Do Managed Futures Make Good Investments?

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In 1995 over $21 billion was invested in managed futures, compared to less than $500 million in 1980. From 1980 to 1995, investments in managed futures grew by more than 28% a year (the annual compounded rate of growth).[1] Pension funds and other institutional investors have increasingly incorporated managed futures investments into their portfolios to enhance investment performance.[2] This article examines the performance of different kinds of managed futures investments over the ten-year period, 1983 to 1992, both as stand-alone investments and as portfolio assets. A general conclusion is that some managed futures make sensible investments while others do not.

[1]Peltz (1996), p. 1.
[2]In 1995 several institutional investors, including the Chicago Transit Authority Employees' Retirement System, Eastman Kodak, and Federal Express, terminated their managed futures investments. Other institutional investors, however, such as the San Diego Employees' Retirement Association, the Oklahoma Police Pension and Retirement System, and the Teamsters Central States, Southeast, Southwest Areas Pension Fund, added managed futures programs to their investment portfolios. See Peltz (1996), p. 1.

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The term, *managed futures,* refers to the trading of futures and forward contracts on physical commodities and financial instruments by either institutions or investment advisors. There are three ways that individuals and institutional investors can invest in (or buy) managed futures. First, investors can purchase the shares of public futures funds, which is similar to buying shares in a mutual fund.[3] A common advantage of investments in public funds is the low minimum-investment required by such funds. Second, investors can place funds with a private Commodity Pool Operators (CPO), who pool their funds together with the funds from other investors. The CPO retains one or more professional traders, or Commodity Traders Advisors (CTAs), to trade the funds. Private futures pools usually charge lower brokerage fees than do public futures funds.[4] Third, if investors are large enough, and can themselves identify and retain professional traders to manage their funds, they can place their funds directly with one or more Commodity Trading Advisors. The main advantage of doing this is that investors can avoid the management fees and brokerage expenses that funds and pools impose.

CTAs are professional commodity investment managers. They must register with the Commodity Futures Trading Commission (CFTC). Their activities are regulated by the CFTC. CPOs place funds with CTAs and are required to register with the CFTC and with the Securities and Exchange Commission (SEC) if they accept public funds. An investment fund is considered to be a public fund if it has more than 35 unaccredited investors. Unaccredited investors are those with a net worth of less than $1 million or an annual income of less than $200,000 for at least two consecutive years. A private pool can have up to 99 accredited and unaccredited investors. Generally, CPOs do not trade themselves.

This article examines the performance of three types of managed futures investments during the ten-year period, 1983 to 1992: funds placed directly with CTAs, funds placed with CPOs and managed as private pools, and funds invested in public commodity funds. The organization of the article is as follows. The first section describes the data examined. The article then discusses two biases that may exist in these data; examines managed futures as stand-alone investments and portfolio assets in diversified portfolios; and, analyzes whether managed futures provide a hedge against inflation. The final section summarizes the findings and conclusions of the article.

[3]Public futures funds are registered as securities under SEC regulations and are advertised and sold like any other registered security.

[4]CPOs typically manage more than one private pool, and commonly retain at least two CTAs to trade the funds in each pool. Managers of public funds and private pools assert that both funds and pools provide diversification across traders and superior monitoring of trader performance.

DATA

The data examined consist of the monthly returns of 596 registered CTAs, 292 private commodity pools, and 361 public commodity funds, for the period, January, 1983 to December, 1992. These data come from two sources: the Managed Account Report (MAR) data base, and a proprietary data base from PARADIGM Capital Management, Inc. (PARADIGM), a commodity pool operator based in New York. Each month, both MAR and PARADIGM receive monthly performance updates from the participating traders and funds in their data bases. Although participants in these data bases report their performance figures on a voluntary basis, in general, CTAs as well as pool and fund managers find it advantageous to participate because of the exposure they receive.[5]

CTAs, pools, and funds are included in the data bases if they began trading at any time before or during the 1983 to 1992 period. Specifically, for pools and funds, performance histories consist of actual monthly returns after registration with the CFTC and the start of trading. For CTAs, however, performance histories consist of returns both before and after registering with the CFTC. In particular, in registering with the CFTC, CTAs commonly report proprietary returns for periods before registration. Those preregistration returns are included in the data bases for this study.[6] This may introduce a self-selection bias in the data that is discussed later. Also, the performance records of all CTAs, pools, and funds which ceased to operate during the sample period are kept in the data base to minimize survivorship bias.

All reported returns are net of all fees and expenses, which can be quite high. CTAs typically charge a combination of a management fee, that ranges from 0 to 4% of principal, and an incentive fee, that ranges from 0 to 35% of net new profits. Pool and fund operators, in addition to passing on the above CTA fees and expenses (which may be reduced for pools and funds), typically charge a management fee of up to 5% of prin-

[5]The PARADIGM database is much smaller than the MAR database. PARADIGM data supplements the MAR data by including (1) newer CTAs who are not yet reporting to MAR but are actively trading customer moneys, and (2) well-established CTAs who no longer report their performance to MAR. This study also analyzes the performance of CTAs, pools, and funds using only MAR data and finds identical results.

[6]According to the Commodity Pool Operator and Trading Advisor Regulations promulgated by the CFTC under the Commodities Exchange Act as amended, CTAs are required to report in their disclosure documents at least three years of prior trading performance (five years starting August 25, 1995). The regulations do not require the disclosure of proprietary trading performance. However, if any proprietary trading performance is disclosed, then all such trading must be disclosed. Typically, a newly registered CTA has little or no pre-registration customer trading performance and therefore has little else to show but a proprietary trading history. Thus, both MAR and PARADIGM databases include the repored CTAs pre-registration proprietary trading history as part of the trader's performance history.

cipal, and may also charge an incentive fee of up to 20% of net new profits as well as one-time front-load and back-load fees of up to 5%. In addition, brokerage commissions and expenses can amount to as much as 10% of principal during a year. Thus, for investors to do well, CTAs, pools, and funds must have sizeable gross (or before-expense) returns.

Finally, to provide performance benchmarks for managed futures investments, these investments are compared to a broad range of other investments. These include buy-and-hold portfolios of large company common stocks, small company stocks, U.S. Treasury-bills, intermediate and long-term government bonds, and long-term corporate bonds. Monthly returns for these hypothetical investments are taken from *Stocks, Bonds, Bills, and Inflation: 1993 Yearbook*, by Ibbotson Associates, Inc. In addition, returns on the Commodity Research Bureau's Composite Index of 21 commodities is used to represent a buy-and-hold passive commodity futures investment.[7]

DATA BIASES

There are two potential biases in the MAR and PARADIGM data bases. First, there is a self-selection bias arising from the inclusion in the data base of performance records of CTAs prior to their registering with the CFTC. There is substantial evidence that the proprietary returns of CTAs prior to their accepting public moneys is significantly upward biased.[8] This bias can be eliminated by deleting the first 28 months of CTAs reported returns.[9]

[7]The passive buy-and-hold futures strategy is identical to the one used in Irwin, Krukemyer, and Zulauf (1992). The investment involves a hypothetical investment in the CRB Index and T-bills. The T-bill returns is included because the hypothetical investment is assumed to be fully collateralized. In addition, margin money in a futures acount is typically invested in T-bills. The CRB Index is based on the prices of 21 commodities: Live Cattle, Hogs, Pork Bellies, Gold, Silver, Platinum, Coffee, Cocoa, Sugar, Orange Juice, Crude Oil, Cotton, Copper, Unleaded Gas, Heating Oil, Lumber, Corn, Wheat, Soybeans, Soybean Meal, and Soybean Oil. For each commodity, CRB calculates a composite price which reflects the prices of several futures contracts. Specifically, CRB uses an arithmetic average of the prices of all contracts expiring within nine months of the current date. This methodology is one way to deal with contract expirations and to incorporate roll-over returns in the index returns. Replicating CRB returns requires a purely passive investment in the CRB index. Transaction costs are not reflected in reported returns on the index. Other commodity indexes, such as the Goldman Sachs Commodity Index, the Investable Commodity Index, the Daiwa Physical Commodity Index, and the J.P. Morgan Index could be used as a proxy for a buy-and-bold passive futures strategy. Among the commodity indexes studied by Greer (1994), the CRB was found to have the best risk/return ratio.

[8]See, for example, Edwards and Ma (1988).

[9]The existence of a self-selection bias within any CTA database is commonly acknowledged. Both Barclays and MAR attempt to address this problem in their data bases but do so in an arbitrary manner. Barclays eliminates the first 48 months of CTA performance data; MAR eliminates the first 12 months as well as data relating to CTAs with less than $500,000 under management. Edwards

Second, there may be a survivorship bias in the early years of the data (1983–1988). Most nonsurviving CTAs may have been excluded from the data, especially in the early years.[10] This presumption is supported by the fact that the data show an average nonsurvival (or failure) rate of 9% in the recent four-year period, 1989–1992, but only one percent in the earlier six-year period, 1983–1988.[11] There is no other obvious explanation for this enormous difference in the nonsurvivorship rate.[12] The omission of many poorly performing CTAs in the 1983–1988 period should cause average returns for CTAs during this period to be upward-biased.

PERFORMANCE MEASURES

Both monthly and annual returns for CTAs, private commodity pools, and public commodity funds are examined over three time periods: 1983–1992, 1983–1988, and 1989–1992. Monthly returns for CTAs, pools, and funds are measured as the change in unit value over a month plus cash distributions per unit made during the month divided by the unit value at the end of the preceding month. This formula assumes that all cash distributions are reinvested during the month in which they are received.

Two methods for calculating the expected annual returns for CTAs, pools, and funds are used: (1) by forming one-trader portfolios where each consists of a single, randomly selected, CTA, pool, or fund in existence in January of each year, and calculating the arithmetic average of the annual returns of all of these portfolios; and (2) by forming an Equal-Weighted Market Portfolio (EWMP) of all CTAs, all pools, or all funds, and calculating annual returns for this portfolio from the monthly returns

and Park (1995a) examine the MAR/PARADIGM CTA data base and identify a self-selection bias. Using rigorous statistical procedures, Edwards and Park (EP) identify a 28-month rule for the inclusion of traders which if used eliminates the self-selection bias in the data. Moreover, EP find that the size of CTAs is unrelated to CTA performance, so that it is inappropriate to the use the size of CTAs as a criterion for omitting traders to eliminate the self-selection bias.

[10]Prior to 1990 (when MAR changed ownership) the MAR data base consisted of only the largest 25 CTAs. Smaller CTAs, and CTAs who went out of business, were not included in the data base. The previous owners, nevertheless, kept the performance records of many CTAs not included in their published data base at that time. The new owners of MAR used those data as well as other data to backfill the data base for early years. In backfilling the data, however, it is likely that many nonsurviving CTAs were nevertheless inadvertently excluded.

[11]CTAs, pools, and funds may cease to exist either because of poor performance or because they voluntarily choose to dissolve or go out business. However, it is probable that most cease to exist because of poor performance.

[12]Such a large difference in the nonsurvival rate is unlikely to be due to mere chance. The most likely explanation for this enormous difference is a data bias due to the exclusion of data in the early years.

on the portfolio, where monthly returns are arithmetic averages of the monthly returns of all CTAs, pools, or funds in the portfolio. The first return represents the annual return that an investor could expect to earn if he or she were to select randomly a single CTA, pool, or fund in which to invest at the beginning of each year. The second represents the annual return that an investor could expect to receive by investing equally in all CTAs, pools, or funds in existence in every month of the year. The EWMP gives an equal weight to each CTA, pool, or fund in the portfolio at the beginning of each month. As such, it implicitly assumes a one-month investment horizon and a rebalancing of the portfolio every month: each month funds are implicitly taken from last month's winners and given to last month's losers.

There are two alternative methods for measuring returns that are considered: a Dollar-Weighted Market Portfolio (DWMP) and a Net-Asset-Value-Weighted Market Portfolio (NWMP). In contrast to an EWMP, a DWMP is dollar weighted: each CTA, pool, or fund is given a weight represented by its total funds under management. Thus, the DWMP return represents the return on the average dollar invested assuming that an investor distributes his or her funds in proportion to the relative size (funds under management) of the respective CTA, pool, or fund at the beginning of each month. The DWMP returns also assume a one-month investment horizon.

In an NWMP, each CTA, pool,or fund is allocated an equal investment at the start of a given investment period (such as at the beginning of a year) and this investment is maintained for the entire investment period. Unlike the EWMP and DWMP returns, NWMP returns do not assume a rebalancing of assets each month. Thus, NWMP returns incorporate the compounding effect that flows naturally from a CTA's, pool's, or fund's performance during the specified investment period. With a time horizon of only a month, the NWMP and EWMP methodologies for calculating portfolio returns will yield identical returns because all portfolio weights are reset each month. For longer time horizons, however, these methodologies can yield quite different returns because NWMP returns are dependent both on the specific investment horizon selected and the starting date of that horizon.

Although not reported in this article, three measures of portfolio returns for CTAs, pools, and funds are examined: EWMP, DWMP, and NWMP returns. The results are nearly identical for all three measures. Thus, in the following discussion, only the results for EWMP returns and for a randomly selected CTA, pool, and fund are reported.

In addition to average monthly and annual returns, the variability of returns as well as risk-adjusted returns (specifically, Sharpe Ratios) are calculated to evaluate performance. Sharpe Ratios for the alternative managed futures investments are calculated as

$$\frac{R_i - R_f}{\sigma_i} \tag{1}$$

where:

R_i = the average rate of return of the ith CTA, pool, or fund during the investment period;

R_f = the average risk-free rate of return during the investment period; and

σ_i = the standard deviation of monthly rates of return of the ith CTA, pool or fund during the investment period.

Finally, these performance measures for managed futures investments are compared to similar measures for alternative futures and nonfutures benchmark investments for the same time periods. Table I provides monthly and annual returns for passive (buy-and-hold) investments in the S&P 500 index, small-cap common stocks, U.S. Treasury bills, intermediate-term government bonds, long-term government bonds, long-term corporate bonds, and a commodity futures index (the CRB Index).

MANAGED FUTURES AS STAND-ALONE INVESTMENTS

Commodity Trading Advisors

Table II provides rates of return and standard deviations both for randomly selected CTAs and for an EWMP of CTAs. The mean monthly return for a randomly selected CTA ranges from a high of 3.27% in 1987 to a low of 0.19% in 1992. The mean monthly return for an EWMP of CTAs ranges from a high of 3.89% per month in 1987 to a low of 0.21% in 1992.

CTAs provide a higher return than every benchmark investment shown in Table I. Randomly selected CTAs have an average annual return of 18.35% for the entire 1983–1992 period, while the average annual return for an EWMP of CTAs over the same period is 20.98%. In comparison, common stocks, as measured by the S&P 500 index, averages 16.80% a year and long-term corporate bonds return 13.46% per year (see Table I).

TABLE I

Returns and Standard Deviations for Alternative Futures and Nonfutures Investments

	Buy-and-Hold Futures			*S&P500*			*Small-Cap Stocks*			*Treasury Bills*		
Year	*Monthly Return*	*Annual Return*	*Standard Deviation*	*Monthly Return*	*Annual Return*	*Standard Deviation*	*Monthly Return*	*Annual Return*	*Standard Deviation*	*Monthly Return*	*Annual Return*	*Standard Deviation*
		Percent			Percent			Percent			Percent	
1983	2.14	28.92	3.46	1.71	22.51	2.74	2.82	39.67	4.37	0.70	8.80	0.05
1984	−0.28	−3.28	3.18	0.51	6.27	3.87	−0.57	−6.67	4.23	0.78	9.84	0.09
1985	0.10	1.22	2.09	2.35	32.16	3.36	1.85	24.66	4.03	0.62	7.72	0.05
1986	−0.27	−3.19	2.41	1.42	18.47	4.96	0.55	6.85	3.98	0.50	6.16	0.05
1987	1.34	17.26	2.49	0.43	5.23	8.43	−0.81	−9.30	9.54	0.44	5.47	0.06
1988	1.18	15.14	3.73	1.30	16.81	2.78	1.73	22.87	3.64	0.51	6.36	0.09
1989	−0.08	−0.99	2.38	2.31	31.49	3.41	0.81	10.18	2.92	0.67	8.38	0.06
1990	0.36	4.44	2.10	−0.27	−3.17	5.08	−2.00	−21.56	5.65	0.63	7.84	0.05
1991	−0.11	−1.28	2.04	2.25	30.55	4.37	3.12	44.63	4.37	0.45	5.60	0.05
1992	0.07	0.87	1.39	0.62	7.67	2.04	1.76	23.35	4.83	0.29	3.50	0.04
Average:												
1983–92	0.45	5.91	2.53	1.26	16.83	4.10	0.93	13.47	4.76	0.56	6.97	0.06
1983–88	0.70	9.34	2.89	1.29	16.91	4.36	0.93	13.01	4.97	0.60	7.39	0.06
1989–92	0.06	0.76	1.98	1.23	16.63	3.73	0.92	14.15	4.44	0.51	6.33	0.05

TABLE I (Continued)

Returns and Standard Deviations for Alternative Futures and Nonfutures Investments

Year	Intermediate-Term Gov't Bonds			Long-Term Gov't Bonds			Long-Term Corporate Bonds		
	Monthly Return	*Annual Return*	*Standard Deviation*	*Monthly Return*	*Annual Return*	*Standard Deviation*	*Monthly Return*	*Annual Return*	*Standard Deviation*
		Percent			Percent			Percent	
1983	0.60	7.41	1.48	0.05	0.65	3.11	0.38	4.70	3.08
1984	1.10	14.03	1.75	1.21	15.49	3.20	1.27	16.39	3.57
1985	1.55	20.34	1.56	2.27	30.97	3.33	2.27	30.90	2.97
1986	1.18	15.13	1.58	1.84	24.52	4.79	1.52	19.85	2.26
1987	0.24	2.89	1.33	−0.23	−2.72	2.84	−0.02	−0.27	2.66
1988	0.49	6.10	1.31	0.77	9.67	2.78	0.85	10.70	2.28
1989	1.04	13.27	1.50	1.40	18.10	2.25	1.26	16.23	1.71
1990	0.78	9.72	1.21	0.50	6.17	2.57	0.55	6.78	1.96
1991	1.20	15.46	0.84	1.48	19.24	1.72	1.52	19.89	1.19
1992	0.58	7.20	1.51	0.65	8.05	1.96	0.75	9.39	1.47
Average:									
1983–92	0.88	11.15	1.41	0.99	13.01	2.86	1.04	13.46	2.32
1983–88	0.86	10.98	1.50	0.99	13.10	3.35	1.05	13.71	2.81
1989–92	0.90	11.41	1.26	1.01	12.89	2.13	1.02	13.07	1.58

Annual Return: the actual monthly returns during the year compounded.
Monthly Return: the twelfth root of the annual return.
Standard Deviation: the standard deviation of monthly returns.
Average: The arithmetic average of monthly returns, annual returns, and annual standard deviations across all years in a period.

TABLE II

CTAs: Returns and Standard Deviations

Year	Number of CTAs	Randomly Selected CTA: Monthly Return	Randomly Selected CTA: Annual Return	Randomly Selected CTA: Standard Deviation	Equal-Weighted Market Portfolio of CTAs: Monthly Return	Equal-Weighted Market Portfolio of CTAs: Annual Return	Equal-Weighted Market Portfolio of CTAs: Standard Deviation
			Percent			Percent	
1983	41	1.78	23.52	10.98	1.80	23.86	8.08
1984	50	1.03	13.04	10.23	1.07	13.63	7.14
1985	60	1.76	23.29	9.96	1.62	21.22	5.03
1986	91	0.80	10.07	11.39	1.33	17.19	5.61
1987	126	3.27	47.15	12.71	3.89	58.03	6.41
1988	164	1.49	19.46	12.16	1.79	23.75	7.96
1989	195	0.78	9.81	9.66	0.92	11.68	4.53
1990	215	2.05	27.53	7.39	2.16	29.22	2.85
1991	245	0.59	7.28	7.40	0.69	8.58	3.84
1992	292	0.19	2.35	5.94	0.21	2.60	2.61
Average:							
1983–92		1.37	18.35	9.78	1.55	20.98	5.41
1983–88		1.69	22.75	11.24	1.92	26.28	6.71
1989–92		0.90	11.74	7.60	1.00	13.02	3.46

Annual Return: the actual monthly returns during the year compounded.
Monthly Return: the twelfth root of the annual return.
Standard Deviation: the standard deviation of monthly returns.
Average: The arithmetic average of monthly returns, annual returns, and annual standard deviations across all years in a period.

However, an examination of the two subperiods, 1983–1988 and 1989–1992, suggests a different conclusion. Although the strong relative performance of CTAs holds for the six-year, 1983–1988 period, during the recent four-year, 1989–1992 period, both common stocks and long-term bonds yield higher annual returns than do CTAs. During 1989–1992, the S&P 500 returns an average of 16.63% per year and long-term corporate bonds return an average of 13.07% per year, compared to 11.74% and 13.02% for a randomly selected CTA and an EWMP of CTAs, respectively.

A striking feature of the CTA returns in Table II is that the 1989–1992 average returns are significantly lower than the 1983–1988 average returns (less than half of the 1983–1988 average returns). Further, in three of the years, 1989, 1991, and 1992, CTA returns are lower than in any other year during the entire 1983–1992 period. Thus, the high CTA returns reported for the entire 1983–1992 period are clearly driven by the high returns during the years from 1983 to 1988. This sharp difference in returns also exists for pools and public funds (which are discussed in subsequent sections of the article). A possible explanation for this difference in returns is the potential survivorship bias in the data, which would have the effect of inflating reported returns for the 1983–1988 period. However, this data bias does not appear to be the entire explanation because the average return on the buy-and-hold futures benchmark investment strategy (the CRB index) also is much higher in 1983–1988 than in the 1989–1992 period (10.22% versus 4.65%) (see Table I). Since there is no possibility of a survivorship bias in the CRB index, the higher relative return in the CRB index in the 1983–1988 period cannot be due to a survivorship bias. Thus, it appears that market conditions during the 1989–1992 period are responsible for the substantially lower CTA returns during this period. A possible explanation is that in 1989–1992 a greater volume of speculative investment may have driven down trading returns.[13] There is also no way of knowing whether the conditions which existed in the 1989–1992 period were anomalous or representative of an equilibrium shift in managed futures returns.

The annual standard deviation of monthly returns of randomly selected CTAs ranges from a high of 12.71% in 1987 to a low of 5.94% in 1992, and for an EWMP of CTA monthly returns it ranges from a high of 8.08% in 1983 to a low of 2.61% in 1992[14] (see Table II). Over the entire ten-year period, the average standard deviation of monthly returns for randomly selected CTAs in 9.78%, compared to 5.41% for EWMP monthly returns.[15] The lower volatility of EWMP returns represents the benefit of holding a diversified portfolio of CTAs, as opposed to investing in a single, randomly selected CTA. In general, however, the standard deviations of monthly returns for both CTA investments are considerably higher than are those for the returns on the alternative nonfutures benchmark investments (see Table I).

Sharpe ratios also can be used to compare the performance of CTA investments with nonfutures investments. These results and the relative rankings of the investments for the three sample periods are shown in

[13]Alternatively, special market conditions may have existed during the 1983–1988 period which resulted in abnormally high returns.

[14]The annual standard deviation of randomly selected CTA monthly returns is the average of the individual CTA standard deviations of monthly returns for the year for all CTAs in existence during the entire year. New entrants and nonsurviving CTAs during the sample year are excluded in calculating the standard deviation because to include them would bias the calculation downward. The annual standard deviation for an EWMP of CTA returns is the standard deviation of EWMP monthly returns for the year. Since the EWMP monthly return is the arithmetic average of monthly returns of all CTAs, new entrants and nonsurvivors are included and excluded on a month by month basis.

[15]Standard deviations for randomly selected CTA returns over multi-year periods are the arithmetic averages of the annual standard deviations calculated for all CTAs. For comparison purposes, the standard deviation of EWMP monthly returns over multi-year periods is also the arithmetic average of the EWMP annual standard deviations.

TABLE III

CTAs: Sharpe Ratios and Relative Rankings

	Sample Period		
Investment	*1983–1992*	*1983–1988*	*1989–1992*
		Sharpe Ratio	
RS CTA	0.083	0.097	0.052
EWMP of CTAs	0.183	0.197	0.140
Buy & hold futures	−0.046	0.037	−0.228
Common stocks	0.171	0.159	0.192
Small stocks	0.077	0.067	0.093
IT gov't bonds	0.224	0.177	0.309
LT gov't bonds	0.151	0.117	0.232
LT corp. bonds	0.205	0.161	0.322
		Sharpe Ratio Rank	
RS CTA	6	6	7
EWMP of CTAs	3	1	5
Buy & hold futures	8	8	8
Common stocks	4	4	4
Small stocks	7	7	6
IT gov't bonds	1	2	2
LT gov't bonds	5	5	3
LT corp bonds	2	3	1

Sharpe ratio is the monthly rate of return minus the risk-free rate, divided by the standard deviation of monthly rates of return.

Table III. Over the entire ten-year period, the randomly selected CTA, despite its high average return, has a Sharpe ratio of only 0.083, ranking well below common stocks and all types of bonds, and above only the buy-and-hold futures strategy and small-cap stocks. In contrast, the EWMP of CTAs has a Sharpe ratio of 0.183, ranking below only long-term corporate bonds and intermediate-term government bonds. The superior EWMP Sharpe ratio is due to the significantly lower standard deviation of EWMP returns.

The superiority of EWMP Sharpe ratios is even greater in the 1983–1988 six-year period (see Table III). During this period the EWMP Sharpe ratio ranks first against all other investments. In the recent 1989–1992 four-year period, however, even the EWMP Sharpe ratio does poorly, ranking well below many other investments. The dramatic drop in the Sharpe ratios for both randomly selected CTA returns and for an EWMP of CTA returns in the 1989–1992 period primarily reflects the low CTA returns for that period.[16] Nevertheless, in the 1989–1992 period, the Sharpe ratio for an EWMP of CTAs (0.140) is still above that for small-cap stocks (0.093).

Thus, for the entire 1983–1992 ten-year period, an investment in a broadly diversified portfolio of CTAs (such as an EWMP of CTAs) would have outperformed an investment in both large-cap and small-cap common stocks, as well as long-term government bonds. In contrast, an undiversified investment in a randomly selected CTA would have produced high returns but also high returns volatility, making it a poor stand-alone investment on a risk-adjusted basis.[17]

Private Pools

Table IV provides monthly and annual rates of return and annual standard deviations of monthly returns for private pools, both for randomly selected pools and for an EWMP of pools. The mean monthly return of a randomly selected pool ranges from a high of 3.46% in 1987 to a low of 0.09% in 1992. The mean monthly return for an EWMP of pools ranges from a high of 4.12% in 1987 to a low of 0.08% in 1992. For the 1983–1992 period, the average annual return for a randomly selected pool is 16.85%, while the average annual return on an EWMP of pools is 22.11%. Similar to CTA returns, however, pool returns are much lower in the 1989–1992 period than in the 1983–1988 period. During the 1989–1992 period, an investment in either a randomly selected pool (6.83% a year) or an EWMP of pools (8.27% a year) would have been outperformed by nearly every one of the nonfutures benchmark investments.

Over the entire ten-year period, the average annual standard deviation of the monthly returns of randomly selected pools is a surprisingly high 9.67%[18] (see Table IV). In contrast, the average annual standard deviation of the monthly returns of an EWMP of pools is 5.09% for the

[16]This occurs even though the standard deviation of CTA returns also is much lower in 1989–1992 than in 1983–1988 (see Table II).

[17]This conclusion is generally consistent with earlier studies of CTA returns which used different return measures and relied on much smaller samples. See Lintner (1983), Baratz and Eresian (1985), Baratz and Eresian (1989), and Oberuc (1990). None of these studies, obviously, was able to examine CTA returns for the different subperiods analyzed in this study.

[18]The annual standard deviation of monthly returns of randomly selected pools is the average of the standard deviations of the monthly returns of each pool during a year. Average standard deviations for randomly selected pool returns over multi-year periods are the arithmetic average of the annual standard deviations calculated for each pool for each year. For comparison purposes, the standard deviation of EWMP monthly returns over multi-year periods is also the arithmetic average of the EWMP standard deviations for each year.

TABLE IV

Private Pools: Returns and Standard Deviations

Year	Number of Pools	*Randomly Selected Pool* Monthly Return	Annual Return	Standard Deviation	*Equal-Weighted Market Portfolio of Pools* Monthly Return	Annual Return	Standard Deviation
			Percent			Percent	
1983	25	1.98	26.51	11.42	2.41	33.08	7.67
1984	32	1.25	16.12	12.53	1.50	19.58	9.25
1985	52	1.60	21.00	11.11	2.03	27.23	5.38
1986	75	1.44	18.70	12.45	2.33	31.85	4.98
1987	110	3.46	50.47	11.58	4.12	62.41	4.68
1988	137	0.67	8.35	10.85	1.09	13.89	6.48
1989	169	0.23	2.73	8.47	0.44	5.47	4.01
1990	208	1.55	20.23	5.88	1.75	23.20	2.25
1991	220	0.27	3.27	6.69	0.28	3.41	3.85
1992	235	0.09	1.07	5.75	0.08	1.01	2.36
Average							
1983–92		1.25	16.85	9.67	1.60	22.11	5.09
1983–88		1.73	23.52	11.66	2.25	31.34	6.41
1989–92		0.53	6.83	6.70	0.64	8.27	3.12

Annual Return: the actual monthly returns during the year compounded.
Monthly Return: the twelfth root of the annual return.
Standard Deviation: the standard deviation of monthly returns.
Average: The arithmetic average of monthly returns, annual returns, and annual standard deviations across all years in a period.

ten-year period. This difference in return volatility indicates that the average pool is not fully diversified, and that an investment in an EWMP of pools will provide a superior Sharpe ratio. It is also noteworthy that the volatility of returns is nearly identical for both a randomly selected CTA and a randomly selected pool[19] (compare Tables II and IV). This indicates that a multi-CTA pool does not, on average, provide a more diversified investment vehicle than does an investment in a single CTA.

Sharpe ratios and rankings for the alternative benchmark investments for the three sample periods are shown in Table V. Over the entire ten-year period, the randomly selected private pool, with its high return and correspondingly high standard deviation, has a Sharpe ratio of 0.072, ranking below every other investment except the buy-and-hold futures strategy. In contrast, an EWMP of pools has a Sharpe ratio of 0.205 and

[19]CTAs often manage customer money by employing a private pool legal structure. Consequently, the performance history of CTAs may be reported in both the MAR CTA and the MAR pool data bases. To avoid this overlap, all one-CTA pools are eliminated from the pool data base.

TABLE V

Pools: Sharpe Ratios and Relative Rankings

Investment	Sample Period 1983–1992	1983–1988	1989–1992
		Sharpe Ratio	
RS pool	0.072	0.098	0.003
EWMP of pools	0.205	0.258	0.041
Buy & hold futures	−0.046	0.037	−0.228
Common stocks	0.171	0.159	0.192
Small stocks	0.077	0.067	0.093
IT gov't bonds	0.224	0.177	0.309
LT gov't bonds	0.151	0.117	0.232
LT corp. bonds	0.205	0.161	0.322
		Sharpe Ratio Rank	
RS pool	7	6	7
EWMP of pools	2	1	6
Buy & hold futures	8	8	8
Common stocks	4	4	4
Small stocks	6	7	5
IT gov't bonds	1	2	2
LT gov't bonds	5	5	3
LT corp. bonds	3	3	1

Sharpe ratio is the monthly rate of return minus the risk-free rate, divided by the standard deviation of monthly rates of return.

ranks above every benchmark investment but intermediate-term bonds (due primarily to the significantly lower standard deviation of EWMP returns).

In the recent 1989–1992 four-year period, a drastic reversal occurs. The Sharpe ratios for both randomly selected pools and for an EWMP of pools fall sharply. During this period, based on Sharpe ratios, randomly selected pools and the EWMP of pools rank above only the buy-and-hold futures strategy (see Table V). The Sharpe ratio for a randomly selected pool is barely positive at 0.003, and is only 0.041 for an EWMP of pools; less than a quarter of the Sharpe ratio for common stocks (0.192).

Thus, based on the entire 1983–1992 period, a broadly diversified portfolio of pools appears to make an outstanding stand-alone investment. However, if only the 1989–1992 results are considered, the data do not support this conclusion.[20]

[20]The only other study that examines private pool data supports this study's ten-year-period result—

TABLE VI

Public Funds: Returns and Standard Deviations

		Randomly Selected Fund			*Equal-Weighted Market Portfolio of Funds*		
Year	*Number of Funds*	*Monthly Return*	*Annual Return*	*Standard Deviation*	*Monthly Return*	*Annual Return*	*Standard Deviation*
			Percent			Percent	
1983	52	−0.58	−6.75	9.66	−0.42	−4.92	6.72
1984	66	1.22	15.65	9.09	1.39	18.04	6.86
1985	77	1.49	19.41	7.49	1.63	21.40	5.07
1986	98	−0.68	−7.84	8.87	−0.53	−6.15	5.78
1987	124	2.41	33.12	7.75	2.71	37.84	5.43
1988	148	0.54	6.69	8.56	0.65	8.05	6.41
1989	196	−0.19	−2.21	8.33	0.19	2.33	4.99
1990	238	1.29	16.69	5.04	1.47	19.07	2.83
1991	281	0.40	4.95	6.10	0.40	4.88	4.22
1992	323	−0.11	−1.32	4.92	−0.13	−1.54	2.96
Average							
1983–92		0.58	7.84	7.58	0.74	9.90	5.13
1983–88		0.73	10.05	8.57	0.91	12.37	6.04
1989–92		0.35	4.53	6.10	0.48	6.19	3.75

Annual Return: the actual monthly returns during the year compounded.
Monthly Return: the twelfth root of the annual return.
Standard Deviation: the standard deviation of monthly returns.
Average: the arithmetic average of monthly returns, annual returns, and annual standard deviations across all years in a period.

Public Futures Funds

Public funds are the poorest of the managed futures investments. Table VI provides the annual rates of return and standard deviations for public funds. In contrast to CTA and private pool returns, not all of the annual returns for public funds are positive. The mean monthly return of a randomly selected fund ranges from a high of 2.41% in 1987 to a low of −0.68% in 1986. The mean monthly return for an EWMP of funds ranges from a high of 2.71% in 1987 to a low of −0.53% in 1986.

Randomly selected funds return an average of only 7.84% annually over the 1983–1992 period and are outperformed by every other benchmark investment except for T-bills and a passive buy-and-hold futures

that a market portfolio of pools makes an outstanding stand-alone investment. Orr (1985, revised 1987) uses the MAR Futures Pool Index from 1980 through 1986. The Sharpe ratio for the Futures Pool Index is found to be greater than the Sharpe ratio for the S&P 500 index, and almost as great as the Sharpe ratio for the Solomon High-Grade Corporate Bond Index, concluding that an investment in a market portfolio of private pools makes a good stand-alone investment. That study, however, covers many fewer years and, in particular, does not examine the 1989–1992 period.

TABLE VII

Funds: Sharpe Ratios and Relative Rankings

	Sample Period		
Investment	*1983–1992*	*1983–1988* *Sharpe Ratio*	*1989–1992*
RS fund	0.002	0.016	−0.026
EWMP of funds	0.034	0.051	−0.008
Buy & hold futures	−0.046	0.037	−0.228
Common stocks	0.171	0.159	0.192
Small stocks	0.077	0.067	0.093
IT gov't bonds	0.224	0.177	0.309
LT gov't bonds	0.151	0.117	0.232
LT corp. bonds	0.205	0.161	0.322
		Sharpe Ratio Rank	
RS fund	7	8	7
EWMP of funds	6	6	6
Buy & hold futures	8	7	8
Common stocks	3	3	4
Small stocks	5	5	5
IT gov't bonds	1	1	2
LT gov't bonds	4	4	3
LT corp. bonds	2	2	1

Sharpe ratio is the monthly rate of return minus t he risk-free rate, divided by the standard deviation of monthly rates of return.

investment. An EWMP of funds yields 9.90% a year over the 1983–1992 period and is also outperformed by every other investment class except T-bills and the buy-and-hold futures strategy.

The average annual standard deviation of monthly returns for a randomly selected fund is 7.58% over the 1983–1992 period, while the average annual standard deviation of an EWMP of funds is 5.13% (close to the 5.41% standard deviation of an EWMP of CTAs). The higher standard deviation of randomly selected funds (7.58%) indicates that the average fund (like the average pool) is not fully diversified.

Sharpe-ratio rankings of fund investments for the three sample periods are presented in Table VII. Over the entire ten-year period, the randomly selected public fund has a Sharpe ratio of 0.002, well below that for common stocks and bonds. The EWMP of funds has a Sharpe ratio of 0.034, and also ranks well below stocks and bonds. Thus, it is difficult to argue that fund investments make good stand-alone investments.

The recent 1989–1992 period portrays an even more dismal picture. In this period, both the randomly selected fund and the EWMP of funds have *negative* Sharpe ratios. The respective Sharpe ratios are −0.026 for a randomly selected fund and −0.008 for the EWMP of funds. Public funds during this period do not provide a return greater than the T-bill yield.

A finding that public funds do not make good stand-alone investments is consistent with the findings of earlier studies. In particular, Elton, Gruber, and Rentzler (1987, 1990) find that public funds perform poorly relative to stocks and bonds during the 1979–1988 period. More recently, Irwin, Krukemyer, and Zulauf (1992) find that under no scenario does the Sharpe ratio of a public fund investment exceed the Sharpe ratio of a stock or bond investment during the 1979–1989 period.[21]

Summary and Implications

Table VIII provides a summary of the average annual rates of return and Sharpe ratios for each of the managed futures investments examined for the three time periods.

These statistics suggest several conclusions.[22]

First, public futures funds clearly provide the poorest stand-alone investment. They yield the lowest rates of return, have the lowest Sharpe ratios, and compare unfavorably with alternative benchmark investments. This is hardly surprising. Public funds are notable for their high fees and expenses—as high as 18% of equity per year. Thus, public funds would have to earn a very high before-fee (or gross) rate of return for investors to receive an attractive return.

Second, investments in an EWMP of CTAs or pools provide attractive stand-alone investments. In terms of Sharpe ratios, for the entire 1983–1992 period, these investments outperformed both the S&P 500 stock index and a portfolio of small-cap stocks (see Tables III and V). Only an investment in intermediate-term bonds would have outperformed

[21]See also Brorsen and Irwin (1985) and Murphy (1986). Earlier studies of public futures funds by Lintner (1983) and Irwin and Brorsen (1985) find some support for the view that funds make good stand-alone investments. However, those studies examine a relatively small number of public funds for only a few early years.

[22]In the discussion which follows, no attempt is made to distinguish between the alternative investments on the basis of statistical significance tests. The returns reported in this table (as well as in all of the other tables in this article) represent returns for the entire universe (or populations) of traders during the time periods reported. Thus, there are no sampling issues to examine.

TABLE VIII

Returns and Sharpe Ratios for Managed Futures and Alternative Investments

	1983–1992		1983–1988		1989–1992	
	Annual Return	*Sharpe Ratio*	*Annual Return*	*Sharpe Ratio*	*Annual Return*	*Sharpe Ratio*
Randomly selected:						
CTAs	18.35	0.083	22.75	0.097	11.74	0.052
Pools	16.85	0.072	23.52	0.098	6.83	0.003
Funds	7.84	0.002	10.05	0.016	4.53	−0.026
EWMP of:						
CTAs	20.98	0.183	26.28	0.197	13.02	0.140
Pools	22.11	0.205	31.34	0.258	8.27	0.041
Funds	9.90	0.034	12.37	0.051	6.19	−0.008
S&P 500	16.80	0.171	16.91	0.159	16.63	0.192
IT gov't bonds	11.15	0.224	10.98	0.177	11.41	0.309
LT gov't bonds	13.01	0.151	13.10	0.117	13.10	0.232
LT corporate bonds	13.46	0.205	13.71	0.161	13.07	0.322
Treasury bills	6.97	0.000	7.39	0.000	6.33	0.000
Buy&Hold futures	5.91	−0.046	9.34	0.037	0.76	−0.228

EWMP = Equal Weighted Market Portfolio, IT = Intermediate-Term, LT = Long-Term.

these managed futures investments, largely because of the very low returns volatility of bonds. However, if only the 1989–1992 period is taken, these conclusions are dramatically reversed: diversified investments in both CTAs and pools appear to make poor stand-alone investments.

Third, for the entire 1983–1992 period, an EWMP of either CTAs or pools outperforms an investment in either a randomly selected CTA or pool. The most dramatic difference occurs with respect to Sharpe ratios: EWMP investments have much higher Sharpe ratios because of their significantly lower returns volatility (due to greater diversification).

Fourth, all three managed futures investments yield significantly lower returns and have much lower Sharpe ratios in the 1989–1992 period than in the 1983–1988 period.[23] The reason for this sharp drop in performance is unclear. A possible explanation is that the higher returns during the 1983–1988 period are due to a survivorship bias in the data for that period, which would have the effect of artificially inflating average

[23]The difference in mean returns in the two subperiods is significantly different at the one percent level for all three managed futures investments. Thus, it is very unlikely that the observed differences in returns are due simply to random variation in returns. In addition, the return variances in the two subperiods are also significantly different for all three managed futures investments. Given that the two subperiods are significantly different from one another, it would be inappropriate to run any statistical tests based on the entire 1983–1992 period.

returns for these years. However, the same pattern of returns (high in 1983–1988 and low in 1989–1992) is observed for CRB index returns (the passive buy-and-hold futures strategy), which are clearly not subject to a survivorship bias. In addition, while there may exist a survivorship bias in the CTA data, there is no reason to believe that such a bias exists in the private pool and public funds data, and investments in both pools and funds exhibit a similar pattern of returns to that of CTAs. Thus, the sharp drop in returns on all managed futures investments during the 1989–1992 period appears to be due to different market conditions in the 1989–1993 period than in the 1983–1988 period. Just what these differences were remains a matter of speculation among traders and academics, and may provide an intriguing subject for future research.

Fifth, a somewhat surprising result is that an investment in a randomly selected pool does not outperform an investment in a randomly selected CTA investment. Commodity pool operators (CPOs) arguably provide three important services to investors: they select superior CTAs to manage investor funds; they place money with more than one CTA, providing diversification benefits; and they monitor the performance of the CTAs they select, moving investor funds from one CTA to another to enhance performance. To the extent that CPOs possess these skills, an investment in a randomly selected pool should outperform an investment in a randomly selected CTA. However, CPOs also charge for these services (about 4–6% of annual equity), which works to lower the net (after-fee) returns to an investment in a pool versus a CTA. This finding—that an investment in a randomly selected pool has a lower rate of return and a lower Sharpe ratio than does an investment in a randomly selected CTA—suggests that the services performed by CPOs do not justify the fees they charge. The poor performance of pools relative to CTAs in the 1989–1992 period is even more striking.

Finally, a buy-and-hold futures strategy always under performs an investment in either a randomly selected or an EWMP of CTAs or pools. This suggests that CTAs and pools either have trading skill or that they trade commodities that are not in the CRB futures index but which yield a higher return.[24]

MANAGED FUTURES AS PORTFOLIO ASSETS

Some institutional investors such as pension funds are now incorporating managed futures investments into their portfolios in an effort to enhance

[24]Different futures indexes may yield higher returns than does the CRB index. A future study is planned to investigate this possibility.

portfolio performance.[25] A major impetus for this movement is that returns on managed futures investments have a low correlation with the returns on most other financial assets. Table IX provides correlation coefficients between the returns on the different managed futures investments and the returns on various alternative asset classes for the 1983–1992 and 1989–1992 periods. The correlations between the different managed futures investments and stocks and bonds are all close to zero (especially for the longer, 1983–1992 period), supporting the view that managed futures may enhance portfolio performance by providing diversification benefits.[26]

More specifically, adding a new asset to an existing portfolio of assets will enhance portfolio performance if the following condition is satisfied.[27]

$$\begin{bmatrix}\text{Sharpe Ratio of}\\ \text{Candidate Asset}\end{bmatrix} \geq \begin{bmatrix}\text{Correlaton}\\ \text{Coefficient}\end{bmatrix} \times \begin{bmatrix}\text{Sharpe Ratio}\\ \text{of Portfolio}\end{bmatrix} \qquad (2)$$

where the correlation is between the returns on the new asset and the returns on the existing portfolio. If this correlation is zero, the above equation reduces to the following condition:

$$\begin{bmatrix}\text{Sharpe Ratio of}\\ \text{Candidate Asset}\end{bmatrix} \geq 0 \qquad (3)$$

This condition will always be true if the rate of return on the new asset is greater than the risk-free rate of return.

In the remainder of this section the above methodology is used to determine, first, whether incorporating a particular managed futures investment into a diversified portfolio enhances portfolio performance; and, second, the optimal amount of the managed futures investment to add to a diversified portfolio in the event that it does enhance portfolio performance. Prior studies have used this methodology to examine only investments in public futures funds.[28]

[25]See Burr (1994) and Mattlin (1991).
[26]The correlation between a randomly selected CTA, pool, or fund and the other asset classes is the average of the individual correlation coefficients between each CTA, pool, or fund and the other asset classes.
[27]See Elton, Gruber and Rentzler (1987).
[28]See, in particular, Elton, Gruber, and Rentzler (1987, 1990), and Irwin, Krukemyer, and Zulauf (1990). These studies generally find that adding public futures funds to a diversified portfolio does not enhance performance. Much more limited studies of CTAs include Lintner (1983), Baratz and Eresian (1986, 1990), Peters (1989), and Oberuc (1990). Orr (1987) also examined a small sample of pools for earlier years.

TABLE IX

Correlations Among Returns, 1983–1992

Investment	*RS CTA*	*EWMP of CTAs*	*RS Pool*	*EWMP of Pools*	*RS Fund*	*EWMP of Funds*	*B & H Futures*	*S&P 500*	*Small-Cap Stocks*	*T-Bills*	*IT Gov't Bonds*	*LT Gov't Bonds*	*LT Corp. Bonds*	*Infla-tion*
	Correlation Coefficient													
RS CTA	1.00													
EWMP of CTAs	0.39	1.00												
RS pool	0.30	0.36	1.00											
EWMP of pools	0.37	0.93	0.38	1.00										
RS fund	0.32	0.49	0.33	0.48	1.00									
EWMP of funds	0.37	0.94	0.35	0.88	0.50	1.00								
B & H futures	0.04	0.16	0.05	0.09	0.01	0.08	1.00							
S&P 500	0.05	0.05	0.07	0.11	0.03	0.01	−0.11	1.00						
Small-cap stocks	−0.02	−0.02	−0.05	0.00	−0.05	−0.04	−0.02	0.82	1.00					
T-bills	0.04	0.04	0.02	0.05	0.05	0.05	0.03	−0.02	−0.14	1.00				
IT gov't bonds	0.04	0.05	0.09	0.08	0.06	0.05	−0.27	0.27	0.04	0.15	1.00			
LT gov't bonds	0.06	0.08	0.12	0.11	0.08	0.08	−0.25	0.35	0.13	0.10	0.92	1.00		
LT corp. bonds	0.06	0.09	0.10	0.11	0.08	0.11	−0.26	0.32	0.13	0.11	0.91	0.93	1.00	
Inflation	0.06	0.01	0.06	−0.02	0.02	−0.02	−0.01	−0.18	−0.19	0.18	−0.17	−0.24	−0.18	1.00

TABLE IX (Continued)

Correlations Among Returns, 1989–1992

Investment	*RS CTA*	*EWMP of CTAs*	*RS Pool*	*EWMP of Pools*	*RS Fund*	*EWMP of Funds*	*B & H Futures*	*S&P 500*	*Small-Cap Stocks*	*T-Bills*	*IT Gov't Bonds*	*LT Gov't Bonds*	*LT Corp. Bonds*	*Inflation*
	Correlation Coefficient													
RS CTA	1.00													
EWMP of CTAs	0.37	1.00												
RS pool	0.13	0.35	1.00											
EWMP of pools	0.37	0.98	0.37	1.00										
RS fund	0.17	0.49	0.17	0.48	1.00									
EWMP of funds	0.35	0.92	0.34	0.92	0.50	1.00								
B & H futures	−0.04	0.03	−0.02	0.02	−0.07	−0.26	1.00							
S&P 500	0.03	−0.02	0.02	−0.02	0.06	0.10	−0.31	1.00						
Small-cap stocks	−0.04	−0.22	−0.08	−0.22	−0.08	−0.15	−0.06	0.72	1.00					
T-bills	0.07	0.15	0.08	0.11	0.03	0.07	0.03	0.03	−0.02	1.00				
IT gov't bonds	0.04	0.13	0.06	0.12	0.10	0.16	−0.36	0.39	0.02	0.09	1.00			
LT gov't bonds	0.06	0.15	0.07	0.15	0.12	0.16	−0.33	0.54	0.21	0.05	0.91	1.00		
LT corp. bonds	0.05	0.12	0.06	0.12	0.10	0.13	−0.34	0.57	0.29	0.03	0.90	0.98	1.00	
Inflation	0.09	0.19	0.05	0.17	0.08	0.13	−0.12	−0.45	−0.49	0.36	−0.14	−0.26	−0.25	1.00

All correlations are for monthly rates of return.

RS = Randomly Selected, EWMP = Equal Weighted Market Portfolio, B&H = Buy and Hold, T = Intermediate Term, LT = Long-Term.

Break-Even Analysis for Investments in CTAs, Pools, and Funds

The minimum rate of return that an asset must have for its inclusion in a portfolio to enhance performance can be determined by rewriting eq. (1) and solving for the required break-even rate of return:

$$\left[\frac{R_c - R_f}{\sigma_c}\right] \geq \rho_{pc}\left[\frac{R_p - R_f}{\sigma_p}\right] \tag{4}$$

where

R_c = the rate of return on managed futures investment, c,
R_f = the riskless rate of return,
σ_c = the standard deviation of monthly rates of return on the managed futures investment, c,
R_p = the rate of return on portfolio, p,
σ_p = the standard deviation of the monthly rates of return on portfolio, p,
ρ_{cp} = the correlation between the monthly returns on the managed futures investment, c, and the monthly returns on portfolio, p.

Solving for R_c yields the minimum (or break-even) return that a candidate asset must have to enhance portfolio performance. Finally, to utilize this methodology empirically, an assumption must be made about the characteristics of the hypothetical portfolio. Two hypothetical portfolios are examined: one invested 100% in S&P 500 stocks, and one invested 60% in S&P 500 stocks and 40% in long-term corporate bonds.

Table X provides the required break-even returns versus the actual returns for alternative CTA, pool, and fund investments. Over the 1983–1992, ten-year period, actual monthly returns for randomly selected CTAs and for an EWMP of CTAs are two to three times greater than the required break-even returns for both the all-stock and the 60/40 stock/bond portfolios. During the 1989–1992 four-year period, actual monthly returns of a randomly selected CTA and of an EWMP of CTAs are still almost two times the required break-even returns.

Over the 1983–1992, ten-year period, actual monthly returns for randomly selected pools and for an EWMP of pools also are more than two times the required break-even returns. During the 1989–1992 period, however, returns of a randomly selected pool are virtually identical to the break-even returns, while the returns of an EWMP of pools exceed the break-even returns by only a small margin.

Finally, actual returns for randomly selected public funds do not exceed the required break-even returns for either the all-stock or the

TABLE X

Portfolio Break-Even Analysis for Managed Futures Investments

Sample Period	*RS CTA*		*EWMP of CTAs*		*RS Pool*		*EWMP of Pools*		*RS Fund*		*EWMP of Funds*	
Investment Portfolio	*Break-Even Return*	*Average Return*	*Break-Even Return*	*Average Return*	*Break-Even Return*	*Average Return*	*Break-Even Return*	*Average Return*	*Break-Even Return*	*Average Return*	*Break-Even Return*	*Average Return*
	Percent per Month		Percent per Month		Percent per Month		Percent per Month		Percent per Month		Percent per Month	
1983–1992:												
100% stock	0.643	1.374	0.613	1.548	0.613	1.254	0.558	1.605	0.653	0.580	0.654	0.736
60% stock, 40% bond	0.614	1.374	0.596	1.548	0.603	1.254	0.577	1.605	0.624	0.580	0.617	0.736
1938–1988:												
100% stock	0.768	1.688	0.679	1.916	0.698	1.734	0.591	2.247	0.780	0.734	0.698	0.905
60% stock, 40% bond	0.688	1.688	0.641	1.916	0.660	1.734	0.613	2.247	0.691	0.734	0.651	0.905
1989–1992:												
100% stock	0.558	0.903	0.499	0.997	0.536	0.532	0.503	0.640	0.583	0.350	0.586	0.481
60% stock, 40% bond	0.551	0.903	0.516	0.997	0.539	0.532	0.517	0.640	0.570	0.350	0.563	0.481

RS = Randomly Selected, EWMP = Equal Weighted Market Portfolio.
Stock: S&P500; Bonds: Long-term Corporate Bonds.

stock/bond portfolio during the 1983–1992 period; and in the 1989–1992 period, the performance of these funds is even worse. However, over the 1983–1992, ten-year period, actual returns for an EWMP of funds does exceed the required break-even returns, but not by much. This result is reversed during the 1989–1992 period: actual EWMP returns fall short of the break-even returns for the all stock and stock/bond portfolios. Thus, in comparison to investments in CTAs and private pools, public funds do not appear to make attractive portfolio investments.

Optimal Portfolio Analysis

The foregoing results indicate that an optimal portfolio should include at least some managed futures investments. In this section, the magnitudes of the various managed futures investments that would optimize portfolio performance are estimated.

These magnitudes can be determined by using a methodology similar to that used by Elton and Gruber (1987) and IKZ (1992) to estimate optimal portfolio weights. Elton and Gruber (1987) show that optimal portfolio proportions can be obtained by solving the following constrained optimization:[29]

$$\text{Maximize } \gamma_p = \frac{R_p - R_f}{\sigma_p} \tag{5}$$

subject to

$$R_p = \sum_{i=1}^{N} R_i X_i, \sum_{i=1}^{N} X_i = 1, X_i \geq 0 \text{ for all } i \tag{6}$$

where

γ_p = Sharpe ratio of optimal portfolio, p,
R_p = the expected rate of return on optimal portfolio, p,
σ_p = the standard deviation of the monthly rates of return on optimal portfolio, p,
R_f = the risk-free rate of return,
X_i = the proportion of asset i in optimal portfolio, p,
R_i = the expected rate of return on asset i.

The objective function represented by eq. (5) is nonlinear. Therefore,

[29]This formulation maximizes the Sharpe ratio and thereby implicitly assumes a specific, risk-preference function. Other assumptions include the possibility of riskless borrowing and lending at the same rate and the impossibility of short sales.

the optimization problem must be solved by using a numerical algorithm (such as that contained in many software packages).[30] In addition, the optimal portfolio weights are estimated under both unconstrained and constrained conditions. IKZ argue that constraining the portfolio proportions reduces the estimation error when solving an optimal portfolio problem.[31] Thus, using IKZ's constrained-estimation procedure, the minimum and maximum portfolio proportions for stocks and bonds are set equal to the minimum and maximum U.S. capital-market-value weights over the 1970–1984 period.[32]

1983–1992

The optimum portfolio allocations for the 1983–1992 period are shown in Tables XI, XII and XIII for CTAs, pools, and funds, respectively.[33] These tables are generated by assuming that a particular managed futures investment is available to be included in a portfolio consisting of the following asset classes: S & P 500, small-cap stocks, intermediate-term government bonds, long-term government bonds, and long-term corporate bonds. Without the inclusion of any managed futures investment, the optimal portfolio allocations based upon the 1983–1992 performance histories of these assets are 15% common stocks and 85% intermediate-term government bonds. Neither small-cap stocks nor long-term government or corporate bonds enters the optimal portfolio. This (unconstrained 85/15 bond/stock) portfolio has an annual return of 11.82%, a standard deviation of monthly returns of 1.53%, and a Sharpe ratio of 0.245, and is used as the benchmark portfolio to evaluate the benefits of incorporating a managed futures investment into the portfolio.

Table XI shows the unconstrained optimal portfolio allocation when CTAs are added to the portfolio. An investment in a randomly selected CTA would receive up to 4% of the optimal portfolio, reducing intermediate-term government bonds from 85% to 81%. The resulting Sharpe ratio is 0.255, which is a 4% improvement over the optimal benchmark

[30]SAS is used in this study.

[31]See also Frost and Savarino (1988).

[32]See Ibbotson, Siegel and Love (1985). The actual ranges are:

Common stocks	45.5 to 64.3%
Small stocks	4.3 to 7.3%
Intermediate-term govt. bonds	8.9 to 19.8%
Long-term govt. bonds	7.1 to 19.0%
Long-term corporate bonds	9.9 to 17.0%

In estimating these ranges, it is assumed that the market portfolio consists of only the above five nonfutures asset classes.

[33]Results for the 1983–1988, six-year period are essentially the same.

TABLE XI

Optimal Portfolio Allocations for CTAs, 1983–1992

Optimal Portfolio	*Without Futures*	*Randomly Selected* *Unconstrained*	*Equal Weighted*	*Without Futures*	*Randomly Selected* *Constrained*	*Equal Weighted*
Proportions:						
CTAs	0%	4%	17%	0%	8%	24%
S&P 500	15%	15%	13%	46%	46%	46%
Small-cap stocks	0%	0%	0%	4%	4%	4%
IT gov't bonds	85%	81%	70%	20%	19%	9%
IT gov't bonds	0%	0%	0%	13%	7%	7%
LT corp. bonds	0%	0%	0%	17%	17%	10%
Expected return						
Per month	0.94%	0.95%	1.04%	1.09%	1.12%	1.24%
Per year	11.82%	12.07%	13.19%	13.95%	14.35%	15.92%
Standard deviation Per month	1.53%	1.54%	1.60%	2.69%	2.70%	2.80%
Sharpe ratio	0.245	0.255	0.297	0.198	0.208	0.242
Change	—	4%	21%	—	5%	22%

Optimal portfolio allocations are those that maximize Sharpe ratio values.
The constrained optimizations use the minimum and maximum U.S. capital market weights over 1970–1984 given in Ibbotson, Siegal, and Love (1985).
The ranges are:

S&P 500	45.5 to 64.3%
Small-cap stocks	4.3 to 7.3%
Intermediate-term gov't bonds	8.9 to 19.8%
Long-term gov't bonds	7.1 to 19.0%
Long-term corporate bonds	9.9 to 17.0%

stock/bond portfolio. An investment in an EWMP of CTAs would receive 17% of the optimal portfolio, reducing the proportions of stocks and bonds to about 13% and 70%, respectively. The resulting Sharpe ratio of 0.297 is a 21% improvement over the benchmark stock/bond portfolio.

The results for the constrained optimal portfolios are even more supportive of CTAs as a portfolio investment. A randomly selected CTA is allocated 8% of the portfolio, with 50% and 42% in stocks and bonds, respectively. The resulting Sharpe ratio of 0.208 is a 5% improvement over the constrained benchmark stock/bond portfolio. An investment in an EWMP of CTAs is allocated the constraint-maximum of 24%, reducing the proportions of stocks and bonds to their constraint-minimums of 50% and 26% respectively. The resulting Sharpe ratio of 0.242 is a 22% improvement over the benchmark portfolio. Thus, the inclusion of an investment in CTAs significantly enhances portfolio performance.

TABLE XII

Optimal Portfolio Allocations for Pools, 1983–1992

Optimal Portfolio	*Without Futures*	*Randomly Selected*	*Equal Weighted*	*Without Futures*	*Randomly Selected*	*Equal Weighted*
		Unconstrained			*Constrained*	
Proportions:						
Pools	0%	4%	20%	0%	6%	24%
S&P 500	15%	15%	13%	46%	46%	46%
Small-cap stocks	0%	0%	0%	4%	4%	4%
IT gov't bonds	85%	81%	67%	20%	20%	9%
LT gov't bonds	0%	0%	0%	13%	7%	7%
LT corp. bonds	0%	0%	0%	17%	17%	10%
Expected return						
Per month	0.94%	0.95%	1.07%	1.09%	1.11%	1.25%
Per year	11.82%	11.98%	13.65%	13.95%	14.17%	16.11%
Standard deviation Per month	1.53%	1.53%	1.63%	2.69%	2.68%	2.75%
Sharpe ratio	0.245	0.251	0.313	0.198	0.205	0.251
Change	—	3%	28%	—	4%	27%

Optimal portfolio allocations are those that maximize Sharpe ratio values.
The constrained optimizations use the minimum and maximum U.S. capital market weights over 1970–1984 given in Ibbotson, Siegal, and Love (1985).
The ranges are:

S&P 500	45.5 to 64.3%
Small-cap stocks	4.3 to 7.3%
Intermediate-term gov't bonds	8.9 to 19.8%
Long-term gov't bonds	7.1 to 19.0%
Long-term corporate bonds	9.9 to 17.0%

Table XII presents the unconstrained optimal portfolio allocation when private pools are added to the portfolio. A randomly selected pool is allocated 4% of an unconstrained optimal portfolio, with 15% in stocks and 81% in intermediate-term government bonds. The resulting Sharpe ratio is 0.251, which is a 3% improvement over the optimal stock/bond benchmark portfolio. An EWMP of pools is allocated 20% of the portfolio, while the proportion of stocks and bonds is about 13% and 67%, respectively. The resulting Sharpe ratio of 0.313 is a 28% improvement over the optimal stock/bond benchmark portfolio.

The results for constrained optimal portfolios also support the inclusion of pools in a diversified portfolio. A randomly selected pool is allocated 6% of the constrained optimal portfolio, with 50% and 44% in stocks and bonds, respectively. The resulting Sharpe ratio of 0.205 is a 4% improvement over the benchmark stock/bond portfolio. An EWMP of

TABLE XIII

Optimal Portfolio Allocations for Funds, 1983–1992

Optimal Portfolio	*Without Futures*	*Randomly Selected*	*Equal Weighted*	*Without Futures*	*Randomly Selected*	*Equal Weighted*
		Unconstrained			*Constrained*	
Proportions:						
Funds	0%	0%	1%	0%	0%	0%
S&P 500	15%	15%	15%	46%	46%	46%
Small-cap stocks	0%	0%	0%	4%	4%	4%
IT gov't bonds	85%	85%	84%	20%	20%	20%
LT gov't bonds	0%	0%	0%	13%	13%	13%
LT corp. bonds	0%	0%	0%	17%	17%	17%
Expected return						
Per month	0.94%	0.94%	0.93%	1.09%	1.09%	1.09%
Per year	11.82%	11.82%	11.79%	13.95%	13.95%	13.95%
Standard deviation Per month	1.53%	1.53%	1.52%	2.69%	2.69%	2.69%
Sharpe ratio	0.245	0.245	0.245	0.198	0.198	0.198
Change	—	0%	0%	—	0%	0%

Optimal portfolio allocations are those that maximize Sharpe ratio values.
The constrained optimizations use the minimum and maximum U.S. capital market weights over 1970–1984 given in Ibbotson, Siegal, and Love (1985).
The ranges are:

S&P 500	45.5 to 64.3%
Small-cap stocks	4.3 to 7.3%
Intermediate-term gov't bonds	8.9 to 19.8%
Long-term gov't bonds	7.1 to 19.0%
Long-term corporate bonds	9.9 to 17.0%

pools receives the constraint-maximum of 24%, while the proportions of stocks and bonds are reduced to their constraint-minimums of 50% and 26%, respectively. The resulting Sharpe ratio is 0.251, a 27% improvement over the constrained benchmark stock/bond portfolio.

Thus, an investment in either an EWMP of CTAs or pools significantly enhances the performance of traditional stock/bond portfolios. In an optimal portfolio, these investments would constitute as much as 17 to 20% of the portfolio, more than stocks, and would increase Sharpe ratios by as much as 28%. A significant attraction of managed futures is the lower portfolio returns volatility that occurs when these investments are added to conventional stock/bond portfolios.

In contrast, an investment in a randomly selected CTA or pool enhances portfolio performance only marginally. An average CTA or pool is allocated less than 5% of the unconstrained optimal portfolio and improves the portfolio Sharpe ratio by less than 5%.

TABLE XIV

Optimal Portfolio Allocations for CTAs, Pools, and Funds When Evaluated Simultaneously, 1983–1992

Optimal Portfolio	*Without Futures*	*Randomly Selected*	*Equal Weighted*	*Without Futures*	*Randomly Selected*	*Equal Weighted*
	Unconstrained			*Constrained*		
Proportions:						
CTAs	0%	4%	0%	0%	6%	0%
Pools	0%	2%	20%	0%	4%	24%
Funds	0%	0%	0%	0%	0%	0%
S&P 500	15%	14%	13%	46%	46%	46%
Small-cap stocks	0%	0%	0%	4%	4%	4%
IT gov't bonds	85%	80%	67%	20%	16%	9%
LT gov't bonds	0%	0%	0%	13%	7%	7%
LT corp. bonds	0%	0%	0%	17%	17%	10%
Expected return						
Per month	0.94%	0.96%	1.07%	1.09%	1.13%	1.25%
Per year	11.82%	12.13%	13.65%	13.95%	14.46%	16.11%
Standard deviation Per month	1.53%	1.54%	1.63%	2.69%	2.71%	2.75%
Sharpe ratio	0.245	0.258	0.313	0.198	0.210	0.251
Change	—	5%	28%	—	6%	27%

Optimal portfolio allocations are those that maximize Sharpe ratio values.
The constrained optimizations use the minimum and maximum U.S. capital market weights over 1970–1984 given in Ibbotson, Siegal, and Love (1985).
The ranges are:

S&P 500	45.5 to 64.3%
Small-cap stocks	4.3 to 7.3%
Intermediate-term gov't bonds	8.9 to 19.8%
Long-term gov't bonds	7.1 to 19.0%
Long-term corporate bonds	9.9 to 17.0%

Table XIII provides the allocations for unconstrained optimal portfolios with an without public funds. A randomly selected public fund does not enter the unconstrained optimal portfolio at all. An EWMP of funds does enter the optimal portfolio, but it receives an allocation of only one percent of the portfolio and there is no discernable increase in the portfolio's Sharpe ratio. Results for constrained optimal portfolios are even less supportive of public funds as portfolio assets: neither the randomly selected public fund nor an EWMP of public funds enters the optimal portfolio.

Table XIV shows the optimal portfolio allocations when all three managed futures investments are permitted to enter the optimal portfolio simultaneously. When randomly selected CTAs, pools, and funds are considered simultaneously, the unconstrained portfolio allocation for managed futures investments is about 6%, divided between a randomly selected CTA (4%) and a randomly selected pool (2%). The shared allocation between randomly selected CTAs and pools occurs because the returns on these investments are not highly correlated.[34]

When EWMPs of CTAs, pools, and funds are considered simultaneously, an EWMP of pools is allocated 20% of the unconstrained optimal portfolio and 24% of the constrained optimal portfolio. An EWMP of CTAs does not enter either the constrained or unconstrained optimal portfolio because of the high correlation between an EWMP of pools and an EWMP of CTAs (0.93), and because an EWMP of pools has a higher return (22.11% a year vs. 20.98% a year) and a lower standard deviation (5.09% vs. 5.41%) than an EWMP of CTAs in the 1983–1992 period.[35] In the absence of an investment in pools, however, an EWMP of CTAs would have received a similar allocation in the optimal portfolio.

1989–1992

Tables XV, XVI, and XVII provide a similar analysis for the 1989–1992, four-year period. Not surprisingly, given the earlier results, managed futures are a less attractive portfolio asset based solely on their performance during the 1989–1992 period. However, an investment in CTAs still enters the optimal portfolio. Table XV shows that a randomly selected CTA receives 2% of the unconstrained optimal portfolio and 4% of the constrained optimal portfolio, and an EWMP of CTAs receives 13% of the unconstrained optimal portfolio and 23% of the constrained optimal portfolio. Further, the inclusion of an EWMP of CTAs in the portfolio improves the Sharpe ratio of the optimal benchmark portfolio by 6 to 8%.

Table XVI shows that the results for pools change drastically in the 1989–1992 period. An investment in a randomly selected pool does not enter the optimal portfolio, and an EWMP of pools receives a significant allocation (6%) only in the constrained optimal portfolio. Further, these investments make virtually no improvement in the Sharpe ratios of the benchmark optimal portfolios. Thus, the results for 1989–1992 stand in sharp contrast to those for the entire 1983–1992 period, where pools received large portfolio allocations (as much as 24%) and improved the portfolio Sharpe ratios by as much as 28%.[36]

[34]The average correlation between a randomly selected CTA and a randomly selected pool is 0.30. See Table IX.

[35]See Tables II and IV.

[36]An investment in pools, however, would still have enhanced the performance of an *all-stock* portfolio during the 1989–1992 period. In such a portfolio, an investment in an EWMP of pools would have received a 33.7% allocation and would have improved the portfolio's Sharpe ratio by 7% (from 0.181–0.194). The resulting portfolios, nevertheless, would not have been optimal portfolios.

TABLE XV

Optimal Portfolio Allocations for CTAs, 1989–1992

Optimal Portfolio	*Without Futures*	*Randomly Selected* (*Unconstrained*)	*Equal Weighted*	*Without Futures*	*Randomly Selected* (*Constrained*)	*Equal Weighted*
Proportions:						
CTAs	0%	2%	13%	0%	4%	23%
S&P 500	1%	0%	0%	46%	46%	46%
Small-cap stocks	2%	3%	6%	4%	4%	4%
IT gov't bonds	48%	49%	55%	20%	20%	9%
LT gov't bonds	0%	0%	0%	13%	9%	7%
LT corp. bonds	49%	46%	26%	17%	17%	11%
Expected return						
Per month	0.96%	0.96%	0.95%	1.08%	1.08%	1.10%
Per year	12.16%	12.09%	11.95%	13.76%	13.73%	14.05%
Standard deviation Per month	1.39%	1.37%	1.27%	2.42%	2.39%	2.33%
Sharpe ratio	0.323	0.325	0.341	0.235	0.237	0.254
Change	—	1%	6%	—	1%	8%

Optimal portfolio allocations are those that maximize Sharpe ratio values.

The constrained optimizations use the minimum and maximum U.S. capital market weights over 1970–1984 given in Ibbotson, Siegal, and Love (1985).

The ranges are:

S&P 500	45.5 to 64.3%
Small-cap stocks	4.3 to 7.3%
Intermediate-term gov't bonds	8.9 to 19.8%
Long-term gov't bonds	7.1 to 19.0%
Long-term corporate bonds	9.9 to 17.0%

Finally, just as in the 1983–1992 period, Table XVII shows that an investment in public funds does not enter either the constrained or unconstrained optimal portfolios in the 1989–1992 period. This is hardly surprising, given the substantially lower returns earned by public funds in the 1989–1992 period.

ARE MANAGED FUTURES A HEDGE AGAINST INFLATION?

Some investors have turned to managed futures investments in the belief that they provide a hedge against general price inflation. This belief stems from the expectation that a positive correlation should exist between commodity prices, in general, and price inflation. Thus, long positions in commodity futures should benefit during inflationary times.

TABLE XVI

Optimal Portfolio Allocations for Pools, 1989–1992

Optimal Portfolio	*Without Futures*	*Randomly Selected*	*Equal Weighted*	*Without Futures*	*Randomly Selected*	*Equal Weighted*
		Unconstrained			*Constrained*	
Proportions:						
Pools	0%	0%	1%	0%	0%	6%
S&P 500	1%	1%	0%	46%	46%	46%
Small-cap stocks	2%	2%	3%	4%	4%	4%
IT gov't bonds	48%	48%	49%	20%	20%	20%
LT gov't bonds	0%	0%	0%	13%	13%	7%
LT corp. bonds	49%	49%	47%	17%	17%	17%
Expected return						
Per month	0.96%	0.96%	0.95	1.08%	1.08%	1.06%
Per year	12.16%	12.16%	12.07%	13.76%	13.76%	13.52%
Standard deviation Per month	1.39%	1.39%	1.37%	2.42%	2.42%	2.33%
Sharpe ratio	0.323	0.323	0.323	0.235	0.235	0.236
Change	—	0%	0%	—	0%	0%

Optimal portfolio allocations are those that maximize Sharpe ratio values.
The constrained optimizations use the minimum and maximum U.S. capital market weights over 1970–1984 given in Ibbotson, Siegal, and Love (1985).
The ranges are:

S&P 500	45.5 to 64.3%
Small-cap stocks	4.3 to 7.3%
Intermediate-term gov't bonds	8.9 to 19.8%
Long-term gov't bonds	7.1 to 19.0%
Long-term corporate bonds	9.9 to 17.0%

The performance of managed futures investments, however, depends on the performance of the related commodity traders, who commonly hold both long and short speculative positions. If these traders are predominantly short during inflationary times, they may incur losses rather than gains. Further, they may hold positions in financial futures, such as currency and stock index futures, for which the expected correlation with inflation is less obvious. Thus, *a priori*, it is not clear whether managed futures investments will provide a good hedge against inflation.

The findings of prior research studies are mixed. Irwin and Brorsen's (1985) study of 84 public futures funds finds a high correlation between the returns of public funds and inflation: 0.606 over the 1975–1983 period. Irwin and Landa (1987), using essentially the same data plus one year, find a correlation of 0.55 between returns on public funds and inflation. In contrast, Elton, Gruber, and Rentzler (1987, 1990) find no

TABLE XVII

Optimal Portfolio Allocations for Funds, 1989–1992

Optimal Portfolio	*Without Futures*	*Randomly Selected* (*Unconstrained*)	*Equal Weighted*	*Without Futures*	*Randomly Selected* (*Constrained*)	*Equal Weighted*
Proportions:						
Funds	0%	0%	0%	0%	0%	0%
S&P 500	1%	1%	1%	46%	46%	46%
Small-cap stocks	2%	2%	2%	4%	4%	4%
IT gov't bonds	48%	48%	48%	20%	20%	20%
LT gov't bonds	0%	0%	0%	13%	13%	13%
LT corp. bonds	49%	49%	49%	17%	17%	17%
Expected return						
Per month	0.96%	0.96%	0.96%	1.08%	1.08%	1.08%
Per year	12.16%	12.16%	12.16%	13.76%	13.76%	13.76%
Standard deviation Per month	1.39%	1.39%	1.39%	2.42%	2.42%	2.42%
Sharpe ratio	0.323	0.323	0.323	0.235	0.235	0.235
Change	—	0%	0%	—	0%	0%

Optimal portfolio allocations are those that maximize Sharpe ratio values.
The constrained optimizations use the minimum and maximum U.S. capital market weights over 1970–1984 given in Ibbotson, Siegal, and Love (1985).
The ranges are:

S&P 500	45.5 to 64.3%
Small-cap stocks	4.3 to 7.3%
Intermediate-term gov't bonds	8.9 to 19.8%
Long-term gov't bonds	7.1 to 19.0%
Long-term corporate bonds	9.9 to 17.0%

evidence of a positive correlation between the returns of public funds and inflation, and conclude that funds do not provide a hedge against inflation. Irwin, Krukemyer, and Zulauf (1992) provide further support for EGR's findings. This study of over 100 public funds from 1979 through 1989 reveals a negative relationship between fund returns and inflation: the average correlation for the 11-year period is −0.01. On a yearly basis, EGR find that the highest correlation between fund returns and inflation is 0.18, and in 4 of the 11 years there is a negative correlation between fund returns and inflation. (In 1986, for example, this correlation is −0.38.)

Table XVIII provides simple correlation coefficients between percentage changes in the Consumer Price Index (CPI) and monthly and annual returns on the different managed futures investments, as well as between percentage changes in the CPI and the returns on alternative

TABLE XVIII

Correlations with CPI

	Monthly Correlations			*Yearly Correlations*
Investment	*1983–1992*	*1983–1988*	*1989–1992*	*1983–1992*
RS CTA	0.06	0.00	0.09	0.30
EWMP of CTAs	0.01	−0.03	0.19	0.41
RS private pool	0.02	−0.02	0.05	0.25
EWMP of Pools	−0.02	−0.06	0.17	0.12
RS public fund	0.06	−0.02	0.08	0.39
EWMP of funds	−0.02	−0.09	0.13	0.54
B&H futures	−0.02	−0.11	0.21	0.22
CRB index	−0.03	−0.11	0.18	0.17
Common stocks	−0.18	−0.01	−0.45	−0.33
Small stocks	−0.19	−0.00	−0.49	−0.43
IT gov't bonds	−0.18	−0.20	−0.14	−0.31
LT gov't bonds	−0.25	−0.25	−0.26	−0.43
LT corp. bonds	−0.18	−0.16	−0.25	−0.39
T-Bills	0.18	0.10	0.36	0.39

The monthly correlations are computed from a series of monthly returns for the entire period.
The yearly correlations are computed from a series of annual returns for the entire period.

portfolio assets. For randomly selected CTAs, pools, or funds, the reported correlation coefficient is the average of the individual correlation coefficients between monthly percentage changes in the CPI and monthly returns of individual CTAs, pools, and funds. For an EWMP of CTAs, pools, or funds, the correlation coefficient is between monthly percentage changes in the CPI and monthly returns on the respective EWMP. These monthly correlation coefficients are very low in all three time periods, and provide little support for the view that managed futures are a hedge against inflation. This finding is consistent with those of both EGR and IKZ.

Correlations based on month-to-month returns, however, may not provide an adequate test of the inflation hypothesis because monthly time periods may be too short to capture the lead–lag relationships that may exist between inflation rates and managed futures returns.[37] To examine this possibility, the last column of Table XVIII provides correlations between annual returns for the alternative managed futures investments

[37]Peters (1992), p. 386.

TABLE XIX

Summary of Prior and Current Results

		Time Frame																			*Performance as a Stand-Alone Investment*			*Performance as a Portfolio Asset*			*Performance as an Inflation Hedge (1)*		
CTAs	*Time Period*	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	*Good*	*Mixed*	*Bad*	*Good*	*Mixed*	*Bad*	*Good*	*Mixed*	*Bad*
Lintner (1983)	7/79–12/82					X	X	X	X												X			X					
Baraz & Eresian (I) (1986)	1/80–12/85						X	X	X	X	X	X									X			X					
Peters (1989)	1/80–12/88						X	X	X	X	X	X	X	X	X						X			X					
Oberuc (1990)	3/79–12/89					X	X	X	X	X	X	X	X	X	X	X					X			X					
Baraz & Eresian (II) (1990)	1/84–12/88										X	X	X	X	X						X			X					
Fischmar & Peters (1990)	1/80–12/88						X	X	X	X	X	X	X	X	X						X[a]			X					
Edwards & Park (1995)	1/83–12/92									X	X	X	X	X	X	X	X	X	X		X			X				X	
	1/83–12/88									X	X	X	X	X	X						X			X					
	1/89–12/92															X	X	X	X		X			X					
Private Commodity Pools																													
Orr (1987)	1/80–12/86						X	X	X	X	X	X	X								X			X			X		
Edwards & Park (1995)	1/83–12/92									X	X	X	X	X	X	X	X	X	X		X			X				X	
	1/83–12/88									X	X	X	X	X	X						X			X					
	1/89–12/92															X	X	X	X				X			X			
Public Commodity Funds																													
Lintner (1983)	7/79–12/82					X	X	X	X												X			X					
Irwin & Brorsen (1985)	1/75–12/83	X	X	X	X	X	X	X	X	X											X			X			X		
Brorsen & Irwin (1985)	12/78–5/83				X	X	X	X	X	X												X[b]							

TABLE XIX (Continued)
Summary of Prior and Current Results

		Time Frame																			*Performance as a Stand-Alone Investment*			*Performance as a Portfolio Asset*			*Performance as an Inflation Hedge (1)*		
CTAs	*Time Period*	*75*	*76*	*77*	*78*	*79*	*80*	*81*	*82*	*83*	*84*	*85*	*86*	*87*	*88*	*89*	*90*	*91*	*92*	*93*	*Good*	*Mixed*	*Bad*	*Good*	*Mixed*	*Bad*	*Good*	*Mixed*	*Bad*
Irwin & Landa (1987)	1/75–12/85	X	X	X	X	X	X	X	X	X	X	X									X			X			X		
Murphy (1987)	5/80–4/85						X	X	X	X	X	X										X			X				
Elton, Gruber & Rentzler (I) (1987)	7/79–6/85					X	X	X	X	X	X	X											X			X			X
Elton, Gruber & Rentzler (II) (1990)	1/80–12/88						X	X	X	X	X	X	X	X	X								X			X			X
Irwin, Krukmeyer & Zulaf (1992)	1/79–12/89					X	X	X	X	X	X	X	X	X	X	X						X			X				X
	1/82–12/89								X	X	X	X	X	X	X	X							X			X			X
	1/85–12/89											X	X	X	X	X							X			X			X
Edwards & Park (1995)	1/83–12/92									X	X	X	X	X	X	X	X	X	X				X			X		X	
	1/83–12/88									X	X	X	X	X	X								X			X			
	1/89–12/92															X	X	X	X				X			X			

[a]Fischmar and Peters use compromise stochastic dominance and find that the best compromise portfolios contain allocations to CTAs of greater than 20%.
[b]Brorsen and Irwin apply stochastic dominance and find public futures funds to be superior for investors with higher risk tolerances, inferior for lower risk tolerance investors.
(1) All results, including this study, indicate that investments with traders, pools, and funds are a good hedge against inflation using year-to-year correlations rather than month-to-month correlations.

and annual percentage changes in the CPI. These correlations are significantly higher than the corresponding month-to-month correlations. For example, the correlation between a randomly selected CTA and the CPI jumps from 0.06 to 0.30, and the correlation between an EWMP of CTAs and the CPI goes from 0.01 to 0.41.[38] Similarly, the yearly correlations for both private pools and public funds rise significantly.[39] Thus, if a one-year rather than a one-month investment horizon is used, there is some support for the contention that managed futures investments provide a hedge against inflation.[40]

SUMMARY

This study examines the performance of managed futures investments during the 1983–1992 period, both as stand-alone investments and as assets in a diversified stock and bond portfolio. Specifically, investments in randomly selected CTAs, private pools, and public funds are examined, as well as investments in equally-weighted market portfolios (EWMPs) of CTAs, pools, and funds. Two subperiods also are examined: 1983–1988 and 1989–1992.

With respect to managed futures as stand-alone investments, this study's findings support the following conclusions. First, public futures funds provide the poorest stand-alone investment. They yield the lowest rates of return, have the lowest Sharpe ratios, and compare unfavorably with alternative nonfutures investments. The chief reason for this finding is undoubtedly the high fees and expenses associated with public futures funds. Second, an EWMP of either CTAs or pools provides an attractive stand-alone investment. During the 1983–1992 period, these investments outperformed, in particular, both the S&P 500 stock index and a portfolio of small-cap stocks. Third, for the 1983–1992 period, an EWMP of either CTAs or pools outperforms an investment in both a randomly selected CTA or pool, both in terms of average rates of return and Sharpe ratios. The most dramatic difference occurs with respect to Sharpe ratios: EWMP investments have much higher Sharpe ratios because EWMP returns have significantly lower volatility due to greater diversification among CTAs. Fourth, and somewhat surprisingly, a randomly selected pool does not outperform a randomly selected CTA. For the entire 1983–

[38]Both of the annual correlation coefficients are significantly different from zero at the 1% level.

[39]This conclusion, of course, is based on only ten years of data.

[40]Monthly returns on the alternative managed futures investments are also regressed on leading and lagged percentage changes in the CPI, ranging from −12 to +12 months. The results do not show a significant relationship between monthly returns and the CPI. The same result holds for regressions using quarterly returns and quarterly CPI changes.

1992 period, an investment in a randomly selected pool yields a lower rate of return and a lower Sharpe ratio than does an investment in a randomly selected CTA. This finding suggests that the services performed by CPOs do not justify the fees they charge. Fifth, all three managed futures investments yield significantly lower returns and have much lower Sharpe ratios in the 1989–1992 period than in both the 1983–1992 and 1983–1988 periods. The reason for this sharp drop in performance is unclear, but it appears to be related to general market conditions during the 1989–1992 period rather than to peculiarities in the data. Finally, any investment in either CTAs or pools is superior to a passive buy-and-hold futures strategy.

With respect to managed futures as a portfolio asset, an investment in an EWMP of either CTAs or pools significantly enhances the performance of conventional stock/bond portfolios. In particular, an EWMP of either CTAs or pools is allocated as much as 20% of an optimal portfolio (more than S&P 500 stocks) and increases the portfolio's Sharpe ratio by as much as 28%. The primary reason for this result is the low correlation between managed futures returns and the returns on other portfolio assets, which results in a lower portfolio returns volatility when managed futures are added to the portfolio. However, including an investment in a randomly selected CTA or pool in a stock/bond portfolio enhances performance only marginally. The optimal portfolio allocation given to either an average CTA or pool is less than 5%, and the improvement in the portfolio's Sharpe ratio is less than 5%. Finally, neither an investment in a randomly selected public fund nor in an EWMP of public funds enhances portfolio performance.

When all three managed futures alternatives are permitted to enter the optimal portfolio simultaneously for the 1983–1992 period, investments in both randomly selected CTAs and pools continue to enter the optimal portfolio, while only an investment in an EWMP of pools enters the optimal portfolio. The latter result occurs because an EWMP of pools dominates an EWMP of CTAs; their returns are highly correlated, but an EWMP of pools has a higher return (22.11% a year vs. 20.98% a year for CTAs) and a lower standard deviation (5.09% vs. 5.41% for CTAs). In the 1989–1992 period, these results change appreciably: investments in pools no longer add significantly to portfolio performance, while investments in CTAs enhance portfolio performance only marginally.

Finally, there is some evidence to support the contention that managed futures investments provide a hedge against inflation for investment horizons of a year or longer. In particular, although correlations between monthly percentage changes in the CPI and monthly returns on the different managed futures investments are virtually zero, correlations between annual rates of return on managed futures investments and yearly percentage changes in the CPI are significantly positive.[41]

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[41]Table XIX provides a comprehensive comparison of this study's findings versus previous studies of managed futures.

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