[Appeared in *Journal of Portfolio Management*, 1997, Vol 24, No 1, 30-41.]

The Information Content of Performance Track Records: Investment Style and Survivorship Bias in the Historical Returns of Commodity Trading Advisors

by

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First Draft: January 1997
Current Draft: June 1997
[Published version: *Journal of Portfolio Management*, Fall, 1997]

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 The authors gratefully acknowledge the help of Tass Asset Management in supplying the data for this study. James Cui and Guy Ingram provided valuable research assistance. The paper benefitted from comments by Amy Hirsch and the principals of Ivy Asset Management. Please send correspondence to David A. Hsieh, Fuqua School of Business, Duke University, Box 90120, Durham, NC 27708-0120; phone: 919-660-7779; e-mail: dah7@mail.duke.edu.

Abstract

Performance track records contain valuable information, as long as investors correct for the biases inherent in using surviving funds. This paper analyzes the effect of survivorship in private funds managed by commodity trading advisors (CTAs). It finds that the dissolution rate and dissolution cost in CTA funds are higher than in mutual funds. Style analysis is not affected by survivorship. CTA funds have a dominant style, identified to be a trend following strategy. A CTA style factor with minimal survivorship bias can be constructed, proxying for the systematic risk in CTA funds. The dissolution cost to investors is further reduced by reputation effects. Multi-fund management companies behave differently than single-fund management companies when it comes to terminating unsuccessful funds in order to protect their reputation.

1. Introduction

"*Past results are no guarantee of future performance...*" Similar disclaimers are nearly always present in solicitation documents from investment funds. While investors are aware of the limitations of performance track records, it is nonetheless widely held that good performance in mutual funds attracts assets and poor performance leads to withdrawals. Clearly the performance track record of a fund contains valuable information. The question is how informative it is in the presence of the bias inherent in using only surviving funds to measure historical performance.

In the world of publicly traded mutual funds, survivorship has been studied extensively. For example, see Grinblatt and Titman (1989), Brown, Goetzman, Ibbotson, and Ross (1992), Brown and Goetzman (1995), and Malkiel (1995). These studies concluded that the average return of surviving funds is 50 to 140 basis points per annum higher than returns on all funds. An investor could, approximately, adjust for the survivorship bias by reducing the returns of surviving funds by approximately this magnitude.[1] However, the measurement problems caused by survivorship bias can be greatly reduced by making use of additional information beyond historical returns that are available to investors. For instance, the "investment style" of the fund [see Sharpe (1992)] and the "reputation" of the management firm are likely to be key inputs in investment decisions in additional to historical performance.[2]

When it comes to private investment vehicles such as hedge funds and private commodity funds, information is much harder to come by, because of the limited disclosure requirements. Often a private investment vehicle's "track record" is the main source of information available to investors. Yet these vehicles frequently employ strategies that are far more complex than the buy-and-hold strategy of mutual funds, as found in Fung and Hsieh (1997). Consequently the assessment of a private fund's performance track record plays a far greater role in the investment decision than would otherwise be the case in mutual funds. In this paper we investigate the information content of performance track records on a comprehensive sample of private funds managed

by commodity trading advisors. In the rest of this paper, "CTAs" refer to commodity trading advisors and "CTA funds" refer to private funds managed by CTAs.

A central issue in the assessment of a performance track record is the identification of the return generating process. It is beyond the scope of the present paper to develop an equilibrium theory on why strategies commonly employed by CTAs can remain profitable. Instead we use principal component analysis to empirically extract the return generating factors in CTA funds and relate them to the commonly used qualitative descriptions of CTA styles, such as "Systems," "Technical," "Trend Following," etc. This approach is a variation of Fung and Hsieh (1997) but on a sample that contains both surviving and dissolved CTA funds. The variable used in this model involves parameters beyond the historical return series and can be used to assess funds with a limited history.

The paper proceeds as follows. Section 2 provides a description of the data. Section 3 calculates the survivorship bias in the private CTA funds. Section 4 analyzes the investment styles of CTAs. Section 5 interprets the dominant CTA investment style. Section 6 constructs a style factor for the dominant CTA investment style that is almost free of survivorship bias. Section 7 discusses the issue of the incentive fee and the value of a track record. Conclusions are summarized in Section 8.

2. Data Description

The sample consists of 901 private CTA funds operated by 546 different CTAs in the Tass Asset Management database. Tass Asset Management is one of the few database vendors specializing in supplying data on hedge funds and CTA funds. Tass obtains its data directly from fund managers. As of October 1996, 304 CTA funds are in operation and 597 have been dissolved since 1986. In aggregate, the surviving funds have assets of $10.7 billion and are operated by 191 CTAs. In contrast, 191 CTAs are managing funds while 355 CTAs no longer operate a fund as of October 1996. Superficially, investors may

conclude that the rate of attrition is of a sufficient magnitude to infer a high attrition cost to investing in these funds. The corollary to this argument is that there is a perceived, significant survivorship bias on the average performance of the existing funds.

Before proceeding with our analysis, we have a few remarks on the scope of our data. We have not conducted a check of CTA registrations with the Commodity Futures Trading Commission, the agency regulating CTAs, or the National Futures Association, the industry body responsible for self-regulation. Thus, we do not know how much of the CTA universe is represented in our sample.

We do know, however, that the 901 CTA funds in our sample is quite a bit larger than the number of publicly offered commodity pools studied in the literature. For example, Elton, Gruber, and Rentzler (1990) found 152 commodity pools between 1980 and 1988.[3] Irwin, Krukemyer, and Zulauf (1993) found 230 commodity pools from 1979 to 1990.[4] Edward and Park (1996) had 361 public commodity pool from 1983 to 1992.

We also know that the 901 CTA funds in Tass Asset Management is one of the largest collections of CTA funds. For example, Schneeweis, Spurgin, and McCarthy (1996) studied 56 CTA funds from 1985 to 1991.[5] Irwin, Zulauf, and Ward (1994) used the A.T.A. database of 363 CTA funds from 1979 to 1989.[6] Billingsley and Chance (1996), Schneeweis and Spurgin (1996), and Schneeweis, Spurgin, and McCarthy (1997) used the MAR/LaPorte CTA data base, which does not provide information on dissolved CTA funds. As far as we can ascertain, MAR/LaPorte had 369 CTA funds that were in operation at the end of 1994. Edwards and Park (1996) found 596 CTA funds from 1983 to 1992 by supplementing the MAR/LaPorte CTA data base from private sources. Diz (1996) is the only study which has a comparable data base to ours; he had 925 managed futures programs from 1975 to 1995 based on the Barclay Trading Group.[7] Lastly, Fung and Hsieh (1997) had 89 CTA funds with at least 36 monthly returns and operated by 89 different management firms having a minimum of $5 million in assets under management. These 89 CTA funds are a subset of our sample and

were analyzed jointly with 320 hedge funds.

3. Dissolution Rate and Survivorship Bias in CTA Funds

The common practice among suppliers of CTA returns, such as Tass Asset Management or MAR/LaPorte, is to provide information on investable funds that are currently in operation. At any given point in time, the investing community has to measure the average performance of CTA funds using the historical returns of currently operating CTA funds. This procedure is likely to produce upwardly biased performance results, because dissolved CTA funds tend to have worse performance than surviving funds. In this section, we investigate the impact of omitting dissolved funds.

We begin by tabulating the entry and dissolution experience of CTA funds from 1990 to June 1996 in Table 1. Funds which entered and dissolved in the same year were excluded. For each year, the attrition rate is the percent of CTA funds in operation at the end of the previous year that dissolved during that year. For example, of the 435 funds that were in operation at the end of 1994, 112 dissolved during 1995. Thus the attrition rate in 1995 was 25.29% [112÷435].

The average attrition rate of our CTA funds during 1989-1995 was 19.0%. This is much higher than the comparable attrition rates in mutual funds. Brown, Goetzmann, Ibbotson, and Ross (1992) found the average attrition rate of 4.8% between 1977 to 1985; ranging between 2.6% in 1985 to 8.5% in 1977.[8]

Table 2 presents the dissolution experience in a different way. Instead of measuring dissolutions each year, many studies report dissolution rates (called mortality rates) during a multi-year interval. This procedure requires starting and ending points. For example, the mortality rates in Table 2 are based on using December 1995 as the common ending point, with starting points ranging from 1989 to 1994. For example, 323 CTA funds were in operation at the end of 1989, and 95 survived until 1995. The mortality rate for 1989 is therefore 70.59% [=(323-95)/323]. During the period 1989-1994, the average mortality rate for CTA funds was 50.4%. This is comparable to the

average mortality rate of 46.7% for managed futures programs during 1982-1994 in Diz (1996), and is higher than the average of 25% for publicly offered commodity pools during 1980-1988 in Elton, Gruber, and Rentzler (1990), and much higher than the average of 14.2% for mutual funds during 1982-1990 in Malkiel (1995).

Naturally, mortality rates, which are dissolution rates over several years, would be higher than attrition rates, which are dissolutions rates during a single year. Caution, however, should be exercised in using the average mortality rates, since the measurement periods are overlapping. The mortality rate during 1989-1995 is not statistically independent of the mortality rate during 1990-1995, as they overlapped five years.

No matter which method one applies to compute the rate at which funds cease to operate, ultimately one is interested in determining the bias in measuring the performance of CTA funds using only surviving funds. We calculate a direct measure of survivorship bias in Table 3, using three different CTA portfolios. The first portfolio, labelled "All CTA Funds," is the return from investing equal amounts in all CTA funds in existence each month. New CTA funds were added to the portfolio by taking capital out of existing funds, and the capital returned from dissolved CTA funds were reinvested in the remaining CTA funds. By construction, this portfolio has the same survivorship experience as the overall sample. Its average return was 1.32% per month during 1989-1995.

The second portfolio, labelled "Surviving CTA Funds", is an equally weighted portfolio of CTA funds that were in operation as of December 1995. New CTA funds (which survived until December 1995) were added to the portfolio by taking capital out of existing funds. Since there were no dissolutions (by construction), the number of funds has increased over time. This portfolio represents the return to an investor who never invested in a dissolved CTA fund. Its average return was 1.61% per month during 1989-1995.

The third portfolio, labelled "Dissolved CTA Funds", is an equally weighted portfolio of CTA funds that ceased operation on or before December

1995. New CTA funds (which subsequently dissolved) were added to the portfolio by taking capital out of existing funds. The capital returned by dissolved funds were reinvested in existing funds that subsequently dissolved. This portfolio represents the return to an investor who never invested in a surviving CTA fund. Its average return was 0.81% per month.

Our measure of survivorship bias in CTA funds is defined as the difference in average returns between "Surviving CTA Funds" and "All CTA Funds". It was 0.29% [=1.61%-1.32%] per month, or 3.42% per year. This is higher than the survivorship bias in mutual funds, which was 0.5% per year in Grinblatt and Titman (1989), 0.80% in Brown and Goetzman (1995), and 1.40% per year in Malkiel (1995). Thus, while CTA funds dissolve more frequently than mutual funds, the bias from using surviving CTA funds to proxy for the returns of all CTA funds is not much greater than that in mutual funds.

A few comments are in order. One, the returns of the "Surviving CTA Funds" in Table 3 are consistent with those reported in Billingsley and Chance (1996), who used CTA funds in the MAR/LaPorte data base that were in operation at the end of 1994.[9] There is no significant difference between the average returns of the CTA funds in Tass and MAR/LaPorte.

Two, the returns from CTA funds were much higher than those of publicly traded commodity pools. While "All CTA Funds" returned an average of 15.84% [=1.32%x12] per year during 1989-1995, publicly offered commodity pools returned only an average of 4.4% per year during 1980-1988 in Elton, Gruber, and Rentzler (1990). Edward and Park (1996) found CTA funds returned 20.98% annually between 1983 and 1992, while public pools returned only 9.9%. How can the performance differ by 10% per year? The answer is higher management fees and brokerage commissions. Edward and Park (1996) stated that, in addition to passing the CTA fees and expenses to investors, pool operators typically charged fees of 5%, incentive fees up to 20%, and front-load and back-load fees up to 5%. Our own reading of offering documents of publicly offered commodity pools from the mid 1980's through the early 1990's showed that the brokerage fees and commissions can easily exceeded 10% of net asset

values per annum. This is substantially higher than commission costs of CTA funds. According to Tass Asset Management, expenses as a fraction of assets were less than 3% per annum for most CTA funds, and less than 4% per annum for nearly three quarters of all CTA funds.

Three, our survivorship bias of 3.42% per annum is higher than that in Schneeweis, Spurgin, and McCarthy (1996). According to their Table III, the portfolio of 44 surviving CTA funds had average annual returns of 11.71% during 1988-1991, while the portfolio of 44 surviving and 12 dissolved CTA funds had average annual returns of 10.51%. Thus, the survivorship bias in their data was only 1.20% per annum.

Four, our estimates of the difference between the returns of "Surviving CTA Funds" and "Dissolved CTA Funds" was 0.80% per month, or 9.60% per annum. This is similar to the estimate of 9.0% per annum given in Table 7 of Diz (1996).

4. Style Analysis of CTA Funds

In order to differentiate the performance across CTA funds, it is important to understand their investment styles. Consequently, we investigate the impact of survivorship on analyzing the investment style of CTA funds in this section.

A common first step in style analysis is to relate CTA returns to those of the major asset classes. Here, we regressed the monthly returns of each CTA fund that has at least 36 monthly returns on nine asset classes: 1-month Eurodollar deposit rate, Gold, US equities and non-US equities (from Morgan Stanley Capital International), US bonds and non-US bonds (from J.P. Morgan), emerging market stocks (from the International Financial Corporation), the US Dollar (from the US Federal Reserve), and high yield bonds (from Merrill Lynch). These asset classes represent a wide range of marketable securities traded by hedge funds, CTA funds, and mutual funds.

Table 4 displays the distribution of R^2's of this multiple regression. The column labelled 'Surviving Funds' summarizes the results for the 223 of

the 304 surviving funds having at least three years of return history. Nine funds have R^2's between 0% and 10%, 50 funds between 10% and 20%, and so on. Almost 90 percent of the surviving funds have R^2's below 40%. The column labelled 'Dissolved Funds' summarizes the results for the 303 of the 597 dissolved funds that have at least three years of returns. Of these, 39 funds have R^2's less than 10%, 107 funds between 10% and 20%, and so on. Again, 90 percent of the dissolved funds have R^2's below 40%. The evidence indicates that the common perception of CTA returns having low correlation with the major asset classes is not affected by survivorship. What also follows is that CTAs that failed did so for reasons other than having high systematic exposure to traditional asset classes.

In the second step of the style analysis, we apply principal component analysis to extract the common investment styles in CTAs. The idea is quite simple. If two CTAs use a similar trading strategy in similar markets, then their returns should be correlated with each other, even if they are not correlated with the major asset classes. These principal components can be used to proxy the statistical characteristics of the dominant investment styles. This idea was implemented in Fung and Hsieh (1997) on a sample of 320 hedge funds and 89 CTA funds with returns during the 1993-95 period.

Table 5 reports the principal component analysis. Using 72 CTA funds with returns during the 9-year period from 1987 to 1995, we found that there was one dominant principal component, which explained 36% of the cross sectional variation in CTA returns. The remaining principal components had limited power in explaining cross sectional variation --- the second through fifth principal components accounted for, respectively, 8%, 6%, 4%, and 4%, of the cross sectional variation in CTA returns.

Given that there are only 72 CTA funds with returns during the 9-year period, it is important to investigate whether the results were affected by survivorship. We repeated the principal component analysis on all CTA funds with returns in six 3-year rolling windows, starting with 1987-89, and ending with 1993-95. Table 5 summarizes our findings. There was a strong first

principal component in all six 3-year subperiods, explaining roughly 30% of the cross sectional variation of CTA funds. None of the second through fifth principal components accounted for more than 8% of the cross sectional variation. Moreover, the proportion of cross sectional variation explained was surprisingly stable, even though the number of CTA funds almost doubled from the first 3-year subperiod (1987-89) to the last 3-year period (1993-95).

Table 6 shows that the statistical behavior of the dominant principal component was very consistent over the entire 9-year period. The correlation between the dominant principal components from the 3-year subperiods and the 9-year overall period never fell below 0.95.

The statistical analysis is further strengthened in Figure 1 which graphs the monthly returns of the portfolio of surviving CTA funds and the portfolio of dissolved CTA funds. Given that these two portfolios are formed with *different* CTA funds, their high correlation, particularly at extremes, suggests are that the surviving and dissolved CTA funds have very similar investment styles. The difference is that the dissolved CTA funds had lower average performance.

The conclusion is clear: there is only one dominant, stable investment style in CTA funds and it is not affected by the entry and dissolution of CTA funds.[10]

5. Interpretation of the Dominant CTA Style

With the earlier observation that CTA funds have low correlation with the major asset classes, it is not surprising that the return characteristics of the dominant CTA style differs from that of a buy-and-hold style such as mutual funds. This is substantiated by the fact that the R^2 of a multiple regression of the first principal component against the nine standard asset classes is 0.068 over the period 1987 to 1995.

The dominant CTA style appears to be a dynamic trading strategy, because it is strongly correlated with two of the five hedge fund styles in Fung and Hsieh (1997). Its correlation is 0.78 with the "Systems/Opportunistic" style,

and 0.70 with the "Systems/Trend Following" style. The R^2 is 0.78 for the multiple regression on those two styles. Fung and Hsieh (1997) showed that these two "Systems" styles were not correlated to major asset classes and they exhibited option-like payouts in some asset classes, which is consistent with the view that the two "Systems" styles use dynamic trading strategies.

Why is there only one dominant CTA style in this paper but two "Systems" styles in Fung and Hsieh (1997)? Fung and Hsieh (1997) applied a factor rotation to the principal components extracted from 320 hedge funds and 89 CTA funds, possibly separating the dominant CTA style into two style factors. To complete the identification process, we applied a factor rotation to the principal components found in our CTA funds. This also resulted in two factors similar to those found in Fung and Hsieh (1997).[11] The two rotated factors differed by market emphasis. The CTA funds most strongly correlated to the first rotated factor tended to trade in all markets and contained the word 'diversified' in the fund names, while those correlated to the second rotated factor tended to trade only in the foreign exchange market and contained the word 'currency' in the fund names.[12] Since the two rotated factors come from one dominant principal component, they represent the same trading strategy with different market emphasis and therefore different return characteristics. For the purposes of this paper, we prefer to use the "unrotated" single factor for measuring the systematic risk of CTA funds.

At this point, it is helpful to label the dominant CTA style. Here we appeal to external descriptive information. Most CTAs use "systems" or "technical" trading rules designed to follow trends. For example, Billingsley and Chance (1996) reported that 57% (10,777÷18,730) of the monthly returns during 1989-1994 period in the MAR/LaPorte CTA database were based on "trend following" strategies. [See Exhibit 3B in Billingsley and Change (1996)]. This motivates the following hypothesis:

"*There is essentially a single dominant strategy among CTA funds. It is primarily trend following.*"

Collaborating evidence can also be found in Schneeweis and Spurgin

(1996) who also identified an important factor in their CTA sample.[13] We interpret this trend following strategy as the "systematic" risk in CTA returns, analogous to the market factor in the one-factor CAPM model for equities.

6. Construction of a CTA Style Factor with Minimal Survivorship Bias

It is useful to construct the returns of a factor portfolio for the trend following strategy identified in the previous section. This CTA style factor can be used to measure the systematic component of CTA returns. For the purpose of performance measurement, we also require the CTA style factor to be investable and to have minimal survivorship bias.

We constructed the CTA style factor as the monthly average of CTA funds which are strongly correlated to the first principal component. To achieve this, we regressed the returns of 202 surviving and 287 dissolved CTA funds with at least 36 monthly returns on the first principal component. We found 136 surviving and 137 dissolved funds that had positive, statistically significant correlation to the first principal component. The CTA style factor is then obtained by averaging their returns in each month.[14] By dropping funds from the average when they were dissolved and adding funds to the average when they came into existence, we created a CTA style factor which should be mostly free of survivorship bias.

The resulting time series satisfies all the requirements of a style factor. It is an investable CTA portfolio that is strongly correlated with all the first principal components from the 3-year subperiods, the overall 1987-95 period, and the 36 surviving CTAs who are correlated with the first principal component, as shown in Table 6. In addition, it has minimal survivorship bias. During the 1989-95 period, the CTA style factor has an average monthly return of 1.36%, which is only 4 basis points per month higher than the return of all existing CTA funds in Table 3.

To verify that there is indeed only one dominant CTA style, we performed principal component analysis on the 216 funds (66 surviving, 150 dissolved)

which were not strongly correlated to the first principal component. In all six 3-year subperiods, there was no evidence of a dominant principal component. Table 7 shows that none of the first principal components had substantially more explanatory power than the second principal components.

7. Incentive Fees and The Value of Track Records

It is important to discuss the role of incentive fees and the reputation value of a CTA with a successful track record when dealing with the survivorship issue. Most CTA funds charge an incentive fee as part of the compensation package for managing capital. It is well known that an incentive fee acts like a call option granted to the fund manager by the investors on the profits of a fund. Suppose a manager takes a large bet. If the bet is profitable, the manager receives a large incentive fee. If the bet is not profitable, the explicit cost to the manager is the loss of his own investment in the fund together with the loss of fixed fee income as assets under management decline.

Most funds have a "high water mark" provision to better balance the sharing of risk between investors and the manager. Under this scheme, an incentive fee is paid only on the portion of a fund's gains which have exceeded the historical peak of the fund's net asset value. This fee structure has the effect of penalizing losses, because profits which make up previous losses do not result in incentive fees.[15] Therefore, on an on-going basis, it has a moderating effect on excessive risk taking. It cannot, however, discourage a single large bet taken in an "end game" situation: when a fund is substantially below its high water mark. At that point, investors typically begin to withdraw their capital. If the manager does not recover the losses quickly, he or she will have to close down the fund when assets dwindle to the point that the fixed management fee does not even cover operating expenses. It is in situations like this that the manager is most likely to take one last large bet.

The "end game" strategy may be mitigated by exogenous offsetting costs

to the manager such as reputation costs. A CTA operating several funds is less likely to use this "end game" strategy than an otherwise comparable single fund firm. This is a direct consequence of the potential negative impact on the surviving funds managed by the same firm.

To test this hypothesis, we divided dissolved CTA funds into two groups: those dissolved by a multi-fund CTA operating other CTA funds, and those dissolved by a single-fund CTA with no other CTA fund in operation. Panel A of Table 8 indicates that dissolved funds operated by multi-fund CTAs outperformed single-fund CTAs by an average of 0.48% per month during 1989-1995. This is consistent with our hypothesis that successful track records are cherished by CTAs. A multi-fund CTA with a successful track record is more likely to protect its reputation. When one of its funds is not performing, it is more likely to look for an early graceful exit than to risk a bitter ending.

Interestingly, half of the performance difference between dissolved funds of multi-fund and single-fund CTAs can be attributed to exposure variations to the CTA style factor. To see this, we first regressed each fund's returns on the CTA style factor. The distribution of the regression coefficients (β's) for all CTA funds are given in Table 9. The majority have β's between 0 and 1. It is interesting to note that dissolved funds of single-fund CTAs have many more negative β's. When we analyzed the residuals of the dissolved CTA funds in Panel B of Table 8, we found that the idiosyncratic returns from CTA funds dissolved by multi-fund CTAs averaged 0.50% per month higher than those dissolved by single-fund CTAs. As β approximates leverage (i.e. size of systematic bets), this evidence is consistent with the conjecture that dissolved funds of single-fund CTAs behaved differently than dissolved funds of multi-fund CTAs. Exactly how these bets differed is beyond the scope of the present paper. It will require an in-depth understanding of the economics of trend following strategies, which is best left as the subject of future research.

8. Conclusions

CTA funds dissolve more frequently than mutual funds (19% versus 5%). The dissolution cost, as measured by the difference between the returns of surviving CTA funds and all CTA funds, is 3.42% per year, which is higher than the 0.50%-1.50% range for mutual funds. This cost to investors can be further reduced by adjusting for the reputation effect. CTAs which operate multiple CTA funds are likely to act in a way to protect their reputation. If a fund in their family is performing poorly, these CTAs are less likely to employ risky "end game" strategies than single-fund CTAs.

Survivorship had little impact on the investment styles of CTA funds. Returns of both surviving and dissolved CTA funds have low correlation to the standard asset classes. The dominant investment style in both surviving and dissolved CTA funds is a trend following strategy, which can be measured with almost no survivorship bias. This CTA style factor can be used to measure the systematic risk in CTA funds in the form of a single-factor model of returns. The exposure to this style factor can account for half of the dissolution costs of funds operated by single-fund CTAs.

Billingsley and Chance (1996) and Edwards and Park (1996) showed that CTA funds can add diversification to stocks and bonds in a mean-variance framework. What we have found is that the dominant CTA style can actually dampen the negative swings in stocks and bonds. Figure 2 graphs the cumulative return of a CTA fund during the down months of the S&P 500 index. The reason for using this CTA fund is that it has a much longer history than the CTA style factor, which can only be reconstructed back to 1989. This CTA fund is fairly representative of the CTA style factor, and they have a correlation coefficient of 0.76 from 1989 to 1996. Figure 2 shows that the CTA fund persistently has a positive return when the S&P has a negative return. Figure 3 graphs the cumulative return during the up months of the S&P 500 index, when the fund has made a small positive return. In order words, the fund provides a costless portfolio insurance policy. This behavior is

also true of the dominant CTA style factor. The addition of the CTA style factor to a stock and bond portfolio would dampen the down swings (in addition to volatility) without giving up average returns.

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Footnotes:

1. Some adjustments may have to be made for excessive risk, or beta, of a mutual fund.

2. Morningstar currently classifies US mutual funds into 36 style categories and provides rankings of funds in each category. *Barrons'* and *Forbes* have ranked mutual fund management firms. Information can also be garnered from reports that mutual funds are required to file with regulatory agencies, such as their holdings of securities to the Securities Exchange Commission on a quarterly basis.

3. 34 commodity pools dissolved between 1980 and 1988.

4. 56 commodity pools dissolved between 1979 and 1990, while 174 commodity pools were in operation at the end of 1990.

5. 44 CTAs survived and 12 dissolved during the period 1985 to 1991.

6. 218 funds were active in 1989, and 47 funds were dissolved between 1979 and 1989.

7. 490 funds were active as of June 1995, and 435 funds dissolved between 1975 and 1995.

8. Fung and Hsieh (1997) estimated the dissolution rate for hedge funds and CTA funds to be between 4.3% to 8.6% per annum, while Brown, Goetzman, and Ibbotson (1996) found that to be 20% for offshore hedge funds.

9. In Exhibit 2 of Billingsley and Chance (1996), the average monthly returns for CTA funds in the MAR/LaPorte database were 1.669% in 1989, 2.721% in 1990, 1.831% in 1991, 0.965% in 1992, 1.457% in 1993, and 0.573% in 1994. The average monthly return during 1989-1994 was 1.357%.

10. Some CTA firms operate more than one fund with highly correlated returns. This could be due to investor demand for offshore vehicles using the same strategies or a minor product modification. In order to avoid potential biases that could arise from including funds that are close substitutes, we repeated the principal component analysis representing each firm by the fund with the longest history. The results are not materially different. The table in Appendix A shows this result.

11. The first two (rotated) CTA factors from the 1987-1995 period are correlated at 0.867 and 0.873, respectively, with the two "Systems" style factors in Fung and Hsieh (1997). Similarly, the first two (rotated) CTA factors from the 1993-1995 period are correlated at 0.847 and 0.938, respectively, with the same two "Systems" style factors.

12. This was also true for the hedge funds and CTA funds in Fung and Hsieh (1997).

13. Schneeweiss and Spurgin (1996) identified the dominant CTA style as trend following, by appealing to the BARRA/Mount Lucas synthetic trend following index. However, this synthetic index has a correlation of 0.277 against the "Systems/ Opportunistic" style and a correlation of 0.219 against the "Systems/Trend Following" style in Fung and Hsieh (1997). Caution should be exercised in using the BARRA/Mount Lucas index as a benchmark for CTA trend

following styles.

14. The average return weighted by asset size has a correlation coefficient of 0.978 with the equally weighted style benchmark. The disadvantage of using assets under management as weights is that it tends to bias the index towards a few large funds. For example, John Henry's funds and Chesapeake account for 10% of the assets in the size-weighted benchmark in 1989 and 28.5% in 1995.

15. In the extreme case when the incentive compensation must remain in the fund and the rate of interest is zero, the high water mark feature essentially means that the incentive fee is paid on cumulative profits over a long horizon.

Table 1

Entry, Dissolution, and Attrition Rates of CTA Funds
During 1990-1996

Year	Number of CTA Funds				
	Year Start	Entry*	Dis-solution*	Year End	Attrition Rate
1989				323	
1990	323	82	48	357	14.86%
1991	357	121	59	419	16.53%
1992	419	125	66	478	15.75%
1993	478	87	86	479	17.99%
1994	479	69	113	435	23.59%
1995	435	38	110	363	25.29%
1996	363	3	54	312*	14.88%*
Average (1990-1995)					19.00%

Notes:
* Excluding funds entering and exiting in the same year.
** Through June 1996.

Table 2

Mortality Rates for CTA Funds by Year

Year End	# of Funds In Operation	# of Funds Surviving Until 1995	Mortality Rate
1989	323	95	70.59%
1990	357	124	65.27%
1991	419	176	58.00%
1992	478	230	51.88%
1993	479	274	42.80%
1994	435	325	25.29%
Average			52.30%

Table 3

Estimates of Survivorship Bias in CTA Funds:
Average Monthly Returns By Year

Year	All CTA Funds		Surviving CTA Funds		Dissolved CTA Funds	
	Avg Return	# of Returns	Avg Return	# of Returns	Avg Return	# of Returns
8912	1.76%	3,604	1.60%	1,077	1.82%	2,527
9012	2.90%	4,307	3.22%	1,393	2.76%	2,914
9112	1.44%	4,836	2.06%	1,932	0.99%	2,904
9212	0.69%	5,609	1.00%	2,536	0.43%	3,073
9312	1.09%	6,062	1.55%	3,210	0.56%	2,852
9412	0.36%	5,774	0.61%	3,786	-0.16%	1,988
9512	1.04%	4,874	1.22%	4,322	-0.71%	552
Mean	1.32%		1.61%		0.81%	

Table 4

Distribution of R^2's Against Nine Asset Classes
CTA Programs with 36 months of Returns

R^2's	All Funds	Surviving Funds	Dissolved Funds
0 - .10	48	9	39
.10 - .20	157	50	107
.20 - .30	158	84	74
.30 - .40	111	57	54
.40 - .50	40	17	23
.50 - .60	9	4	5
.60 - .70	1	1	0
.70 - .80	1	1	0
.80 - .90	0	0	0
.90 - 1.00	1	0	1
Total	526	223	303

Note:
The nine asset classes are: 1-month Eurodollar deposit rate, Gold, US equities and non-US equities (from Morgan Stanley Capital International), US bonds and non-US bonds (from J.P. Morgan), emerging market stocks (from the International Financial Corporation), the US Dollar (from the US Federal Reserve), and high yield bonds (from Merrill Lynch).

Table 5

Proportion of CTA Cross Sectional Variantion
Explained by The First Five Principal Components
In Different Sub-Periods

Years	No. of Funds	Principal Components 1st	2nd	3rd	4th	5th
87-89	172	36%	7%	6%	6%	4%
88-90	195	35%	8%	5%	5%	4%
89-91	217	33%	6%	5%	5%	4%
90-92	259	33%	7%	5%	5%	4%
91-93	290	34%	7%	5%	4%	4%
92-94	319	29%	7%	5%	5%	4%
93-95	329	23%	8%	6%	5%	5%
87-95	72	36%	8%	6%	4%	4%

Table 6

Correlation Among the First Principal Components
In Different Sub-Periods

	87-89	88-90	89-91	90-92	91-93	92-94	93-95	87-95	36 CTAs
87-89									
88-90	0.999								
89-91	0.996	0.996							
90-92		0.980	0.997						
91-93			0.998	0.998					
92-94				0.998	0.998				
93-95					0.997	0.994			
87-95	0.994	0.990	0.992	0.994	0.986	0.967	0.976		
36 CTAs	0.985	0.975	0.986	0.991	0.986	0.968	0.992	0.973	
Style Factor	0.997	0.994	0.991	0.994	0.997	0.994	0.988	0.986	0.980

Table 7

Proportion Cross Sectional Variation
Explained by The First Five Principal Components
In Different Sub-Periods
216 CTAs Not Correlated With the Style Factor

Years	No. of Funds	Principal Components				
		1st	2nd	3rd	4th	5th
87-89	51	14%	11%	8%	7%	6%
88-90	65	13%	8%	7%	6%	6%
89-91	67	9%	8%	7%	7%	6%
90-92	77	11%	8%	7%	6%	5%
91-93	85	9%	7%	7%	6%	6%
92-94	83	10%	7%	7%	6%	6%
93-95	96	9%	8%	7%	6%	5%

Table 8

Value of Track Record:
Average Monthly Returns of Dissolved CTA Funds
in Multi-Fund and Single-Fund Management Companies

	Dissolved Funds	
	Multi-Fund Companies	Single-Fund Companies
A. Raw Returns		
1989	2.77%	1.49%
1990	4.18%	2.22%
1991	0.84%	1.02%
1992	0.38%	0.45%
1993	0.50%	0.59%
1994	-0.34%	-0.09%
1995	-0.17%	-0.94%
Average	1.16%	0.68%
B. Residuals from Regression Against the CTA Style Factor		
1989	2.27%	1.28%
1990	2.92%	1.60%
1991	0.30%	0.80%
1992	0.25%	0.40%
1993	0.25%	0.47%
1994	-0.29%	-0.09%
1995	-0.74%	-1.14%
Average	0.72%	0.47%

Table 9

One-Factor Model of CTA Returns:
Distribution of Regression Coefficients (β's)
for CTA Funds with At Least 36 Monthly Returns

β's		Surviving Funds		Dissolved Funds in Multi-Fund Companies		Dissolved Funds in Single-Fund Companies	
		#	%	#	%	#	%
-1.0 to	-0.5	0	0.0%	0	0.00%	4	1.87%
-0.5 to	0.0	25	12.4%	7	8.97%	44	20.56%
0.0 to	0.5	52	25.7%	32	41.03%	88	41.12%
0.5 to	1.0	59	29.2%	13	16.67%	45	21.03%
1.0 to	2.0	61	30.2%	16	20.51%	19	8.88%
2.0 to	3.0	5	2.5%	6	7.69%	7	3.27%
3.0 to	4.0	0	0.0%	4	5.13%	5	2.34%
4.0 to	5.0	0	0.0%	0	0.00%	2	0.93%
Total		202	100%	78	100%	214	100%

Figure 1
RETURNS OF SURVIVING AND DISSOLVED CTA FUNDS

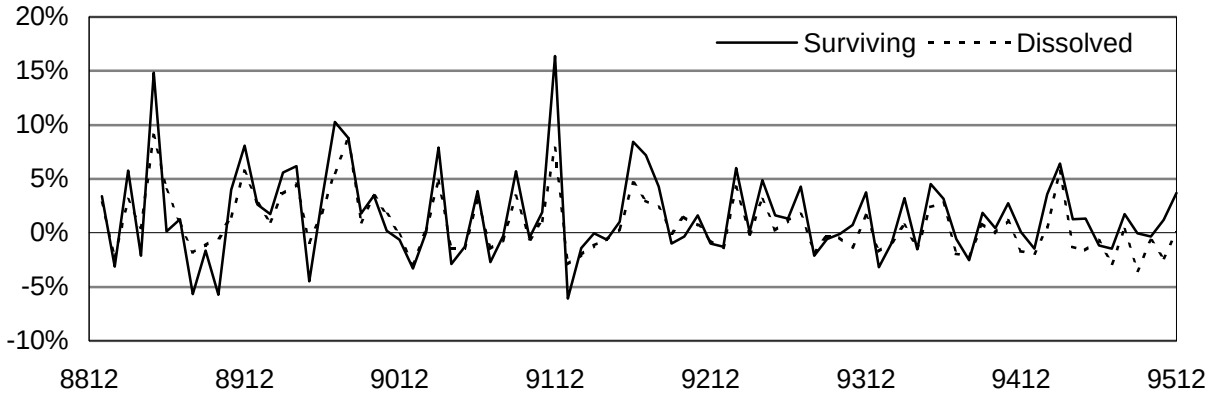

Figure 2
AVERAGE MONTHLY RETURNS IN DIFFERENT WORLD EQUITY MARKET ENVIRONMENTS

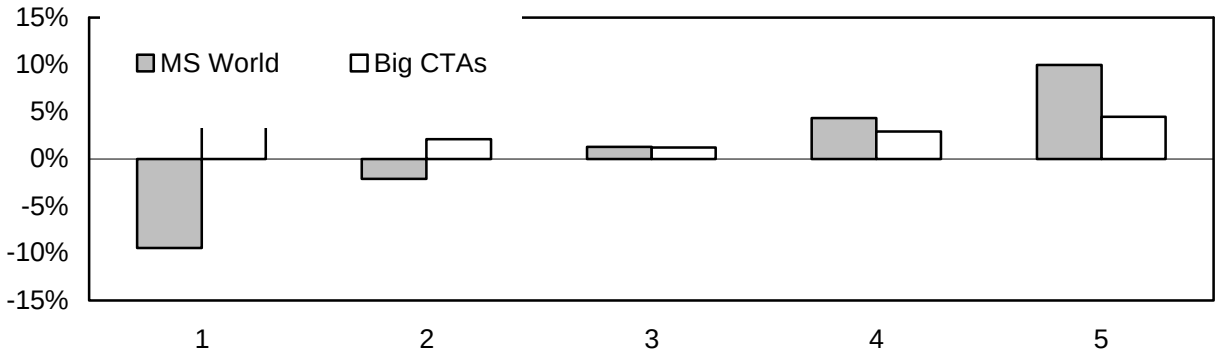

Figure 3
CUMULATIVE RETURNS DURING DOWN MONTHS IN THE WORLD EQUITY MARKETS