.635	0.792**
VW All Hedge Funds					2.139	0.068	-0.321	0.556**
EW Funds of Funds					1.323	0.223*	-0.301	0.657**
VW Funds of Funds					1.726	0.323**	-0.735	0.651**
EW Event Driven Funds					2.015	0.216*	-0.349	0.792**
VW Event Driven Funds					1.555	0.058	0.135	0.751**
EW Global Macro Funds					1.976	0.344**	-0.377	0.317
VW Global Macro Funds					2.690	-0.013	0.037	0.302
EW Global Funds					2.407	0.466**	-1.726	0.834**
VW Global Funds					2.419	0.428**	-1.602	0.822**
EW Long-only Funds					3.335	0.419**	-2.085	0.636**
VW Long-only Funds					3.327	0.487**	-2.207	0.608**
EW Mkt. Neutral Funds					1.185	0.350**	0.538	0.558**
VW Mkt. Neutral Funds					0.799	0.113	0.455	0.665**
EW Sector Specific Funds					3.357	0.361**	-1.790	0.611**
VW Sector Specific Funds					2.920	0.273**	-1.850	0.311
EW Short-sell Funds					-1.594	-0.453**	5.116	-0.698**
VW Short-sell Funds					-0.634	-0.375**	3.399	-0.641**

There are 38 months of observation when S&P 500 is down more than -1% in a month, and 99 months of observation when S&P 500 is up more than 1% in a month for the period 1985 – 1998.
There are 25 months of observation when S&P 500 is down more than -1% in a month, and 62 months of observation when S&P 500 is up more than 1% in a month for the period 1990 – 1998.
Test statistic $t(n-2) = r / [(1 - r^2)/(n-2)]^{(0.5)}$
* Significant at the 10% level
** Significant at the 5% level

Table 16A
Optimal Portfolio Allocations for EW Managed Futures and Hedge Fund Investment Styles
in the Months when S&P 500 is up more than 1%
Period: 1990:01 - 1998:08

	Unconstrained																				
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]
Managed Futures																						
EW Public Funds	0.00									0.00												
EW Private Pools		0.00								0.00												
EW All CTAs*			0.00							0.00												
EW Currency CTAs				0.00							0.00											0.00
EW Agriculture CTAs					0.14						0.12											0.08
EW Diversified CTAs						0.00					0.00											0.00
EW Financial CTAs							0.00				0.00											0.00
EW Stock CTAs								0.19			0.12											0.06
EW Energy CTAs									0.00		0.00											0.00
Hedge Funds																						
EW All Hedge Funds												0.43										
EW Funds of Funds													0.18								0.00	0.00
EW Event Driven Funds														0.55							0.46	0.40
EW Global Macro Funds															0.24						0.00	0.00
EW Global Funds																0.22					0.00	0.00
EW Long-only Funds																	0.08				0.00	0.00
EW Mkt. Neutral Funds																		0.58			0.00	0.00
EW Sector Specific Funds																			0.34		0.11	0.09
EW Short-sell Funds																				0.12	0.10	0.08
Standard Assets																						
S&P 500	0.56	0.56	0.56	0.56	0.42	0.56	0.56	0.41	0.56	0.56	0.35	0.38	0.48	0.32	0.43	0.47	0.55	0.28	0.55	0.49	0.30	0.23
US Small Stock	0.17	0.17	0.17	0.17	0.15	0.17	0.17	0.15	0.17	0.17	0.14	0.02	0.12	0.00	0.11	0.07	0.13	0.04	0.00	0.20	0.00	0.00
Int.-Term Govt. Bonds	0.27	0.27	0.27	0.27	0.29	0.27	0.27	0.25	0.27	0.27	0.27	0.17	0.22	0.13	0.22	0.24	0.24	0.10	0.11	0.19	0.03	0.05
Long-Term Govt. Bonds	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Long-Term Corp. Bonds	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual Return (%)	34.23	34.23	34.23	34.23	30.20	34.20	34.24	30.00	34.23	34.23	28.06	28.71	30.92	28.60	31.30	32.45	35.06	23.32	38.94	29.04	26.70	24.98
Annual Std. Dev. (%)	5.53	5.53	5.53	5.53	4.42	5.52	5.53	4.64	5.53	5.53	4.00	4.30	4.84	3.79	4.82	5.13	5.06	3.26	6.04	4.42	3.29	2.84
Sharpe Ratio	5.31	5.31	5.31	5.31	5.73	5.31	5.31	5.42	5.31	5.31	5.79	5.55	5.38	6.27	5.48	5.38	5.14	5.66	5.64	5.47	6.65	7.09

EW: Equally-Weighted Market Portfolio
* For the category "All CTAs", first twelve-month returns of CTAs are excluded

Table 16B
Optimal Portfolio Allocations for VW Managed Futures and Hedge Fund Investment Styles
in the Months when S&P 500 is up more than 1%
Period: 1990:01 – 1998:08

	Unconstrained																				
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]
Managed Futures																						
VW Public Funds	0.00									0.00												
VW Private Pools		0.03								0.03												
VW All CTAs*			0.00							0.00												
VW Currency CTAs				0.00							0.00											0.00
VW Agriculture CTAs					0.09						0.09											0.03
VW Diversified CTAs						0.00					0.00											0.00
VW Financial CTAs							0.00				0.00											0.00
VW Stock CTAs								0.00			0.00											0.00
VW Energy CTAs									0.00		0.00											0.00
Hedge Funds																						
VW All Hedge Funds												0.25										
VW Funds of Funds													0.25								0.00	0.00
VW Event Driven Funds														0.49							0.40	0.37
VW Global Macro Funds															0.16						0.05	0.05
VW Global Funds																0.14					0.00	0.00
VW Long-only Funds																	0.00				0.00	0.00
VW Mkt. Neutral Funds																		0.42			0.00	0.00
VW Sector Specific Funds																			0.00		0.00	0.00
VW Short-sell Funds																				0.12	0.06	0.06
Standard Assets																						
S&P 500	0.56	0.55	0.56	0.56	0.47	0.56	0.56	0.56	0.56	0.55	0.47	0.47	0.44	0.30	0.48	0.50	0.56	0.33	0.56	0.54	0.31	0.29
US Small Stock	0.17	0.17	0.17	0.17	0.15	0.17	0.17	0.17	0.17	0.17	0.15	0.11	0.10	0.05	0.16	0.11	0.17	0.08	0.17	0.18	0.08	0.08
Int.-Term Govt. Bonds	0.27	0.25	0.27	0.27	0.29	0.27	0.27	0.27	0.27	0.25	0.29	0.17	0.21	0.16	0.20	0.25	0.27	0.17	0.27	0.16	0.10	0.12
Long-Term Govt. Bonds	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Long-Term Corp. Bonds	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual Return (%)	34.23	33.78	34.23	34.23	30.67	34.23	34.23	34.23	34.23	33.78	30.67	33.19	30.73	26.04	34.67	33.02	34.23	23.50	34.23	31.70	26.40	25.47
Annual Std. Dev. (%)	5.53	5.44	5.53	5.53	4.82	5.53	5.53	5.53	5.53	5.44	4.82	4.93	4.74	3.41	5.15	5.25	5.53	3.39	5.53	4.88	3.34	3.18
Sharpe Ratio	5.31	5.32	5.31	5.31	5.35	5.31	5.31	5.31	5.31	5.32	5.35	5.74	5.46	6.20	5.79	5.37	5.31	5.49	5.31	5.50	6.46	6.47

VW: Equally-Weighted Market Portfolio
* For the category "All CTAs", first twelve-month returns of CTAs are excluded

Table 16C
Optimal Portfolio Allocations for EW Managed Futures and Hedge Fund Investment Styles
in the Months when S&P 500 is down more than -1%
Period: 1990:01 -- 1998:08

	Unconstrained																				
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]
Managed Futures																						
EW Public Funds	1.00									0.00												
EW Private Pools		1.00								0.00												
EW All CTAs*			1.00							1.00												
EW Currency CTAs				1.00							0.40											0.08
EW *Agriculture* CTAs					1.00						0.43											0.15
EW Diversified CTAs						1.00					0.00											0.00
EW Financial CTAs							1.00				0.13											0.00
EW Stock CTAs								1.00			0.00											0.00
EW Energy CTAs									1.00		0.04											0.00
Hedge Funds																						
EW All Hedge Funds												0.00										
EW Funds of Funds													0.00								0.00	0.00
EW Event Driven Funds														1.00							0.07	0.00
EW Global Macro Funds															0.00						0.00	0.00
EW Global Funds																0.00					0.00	0.00
EW Long-only Funds																	0.00				0.00	0.00
EW Mkt. Neutral Funds																		1.00			0.71	0.63
EW Sector Specific Funds																			0.00		0.00	0.00
EW Short-sell Funds																				0.76	0.22	0.14
Standard Assets																						
S&P 500	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
US Small Stock	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.00	0.00
Int.-Term Govt. Bonds	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	0.00	1.00	0.00	0.00	0.00
Long-Term Govt. Bonds	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Long-Term Corp. Bonds	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual Return (%)	9.64	12.15	16.02	19.64	9.44	18.90	17.26	-2.27	11.67	16.02	14.57	-1.13	-1.13	7.16	-1.13	-1.13	1.13	6.45	-1.13	36.30	17.62	15.32
Annual Std. Dev. (%)	10.26	10.53	9.53	9.80	7.00	11.53	9.45	7.16	16.17	9.53	4.90	4.98	4.98	7.75	4.98	4.98	4.98	2.87	4.98	9.00	2.74	1.89
Sharpe Ratio	0.46	0.69	1.17	1.50	0.65	1.21	1.31	-1.00	0.42	1.17	1.97	-1.21	-1.21	0.29	-1.21	-1.21	1.21	0.54	-1.21	3.49	4.64	5.52

EW: Equally-Weighted Market Portfolio
* For the category "All CTAs", first twelve-month returns of CTAs are excluded

Table 16D
Optimal Portfolio Allocations for VW Managed Futures and Hedge Fund Investment Styles
in the Months when S&P 500 is down more than -1%
Period: 1990:01 - 1998:08

	Unconstrained																				
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]
Managed Futures																						
VW Public Funds	1.00									0.00												
VW Private Pools		1.00								1.00												
VW All CTAs*			1.00							0.00												
VW Currency CTAs				1.00							0.22											0.04
VW Agriculture CTAs					1.00						0.52											0.16
VW Diversified CTAs						1.00					0.06											0.02
VW Financial CTAs							1.00				0.07											0.00
VW Stock CTAs								1.00			0.13											0.04
VW Energy CTAs									1.00		0.00											0.00
Hedge Funds																						
VW All Hedge Funds												0.00										
VW Funds of Funds													0.00								0.00	0.00
VW Event Driven Funds														1.00							0.11	0.00
VW Global Macro Funds															1.00						0.00	0.00
VW Global Funds																0.00					0.00	0.00
VW Long-only Funds																	0.00				0.00	0.00
VW Mkt. Neutral Funds																		0.00			0.63	0.63
VW Sector Specific Funds																			0.00		0.00	0.00
VW Short-sell Funds																				1.00	0.26	0.11
Standard Assets																						
S&P 500	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
US Small Stock	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Int.-Term Govt. Bonds	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00
Long-Term Govt. Bonds	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Long-Term Corp. Bonds	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual Return (%)	12.90	20.16	18.74	15.36	10.81	19.58	21.63	15.42	-0.77	20.16	13.69	-1.13	-1.13	1.62	0.44	-1.13	-1.13	-1.13	-1.13	40.79	14.06	11.41
Annual Std. Dev. (%)	10.09	8.76	9.79	9.67	5.95	11.54	12.86	10.42	19.64	8.76	3.96	4.98	4.98	8.28	12.73	4.98	4.98	4.98	4.98	12.34	2.42	1.28
Sharpe Ratio	0.79	1.74	1.41	1.08	0.99	1.27	1.30	1.01	-0.29	1.74	2.22	-1.21	-1.21	-0.40	-0.35	-1.21	-1.21	-1.21	-1.21	2.91	3.78	5.08

VW: Equally-Weighted Market Portfolio
* For the category "All CTAs", first twelve-month returns of CTAs are excluded

Table 17A
The Three Best Hedge Fund Styles in All, Up, and Down Markets
Period: 1990:01 – 1998:08

	Weight in the Portfolio (%)	Annual Return of the Portfolio (%)	Sharpe Ratio of the Portfolio	Risk-adjusted Return of the Portfolio (%)**
All Markets				
Benchmark Portfolio*	0	12.75	0.85	12.75
1- EW Mkt. Neutral	96	12.54	3.08	33.42
2- EW Event Driven	72	14.00	1.85	21.96
3- EW Global Macro	74	13.81	1.73	20.86
1- VW Mkt. Neutral	83	8.64	2.01	23.48
2- VW Event Driven	73	12.95	1.79	21.40
3- VW Global Macro	45	15.67	1.53	18.98
Up Markets* **				
Benchmark Portfolio	0	32.18	5.01	32.18
1- EW Event Driven	55	28.60	6.27	39.06
2- EW Mkt. Neutral	58	23.32	5.66	35.77
3- EW Sector	34	38.94	5.64	35.67
1- VW Event Driven	49	26.04	6.20	38.77
2- VW Global Macro	16	34.67	5.79	36.46
3- VW Mkt. Neutral	42	23.50	5.49	34.88
Down Markets* **				
Benchmark Portfolio	0	-29.70	NA	-29.70
1- EW Short-sell	76	36.30	3.49	28.45
2- EW Mkt. Neutral	100	6.45	0.54	8.53
3- EW Event Driven	100	7.16	0.29	6.87
1- VW Short-sell	100	40.79	2.91	24.54
2- VW Event Driven	100	1.62	NA	2.63
3- VW Global Macro	100	0.44	NA	2.54

* Benchmark Portfolio: 50% S&P 500, 10% US Small Stock, 10% Int.-term Government Bonds, 15% Long-term Government Bonds, 15% Long-term Corporate Bonds.
** Risk-adjusted Return of the Portfolio is calculated by adjusting the return of the portfolio to the same risk level of the Benchmark Portfolio.
*** Up market optimal portfolio allocations are computed in the months when the S&P 500 Index is up more than 1% in a month and down market optimal portfolio allocations are computed when the S&P 500 Index is down more than –1% in a month.

Table 17B
The Three Best Managed Futures Fund Styles in All, Up, and Down Markets
Period: 1990:01 – 1998:08

	Weight in the Portfolio (%)	Annual Return of the Portfolio (%)	Sharpe Ratio of the Portfolio	Risk-adjusted Return of the Portfolio (%)**
All Markets				
Benchmark Portfolio*	0	12.75	0.85	12.75
1- EW Financial CTAs	58	13.36	1.43	18.16
2- EW Agriculture CTAs	38	12.24	1.39	17.71
3- EW Diversified CTAs	34	10.97	1.23	16.24
1- VW Private Pools	57	13.00	1.59	19.61
2- VW Agriculture CTAs	37	9.66	1.27	16.59
3- VW Diversified CTAs	38	11.74	1.25	16.44
Up Markets* **				
Benchmark Portfolio	0	32.18	5.01	32.18
1- EW Agriculture CTAs	14	30.20	5.73	36.16
2- EW Stock CTAs	19	30.00	5.42	34.44
1- VW Agriculture CTAs	9	30.67	5.35	34.10
2- VW Private Pools	3	33.78	5.32	33.89
Down Markets* **				
Benchmark Portfolio	0	-29.70	NA	-29.70
1- EW Currency CTAs	100	19.64	1.50	15.06
2- EW Financial CTAs	100	17.26	1.31	13.73
3- EW Diversifed CTAs	100	18.90	1.21	13.10
1- VW Private Pools	100	20.16	1.74	16.66
2- VW Financial CTAs	100	21.63	1.30	13.69
3- VW Diversified CTAs	100	19.58	1.27	13.49

* Benchmark Portfolio: 50% S&P 500, 10% US Small Stock, 10% Int.-term Government Bonds, 15% Long-term Government Bonds, 15% Long-term Corporate Bonds.
** Risk-adjusted Return of the Portfolio is calculated by adjusting the return of the portfolio to the same risk level of the Benchmark Portfolio.
*** Up market optimal portfolio allocations are computed in the months when the S&P 500 Index is up more than 1% in a month and down market optimal portfolio allocations are computed when the S&P 500 Index is down more than –1% in a month.

Table 18
Six-Factor Time-series Cross-section Pooled Regressions of Hedge Fund Returns by Hedge Fund Style
Period: 1990:01 – 1998:08

$$R_t - R_f = \alpha + b^*(S\&P500 - R_f) + h^*(HML) + s^*(SMB) + w^*(WML) + g^*(TERM) + k^*(DEF) + e_t$$

	All Hedge Funds	Funds of Funds	Event-Driven Funds	Global Macro Funds	Global Funds	Long-only Funds	Mkt. Neutral Funds	Sector-Specific Funds	Short-sell Funds
Variables									
Constant	0.383**	0.179**	0.661**	0.359**	0.309**	0.299	0.544**	0.763**	0.462**
S&P500 - R_f	0.324**	0.252**	0.281**	0.282**	0.525**	0.869**	0.062**	0.615**	-0.906**
HML	0.009	0.029	-0.014	0.165**	-0.069**	0.006	0.036	0.016	0.286**
SMB	-0.305**	-0.200**	-0.360**	-0.136**	-0.502**	-0.890**	-0.064**	-0.840**	1.024**
WML	0.022**	0.057**	-0.004	0.146**	0.005	-0.035	0.021	-0.041	-0.092
TERM	0.098**	0.129**	0.173**	0.080	0.065*	-0.048	0.151**	-0.134	0.305**
DEF	0.457**	0.512**	0.653**	-0.095	0.634**	-0.083	0.570**	-1.115**	0.690*
Total Panel Observations	70073	15719	6793	5690	26025	812	11885	1924	1225
Adj. R^2	0.102	0.144	0.115	0.051	0.161	0.355	0.028	0.272	0.274

R_t: Hedge Fund Returns ; R_f: 30 day T-bill rate.
HML: Returns on a portfolio of high book-to-market stocks minus portfolio of low book-to-market stocks
SMB: Returns on a portfolio of small stocks minus portfolio of large stocks
WML: Returns on a portfolio of past year's winners minus portfolio of last year's losers
TERM: Long-term government bond returns minus 30 day Treasury bill rate measured at the end of the previous month (LTGOVTB - $R_f(-1)$)
DEF: Long-term corporate bond returns minus the long-term government bond returns (LTCORPB - LTGOVTB)
* Significant at the 10% level.
** Significant at the 5% level.

Table 19
Time-series Cross-section Pooled Regressions of Hedge Fund Returns with Style and Time Dummies
Period: 1990:01 – 1998:08

(1) $R_t - R_f = \alpha_j + b_j*(S\&P500 - R_f) + e_t$

(2) $R_t - R_f = \alpha_j + b_j*(S\&P500 - R_f) + h_j*(HML) + s_j*(SMB) + w_j*(WML) + e_t$

(3) $R_t - R_f = \alpha_j + b_j*(S\&P500 - R_f) + h_j*(HML) + s_j*(SMB) + w_j*(WML) + g_j*(TERM) + k_j*(DEF) + e_t$

(4) $R_t - R_f = \alpha_j + b_j*(S\&P500 - R_f) + h_j*(HML) + s_j*(SMB) + w_j*(WML) + g_j*(TERM) + k_j*(DEF) + T_m + e_t$

	(1)	(2)	(3)	(4)
Intercept Coefficients (α's)				
Funds of Funds	0.113**	0.141**	0.179**	0.274**
Event-Driven Funds	0.479**	0.618**	0.661**	0.755**
Global Macro Funds	0.497**	0.362**	0.359**	0.409**
Global Funds	0.091**	0.286**	0.309**	0.411**
Long-only Funds	-0.096	0.306	0.299	0.442**
Mkt. Neutral Funds	0.487**	0.497**	0.544**	0.650**
Sector-Specific Funds	0.534**	0.890**	0.763**	0.936**
Short-sell Funds	0.435**	0.452**	0.462**	0.443**
Slope Coefficients for S&P500 - R_f				
Funds of Funds	0.309**	0.288**	0.252**	0.171**
Event-Driven Funds	0.360**	0.327**	0.281**	0.200**
Global Macro Funds	0.317**	0.302**	0.282**	0.221**
Global Funds	0.576**	0.537**	0.525**	0.439**
Long-only Funds	0.944**	0.858**	0.869**	0.771**
Mkt. Neutral Funds	0.114**	0.105**	0.062**	-0.023
Sector-Specific Funds	0.626**	0.550**	0.615**	0.512**
Short-sell Funds	-0.899**	-0.834**	-0.906**	-0.960**
Slope Coefficients for HML				
Funds of Funds		0.035	0.029	-0.050
Event-Driven Funds		-0.006	-0.014	-0.097**
Global Macro Funds		0.199**	0.165**	0.108**
Global Funds		-0.082**	-0.069**	-0.139**
Long-only Funds		-0.004	0.006	-0.094
Mkt. Neutral Funds		0.043	0.036	-0.051
Sector-Specific Funds		0.075	0.016	-0.092
Short-sell Funds		0.345**	0.286**	0.240**
Slope Coefficients for SMB				
Funds of Funds		-0.234**	-0.200**	-0.172**
Event-Driven Funds		-0.404**	-0.360**	-0.332**
Global Macro Funds		-0.077**	-0.136**	-0.119**
Global Funds		-0.575**	-0.502**	-0.472**
Long-only Funds		-0.897**	-0.890**	-0.854**
Mkt. Neutral Funds		-0.101**	-0.064**	-0.034
Sector-Specific Funds		-0.675**	-0.840**	-0.797**
Short-sell Funds		1.047**	1.024**	1.037**

	(1)	(2)	(3)	(4)
Slope Coefficients for WML				
Funds of Funds		0.053**	0.057**	-0.009
Event-Driven Funds		-0.007	-0.004	-0.076**
Global Macro Funds		0.167**	0.146**	0.084**
Global Funds		-0.014	0.005	-0.065**
Long-only Funds		-0.039	-0.035	-0.111
Mkt. Neutral Funds		0.018	0.021	-0.049**
Sector-Specific Funds		-0.009	-0.041	-0.120**
Short-sell Funds		-0.072	-0.092	-0.153**
Slope Coefficients for TERM				
Funds of Funds			0.129**	0.224**
Event-Driven Funds			0.173**	0.272**
Global Macro Funds			0.080	0.117*
Global Funds			0.065*	0.142**
Long-only Funds			-0.048	0.085
Mkt. Neutral Funds			0.151**	0.256**
Sector-Specific Funds			-0.134	0.023
Short-sell Funds			0.305**	0.324**
Slope Coefficients for DEF				
Funds of Funds			0.512**	0.728**
Event-Driven Funds			0.653**	0.867**
Global Macro Funds			-0.095	-0.072
Global Funds			0.634**	0.731**
Long-only Funds			-0.083	0.260
Mkt. Neutral Funds			0.570**	0.816**
Sector-Specific Funds			-1.115**	-0.687**
Short-sell Funds			0.690*	0.649*
Time Dummies				
Aug 90				-0.223
Mar 91				1.717**
Dec 91				1.329**
Dec 93				2.318**
Mar 94				-0.999**
Apr 96				1.851**
Jul 96				-1.361**
Jan 97				1.895**
May 97				-0.528**
Jul 97				0.798**
Sep 97				1.673**
May 98				-1.835**
Aug 98				-1.230**
Adj. R^2	0.112	0.147	0.149	0.158

Subscript j stands for alternative hedge fund styles.
R_t: All Individual Hedge Fund Returns ; R_f: 30 day T-bill rate.
HML: Returns on a portfolio of high book-to-market stocks minus portfolio of low book-to-market stocks.
SMB: Returns on a portfolio of small stocks minus portfolio of large stocks.
WML: Returns on a portfolio of past year's winners minus portfolio of last year's losers.
TERM: Long-term government bond returns *minus* 30 day Treasury bill rate measured at the end of the previous month (LTGOVTB - $R_f(-1)$).
DEF: Long-term corporate bond returns minus the long-term government bond returns (LTCORPB – LTGOVTB).
T_m: Time Dummy Coefficients.
* Significant at the 10% level.
** Significant at the 5% level.

Table 20
Descriptive Statistics on the Excess Returns of Hedge Funds
Period: 1990:01 – 1998:08

$$R_t - R_f = \alpha_t + b_t*(S\&P500 - R_f) + h_t*(HML) + s_t*(SMB) + w_t*(WML) + g_t*(TERM) + k_t*(DEF) + e_t$$

	Funds of Funds	Event Driven Funds	Global Macro Funds	Global Funds	Long-only Funds	Market Neutral Funds	Sector Specific Funds	Short-sell Funds
# of Funds	349	149	125	586	22	300	60	20
#of Funds with Positive Significant Alphas	42	23	19	59	3	85	15	6
Percent of Funds with Positive Significant Alphas	12%	15%	15%	10%	14%	28%	25%	30%
Avg. of Positive Significant Alphas (%)	1.27	2.00	2.29	3.37	2.20	1.58	2.18	2.12
Avg. of All Other Funds' Alphas (%)	0.03	0.42	0.05	-0.09	-0.01	0.18	0.19	-0.25
Avg. Raw Returns of Funds with Positive Significant Alphas (%)	1.90	2.59	2.95	3.48	2.32	2.01	3.07	1.91
Avg. Raw Returns of All Other Funds (%)	0.61	0.94	0.74	0.70	0.83	0.60	0.68	-0.13
Avg. Size of Funds with Positive Significant Alphas (million $s)	74.00	61.85	997.28	83.30	4.22	53.48	36.80	10.20
Avg. Size of All Other Funds (million $s)	36.59	44.07	77.64	44.25	20.84	53.39	23.89	29.27
Avg. # of Months in Existence for Funds with Positive Significant Alphas	53	55	64	35	48	43	42	47
Avg. # of Months in Existence for All Other Funds	44	44	42	46	35	38	29	67
Median Incentive Fees of Funds with Positive Significant Alphas (%)*	10.00	20.00	20.00	10.00	NA	20.00	20.00	17.50
Median Incentive Fees of All Other Funds (%)*	5.00	15.00	2.00	6.00	15.00	5.00	2.00	10.75

All returns and excess returns (alphas) are monthly averages.
* Only 934 out of the 1611 funds in the sample reported their incentive fees.

Table 21
Seven-Factor Time-series Cross-section Pooled Regressions of Managed Futures Fund Returns by Managed Futures Fund Style
Period: 1985:01 – 1998:08

$$R_t - R_f = \alpha + m*(MLM - R_f) + b*(S\&P500 - R_f) + h*(HML) + s*(SMB) + w*(WML) + g*(TERM) + k*(DEF) + e_t$$

	Public Funds	Private Pools	All CTAs	Currency CTAs	Agriculture CTAs	Diversified CTAs	Financial CTAs	Stock CTAs	Energy CTAs
Variables									
Constant	-0.386**	0.172**	0.749**	0.557**	1.472**	0.771**	0.704**	0.495**	1.083**
MLM - R_f	0.810**	0.760**	0.631**	0.710**	0.518**	0.889**	0.429**	0.021	0.084**
S&P500 - R_f	0.124**	0.019	0.021*	-0.096**	0.146*	0.006	-0.007	0.141**	-0.050
HML	0.106**	-0.033	-0.027	-0.034	-0.205	-0.024	0.113*	0.001	-1.018**
SMB	0.077**	0.068**	0.086**	0.102**	-0.206	0.086**	0.221**	0.158**	-0.056
WML	0.097**	-0.021	-0.009	0.205**	-0.183	-0.097**	0.097**	0.013	-0.551**
TERM	0.077**	0.235**	0.258**	0.443**	-0.130	0.221**	0.379**	0.046	0.528**
DEF	-0.490**	-0.024	0.179**	1.079**	-0.176	-0.100	0.920**	0.366	1.661**
Total Panel Observations	40146	27176	66460	9126	2694	35947	11617	3905	2011
Adj. R^2	0.034	0.023	0.012	0.032	0.006	0.019	0.018	0.003	0.017

R_t: Managed Futures Fund Returns ; R_f: 30 day T-bill rate
MLM: Returns on the Mount Lucas Management Index. For each CTA style the relevant MLM Sub-indices are used in the regressions
HML: Returns on a portfolio of high book-to-market stocks minus portfolio of low book-to-market stocks
SMB: Returns on a portfolio of small stocks minus portfolio of large stocks
WML: Returns on a portfolio of past year's winners minus portfolio of last year's losers
TERM: Long-term government bond returns minus 30 day Treasury bill rate measured at the end of the previous month (LTGOVTB - $R_f(-1)$)
DEF: Long-term corporate bond returns minus the long-term government bond returns (LTCORPB – LTGOVTB)
* Significant at the 10% level.
** Significant at the 5% level.

Table 22
Time-series Cross-section Pooled Regressions of CTA Returns with Style and Time Dummies
Period: 1985:01 – 1998:08

(1) $R_i - R_f = \alpha_j + m_j*(MLM - R_f) + e_i$

(2) $R_i - R_f = \alpha_j + b_j*(S\&P500 - R_f) + h_j*(HML) + s_j*(SMB) + w_j*(WML) + g_j*(TERM) + k_j*(DEF) + e_i$

(3) $R_i - R_f = \alpha_j + m_j*(MLM - R_f) + b_j*(S\&P500 - R_f) + h_j*(HML) + s_j*(SMB) + w_j*(WML) + g_j*(TERM) + k_j*(DEF) + e_i$

(4) $R_i - R_f = \alpha_j + m_j*(MLM - R_f) + b_j*(S\&P500 - R_f) + h_j*(HML) + s_j*(SMB) + w_j*(WML) + g_j*(TERM) + k_j*(DEF) + T_m + e_i$

	(1)	(2)	(3)	(4)
Intercept Coefficients (α's)				
CTA-CUR	0.807**	0.724**	0.626**	0.529**
CTA-AG	1.364**	1.755**	1.397**	1.195**
CTA-DIV	0.824**	1.220**	0.771**	0.449**
CTA-FIN	0.937**	0.760**	0.679**	0.532**
CTA-STX	0.659**	0.506**	0.495**	0.430**
CTA-EN	0.842**	1.174**	1.083**	0.846**
Slope Coefficients for $MLM - R_f$				
CTA-CUR	0.169**		0.191**	-0.034
CTA-AG	0.612**		0.693**	0.416**
CTA-DIV	0.959**		0.889**	0.536**
CTA-FIN	0.168**		0.159**	-0.071
CTA-STX	-0.044		0.021	-0.167
CTA-EN	0.565**		0.463**	0.017
Slope Coefficients for $S\&P500 - R_f$				
CTA-CUR		-0.070*	-0.090**	-0.153**
CTA-AG		0.160**	0.197**	0.095
CTA-DIV		-0.035**	0.006	-0.115**
CTA-FIN		-0.002	0.006	-0.092**
CTA-STX		0.140**	0.141**	0.068
CTA-EN		-0.089	-0.057	-0.197**
Slope Coefficients for HML				
CTA-CUR		-0.087	-0.063	0.106
CTA-AG		-0.284*	-0.199	-0.019
CTA-DIV		-0.141**	-0.024	0.186**
CTA-FIN		0.054	0.113*	0.236**
CTA-STX		-0.003	0.001	0.137
CTA-EN		-1.047**	-0.939**	-0.581**
Slope Coefficients for SMB				
CTA-CUR		0.148**	0.141**	0.175**
CTA-AG		-0.152	-0.164	-0.102
CTA-DIV		0.097**	0.086**	0.156**
CTA-FIN		0.158**	0.154**	0.194**
CTA-STX		0.158	0.158**	0.189*
CTA-EN		-0.054	-0.074	0.006

	(1)	(2)	(3)	(4)
Slope Coefficients for WML				
CTA-CUR		0.242**	0.262**	0.301**
CTA-AG		-0.301**	-0.183	-0.175
CTA-DIV		-0.173**	-0.097**	-0.013
CTA-FIN		0.081	0.097**	0.141**
CTA-STX		0.011	0.013	0.049
CTA-EN		-0.572**	-0.491**	-0.362**
Slope Coefficients for TERM				
CTA-CUR		0.418**	0.430**	0.413**
CTA-AG		-0.195	-0.164	-0.153
CTA-DIV		0.194**	0.222**	0.246**
CTA-FIN		0.425**	0.436**	0.441**
CTA-STX		0.045	0.046	0.032
CTA-EN		0.515**	0.516**	0.345*
Slope Coefficients for DEF				
CTA-CUR		0.932**	1.024**	1.068**
CTA-AG		-0.449	-0.133	0.009
CTA-DIV		-0.490**	-0.101	0.068
CTA-FIN		0.479**	0.564**	0.688**
CTA-STX		0.355	0.367	0.424
CTA-EN		1.619**	1.779**	1.403**
Time Dummies				
Jul 85				20.473**
Feb 86				15.159**
Jan 87				12.034**
Apr 87				20.044**
May 88				6.921**
Jun 88				22.097**
Jul 88				-3.894**
May 89				9.466**
Dec 91				9.125**
Adj. R^2	0.012	0.008	0.017	0.060

Subscript j stands for alternative CTA styles.
R_j: Individual CTA Returns ; R_f: 30 day T-bill rate.
MLM: Returns on the Mount Lucas Management Index.
HML: Returns on a portfolio of high book-to-market stocks minus portfolio of low book-to-market stocks.
SMB: Returns on a portfolio of small stocks minus portfolio of large stocks.
WML: Returns on a portfolio of past year's winners minus portfolio of last year's losers.
TERM: Long-term government bond returns minus 30 day Treasury bill rate measured at the end of the previous month (LTGOVTB - $R_f(-1)$).
DEF: Long-term corporate bond returns minus the long-term government bond returns (LTCORPB – LTGOVTB).
T_m: Time Dummy Coefficients.
* Significant at the 10% level.
** Significant at the 5% level.

Table 23
Descriptive Statistics on the Excess Returns of Managed Futures Funds
Period: 1985:01 – 1998:08

$$R_t - R_f = \alpha_i + m_i*(MLM - R_f) + b_i*(S\&P500 - R_f) + h_i*(HML) + s_i*(SMB) + w_i*(WML) + g_i*(TERM) + k_i*(DEF) + e_i$$

	Public Funds	Private Pools	Currency CTAs	Agriculture CTAs	Diversified CTAs	Financial CTAs	Stock CTAs	Energy CTAs
# of Funds	704	466	175	49	599	226	90	36
#of Funds with Positive Significant Alphas	15	30	17	7	55	30	8	-
Percent of Funds with Positive Significant Alphas	2%	6%	10%	14%	9%	13%	9%	19%
Avg of Positive Significant Alphas (%)	2.79	3.08	2.25	7.99	4.88	3.38	2.84	6.02
Avg of All Other Funds' Alphas (%)	-0.45	-0.02	0.36	0.28	0.35	0.30	0.26	-0.11
Avg Raw Returns of Funds with Positive Significant Alphas (%)	3.79	4.01	3.03	8.53	5.77	4.16	3.64	6.70
Avg Raw Returns of All Other Funds (%)	0.51	0.44	0.64	0.88	1.02	0.80	0.59	0.36
Avg Size of Funds with Positive Significant Alphas (million $s)	20.54	9.24	31.06	2.11	21.45	28.29	3.05	2.59
Avg Size of All Other Funds (million $s)	22.35	8.97	26.61	9.78	23.28	22.40	5.16	6.48
Avg # of Months in Existence for Funds with Positive Significant Alphas	92	92	95	53	80	71	55	47
Avg # of Months in Existence for All Other Funds	56	56	48	55	58	48	42	58
Median Incentive Fees of Funds with Positive Significant Alphas (%)*	20.00	20.00	17.50	20.00	15.00	12.50	20.00	25.00
Median Incentive Fees of All Other Funds (%)*	4.00	18.00	4.00	13.00	11.00	6.75	15.00	17.00

All returns and excess returns (alphas) are monthly averages
* Only 939 out of the 1175 CTAs in the sample reported their incentive fees In the same way, 449 out of the 704 Public Funds and 260 out of the 466 Private Pools reported their incentive fees

Table 24
Cross-section Regressions of Six-Factor Hedge Fund Alphas on Size, Age, and Incentive Fee
Period: 1990 – 1998

6-Factor Alpha = b_0 + b_1*Medium Incentive Fee + b_2*High Incentive Fee + b_3*Size + b_4*Age + ε

	All Hedge Funds	Funds of Funds	Event-Driven Funds	Global Macro Funds	Global Funds	Mkt. Neutral Funds
Variables						
Constant	0.1268	-0.1481	0.4850**	-0.0092	0.2270	0.3918**
Medium Fee	0.1809	0.2202	-0.2239	0.4429	0.0801	0.0484
High Fee	0.3324**	0.2949**	0.2461	0.1336	0.4086**	0.3283**
Size	0.0004**	0.0002	0.0008	0.0003**	0.0008	-0.0003
Age	0.0007	0.0032*	0.0037	0.0032	-0.0017	-0.0005
# of Observations	927	213	71	76	334	180
Adj. R^2	0.049	0.032	0.006	0.094	0.039	0.059

Table 25
Cross-section Regressions of Seven-Factor CTA Alphas on Size, Age, and Incentive Fee
Period: 1985 – 1998

7-Factor Alpha = b_0 + b_1*Medium Incentive Fee + b_2*High Incentive Fee + b_3*Size + b_4*Age + ε

	All CTAs	Currency CTAs	Agriculture CTAs	Diversified CTAs	Financial CTAs	Stock CTAs
Variables						
Constant	-0.1091	-0.6354**	0.4368	-0.1233	0.1513	-0.0344
Medium Fee	0.3085	0.0974	1.8064**	0.4755*	0.0001	0.1223
High Fee	0.2757*	0.1288	0.7499*	0.3302*	0.0557	0.0727
Size	-0.0002	-0.0010	0.0036	0.0002	-0.0014	-0.0158
Age	0.0079**	0.0178**	0.0013	0.0066**	0.0081*	0.0086
# of Observations	929	128	44	470	180	78
Adj. R^2	0.042	0.217	0.028	0.035	0.008	0.021

High Incentive Fee is a 0, 1 dummy variable which takes the value 1 for funds with incentive fees 20% or higher.
Medium Incentive Fee is a 0, 1 dummy variable which takes the value 1 for funds with incentive fees higher than 5% and smaller than 20%.
Low Incentive is the omitted category and it includes funds with incentive fees 5% or smaller.
* Significant at the 10% level.
** Significant at the 5% level.

Table 26
Persistence in Performance of Hedge Funds: Raw Returns

		Quintile Sorted Portfolios by Past 12 Month Returns						Subsequent Month Mean Return Differences			
		(1)	(2)	(3)	(4)	(5)		(1) – (5)	(1) – (4)	(2) – (5)	(2) – (4)
All Hedge Funds	Mean of Past 12 Month Returns	3.206	1.683	1.135	0.666	-0.441					
(1990:01–1998:08)	Mean of Subsequent Month Returns	1.576	1.138	1.018	0.905	0.572		1.003**	0.671**	0.565**	0.232**
							t-statistic	(4.389)	(4.119)	(3.071)	(2.304)
Funds of Funds	Mean of Past 12 Month Returns	2.005	1.283	0.962	0.655	-0.125					
(1990:01–1998:08)	Mean of Subsequent Month Returns	1.124	0.959	0.849	0.715	0.516		0.608**	0.409**	0.443**	0.244**
							t-statistic	(2.959)	(2.815)	(2.698)	(2.622)
Event-Driven Funds	Mean of Past 12 Month Returns	3.170	1.654	1.203	0.843	0.067					
(1990:01–1998:08)	Mean of Subsequent Month Returns	1.949	1.158	1.179	0.972	1.178		0.770**	0.976**	-0.020	0.186
							t-statistic	(2.114)	(3.315)	(-0.080)	(1.264)
Global Macro Funds	Mean of Past 12 Month Returns	3.361	2.045	1.447	0.868	-0.381					
(1990:01–1998:08)	Mean of Subsequent Month Returns	1.427	1.193	1.316	1.412	0.898		0.529*	0.015	0.294	-0.219
							t-statistic	(1.612)	(0.050)	(1.040)	(-0.894)
Global Funds	Mean of Past 12 Month Returns	3.642	1.915	1.283	0.681	-0.561					
(1990:01–1998:08)	Mean of Subsequent Month Returns	1.526	1.306	1.144	0.872	0.533		0.994**	0.654**	0.774**	0.434**
							t-statistic	(3.691)	(2.813)	(3.306)	(2.801)
Long-only Funds	Mean of Past 12 Month Returns	3.700	2.835	2.272	1.749	0.538					
(1996:01–1998:08)	Mean of Subsequent Month Returns	0.832	1.033	1.403	1.305	-0.196		1.028	-0.473	1.229	-0.272
							t-statistic	(0.917)	(-0.595)	(1.136)	(-0.432)
Market-Neutral Funds	Mean of Past 12 Month Returns	2.409	1.315	0.946	0.630	-0.091					
(1990:01–1998:08)	Mean of Subsequent Month Returns	1.470	1.083	0.969	0.707	0.424		1.046**	0.763**	0.660**	0.377**
							t-statistic	(5.929)	(5.173)	(4.831)	(3.821)
Sector-Specific Funds	Mean of Past 12 Month Returns	4.305	2.860	2.083	1.512	0.594					
(1995:01–1998:08)	Mean of Subsequent Month Returns	2.545	2.079	1.985	1.198	1.969		0.576	1.347**	0.110	0.881**
							t-statistic	(0.939)	(2.253)	(0.234)	(1.807)
Short-sell Funds	Mean of Past 12 Month Returns	2.449	0.940	0.238	-0.439	-1.308					
(1990:01–1998:08)	Mean of Subsequent Month Returns	0.735	0.004	0.060	0.581	0.584		0.151	0.154	-0.580	-0.577
							t-statistic	(0.226)	(0.223)	(-0.937)	(-0.878)

For the period 1990:01-1998:08, t critical values at 5% and 10% level are 1.660 and 1.290, respectively
For the period 1995:01-1998:08, t critical values at 5% and 10% level are 1.684 and 1.303, respectively
For the period 1996:01-1998:08, t critical values at 5% and 10% level are 1.697 and 1.311, respectively

Table 27A
Persistence in Performance of Hedge Funds: Six-Factor Risk-adjusted Excess Returns
Selection Period: 1 Year; Performance Period: 1 Year

		Quintile Sorted Portfolios by Past Year's Alphas						Following Year's Alpha Differences			
		(1)	(2)	(3)	(4)	(5)		(1) - (5)	(1) - (4)	(2) - (5)	(2) - (4)
All Hedge Funds	Mean of Past Year's Alphas	2.599	1.002	0.390	-0.185	-1.536					
(1990 – 1998)	Mean of Following Year's Alphas	0.522	0.419	0.295	0.227	0.159		0.363*	0.295*	0.261*	0.192*
							t-statistic	(1.402)	(1.437)	(1.448)	(1.627)
Funds of Funds	Mean of Past Year's Alphas	1.796	0.773	0.332	-0.035	-0.972					
(1990 – 1998)	Mean of Following Year's Alphas	0.209	0.425	0.342	0.223	0.220		-0.011	-0.013	0.205*	0.202**
							t-statistic	(-0.032)	(-0.048)	(1.547)	(2.256)
Event-Driven Funds	Mean of Past Year's Alphas	2.648	0.990	0.461	0.054	-0.835					
(1990 – 1998)	Mean of Following Year's Alphas	0.715	0.491	0.311	0.367	0.539		0.176	0.348*	-0.048	0.124
							t-statistic	(0.462)	(1.434)	(-0.156)	(0.753)
Global Macro Funds	Mean of Past Year's Alphas	2.996	1.465	0.814	0.121	-1.260					
(1990 – 1998)	Mean of Following Year's Alphas	0.626	0.780	0.646	0.536	0.287		0.339*	0.090	0.493**	0.244
							t-statistic	(1.798)	(0.437)	(2.235)	(1.073)
Global Funds	Mean of Past Year's Alphas	2.709	0.960	0.267	-0.459	-1.871					
(1990 – 1998)	Mean of Following Year's Alphas	0.487	0.195	0.145	0.078	0.148		0.339*	0.408**	0.047	0.116
							t-statistic	(1.399)	(2.045)	(0.206)	(0.772)
Long-only Funds	Mean of Past Year's Alphas	2.480	1.163	0.382	-0.147	-1.094					
(1993 – 1998)	Mean of Following Year's Alphas	0.317	-0.116	-0.261	-0.202	0.287		0.031	0.520	-0.403	0.086
							t-statistic	(0.041)	(0.997)	(-0.599)	(0.140)
Mkt. Neutral Funds	Mean of Past Year's Alphas	2.015	0.738	0.328	-0.042	-0.976					
(1990 – 1998)	Mean of Following Year's Alphas	0.755	0.424	0.252	0.178	0.095		0.661**	0.577**	0.330**	0.246**
							t-statistic	(4.087)	(5.690)	(2.071)	(2.854)
Sector-Specific Funds	Mean of Past Year's Alphas	3.504	1.684	0.814	0.144	-1.002					
(1992 – 1998)	Mean of Following Year's Alphas	0.842	0.814	0.194	0.220	0.192		0.650**	0.622*	0.623*	0.595
							t-statistic	(2.079)	(1.473)	(1.672)	(1.207)
Short-sell Funds	Mean of Past Year's Alphas	2.568	0.964	0.311	-0.312	-1.798					
(1990 – 1998)	Mean of Following Year's Alphas	1.022	0.272	1.024	0.015	1.029		-0.007	1.007**	-0.757	0.257
							t-statistic	(-0.009)	(2.273)	(-1.324)	(0.463)

** Significant at the 5% level, * Significant at the 10% level
For the period 1990-1998, t critical values at 5% and 10% level are 1.860 and 1.397, respectively
Excess returns (alphas) are monthly averages

Table 27B
Persistence in Performance of Hedge Funds: Six-Factor Risk-adjusted Excess Returns
Selection Period: 2 Years; Performance Period: 1 Year

		Quintile Sorted Portfolios by Past 2 Years' Alphas						Following Year's Alpha Differences			
		(1)	(2)	(3)	(4)	(5)		(1) – (5)	(1) – (4)	(2) – (5)	(2) – (4)
All Hedge Funds	Mean of Past 2 Years' Alphas	2.435	0.962	0.456	-0.025	-1.201					
(1990 – 1998)	Mean of Following Year's Alphas	0.644	0.568	0.357	0.267	0.147		0.497**	0.376*	0.421**	0.301**
							t-statistic	(2.001)	(1.588)	(2.864)	(2.536)
Funds of Funds	Mean of Past 2 Years' Alphas	1.604	0.719	0.359	0.013	-0.844					
(1990 – 1998)	Mean of Following Year's Alphas	0.533	0.442	0.440	0.410	0.073		0.459**	0.123	0.369**	0.032
							t-statistic	(1.973)	(0.593)	(2.191)	(0.227)
Event-Driven Funds	Mean of Past 2 Years' Alphas	2.528	1.010	0.525	0.174	-0.464					
(1990 – 1998)	Mean of Following Year's Alphas	0.735	0.617	0.392	0.359	0.640		0.095	0.376*	-0.024	0.258
							t-statistic	(0.183)	(1.796)	(-0.068)	(1.175)
Global Macro Funds	Mean of Past 2 Years' Alphas	2.452	1.153	0.602	0.099	-1.215					
(1990 – 1998)	Mean of Following Year's Alphas	0.888	0.938	0.676	0.450	0.267		0.621**	0.438*	0.671**	0.488**
							t-statistic	(1.990)	(1.485)	(2.593)	(3.296)
Global Funds	Mean of Past 2 Years' Alphas	2.697	1.035	0.396	-0.182	-1.495					
(1990 – 1998)	Mean of Following Year's Alphas	0.323	0.408	0.277	0.219	0.099		0.225	0.104	0.309	0.189**
							t-statistic	(0.657)	(0.407)	(1.402)	(2.197)
Long-only Funds	Mean of Past 2 Years' Alphas	2.580	1.453	0.839	0.099	-0.752					
(1992 – 1998)	Mean of Following Year's Alphas	0.194	0.267	-0.338	-0.407	0.291		-0.097	0.601	-0.025	0.673**
							t-statistic	(-0.125)	(1.027)	(-0.053)	(3.450)
Mkt. Neutral Funds	Mean of Past 2 Years' Alphas	2.055	0.796	0.417	0.119	-0.703					
(1990 – 1998)	Mean of Following Year's Alphas	0.884	0.575	0.414	0.244	0.180		0.703**	0.639**	0.395**	0.331**
							t-statistic	(3.477)	(3.350)	(3.207)	(2.896)
Sector-Specific Funds	Mean of Past 2 Years' Alphas	2.706	1.726	0.752	0.139	-0.950					
(1991 – 1998)	Mean of Following Year's Alphas	0.918	0.657	0.137	0.427	0.076		0.842**	0.491	0.581**	0.230
							t-statistic	(2.991)	(1.275)	(3.298)	(0.580)
Short-sell Funds	Mean of Past 2 Years' Alphas	2.492	1.073	0.353	-0.262	-1.315					
(1990 – 1998)	Mean of Following Year's Alphas	1.705	0.573	0.664	0.255	0.992		0.712*	1.450**	-0.419	0.318
							t-statistic	(1.487)	(2.244)	(-0.669)	(0.509)

** Significant at the 5% level, * Significant at the 10% level
For the period 1990-1998, t critical values at 5% and 10% level are 1.895 and 1.415, respectively
Excess returns (alphas) are monthly averages

Table 27C
Persistence in Performance of Hedge Funds: Six-Factor Risk-adjusted Excess Returns
Selection Period: 2 Years; Performance Period: 2 Years

		Quintile Sorted Portfolios by Past 2 Years' Alphas						Following 2 Years' Alpha Differences			
		(1)	(2)	(3)	(4)	(5)		(1) – (5)	(1) – (4)	(2) – (5)	(2) – (4)
All Hedge Funds	Mean of Past 2 Years' Alphas	2.422	0.974	0.470	-0.011	-1.148					
(1990 – 1998)	Mean of Following 2 Years' Alphas	0.522	0.438	0.308	0.249	0.171		0.350*	0.272*	0.266	0.188*
							t-statistic	(1.583)	(1.599)	(1.307)	(1.857)
Funds of Funds	Mean of Past 2 Years' Alphas	1.597	0.744	0.377	0.021	-0.816					
(1990 – 1998)	Mean of Following 2 Years' Alphas	0.384	0.375	0.307	0.280	-0.163		0.547**	0.104	0.538**	0.095
							t-statistic	(2.695)	(0.667)	(3.247)	(0.902)
Event-Driven Funds	Mean of Past 2 Years' Alphas	2.524	1.014	0.536	0.179	-0.428					
(1990 – 1998)	Mean of Following 2 Years' Alphas	0.775	0.532	0.527	0.399	0.409		0.366*	0.377**	0.123	0.133
							t-statistic	(1.533)	(2.215)	(0.621)	(1.109)
Global Macro Funds	Mean of Past 2 Years' Alphas	2.546	1.286	0.753	0.259	-1.035					
(1990 – 1998)	Mean of Following 2 Years' Alphas	0.434	0.414	0.167	-0.040	-0.017		0.451*	0.474**	0.431*	0.454**
							t-statistic	(1.448)	(1.969)	(1.599)	(3.252)
Global Funds	Mean of Past 2 Years' Alphas	2.692	1.055	0.423	-0.146	-1.389					
(1990 – 1998)	Mean of Following 2 Years' Alphas	0.357	0.404	0.347	0.188	0.371		-0.014	0.169	0.033	0.216*
							t-statistic	(-0.046)	(0.834)	(0.138)	(1.601)
Long-only Funds	Mean of Past 2 Years' Alphas	2.480	1.535	0.894	0.119	-0.688					
(1992 – 1998)	Mean of Following 2 Years' Alphas	0.676	0.162	0.249	-0.418	-0.169		0.845*	1.094*	0.331	0.580**
							t-statistic	(1.641)	(1.664)	(0.784)	(2.288)
Mkt. Neutral Funds	Mean of Past 2 Years' Alphas	2.002	0.740	0.368	0.085	-0.725					
(1990 – 1998)	Mean of Following 2 Years' Alphas	0.761	0.560	0.385	0.231	0.163		0.598**	0.530**	0.398**	0.330**
							t-statistic	(3.365)	(3.212)	(4.113)	(4.530)
Sector-Specific Funds	Mean of Past 2 Years' Alphas	2.593	1.709	0.729	0.126	-0.975					
(1991 – 1998)	Mean of Following 2 Years' Alphas	0.655	0.755	0.230	0.578	0.201		0.454*	0.077	0.554**	0.176
							t-statistic	(1.502)	(0.550)	(3.097)	(0.806)
Short-sell Funds	Mean of Past 2 Years' Alphas	2.238	0.770	0.071	-0.509	-1.624					
(1990 – 1998)	Mean of Following 2 Years' Alphas	1.002	0.769	0.708	-0.171	0.399		0.603*	1.173**	0.370	0.940**
							t-statistic	(1.453)	(2.012)	(0.685)	(2.269)

** Significant at the 5% level; * Significant at the 10% level
For the period 1990-1998, t critical values at 5% and 10% level are 1.943 and 1.440, respectively
Excess returns (alphas) are monthly averages

Table 28A
Cross-section Regressions for Performance Persistence of Hedge Funds:
One Year Alphas on One Year Alphas
Future Six-Factor Alphas = a + b * Past Six-Factor Alphas + e

	Dependent Variable	Independent Variable	# of Obs.	a	b	Adjusted R^2
All Hedge Funds	1991 Alphas	1990 Alphas	187	-0.224**	-0.118*	0.012
	1992 Alphas	1991 Alphas	259	0.657**	0.233**	0.102
	1993 Alphas	1992 Alphas	369	1.463**	0.256**	0.037
	1994 Alphas	1993 Alphas	544	-0.155**	-0.047	0.002
	1995 Alphas	1994 Alphas	776	0.476**	-0.154*	0.011
	1996 Alphas	1995 Alphas	923	0.199**	0.063**	0.005
	1997 Alphas	1996 Alphas	1087	0.319**	0.304**	0.095
	1998 Alphas	1997 Alphas	1232	-0.412**	0.066**	0.002
Funds of Funds	1991 Alphas	1990 Alphas	38	-0.415**	-0.735**	0.368
	1992 Alphas	1991 Alphas	53	0.672**	0.195**	0.100
	1993 Alphas	1992 Alphas	78	1.404**	0.297*	0.025
	1994 Alphas	1993 Alphas	113	-0.113	-0.193**	0.058
	1995 Alphas	1994 Alphas	175	0.329**	-0.079	-0.002
	1996 Alphas	1995 Alphas	218	0.056	0.045	-0.002
	1997 Alphas	1996 Alphas	246	0.468**	0.460**	0.155
	1998 Alphas	1997 Alphas	276	-0.126	0.004	-0.004
Event Driven Funds	1991 Alphas	1990 Alphas	21	0.222	0.094	-0.039
	1992 Alphas	1991 Alphas	30	0.127	0.368**	0.256
	1993 Alphas	1992 Alphas	31	1.713**	0.320**	0.155
	1994 Alphas	1993 Alphas	49	0.205	-0.171	0.026
	1995 Alphas	1994 Alphas	61	1.066**	-0.691**	0.084
	1996 Alphas	1995 Alphas	87	0.390**	-0.121*	0.025
	1997 Alphas	1996 Alphas	110	0.348**	0.235**	0.076
	1998 Alphas	1997 Alphas	126	0.214	-0.244**	0.035
Global Macro Funds	1991 Alphas	1990 Alphas	23	0.356	-0.303	0.061
	1992 Alphas	1991 Alphas	29	1.932**	0.361**	0.221
	1993 Alphas	1992 Alphas	42	1.812**	0.373**	0.112
	1994 Alphas	1993 Alphas	67	0.211	-0.353**	0.083
	1995 Alphas	1994 Alphas	80	1.609**	0.048	-0.012
	1996 Alphas	1995 Alphas	68	-0.521*	0.068	-0.009
	1997 Alphas	1996 Alphas	64	0.145	0.171*	0.029
	1998 Alphas	1997 Alphas	69	-0.520**	0.143*	0.037
Global Funds	1991 Alphas	1990 Alphas	71	-0.249	-0.043	-0.013
	1992 Alphas	1991 Alphas	103	0.584**	0.175**	0.072
	1993 Alphas	1992 Alphas	142	2.035**	0.002	-0.007
	1994 Alphas	1993 Alphas	193	0.182	-0.081	0.005
	1995 Alphas	1994 Alphas	284	-0.137	-0.049	-0.002
	1996 Alphas	1995 Alphas	350	0.139*	0.090**	0.009
	1997 Alphas	1996 Alphas	423	0.192**	0.340**	0.093
	1998 Alphas	1997 Alphas	445	-1.023**	0.037*	0.033
Long-only Funds	1993 Alphas	1992 Alphas	3	0.121	0.025	0.434
	1994 Alphas	1993 Alphas	6	-0.820	0.779	0.269
	1995 Alphas	1994 Alphas	7	0.778	-0.554	0.183
	1996 Alphas	1995 Alphas	10	0.136	0.399**	0.451
	1997 Alphas	1996 Alphas	13	0.199	-0.098	-0.085
	1998 Alphas	1997 Alphas	19	-1.09**	-0.313	-0.001

	Dependent Variable	Independent Variable	# of Obs.	a	b	Adjusted R^2
Mkt. Neutral Funds	1991 Alphas	1990 Alphas	24	-0.567**	-0.064	-0.015
	1992 Alphas	1991 Alphas	32	0.265*	0.162*	0.010
	1993 Alphas	1992 Alphas	58	0.634**	0.611**	0.365
	1994 Alphas	1993 Alphas	93	-0.489**	0.252**	0.051
	1995 Alphas	1994 Alphas	137	0.761**	-0.260*	0.068
	1996 Alphas	1995 Alphas	156	0.646**	0.142**	0.021
	1997 Alphas	1996 Alphas	186	0.574**	0.143**	0.027
	1998 Alphas	1997 Alphas	232	-0.025	0.258**	0.043
Sector-Specific Funds	1993 Alphas	1992 Alphas	5	-0.188	0.280	0.372
	1994 Alphas	1993 Alphas	9	-0.458	0.094	-0.078
	1995 Alphas	1994 Alphas	15	2.953**	-0.010	-0.077
	1996 Alphas	1995 Alphas	22	-0.088	0.166	-0.025
	1997 Alphas	1996 Alphas	33	-0.083	0.373**	0.267
	1998 Alphas	1997 Alphas	52	-0.483	-0.008	0.020
Short-sell Funds	1991 Alphas	1990 Alphas	8	0.853	-1.263**	0.453
	1992 Alphas	1991 Alphas	9	-0.247	0.569**	0.422
	1993 Alphas	1992 Alphas	10	-2.182**	-0.107	-0.106
	1994 Alphas	1993 Alphas	14	-0.178	0.129	-0.017
	1995 Alphas	1994 Alphas	17	0.974	0.394	-0.048
	1996 Alphas	1995 Alphas	12	1.301	0.361	0.006
	1997 Alphas	1996 Alphas	12	0.477	0.544*	0.246
	1998 Alphas	1997 Alphas	13	4.307**	-0.074	-0.086

* Significant at the 10% level.
** Significant at the 5% level.

Table 28B
Cross-section Regressions for Performance Persistence of Hedge Funds:
One Year Alphas on Two Year Alphas
Future Six-Factor Alphas = a + b * Past Six-Factor Alphas + e

	Dependent Variable	Independent Variable	# of Obs.	a	b	Adjusted R^2
All Hedge Funds	1992 Alphas	1990-91 Alphas	260	0.534**	0.304**	0.115
	1993 Alphas	1991-92 Alphas	369	1.503**	0.196**	0.024
	1994 Alphas	1992-93 Alphas	544	-0.180**	-0.046	0.001
	1995 Alphas	1993-94 Alphas	775	0.561**	-0.137**	0.007
	1996 Alphas	1994-95 Alphas	923	0.220**	0.146**	0.021
	1997 Alphas	1995-96 Alphas	1087	0.265**	0.292**	0.071
	1998 Alphas	1996-97 Alphas	1231	-0.427**	0.099**	0.005
Funds of Funds	1992 Alphas	1990-91 Alphas	53	0.566**	0.264**	0.066
	1993 Alphas	1991-92 Alphas	78	1.193**	0.595**	0.205
	1994 Alphas	1992-93 Alphas	113	-0.196	-0.201**	0.035
	1995 Alphas	1993-94 Alphas	175	0.371**	-0.055	-0.004
	1996 Alphas	1994-95 Alphas	218	0.080	0.006	-0.005
	1997 Alphas	1995-96 Alphas	246	0.440**	0.378**	0.101
	1998 Alphas	1996-97 Alphas	275	-0.125	0.008	-0.004
Event Driven Funds	1992 Alphas	1990-91 Alphas	30	-0.218	0.640**	0.492
	1993 Alphas	1991-92 Alphas	31	1.753**	0.180	0.035
	1994 Alphas	1992-93 Alphas	49	0.028	-0.154	0.016
	1995 Alphas	1993-94 Alphas	61	1.781**	-0.842**	0.080
	1996 Alphas	1994-95 Alphas	87	0.278*	-0.064	-0.007
	1997 Alphas	1995-96 Alphas	110	0.276*	0.202**	0.031
	1998 Alphas	1996-97 Alphas	126	0.253	-0.236**	0.029
Global Macro Funds	1992 Alphas	1990-91 Alphas	29	1.281**	0.563**	0.327
	1993 Alphas	1991-92 Alphas	42	1.862**	0.402**	0.127
	1994 Alphas	1992-93 Alphas	67	-0.130	-0.297**	0.048
	1995 Alphas	1993-94 Alphas	80	1.412**	0.284	0.010
	1996 Alphas	1994-95 Alphas	68	-0.382*	0.012	-0.015
	1997 Alphas	1995-96 Alphas	64	0.108	0.249*	0.042
	1998 Alphas	1996-97 Alphas	69	-0.433**	0.257*	0.025
Global Funds	1992 Alphas	1990-91 Alphas	104	0.563**	0.206**	0.066
	1993 Alphas	1991-92 Alphas	142	2.060**	-0.046	-0.005
	1994 Alphas	1992-93 Alphas	193	0.136	-0.087	0.003
	1995 Alphas	1993-94 Alphas	283	-0.036	-0.161**	0.014
	1996 Alphas	1994-95 Alphas	350	0.143*	0.108**	0.008
	1997 Alphas	1995-96 Alphas	423	0.120	0.304**	0.069
	1998 Alphas	1996-97 Alphas	445	-1.039**	0.070	0.001
Long-only Funds	1993 Alphas	1991-92 Alphas	3	0.133	0.014	0.082
	1994 Alphas	1992-93 Alphas	6	-1.577	0.783*	0.448
	1995 Alphas	1993-94 Alphas	7	1.056	-0.464	0.013
	1996 Alphas	1994-95 Alphas	10	0.408*	0.608**	0.406
	1997 Alphas	1995-96 Alphas	13	0.231	-0.077	-0.085
	1998 Alphas	1996-97 Alphas	19	-1.149**	-0.169	-0.042

	Dependent Variable	Independent Variable	# of Obs.	a	b	Adjusted R^2
Mkt. Neutral Funds	1992 Alphas	1990-91 Alphas	32	0.214	0.004	-0.033
	1993 Alphas	1991-92 Alphas	58	0.660**	0.713**	0.486
	1994 Alphas	1992-93 Alphas	93	-0.435**	0.258**	0.050
	1995 Alphas	1993-94 Alphas	137	0.844**	-0.209*	0.019
	1996 Alphas	1994-95 Alphas	156	0.634**	0.238**	0.101
	1997 Alphas	1995-96 Alphas	186	0.482**	0.245**	0.055
	1998 Alphas	1996-97 Alphas	232	-0.010	0.211**	0.024
Sector-Specific Funds	1993 Alphas	1991-92 Alphas	5	-0.121	0.319	0.478
	1994 Alphas	1992-93 Alphas	9	-0.512	0.139*	0.089
	1995 Alphas	1993-94 Alphas	15	2.978**	-0.088	-0.068
	1996 Alphas	1994-95 Alphas	22	0.308	0.123*	0.052
	1997 Alphas	1995-96 Alphas	33	-0.293	0.393**	0.175
	1998 Alphas	1996-97 Alphas	52	-0.466	0.036	-0.020
Short-sell Funds	1992 Alphas	1990-91 Alphas	9	-0.995*	1.156**	0.517
	1993 Alphas	1991-92 Alphas	10	-2.150**	-0.025	-0.124
	1994 Alphas	1992-93 Alphas	14	-0.373	0.151	0.002
	1995 Alphas	1993-94 Alphas	17	1.601	0.931*	0.247
	1996 Alphas	1994-95 Alphas	12	1.890**	0.163	-0.078
	1997 Alphas	1995-96 Alphas	12	0.448	0.860**	0.389
	1998 Alphas	1996-97 Alphas	13	4.325**	-0.073	-0.088

* Significant at the 10% level.
** Significant at the 5% level.

Table 28C
Cross-section Regressions for Performance Persistence of Hedge Funds:
Two Year Alphas on Two Year Alphas
Future Six-Factor Alphas = a + b * Past Six-Factor Alphas + e

	Dependent Variable	Independent Variable	# of Obs.	a	b	Adjusted R^2
All Hedge Funds	1992-93 Alphas	1990-91 Alphas	260	0.867**	0.171**	0.043
	1993-94 Alphas	1991-92 Alphas	368	0.556**	0.139**	0.036
	1994-95 Alphas	1992-93 Alphas	544	-0.029	-0.094**	0.014
	1995-96 Alphas	1993-94 Alphas	775	0.279**	-0.082**	0.005
	1996-97 Alphas	1994-95 Alphas	923	0.277**	0.132**	0.019
	1997-98 Alphas	1995-96 Alphas	1087	0.004	0.193**	0.035
Funds of Funds	1992-93 Alphas	1990-91 Alphas	53	0.666**	0.476**	0.247
	1993-94 Alphas	1991-92 Alphas	78	0.343**	0.326**	0.257
	1994-95 Alphas	1992-93 Alphas	113	-0.484**	-0.006	-0.009
	1995-96 Alphas	1993-94 Alphas	175	0.044	-0.029	-0.005
	1996-97 Alphas	1994-95 Alphas	218	0.269**	0.101*	0.007
	1997-98 Alphas	1995-96 Alphas	246	0.183**	0.284**	0.074
Event Driven Funds	1992-93 Alphas	1990-91 Alphas	30	0.418**	0.389**	0.410
	1993-94 Alphas	1991-92 Alphas	31	0.780**	0.108*	0.060
	1994-95 Alphas	1992-93 Alphas	49	-0.033	0.081	0.010
	1995-96 Alphas	1993-94 Alphas	61	0.822**	-0.324**	0.057
	1996-97 Alphas	1994-95 Alphas	87	0.532**	0.016	-0.011
	1997-98 Alphas	1995-96 Alphas	110	0.437**	0.026*	0.049
Global Macro Funds	1992-93 Alphas	1990-91 Alphas	29	0.972**	0.487**	0.364
	1993-94 Alphas	1991-92 Alphas	42	0.323*	0.270**	0.135
	1994-95 Alphas	1992-93 Alphas	67	0.183	-0.182	0.013
	1995-96 Alphas	1993-94 Alphas	80	-0.454**	0.077*	0.059
	1996-97 Alphas	1994-95 Alphas	68	-0.338*	-0.066	-0.011
	1997-98 Alphas	1995-96 Alphas	64	-0.189	0.146*	0.047
Global Funds	1992-93 Alphas	1990-91 Alphas	104	1.144**	0.047	-0.006
	1993-94 Alphas	1991-92 Alphas	141	0.883**	0.035	-0.005
	1994-95 Alphas	1992-93 Alphas	193	0.106	-0.196**	0.071
	1995-96 Alphas	1993-94 Alphas	283	0.338**	-0.131**	0.015
	1996-97 Alphas	1994-95 Alphas	350	0.126	0.075	0.002
	1997-98 Alphas	1995-96 Alphas	423	-0.332**	0.203**	0.033
Long-only Funds	1993-94 Alphas	1991-92 Alphas	3	0.228	0.082	0.053
	1994-95 Alphas	1992-93 Alphas	6	-0.676	0.270	0.162
	1995-96 Alphas	1993-94 Alphas	7	1.328**	-0.260	-0.047
	1996-97 Alphas	1994-95 Alphas	10	0.377	0.381	0.181
	1997-98 Alphas	1995-96 Alphas	13	-1.255**	0.650**	0.318

	Dependent Variable	Independent Variable	# of Obs.	a	b	Adjusted R^2
Mkt. Neutral Funds	1992-93 Alphas	1990-91 Alphas	32	0.420**	0.072	-0.017
	1993-94 Alphas	1991-92 Alphas	58	0.151*	0.528**	0.345
	1994-95 Alphas	1992-93 Alphas	93	-0.034	0.104*	0.006
	1995-96 Alphas	1993-94 Alphas	137	0.610**	-0.041	-0.005
	1996-97 Alphas	1994-95 Alphas	156	0.553**	0.214**	0.127
	1997-98 Alphas	1995-96 Alphas	186	0.408**	0.139**	0.016
Sector-Specific Funds	1993-94 Alphas	1991-92 Alphas	5	0.156	0.178	0.432
	1994-95 Alphas	1992-93 Alphas	9	0.089	0.159*	0.041
	1995-96 Alphas	1993-94 Alphas	15	0.999**	-0.334*	0.156
	1996-97 Alphas	1994-95 Alphas	22	0.837**	0.015*	0.050
	1997-98 Alphas	1995-96 Alphas	33	0.172	0.045	-0.028
Short-sell Funds	1992-93 Alphas	1990-91 Alphas	9	-0.968**	0.804**	0.424
	1993-94 Alphas	1991-92 Alphas	10	-0.812*	0.022	-0.123
	1994-95 Alphas	1992-93 Alphas	14	0.785**	0.185	0.013
	1995-96 Alphas	1993-94 Alphas	17	0.824	0.630*	0.325
	1996-97 Alphas	1994-95 Alphas	12	1.544**	0.305*	0.401
	1997-98 Alphas	1995-96 Alphas	12	1.211**	0.290	-0.004

* Significant at the 10% level.
** Significant at the 5% level.

Table 29
Persistence in Performance of Managed Futures Funds: Raw Returns

		Quintile Sorted Portfolios by Past 12 Month Returns						Subsequent Month Mean Return Differences			
		(1)	(2)	(3)	(4)	(5)		(1) - (5)	(1) - (4)	(2) - (5)	(2) - (4)
Public Funds	Mean of Past 12 Month Returns	2.672	1.126	0.509	-0.089	-1.392					
(1990:01-1998:08)	Mean of Subsequent Month Returns	0.819	0.655	0.479	0.412	0.228		0.592**	0.408**	0.427**	0.243**
							t-statistic	(2.304)	(1.979)	(2.112)	(1.732)
Private Pools	Mean of Past 12 Month Returns	3.237	1.525	0.815	0.140	-1.605					
(1990:01-1998:08)	Mean of Subsequent Month Returns	1.037	0.797	0.685	0.845	0.360		0.677**	0.192	0.437**	-0.048
							t-statistic	(2.190)	(0.702)	(1.937)	(-0.291)
All CTAs	Mean of Past 12 Month Returns	4.168	1.816	0.949	0.173	-1.433					
(1990:01-1998:08)	Mean of Subsequent Month Returns	1.042	0.929	0.904	0.857	0.918		0.124	0.185	0.011	0.072
							t-statistic	(0.473)	(1.005)	(0.045)	(0.497)
Currency CTAs	Mean of Past 12 Month Returns	3.865	1.875	1.047	0.340	-1.031					
(1990:01-1998:08)	Mean of Subsequent Month Returns	1.437	0.738	0.990	1.123	1.036		0.401	0.314	-0.298	-0.385
							t-statistic	(0.969)	(0.776)	(-0.827)	(-1.181)
Agriculture CTAs	Mean of Past 12 Month Returns	5.398	1.665	0.701	-0.091	-1.789					
(1992:01-1998:08)	Mean of Subsequent Month Returns	0.772	0.939	1.342	0.859	1.614		-0.842	-0.087	-0.675	0.080
							t-statistic	(-0.752)	(-0.083)	(-0.764)	(0.104)
Diversified CTAs	Mean of Past 12 Month Returns	4.117	1.811	0.941	0.130	-1.504					
(1990:01-1998:08)	Mean of Subsequent Month Returns	1.040	0.907	1.002	0.825	0.848		0.192	0.216	0.059	0.082
							t-statistic	(0.676)	(0.840)	(0.283)	(0.446)
Financial CTAs	Mean of Past 12 Month Returns	3.873	1.910	1.142	0.429	-0.940					
(1990:01-1998:08)	Mean of Subsequent Month Returns	1.086	1.088	1.157	0.973	0.818		0.268	0.112	0.270	0.115
							t-statistic	(0.774)	(0.361)	(0.914)	(0.538)
Stock CTAs	Mean of Past 12 Month Returns	3.366	1.658	0.929	0.390	-0.985					
(1990:01-1998:08)	Mean of Subsequent Month Returns	0.686	0.639	0.594	0.617	0.942		-0.256	0.069	-0.303	0.022
							t-statistic	(-0.508)	(0.139)	(-0.506)	(0.056)
Energy CTAs	Mean of Past 12 Month Returns	5.292	2.055	0.839	0.135	-1.025					
(1990:01-1993:12)	Mean of Subsequent Month Returns	1.135	1.052	0.878	1.013	-0.189		1.324*	0.122	1.241**	0.039
							t-statistic	(1.474)	(0.136)	(1.805)	(0.052)

For the period 1990.01-1998.08, t critical values at 5% and 10% level are 1.660 and 1.290, respectively
For the period 1992.01-1998.08, t critical values at 5% and 10% level are 1.664 and 1.292, respectively
For the period 1992.01-1993.12, t critical values at 5% and 10% level are 1.680 and 1.301, respectively

Table 30A
Persistence in Performance of Managed Futures Funds: Seven-Factor Risk-adjusted Excess Returns
Selection Period: 1 Year; Performance Period: 1 Year

		Quintile Sorted Portfolios by Past Year's Alphas						Following Year's Alpha Differences			
		(1)	(2)	(3)	(4)	(5)		(1) – (5)	(1) – (4)	(2) – (5)	(2) – (4)
Public Funds	Mean of Past Year's Alphas	1.589	-0.218	-0.941	-1.677	-3.561					
(1985 – 1998)	Mean of Following Year's Alphas	-0.165	-0.490	-0.713	-0.735	-0.938		0.772**	0.569**	0.448*	0.245*
							t-statistic	(2.459)	(2.617)	(1.677)	(1.409)
Private Pools	Mean of Past Year's Alphas	2.973	0.832	-0.198	-1.192	-3.379					
(1985 – 1998)	Mean of Following Year's Alphas	0.763	0.308	0.259	0.327	-0.003		0.766**	0.436**	0.311	-0.018
							t-statistic	(2.724)	(2.439)	(1.121)	(-0.119)
All CTAs	Mean of Past Year's Alphas	4.222	1.744	0.325	-0.901	-3.119					
(1985 – 1998)	Mean of Following Year's Alphas	1.038	0.442	0.239	0.232	0.355		0.683**	0.806**	0.087	0.210*
							t-statistic	(1.901)	(2.681)	(0.289)	(1.753)
Currency CTAs	Mean of Past Year's Alphas	2.893	1.111	0.051	-0.870	-2.472					
(1985 – 1998)	Mean of Following Year's Alphas	0.369	0.199	-0.071	0.324	0.173		0.196	0.044	0.027	-0.125
							t-statistic	(0.483)	(0.100)	(0.082)	(-0.380)
Agriculture CTAs	Mean of Past Year's Alphas	3.746	1.437	0.526	-0.450	-1.997					
(1985 – 1998)	Mean of Following Year's Alphas	1.148	-0.141	0.448	0.285	0.994		0.154	0.863	-1.135	-0.426
							t-statistic	(0.194)	(1.051)	(-1.113)	(-0.604)
Diversified CTAs	Mean of Past Year's Alphas	4.067	1.466	0.181	-0.879	-2.967					
(1985 – 1998)	Mean of Following Year's Alphas	1.179	0.421	0.032	0.108	-0.014		1.193**	1.071**	0.435**	0.313**
							t-statistic	(3.988)	(3.227)	(2.187)	(2.682)
Financial CTAs	Mean of Past Year's Alphas	3.716	1.280	-0.001	-0.898	-2.782					
(1985 – 1998)	Mean of Following Year's Alphas	0.844	1.008	0.135	0.216	-0.109		0.953**	0.629*	1.116**	0.792**
							t-statistic	(3.978)	(1.564)	(2.690)	(2.294)
Stock CTAs	Mean of Past Year's Alphas	3.452	1.503	0.639	-0.073	-1.760					
(1987 – 1998)	Mean of Following Year's Alphas	0.323	0.215	-0.139	-0.134	-0.066		0.389	0.457	0.282	0.349
							t-statistic	(0.769)	(1.142)	(0.465)	(0.873)
Energy CTAs	Mean of Past Year's Alphas	3.787	1.905	0.864	-0.062	-1.666					
(1987 – 1998)	Mean of Following Year's Alphas	1.307	1.151	0.653	0.948	0.854		0.453	0.359	0.297	0.203
							t-statistic	(0.547)	(0.429)	(0.522)	(0.344)

For the period 1985-1998, t critical values at 5% and 10% level are 1.771 and 1.350, respectively
Excess returns (alphas) are monthly averages

Table 30B
Persistence in Performance of Managed Futures Funds: Seven-Factor Risk-adjusted Excess Returns
Selection Period: 2 Years; Performance Period: 1 Year

		Quintile Sorted Portfolios by Past 2 Years' Alphas						Following Year's Alpha Differences			
		(1)	(2)	(3)	(4)	(5)		(1) – (5)	(1) – (4)	(2) – (5)	(2) – (4)
Public Funds	Mean of Past 2 Years' Alphas	1.924	0.340	-0.291	-0.942	-2.601					
(1985 – 1998)	Mean of Following Year's Alphas	0.029	-0.296	-0.621	-0.627	-0.994		1.023**	0.656**	0.698**	0.331**
							t-statistic	(2.997)	(2.710)	(3.570)	(2.782)
Private Pools	Mean of Past 2 Years' Alphas	3.100	1.182	0.356	-0.441	-2.769					
(1985 – 1998)	Mean of Following Year's Alphas	0.837	0.267	0.321	0.227	-0.070		0.907**	0.610**	0.338	0.041
							t-statistic	(4.387)	(2.663)	(1.175)	(0.223)
All CTAs	Mean of Past 2 Years' Alphas	4.302	1.959	0.796	-0.136	-2.040					
(1985 – 1998)	Mean of Following Year's Alphas	1.080	0.568	0.328	0.246	0.346		0.734**	0.834**	0.221	0.322**
							t-statistic	(3.344)	(3.261)	(1.293)	(2.211)
Currency CTAs	Mean of Past 2 Years' Alphas	3.531	1.270	0.477	-0.315	-2.065					
(1985 – 1998)	Mean of Following Year's Alphas	0.055	0.514	0.232	0.153	-0.057		0.112	-0.098	0.570**	0.361
							t-statistic	(0.278)	(-0.266)	(2.015)	(0.956)
Agriculture CTAs	Mean of Past 2 Years' Alphas	4.286	1.961	0.742	0.004	-1.195					
(1985 – 1998)	Mean of Following Year's Alphas	1.237	-0.088	0.584	0.395	0.284		0.953*	0.842*	-0.372	-0.483
							t-statistic	(1.539)	(1.401)	(-0.870)	(-1.087)
Diversified CTAs	Mean of Past 2 Years' Alphas	4.259	1.907	0.771	-0.116	-2.074					
(1985 – 1998)	Mean of Following Year's Alphas	1.317	0.798	0.540	0.191	0.281		1.036**	1.126**	0.517**	0.608**
							t-statistic	(3.759)	(4.124)	(2.856)	(4.417)
Financial CTAs	Mean of Past 2 Years' Alphas	3.999	1.897	0.878	-0.015	-1.919					
(1985 – 1998)	Mean of Following Year's Alphas	1.111	0.457	0.534	0.411	0.222		0.889**	0.700**	0.235	0.046
							t-statistic	(3.242)	(2.876)	(0.856)	(0.186)
Stock CTAs	Mean of Past 2 Years' Alphas	4.058	2.093	1.222	0.637	-0.885					
(1986 – 1998)	Mean of Following Year's Alphas	0.399	0.026	-0.378	-0.098	-0.026		0.424	0.496*	0.052	0.124
							t-statistic	(0.814)	(1.655)	(0.080)	(0.274)
Energy CTAs	Mean of Past 2 Years' Alphas	4.426	2.389	1.195	0.305	-1.723					
(1986 – 1998)	Mean of Following Year's Alphas	1.883	0.352	1.086	0.764	0.468		1.415**	1.120**	-0.116	-0.411
							t-statistic	(1.942)	(1.936)	(-0.150)	(-1.226)

For the period 1985-1998, t critical values at 5% and 10% level are 1.782 and 1.356, respectively
Excess returns (alphas) are monthly averages

Table 30C
Persistence in Performance of Managed Futures Funds: Seven-Factor Risk-adjusted Excess Returns
Selection Period: 2 Years; Performance Period: 2 Years

		Quintile Sorted Portfolios by Past 2 Years' Alphas						Following 2 Years' Alpha Differences			
		(1)	(2)	(3)	(4)	(5)		(1) – (5)	(1) – (4)	(2) – (5)	(2) – (4)
Public Funds	Mean of Past 2 Years' Alphas	1.994	0.372	-0.268	-0.934	-2.605					
(1985 – 1998)	Mean of Following 2 Years' Alphas	0.055	-0.152	-0.492	-0.471	-0.844		0.899**	0.526**	0.692**	0.319**
							t-statistic	(3.765)	(3.087)	(4.390)	(2.699)
Private Pools	Mean of Past 2 Years' Alphas	3.248	1.289	0.438	-0.384	-2.770					
(1985 – 1998)	Mean of Following 2 Years' Alphas	0.358	0.022	-0.035	-0.152	-0.565		0.923**	0.510**	0.587**	0.174
							t-statistic	(4.280)	(2.879)	(2.375)	(1.050)
All CTAs	Mean of Past 2 Years' Alphas	4.489	2.116	0.910	-0.051	-1.981					
(1985 – 1998)	Mean of Following 2 Years' Alphas	1.034	0.478	0.206	0.128	0.176		0.858**	0.906**	0.302**	0.350**
							t-statistic	(4.488)	(4.570)	(2.668)	(3.613)
Currency CTAs	Mean of Past 2 Years' Alphas	3.704	1.381	0.565	-0.250	-2.068					
(1985 – 1998)	Mean of Following 2 Years' Alphas	0.677	0.771	0.694	0.444	0.273		0.404	0.233	0.498*	0.327
							t-statistic	(1.326)	(0.964)	(1.744)	(0.801)
Agriculture CTAs	Mean of Past 2 Years' Alphas	4.409	2.128	0.851	0.110	-1.072					
(1985 – 1998)	Mean of Following 2 Years' Alphas	1.358	-0.046	0.306	0.271	-0.390		1.748**	1.087*	0.344	-0.317
							t-statistic	(2.881)	(1.695)	(0.858)	(-0.691)
Diversified CTAs	Mean of Past 2 Years' Alphas	4.450	2.062	0.883	-0.025	-2.015					
(1985 – 1998)	Mean of Following 2 Years' Alphas	0.992	0.483	0.208	-0.036	0.084		0.908**	1.028**	0.399**	0.518**
							t-statistic	(4.444)	(4.633)	(3.430)	(5.522)
Financial CTAs	Mean of Past 2 Years' Alphas	4.186	2.049	0.998	0.071	-1.831					
(1985 – 1998)	Mean of Following 2 Years' Alphas	1.191	0.449	0.626	0.486	0.112		1.080**	0.705**	0.338*	-0.037
							t-statistic	(3.485)	(3.539)	(1.598)	(-0.169)
Stock CTAs	Mean of Past 2 Years' Alphas	4.183	2.253	1.402	0.834	-0.693					
(1986 – 1998)	Mean of Following 2 Years' Alphas	0.394	0.411	0.210	-0.173	0.426		-0.032	0.567*	-0.015	0.585*
							t-statistic	(-0.083)	(1.568)	(-0.031)	(1.574)
Energy CTAs	Mean of Past 2 Years' Alphas	4.440	2.412	1.173	0.284	-1.538					
(1986 – 1998)	Mean of Following 2 Years' Alphas	1.814	0.341	0.179	0.157	-0.028		1.841**	1.657**	0.369	0.184
							t-statistic	(3.381)	(2.333)	(0.399)	(0.606)

For the period 1985-1998, t critical values at 5% and 10% level are 1.796 and 1.363, respectively
Excess returns (alphas) are monthly averages

Table 31A
Cross-section Regressions for Performance Persistence of Managed Futures Funds: One Year Alphas on One Year Alphas
Future Seven-Factor Alphas = a + b * Past Seven-Factor Alphas + e

	Dependent Variable	Independent Variable	# of Obs.	a	b	Adjusted R^2
Public Funds	1986 Alphas	1985 Alphas	81	-1.968**	0.099	-0.004
	1987 Alphas	1986 Alphas	103	0.694**	0.270**	0.074
	1988 Alphas	1987 Alphas	129	-0.767**	-0.049	-0.003
	1989 Alphas	1988 Alphas	155	-3.858**	-0.195**	0.027
	1990 Alphas	1989 Alphas	206	2.155**	0.161**	0.021
	1991 Alphas	1990 Alphas	235	-3.874**	0.148**	0.020
	1992 Alphas	1991 Alphas	270	0.689**	0.035	-0.002
	1993 Alphas	1992 Alphas	301	-0.371**	0.107*	0.006
	1994 Alphas	1993 Alphas	341	-2.000**	0.128**	0.030
	1995 Alphas	1994 Alphas	384	0.127	-0.071	0.001
	1996 Alphas	1995 Alphas	362	-.392**	0.427**	0.186
	1997 Alphas	1996 Alphas	346	-0.520**	0.422**	0.118
	1998 Alphas	1997 Alphas	307	3.282**	0.719**	0.227
Private Pools	1986 Alphas	1985 Alphas	54	0.364	0.068	-0.015
	1987 Alphas	1986 Alphas	77	2.357**	0.030	-0.012
	1988 Alphas	1987 Alphas	114	0.371	-0.156*	0.023
	1989 Alphas	1988 Alphas	141	-1.686**	0.056	-0.001
	1990 Alphas	1989 Alphas	167	2.356**	0.444**	0.127
	1991 Alphas	1990 Alphas	188	-3.858**	0.110*	0.010
	1992 Alphas	1991 Alphas	209	1.458**	0.302**	0.072
	1993 Alphas	1992 Alphas	211	-0.074	-0.042	-0.004
	1994 Alphas	1993 Alphas	231	-1.674**	0.138*	0.011
	1995 Alphas	1994 Alphas	200	0.789**	-0.058	-0.002
	1996 Alphas	1995 Alphas	201	-0.031	0.154**	0.017
	1997 Alphas	1996 Alphas	190	-0.496**	0.150*	0.054
	1998 Alphas	1997 Alphas	177	6.404**	0.481**	0.098
All CTAs	1986 Alphas	1985 Alphas	136	-0.812**	0.307**	0.065
	1987 Alphas	1986 Alphas	179	2.288**	0.219**	0.059
	1988 Alphas	1987 Alphas	215	0.987**	0.025	-0.004
	1989 Alphas	1988 Alphas	258	-1.174**	0.130**	0.017
	1990 Alphas	1989 Alphas	316	1.554**	0.113**	0.010
	1991 Alphas	1990 Alphas	371	-0.783**	-0.244**	0.062
	1992 Alphas	1991 Alphas	460	1.102**	0.058*	0.005
	1993 Alphas	1992 Alphas	535	0.093	-0.007	-0.002
	1994 Alphas	1993 Alphas	582	-1.208**	0.091*	0.005
	1995 Alphas	1994 Alphas	597	-1.031**	-0.050	0.001
	1996 Alphas	1995 Alphas	574	-0.285**	0.175**	0.037
	1997 Alphas	1996 Alphas	514	-0.110	0.180**	0.029
	1998 Alphas	1997 Alphas	432	2.829**	0.312**	0.015
CTAs-CUR	1986 Alphas	1985 Alphas	3	-5.774	0.408	-0.006
	1987 Alphas	1986 Alphas	10	0.584	-0.098	-0.110
	1988 Alphas	1987 Alphas	15	3.310**	-0.187	-0.028
	1989 Alphas	1988 Alphas	22	0.638	-0.421**	0.198
	1990 Alphas	1989 Alphas	31	-2.823**	0.089	-0.026
	1991 Alphas	1990 Alphas	50	1.768**	0.020	-0.021
	1992 Alphas	1991 Alphas	70	1.858**	0.324**	0.141
	1993 Alphas	1992 Alphas	88	0.024	-0.065	-0.007
	1994 Alphas	1993 Alphas	95	-0.866**	0.374**	0.153
	1995 Alphas	1994 Alphas	101	1.781**	-0.064	-0.007
	1996 Alphas	1995 Alphas	89	-0.153	-0.007	-0.011
	1997 Alphas	1996 Alphas	81	-0.780**	0.167	0.014
	1998 Alphas	1997 Alphas	66	-1.578**	0.229*	0.032

			# of Obs.	a	b	Adj. R^2
CTAs-AG	1986 Alphas	1985 Alphas	5	1.810	-0.167	-0.287
	1987 Alphas	1986 Alphas	6	1.235	0.271	-0.196
	1988 Alphas	1987 Alphas	7	1.398	0.421	0.228
	1989 Alphas	1988 Alphas	9	0.402	0.052	-0.138
	1990 Alphas	1989 Alphas	10	0.133	-0.037	-0.124
	1991 Alphas	1990 Alphas	12	0.895	-0.503	0.125
	1992 Alphas	1991 Alphas	17	0.304	-0.285	0.069
	1993 Alphas	1992 Alphas	23	-0.027	-0.018	-0.047
	1994 Alphas	1993 Alphas	25	-1.188*	0.219	-0.018
	1995 Alphas	1994 Alphas	29	0.991**	0.165	0.028
	1996 Alphas	1995 Alphas	25	1.446**	0.351**	0.177
	1997 Alphas	1996 Alphas	21	-0.830*	-0.399**	0.180
	1998 Alphas	1997 Alphas	22	-1.940**	-1.173**	0.444
CTAs-DIV	1986 Alphas	1985 Alphas	110	-1.241**	0.444**	0.105
	1987 Alphas	1986 Alphas	140	2.351**	0.215**	0.057
	1988 Alphas	1987 Alphas	157	0.568*	0.108	0.005
	1989 Alphas	1988 Alphas	179	-1.718**	0.190**	0.046
	1990 Alphas	1989 Alphas	201	2.322**	0.160**	0.031
	1991 Alphas	1990 Alphas	211	-3.206**	0.149**	0.026
	1992 Alphas	1991 Alphas	241	1.729**	0.167**	0.036
	1993 Alphas	1992 Alphas	265	0.056	0.003	-0.004
	1994 Alphas	1993 Alphas	283	-1.531**	-0.026	-0.003
	1995 Alphas	1994 Alphas	293	1.562**	0.047	-0.002
	1996 Alphas	1995 Alphas	285	-0.456**	0.184**	0.040
	1997 Alphas	1996 Alphas	261	-0.075	0.267**	0.072
	1998 Alphas	1997 Alphas	225	5.960**	0.536**	0.072
CTAs-FIN	1986 Alphas	1985 Alphas	13	-1.519*	0.124	-0.057
	1987 Alphas	1986 Alphas	18	3.318**	0.625**	0.208
	1988 Alphas	1987 Alphas	25	0.045	0.032	-0.040
	1989 Alphas	1988 Alphas	29	0.863*	0.196*	0.068
	1990 Alphas	1989 Alphas	44	0.947*	0.130	-0.009
	1991 Alphas	1990 Alphas	57	1.241**	1.174*	0.033
	1992 Alphas	1991 Alphas	85	-0.272	0.192**	0.050
	1993 Alphas	1992 Alphas	107	0.444**	-0.044	-0.007
	1994 Alphas	1993 Alphas	119	-1.284**	0.209*	0.021
	1995 Alphas	1994 Alphas	118	-0.259	-0.253**	0.050
	1996 Alphas	1995 Alphas	117	-0.294	0.284**	0.087
	1997 Alphas	1996 Alphas	104	1.046**	0.199**	0.040
	1998 Alphas	1997 Alphas	82	0.523**	0.204*	0.029
CTAs-STX	1988 Alphas	1987 Alphas	5	2.611	-0.606	-0.034
	1989 Alphas	1988 Alphas	7	2.668**	-0.503	-0.006
	1990 Alphas	1989 Alphas	11	2.576**	-0.343*	0.287
	1991 Alphas	1990 Alphas	18	-1.024	-0.013	-0.062
	1992 Alphas	1991 Alphas	24	0.810**	0.122*	0.083
	1993 Alphas	1992 Alphas	32	0.401	0.192	-0.008
	1994 Alphas	1993 Alphas	43	0.110	0.229	0.035
	1995 Alphas	1994 Alphas	43	-0.073	-0.292	0.026
	1996 Alphas	1995 Alphas	47	-0.461*	0.078	-0.011
	1997 Alphas	1996 Alphas	39	-1.087**	0.220	-0.002
	1998 Alphas	1997 Alphas	32	-1.826**	0.384*	0.085
CTAs-EN	1988 Alphas	1987 Alphas	6	4.264**	0.214	-0.045
	1989 Alphas	1988 Alphas	12	-9.655**	1.901**	0.266
	1990 Alphas	1989 Alphas	19	3.128**	0.200*	0.102
	1991 Alphas	1990 Alphas	23	1.531*	-0.135	-0.031
	1992 Alphas	1991 Alphas	23	-1.090**	0.449**	0.183
	1993 Alphas	1992 Alphas	20	-0.865*	0.468	0.076
	1994 Alphas	1993 Alphas	17	-0.623	0.099	-0.053
	1995 Alphas	1994 Alphas	13	0.677	0.442	0.030
	1996 Alphas	1995 Alphas	11	2.693*	-0.728	-0.017
	1997 Alphas	1996 Alphas	8	0.370	-0.139	-0.129
	1998 Alphas	1997 Alphas	5	4.525**	-1.179**	0.701

* Significant at the 10% level. ; ** Significant at the 5% level.

Table 31B
Cross-section Regressions for Performance Persistence of Managed Futures Funds: One Year Alphas on Two Year Alphas
Future Seven-Factor Alphas = a + b * Past Seven-Factor Alphas + e

	Dependent Variable	Independent Variable	# of Obs.	a	b	Adjusted R^2
Public Funds	1987 Alphas	1985-86 Alphas	103	0.442**	0.449**	0.154
	1988 Alphas	1986-87 Alphas	129	-0.798**	-0.108	0.012
	1989 Alphas	1987-88 Alphas	153	-3.727**	-0.251**	0.049
	1990 Alphas	1988-89 Alphas	206	2.081**	0.256**	0.035
	1991 Alphas	1989-90 Alphas	235	-3.576**	0.233**	0.046
	1992 Alphas	1990-91 Alphas	270	0.616**	-0.053	0.001
	1993 Alphas	1991-92 Alphas	301	-0.568**	0.234**	0.034
	1994 Alphas	1992-93 Alphas	341	-2.146**	0.335**	0.062
	1995 Alphas	1993-94 Alphas	384	0.346**	0.103	0.003
	1996 Alphas	1994-95 Alphas	362	-0.220**	0.417**	0.101
	1997 Alphas	1995-96 Alphas	346	-0.506**	0.420**	0.108
	1998 Alphas	1996-97 Alphas	307	3.424**	0.767**	0.165
Private Pools	1987 Alphas	1985-86 Alphas	77	2.274**	0.078	-0.006
	1988 Alphas	1986-87 Alphas	113	0.123	-0.023	-0.008
	1989 Alphas	1987-88 Alphas	141	-1.788**	0.088	0.005
	1990 Alphas	1988-89 Alphas	166	1.964**	0.288**	0.054
	1991 Alphas	1989-90 Alphas	188	-3.817**	0.221**	0.046
	1992 Alphas	1990-91 Alphas	209	0.080	0.203**	0.031
	1993 Alphas	1991-92 Alphas	211	-0.023	-0.088	-0.001
	1994 Alphas	1992-93 Alphas	231	-1.725**	0.153*	0.027
	1995 Alphas	1993-94 Alphas	200	0.886**	0.026	-0.004
	1996 Alphas	1994-95 Alphas	201	0.032	0.192**	0.018
	1997 Alphas	1995-96 Alphas	190	-0.487**	0.221**	0.025
	1998 Alphas	1996-97 Alphas	177	6.571**	0.638**	0.128
All CTAs	1987 Alphas	1985-86 Alphas	179	1.522**	0.366**	0.113
	1988 Alphas	1986-87 Alphas	215	1.019**	0.010	-0.005
	1989 Alphas	1987-88 Alphas	258	-1.602**	0.226**	0.038
	1990 Alphas	1988-89 Alphas	317	1.483**	0.019	-0.003
	1991 Alphas	1989-90 Alphas	372	-1.175**	0.080*	0.032
	1992 Alphas	1990-91 Alphas	461	0.643**	0.202**	0.043
	1993 Alphas	1991-92 Alphas	536	0.057	0.018	-0.002
	1994 Alphas	1992-93 Alphas	582	-1.305**	0.098*	0.004
	1995 Alphas	1993-94 Alphas	597	1.075**	-0.019	-0.001
	1996 Alphas	1994-95 Alphas	575	-0.155*	0.164**	0.022
	1997 Alphas	1995-96 Alphas	514	-0.134	0.160**	0.019
	1998 Alphas	1996-97 Alphas	432	2.902**	0.368**	0.016
CTAs-CUR	1987 Alphas	1985-86 Alphas	10	0.699	0.128	-0.102
	1988 Alphas	1986-87 Alphas	15	3.066**	-0.250	0.060
	1989 Alphas	1987-88 Alphas	22	-0.896	0.002	-0.050
	1990 Alphas	1988-89 Alphas	31	-2.792**	-0.125	-0.019
	1991 Alphas	1989-90 Alphas	50	1.531**	-0.255*	0.057
	1992 Alphas	1990-91 Alphas	70	2.043**	0.184*	0.032
	1993 Alphas	1991-92 Alphas	89	0.183	-0.147	0.019
	1994 Alphas	1992-93 Alphas	95	-1.381**	0.307**	0.075
	1995 Alphas	1993-94 Alphas	101	1.810**	0.038	-0.009
	1996 Alphas	1994-95 Alphas	89	-0.228	0.097	-0.004
	1997 Alphas	1995-96 Alphas	81	-0.910**	0.306**	0.060
	1998 Alphas	1996-97 Alphas	66	-1.661**	0.194	0.014

			# of Obs.	a	b	Adj. R^2
CTAs-AG	1987 Alphas	1985-86 Alphas	6	0.941	0.550	-0.001
	1988 Alphas	1986-87 Alphas	7	-0.280	0.784*	0.417
	1989 Alphas	1987-88 Alphas	9	0.343	0.069	-0.131
	1990 Alphas	1988-89 Alphas	10	0.700	-0.235	-0.067
	1991 Alphas	1989-90 Alphas	12	0.974	-0.590	0.022
	1992 Alphas	1990-91 Alphas	17	0.055	-0.176	-0.045
	1993 Alphas	1991-92 Alphas	23	-0.055	0.093	-0.038
	1994 Alphas	1992-93 Alphas	25	-1.838**	0.671**	0.190
	1995 Alphas	1993-94 Alphas	29	0.582	0.370**	0.208
	1996 Alphas	1994-95 Alphas	25	1.818**	0.299**	0.191
	1997 Alphas	1995-96 Alphas	21	-1.078**	-0.403**	0.350
	1998 Alphas	1996-97 Alphas	22	-0.740	-0.954**	0.222
CTAs-DIV	1987 Alphas	1985-86 Alphas	140	1.501**	0.380**	0.122
	1988 Alphas	1986-87 Alphas	157	0.429	0.170*	0.015
	1989 Alphas	1987-88 Alphas	179	-2.038**	0.198**	0.032
	1990 Alphas	1988-89 Alphas	201	2.186**	0.119*	0.014
	1991 Alphas	1989-90 Alphas	212	-3.041**	0.137**	0.020
	1992 Alphas	1990-91 Alphas	242	0.897**	0.175**	0.031
	1993 Alphas	1991-92 Alphas	265	-0.002	0.032	-0.003
	1994 Alphas	1992-93 Alphas	283	-1.516**	-0.018	-0.003
	1995 Alphas	1993-94 Alphas	293	1.517**	0.066	-0.001
	1996 Alphas	1994-95 Alphas	285	-0.322**	0.209**	0.034
	1997 Alphas	1995-96 Alphas	261	-0.145	0.270**	0.059
	1998 Alphas	1996-97 Alphas	225	6.070**	0.655**	0.095
CTAs-FIN	1987 Alphas	1985-86 Alphas	18	2.080**	0.394*	0.036
	1988 Alphas	1986-87 Alphas	25	0.063	0.021	-0.042
	1989 Alphas	1987-88 Alphas	29	0.722	0.091*	0.030
	1990 Alphas	1988-89 Alphas	44	1.008**	0.039	-0.023
	1991 Alphas	1989-90 Alphas	57	0.695*	0.282**	0.072
	1992 Alphas	1990-91 Alphas	85	-0.539**	0.312**	0.140
	1993 Alphas	1991-92 Alphas	107	0.413**	0.012	-0.009
	1994 Alphas	1992-93 Alphas	119	-1.541**	0.313**	0.050
	1995 Alphas	1993-94 Alphas	118	-0.039	-0.323**	0.051
	1996 Alphas	1994-95 Alphas	118	-0.199	0.103*	0.031
	1997 Alphas	1995-96 Alphas	104	1.055**	0.224**	0.053
	1998 Alphas	1996-97 Alphas	82	0.783**	0.121*	0.042
CTAs-STX	1988 Alphas	1986-87 Alphas	5	5.199	-1.115	0.313
	1989 Alphas	1987-88 Alphas	7	3.415	-0.165	-0.161
	1990 Alphas	1988-89 Alphas	12	2.176**	-0.195	0.108
	1991 Alphas	1989-90 Alphas	18	-1.323*	0.126	-0.046
	1992 Alphas	1990-91 Alphas	24	0.503**	0.159	0.073
	1993 Alphas	1991-92 Alphas	32	0.482	0.143	-0.001
	1994 Alphas	1992-93 Alphas	43	0.289	0.024	-0.024
	1995 Alphas	1993-94 Alphas	43	0.013	-0.312	0.035
	1996 Alphas	1994-95 Alphas	47	-0.452*	-0.005	-0.022
	1997 Alphas	1995-96 Alphas	39	-1.191**	0.219	-0.002
	1998 Alphas	1996-97 Alphas	32	-1.976**	0.589**	0.166
CTAs-EN	1988 Alphas	1986-87 Alphas	6	4.751**	-0.038	-0.237
	1989 Alphas	1987-88 Alphas	12	-6.540**	1.316**	0.447
	1990 Alphas	1988-89 Alphas	19	2.599**	0.253*	0.150
	1991 Alphas	1989-90 Alphas	23	2.058**	-0.260*	0.116
	1992 Alphas	1990-91 Alphas	23	-1.802**	0.388*	0.107
	1993 Alphas	1991-92 Alphas	20	-1.278**	0.320	0.066
	1994 Alphas	1992-93 Alphas	17	-0.707	0.040	-0.064
	1995 Alphas	1993-94 Alphas	13	0.851	0.598	0.023
	1996 Alphas	1994-95 Alphas	11	1.246	0.994	-0.021
	1997 Alphas	1995-96 Alphas	8	0.144	-0.054	-0.162
	1998 Alphas	1996-97 Alphas	5	2.977	-0.002	-0.333

* Significant at the 10% level.
** Significant at the 5% level.

Table 31C
Cross-section Regressions for Performance Persistence of Managed Futures Funds: Two Year Alphas on Two Year Alphas
Future Seven-Factor Alphas = a + b * Past Seven-Factor Alphas + e

	Dependent Variable	Independent Variable	# of Obs.	a	b	Adjusted R^2
Public Funds	1987-88 Alphas	1985-86 Alphas	101	0.590**	0.221**	0.054
	1988-89 Alphas	1986-87 Alphas	129	-1.892**	-0.076	0.009
	1989-90 Alphas	1987-88 Alphas	153	-0.368**	-0.106	0.010
	1990-91 Alphas	1988-89 Alphas	206	1.547**	0.353**	0.100
	1991-92 Alphas	1989-90 Alphas	235	0.939**	0.149**	0.025
	1992-93 Alphas	1990-91 Alphas	270	0.164	0.044	-0.001
	1993-94 Alphas	1991-92 Alphas	301	-1.151**	0.217**	0.040
	1994-95 Alphas	1992-93 Alphas	341	-0.681**	0.400**	0.101
	1995-96 Alphas	1993-94 Alphas	384	-0.788**	0.147**	0.011
	1996-97 Alphas	1994-95 Alphas	362	-0.614**	0.272**	0.049
	1997-98 Alphas	1995-96 Alphas	346	-1.005**	0.403**	0.072
Private Pools	1987-88 Alphas	1985-86 Alphas	77	1.658**	0.065*	0.007
	1988-89 Alphas	1986-87 Alphas	113	-1.069**	0.044	-0.006
	1989-90 Alphas	1987-88 Alphas	141	0.415**	0.039	-0.005
	1990-91 Alphas	1988-89 Alphas	166	1.106**	0.316**	0.079
	1991-92 Alphas	1989-90 Alphas	188	0.086	0.336**	0.081
	1992-93 Alphas	1990-91 Alphas	209	-0.041	0.208**	0.038
	1993-94 Alphas	1991-92 Alphas	211	-0.639**	-0.108	0.003
	1994-95 Alphas	1992-93 Alphas	231	-0.355**	0.213**	0.020
	1995-96 Alphas	1993-94 Alphas	200	-0.611**	0.130*	0.009
	1996-97 Alphas	1994-95 Alphas	201	-0.561**	0.174**	0.024
	1997-98 Alphas	1995-96 Alphas	190	-0.914**	0.313**	0.057
All CTAs	1987-88 Alphas	1985-86 Alphas	179	1.851**	0.305**	0.132
	1988-89 Alphas	1986-87 Alphas	215	-0.645**	0.143**	0.024
	1989-90 Alphas	1987-88 Alphas	259	0.420**	0.227**	0.053
	1990-91 Alphas	1988-89 Alphas	318	1.444**	0.061	0.003
	1991-92 Alphas	1989-90 Alphas	373	1.220**	0.017	-0.002
	1992-93 Alphas	1990-91 Alphas	462	0.454**	0.201**	0.059
	1993-94 Alphas	1991-92 Alphas	536	-0.357**	0.014	-0.002
	1994-95 Alphas	1992-93 Alphas	582	-0.109	0.068	0.002
	1995-96 Alphas	1993-94 Alphas	598	-0.598**	0.086*	0.004
	1996-97 Alphas	1994-95 Alphas	575	-0.447**	0.123**	0.015
	1997-98 Alphas	1995-96 Alphas	514	-0.787**	0.209**	0.040
CTAs-CUR	1987-88 Alphas	1985-86 Alphas	10	2.552**	0.025	-0.123
	1988-89 Alphas	1986-87 Alphas	15	1.526**	0.087	-0.040
	1989-90 Alphas	1987-88 Alphas	22	-0.432	0.089	-0.041
	1990-91 Alphas	1988-89 Alphas	31	1.814**	-0.061	-0.030
	1991-92 Alphas	1989-90 Alphas	50	1.887**	-0.065	-0.015
	1992-93 Alphas	1990-91 Alphas	71	1.181**	0.120	0.010
	1993-94 Alphas	1991-92 Alphas	89	-0.443**	-0.021	-0.011
	1994-95 Alphas	1992-93 Alphas	95	-0.875**	0.329**	0.090
	1995-96 Alphas	1993-94 Alphas	101	-0.273	0.033	-0.009
	1996-97 Alphas	1994-95 Alphas	89	-0.275*	0.011	-0.011
	1997-98 Alphas	1995-96 Alphas	81	-1.078**	0.248**	0.044

			# of Obs.	a	b	Adj. R^2
CTAs-AG	1987-88 Alphas	1985-86 Alphas	6	0.982	0.475	0.084
	1988-89 Alphas	1986-87 Alphas	7	-0.824	0.858**	0.623
	1989-90 Alphas	1987-88 Alphas	9	0.749	-0.133	-0.088
	1990-91 Alphas	1988-89 Alphas	10	0.482	-0.236	0.073
	1991-92 Alphas	1989-90 Alphas	12	-0.538	0.007	-0.100
	1992-93 Alphas	1990-91 Alphas	17	-0.118	0.012*	0.067
	1993-94 Alphas	1991-92 Alphas	23	0.526**	0.491**	0.281
	1994-95 Alphas	1992-93 Alphas	25	-0.729	0.692**	0.194
	1995-96 Alphas	1993-94 Alphas	29	0.492	0.399**	0.203
	1996-97 Alphas	1994-95 Alphas	25	-0.666**	0.337**	0.287
	1997-98 Alphas	1995-96 Alphas	21	-1.131**	0.054	-0.047
CTAs-DIV	1987-88 Alphas	1985-86 Alphas	140	1.683**	0.333**	0.148
	1988-89 Alphas	1986-87 Alphas	157	-1.362**	0.231**	0.058
	1989-90 Alphas	1987-88 Alphas	179	0.388	0.203**	0.043
	1990-91 Alphas	1988-89 Alphas	202	1.327**	0.090*	0.009
	1991-92 Alphas	1989-90 Alphas	213	1.219**	0.121**	0.018
	1992-93 Alphas	1990-91 Alphas	242	0.572**	0.168**	0.040
	1993-94 Alphas	1991-92 Alphas	265	-0.599**	0.049	-0.001
	1994-95 Alphas	1992-93 Alphas	283	0.281*	-0.047	-0.002
	1995-96 Alphas	1993-94 Alphas	293	-0.616**	0.146**	0.012
	1996-97 Alphas	1994-95 Alphas	285	-0.555**	0.155**	0.024
	1997-98 Alphas	1995-96 Alphas	261	-0.728**	0.259**	0.055
CTAs-FIN	1987-88 Alphas	1985-86 Alphas	18	2.338**	0.297	0.056
	1988-89 Alphas	1986-87 Alphas	25	0.379	0.031	-0.041
	1989-90 Alphas	1987-88 Alphas	29	1.284*	0.244*	0.052
	1990-91 Alphas	1988-89 Alphas	44	1.699**	0.177*	0.047
	1991-92 Alphas	1989-90 Alphas	57	0.548	0.234**	0.068
	1992-93 Alphas	1990-91 Alphas	85	0.181	0.368**	0.213
	1993-94 Alphas	1991-92 Alphas	107	-0.157	0.064	-0.001
	1994-95 Alphas	1992-93 Alphas	119	-0.563**	0.190**	0.030
	1995-96 Alphas	1993-94 Alphas	119	-1.057**	-0.265**	0.040
	1996-97 Alphas	1994-95 Alphas	118	-0.404**	0.160*	0.024
	1997-98 Alphas	1995-96 Alphas	104	-0.442**	0.134*	0.017
CTAs-STX	1988-89 Alphas	1986-87 Alphas	5	0.344	0.127	-0.315
	1989-90 Alphas	1987-88 Alphas	8	2.137**	-0.009	-0.165
	1990-91 Alphas	1988-89 Alphas	12	1.665**	-0.426**	0.515
	1991-92 Alphas	1989-90 Alphas	18	-0.108	0.277	0.050
	1992-93 Alphas	1990-91 Alphas	24	0.242	0.096	-0.018
	1993-94 Alphas	1991-92 Alphas	32	0.309	-0.220*	0.058
	1994-95 Alphas	1992-93 Alphas	43	0.173	-0.207	0.021
	1995-96 Alphas	1993-94 Alphas	43	-0.413	-0.394**	0.092
	1996-97 Alphas	1994-95 Alphas	47	-0.390	-0.002	-0.022
	1997-98 Alphas	1995-96 Alphas	39	-1.337**	0.157	-0.015
CTAs-EN	1988-89 Alphas	1986-87 Alphas	6	0.401	0.263	-0.191
	1989-90 Alphas	1987-88 Alphas	12	-0.722	0.864**	0.509
	1990-91 Alphas	1988-89 Alphas	19	2.558**	0.178	0.055
	1991-92 Alphas	1989-90 Alphas	23	0.628	-0.130	-0.009
	1992-93 Alphas	1990-91 Alphas	23	-2.037**	0.501*	0.117
	1993-94 Alphas	1991-92 Alphas	20	-1.174**	0.406*	0.122
	1994-95 Alphas	1992-93 Alphas	17	-0.139	0.029	-0.065
	1995-96 Alphas	1993-94 Alphas	13	-0.404	0.587*	0.252
	1996-97 Alphas	1994-95 Alphas	11	0.348	0.810*	0.214
	1997-98 Alphas	1995-96 Alphas	8	-0.019	0.520*	0.311

* Significant at the 10% level.
** Significant at the 5% level.

Appendix 1
The MAR Classification and Definitions of Hedge Fund Investment Styles

Investment Style	Description
Funds of Funds	Capital is allocated among a number of hedge funds, providing investors with access to managers they might not be able to invest on their own. *Diversified* – Allocate capital to a variety of fund types. *Niche* – Allocate capital to a specific type of fund.
Event-Driven	Investment theme is dominated by events that are seen as special situations or opportunities to capitalize from price fluctuations. *Distressed Securities* – Focus on securities of companies in reorganization and/or bankruptcy. *Risk Arbitrage* – Simultaneously buys stock in a company being acquired and sells stock in its acquirers.
Global Macro	Opportunistic funds that invest anywhere they see a value opportunity; attempt to take advantage of macro changes in global economies, particularly major interest rate shifts; and use leverage and derivatives to enhance positions.
Global	*International* – Focus on economic macro changes around the world (mostly outside of the US), tend to be stock-pickers in equity markets; use index derivatives, but to a lesser extent than macro managers. *Emerging* – Invest in less mature financial markets; because shorting is not permitted in many emerging markets, managers go to cash or other markets when valuations make being long equity unattractive. *Regional* – Focus on specific regions of the world, e.g. Asia, Europe, Latin America.
Long-only	Traditional equity funds, but structured as hedge funds, permitting extensive use of leverage and incentive fees.
Market-Neutral	Attempt to lock-out or neutralize market risk by being both long and short. Thus, with greatly reduced market risk, the emphasis is asset selection. *Long/short stock* – take long and short stock positions to eliminate or reduce exposure to market risk. *Convertible arbitrage* – Go long convertible securities and short underlying equities, profiting from mispricing in the relationship between the two. *Stock arbitrage* – Buy a basket of stocks and short stock index futures, or the reverse. *Fixed income arbitrage* – Buy bonds – often T-bonds – and short other instruments that replicate the purchased bonds, in terms of rate and maturity.
Sector	Stock funds that follow specific economic sectors and/or industries.
Short-sell	Short overvalued stocks in the hopes buying them back at a lower price.

Appendix 2
Prior Literature on Mutual Funds' and Hedge Funds' Excess Returns

Author	Analysis Period	Model	Results
Jensen (1968)	1945-1964	CAPM	Finds the annualized average α to be -1.1% per year for a broad sample of mutual funds. Treynor (1965), and Sharpe (1966) provide similar results.
Hendricks, Patel, and Zeckhauser (1993)	1974-1988	CAPM for different indices (VWCRSP, EW Mutual Fund Index, EWNYSE)	Find that most of the estimated individual fund α's are not significantly different from zero. The mean (median) of annualized individual fund alphas is -1.12% (-0.80%) per year, when VWCRSP is used as the market index. (VWCRSP: Value-weighted index of NYSE and AMEX stocks)
Elton, Gruber, Das, and Hlavka (1993)	1965-1984	3-Index Model (S&P 500, Small Stock Index, Bond Index)	Find the annualized average α to be -1.59% per year and statistically significant at the 1% level. More than 2/3 of the funds have negative alphas.
Goetzmann and Ibbotson (1994)	1976-1988	CAPM (S&P 500)	Find persistence in Jensen alphas (the paper does not report the magnitude of alphas, however it is probably not statistically different from zero).
Malkiel (1995)	1971-1991	CAPM (Use two different indices: S&P 500 and Wilshire 5000)	For the period 1971-91, finds that annualized mean alpha is -0.24% per year, which is indistinguishable from zero at the 10% level. For the 1982-1991 period, finds that mutual funds underperform the S&P 500 Index (i.e. had negative and statistically significant alphas: -3.20% annualized average excess return)
Brown and Goetzmann (1995)	1976-1988	1) CAPM(S&P 500) 2) 3-Index Model (S&P 500, Ibbotson Small Firm Index, and Government Bond Index)	Compute CAPM Jensen alphas for the octile portfolios and finds that the best performing octile portfolio has an annualized alpha of 4.64%. However, the annualized average alpha of the octile portfolios is found to be 0.36%, which is statistically not different from zero. The results from the 3-Index model are similar (magnitude of alphas are not reported for the 3-Index model).
Elton, Gruber, and Blake (1996)	1977-1993	4-Factor Model (S&P 500, SMB, HML, Bond Index)	Find that 1-year and 3-year average fund performance is negative: 3-year annualized average risk-adjusted return (α) is -0.91% per year and statistically significant at the 1% level; 1-year annualized average risk-adjusted return is -0.94% per year and statistically significant at the 5% level.
Carhart (1997)	1962-1993	4-Factor Model (S&P 500, SMB, HML, Risk factor related to momentum)	Finds that mutual funds do not earn significantly positive risk-adjusted returns. The annualized four-factor alphas computed for individual funds have an average of -1.57% per year.
Gruber (1996)	1985-1994	1) Absolute Excess Return over S&P 500 (R_t – S&P 500) 2) CAPM (S&P 500) 3) 4-Factor Model (S&P 500, SMB, HML, Bond Index)	Finds that mutual funds underperform the market by 1.94% per year in terms of unadjusted returns (absolute excess returns). Using the single-index (CAPM), the risk-adjusted return is estimated to be -1.56% per year. Four-factor model suggests that mutual funds underperform by 65 basis points per year.
Brown, Goetzmann, and Ibbotson (1999)	1989-1995	CAPM (S&P 500)	Using annual return data for offshore hedge funds, find positive excess returns for all categories of hedge funds, except for short-sellers.
Ackerman, McEnally, and Ravenscraft (1999)	1988-1995	CAPM (S&P 500) (More emphasize is given on Sharpe ratio)	Find that annualized Jensen alphas are significantly positive for hedge funds and range from 6 to 8 percent per year for different time periods, except for the period 1994-95. (Does not compute annualized alphas for different investment styles).

Appendix 3
An Alternative Multi-factor Model: Time-series Cross-section Pooled Regressions of Hedge Fund Returns by Hedge Fund Style
Period: 1990:01 – 1998:08

$$R_t - R_f = \alpha + b^*(S\&P500 - R_f) + h^*(HML) + s^*(SMB) + w^*(WML) + g^*(TERM) + k^*(DEF) + d^*(MSCI\ EAFE) + m^*(MARK) + p^*(POUND) + y^*(YEN) + e_t$$

	All Hedge Funds	Funds of Funds	Event-Driven Funds	Global Macro Funds	Global Funds	Long-only Funds	Mkt. Neutral Funds	Sector-Specific Funds	Short-sell Funds
Variables									
Constant	0.392**	0.187**	0.666**	0.381**	0.321**	0.311	0.548**	0.742**	0.475**
S&P500 - R_f	0.258**	0.157**	0.242**	0.186**	0.439**	0.874**	0.036**	0.641**	-0.839**
HML	-0.004	-0.031	-0.043	0.154**	-0.120**	-0.031	0.025	-0.023	0.389**
SMB	-0.349**	-0.260**	-0.380**	-0.218**	-0.539**	-0.886**	-0.078**	-0.890**	1.028**
WML	0.025**	0.058**	-0.026	0.065*	-0.015	-0.055	0.013	-0.107	-0.076
TERM	0.111**	0.137**	0.173**	0.094	0.078**	-0.065	0.153**	-0.159	0.288*
DEF	0.410**	0.390**	0.573**	-0.269	0.563**	-0.189	0.544**	-1.316**	0.713*
MSCI EAFE	0.061**	0.087**	0.041**	0.078**	0.081**	0.003	0.026**	-0.028	-0.073
MARK	0.142**	0.192**	0.059*	0.245**	0.169**	-0.017	0.045**	-0.014	-0.210**
POUND	0.006	-0.024*	0.030	0.080**	0.018	0.154	-0.010	-0.017	-0.136
YEN	0.019**	0.041	0.018	0.056*	-0.001	-0.028	0.011	0.105**	0.098
Total Panel Observations	70073	15719	6793	5690	26025	812	11885	1924	1225
Adj. R^2	0.108	0.156	0.117	0.067	0.166	0.353	0.029	0.273	0.281

R_t: Hedge Fund Returns ; R_f: 30 day T-bill rate.
HML: Returns on a portfolio of high book-to-market stocks minus portfolio of low book-to-market stocks
SMB: Returns on a portfolio of small stocks minus portfolio of large stocks.
WML: Returns on a portfolio of past year's winners minus portfolio of last year's losers.
TERM: Long-term government bond returns minus 30 day Treasury bill rate measured at the end of the previous month (LTGOVTB - $R_f(-1)$)
DEF: Long-term corporate bond returns minus the long-term government bond returns (LTCORPB – LTGOVTB)
MSCI EAFE Index: Morgan Stanley Capital International Europe-Asia-Far East Index
MARK: Monthly returns on Deutsche Mark.
POUND: Monthly returns on British Pound.
YEN: Monthly returns on Japanese Yen.
* Significant at the 10% level.
** Significant at the 5% level.

Appendix 4A
Alternative Excess Return Measures by Hedge Fund Style*
Period: 1990:01 – 1998:08

	Annualized 6-Factor Alpha	Annualized Sharpe Ratio	Annualized Absolute Excess Return**
All Hedge Funds	4.60%	0.76	8.83%
Funds of Funds	2.15%	0.67	5.85%
Event Driven Funds	7.93%	0.91	11.20%
Global Macro Funds	4.63%	0.52	10.98%
Global Funds	3.11%	0.54	9.74%
Long-only Funds	3.59%	0.46	17.05%
Market-Neutral Funds	6.53%	1.38	7.67%
Sector Funds	8.16%	0.67	16.36%
Short-sell Funds	5.54%	0.15	2.04%

*Different measures of excess returns reported for each style is the averages of individual funds' excess returns in that particular style
** Absolute Excess Return is the additional return over the risk-free rate ($R_i - R_f$).

Correlation Coefficients between Alternative Excess Return Measures of Hedge Funds
Period: 1990:01 – 1998:08

	6-Factor Alpha	Sharpe Ratio	Absolute Excess Return
6-Factor Alpha	1.00		
Sharpe Ratio	0.53**	1.00	
Absolute Excess Return	0.88**	0.56**	1.00

Test statistic: $t(n-2) = r / [(1 - r^2)/(n-2)]^{(0.5)}$
** Significant at the 1% level.

Appendix 4B
Alternative Excess Return Measures by CTA Style*
Period: 1985:01 – 1998:08

	Annualized 7-Factor Alpha	Annualized Sharpe Ratio	Annualized Absolute Excess Return**
All CTAs	8.99%	0.23	16.36%
Currency CTAs	6.68%	0.08	27.22%
Agriculture CTAs	16.31%	0.27	17.16%
Diversified CTAs	9.15%	0.29	15.43%
Financial CTAs	8.45%	0.27	16.52%
Stock CTAs	5.94%	0.06	18.11%
Energy CTAs	12.65%	0.19	14.62%

*Different measures of excess returns reported for each style is the averages of individual CTAs' excess returns in that particular style.
** Absolute Excess Return is the additional return over the risk-free rate ($R_i - R_f$)

Correlation Coefficients between Alternative Excess Return Measures of CTAs
Period: 1985:01 – 1998:08

	7-Factor Alpha	Sharpe Ratio	Absolute Excess Return
7-Factor Alpha	1.00		
Sharpe Ratio	0.63**	1.00	
Absolute Excess Return	0.92**	0.64**	1.00

Test statistic: $t(n-2) = r / [(1 - r^2)/(n-2)]^{(0.5)}$
** Significant at the 1% level.

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