Hedge Fund and Commodity Fund Investments in Bull and Bear Markets

Commodity funds generally offer better downside protection than hedge funds.

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A primary motivation for investing in alternative asset classes is to diversify against the chance of poor performance in traditional asset classes, particularly equities. It is important, therefore, that investors understand how these asset classes can be expected to perform in bear stock markets. We examine the performance of two popular alternative asset classes in bear and bull stock markets, hedge funds and commodity funds.

Most studies of hedge fund and commodity fund performance do not distinguish between up and down stock markets (see Ackermann, McEnally, and Ravenscraft [1999]; Agarwal and Naik [2000]; Brown, Goetzmann, and Ibbotson [1999]; Edwards and Caglayan [2001]; Edwards and Liew [1999a and 1999b]; Fung and Hsieh [1997]; and Liang [1999]). Researchers also rely primarily on data from only the past decade, during which stock prices experienced a strong upward trend. Thus, the conclusions of these studies are based largely on an environment of rising stock prices. It is not clear how these funds would perform during a period of declining stock prices.

An exception is Schneeweis and Spurgin [1998 and 1999]. They find that the simple correlations between the returns on some alternative investments and stock returns are often quite different during extreme up and down movements in stock prices.

Our study examines in greater detail the performance of hedge funds and commodity funds in bear versus bull stock markets. Specifically, we analyze the performance of 16 different investment styles used by hedge

funds and commodity funds as both stand-alone assets and portfolio assets.

We compute optimal portfolio weights for each investment style in both bull and bear stock markets by including each investment style in an optimum stock and bond portfolio and maximizing the Sharpe ratio of the portfolio. Finally, we evaluate the performance of the different hedge fund and commodity fund investment styles using safety-first performance criteria that emphasize limiting downside risk, and compare these results to those obtained using the more conventional Sharpe ratio performance criterion.

The investment styles are listed in Exhibit 1. Descriptions are in the appendix. Our data, provided by Managed Accounts Reports (MAR), consist of the monthly returns of 1,665 hedge funds and 2,345 commodity funds during the 104-month period 1990:01 through 1998:08. As of mid-1998, these funds together managed about $175 billion, roughly two-thirds of the estimated total capital managed by all hedge funds and commodity funds. (For a more complete description of these data, see Edwards and Caglayan [2001].)

We construct both equal-weighted (EW) and value-weighted (VW) monthly return indexes for the various investment styles using the returns of individual hedge funds and commodity funds (including non-survivors) during the nine-year period 1990:01 through 1998:08. This differs from Schneeweis and Spurgin [1999], who use the indexes of hedge fund and commodity fund returns that are provided by data vendors, which may not include non-survivors.

PERFORMANCE IN BULL VERSUS BEAR STOCK MARKETS

To provide a benchmark against which to compare the performance of hedge funds and commodity funds in bull and bear markets, Exhibits 1 and 2 rank investment styles in terms of their overall performance during the 1990:01 through 1998:08 period. No distinction is made between bull and bear markets.

Exhibit 1 ranks the investment styles according to their respective individual Sharpe ratios, or as *stand-alone assets*. Exhibit 2 ranks the investment styles as *portfolio assets*, according to their respective contribution to the performance of an optimum diversified domestic stock and bond portfolio. Specifically, their rank is determined by the increase in the Sharpe ratio of the portfolio that results from their inclusion in an optimum stock and bond portfolio.[1]

The optimal benchmark portfolio to which hedge funds and commodity funds are added consists of S&P 500 index stocks (23%), intermediate-term government bonds (70%), U.S. small-stock index (3%), and long-term government bonds (4%). This portfolio produces the highest Sharpe ratio (0.92) during 1990:01 through 1998:08 of all domestic stock and bond index portfolios.

The rankings in Exhibits 1 and 2 are similar whether the styles are ranked as stand-alone or portfolio assets, or whether an EW or VW measure of returns is used. With respect to hedge funds, market-neutral, event-driven, and global macro are always ranked one, two, and three, no matter which ranking criterion or return measure is used. An exception, not surprisingly, is short-selling, which receives a higher ranking as a portfolio asset than as a stand-alone asset. Short-selling funds typically have a significant inverse correlation with stock returns, which makes them an attractive portfolio asset in declining stock markets.

Although the rankings of commodity funds differ somewhat, when the same measure of return is used, three of the four top-ranked styles are the same in both Exhibits 1 and 2. When EW returns are used, financial, agriculture, and currency are always in the top four styles. Similarly, when VW returns are used, private pools, financial, diversified, and agriculture are always in the top four styles.

Thus, the same styles receive a top ranking whether they are ranked on the basis of individual Sharpe ratios or on the basis of their contribution to a diversified asset portfolio. This conclusion is undoubtedly driven by the fact that all styles have a relatively low correlation with returns on stocks and bonds.

To examine performance separately in bull and bear stock markets, Exhibits 3 and 4 rank the respective investment styles separately for bull and bear market months, using the same performance criteria used in Exhibit 1 (stand-alone asset) and Exhibit 2 (portfolio asset). Exhibit 3 also provides, for bull and bear market months separately, mean annualized returns and Sharpe ratios for each investment style as well as the simple correlations between the monthly returns on each style and the monthly returns on the S&P 500 stock index.[2]

Bull market months are defined as those in which the S&P 500 index rises by 1% or more (or at an annualized rate of 12% or more), and bear market months are defined as those in which the S&P 500 falls by 1% or more (or at an annualized rate of minus 12% or more). Of the 104 months during 1990:01-1998:08, 62 qualify as bull market months and 25 as bear market months. The mean annualized return for the S&P 500 index is 43.49% in bull

EXHIBIT 1
STAND-ALONE ANALYSIS OF HEDGE FUND AND
COMMODITY FUND INDEX RETURNS BY INVESTMENT STYLE 1990:01-1998:08

	Rank by Sharpe Ratio	Sharpe Ratio	Average Annual Excess Return (%)	Annual Std. Deviation (%)	M² (%)
Hedge Funds					
EW Mkt.-Neutral Funds	1	3.06	7.67	2.52	30.483
EW Event-Driven Funds	2	1.77	11.20	6.36	13.279
EW Global Macro Funds	3	1.69	10.98	6.54	12.181
EW Sector-Specific Funds	4	1.42	16.36	11.59	8.581
EW Funds of Funds	5	1.11	5.85	5.31	4.529
EW Long-Only Funds	6	1.09	17.05	15.64	4.183
EW Global Funds	7	1.05	9.74	9.38	3.644
EW Short-Sell Funds	8	0.13	2.04	16.42	−8.554
EW All Hedge Funds	*NA*	*1.50*	*8.83*	*5.93*	*9.684*
VW Mkt.-Neutral Funds	1	1.83	3.78	2.10	14.091
VW Event-Driven Funds	2	1.64	9.17	5.61	11.613
VW Global Macro Funds	3	1.42	18.95	13.36	8.677
VW Funds of Funds	4	1.22	7.66	6.32	6.001
VW Global Funds	5	1.08	10.41	9.70	4.098
VW Sector-Specific Funds	6	0.89	12.26	13.79	1.629
VW Long-Only Funds	7	0.84	13.81	16.54	0.923
VW Short-Sell Funds	8	0.16	2.12	13.54	−8.110
VW All Hedge Funds	*NA*	*1.55*	*12.99*	*8.40*	*10.400*
Commodity Funds					
EW Financial CTAs	1	1.19	10.07	8.53	5.538
EW Stock CTAs	2	0.97	5.94	6.15	2.701
EW Agriculture CTAs	3	0.93	10.03	10.79	2.179
EW Currency CTAs	4	0.79	8.22	10.53	0.191
EW Diversified CTAs	5	0.77	7.94	10.46	0.000
EW Private Pools	6	0.43	4.08	9.63	−4.536
EW Public Funds	7	0.20	1.79	9.31	−7.617
EW Energy CTAs	8	−0.06	−0.77	12.33	−11.015
EW All CTAs	*NA*	*0.74*	*6.24*	*8.47*	*−0.375*
VW Private Pools	1	1.21	9.80	8.12	5.901
VW Financial CTAs	2	0.85	10.83	12.82	1.039
VW Diversified CTAs	3	0.83	8.77	10.59	0.831
VW Agriculture CTAs	4	0.71	5.12	7.27	−0.782
VW Public Funds	5	0.56	5.35	9.69	−2.821
VW Currency CTAs	6	0.51	5.27	10.39	−3.440
VW Stock CTAs	7	0.27	2.11	8.08	−6.682
VW Energy CTAs	8	−0.48	−7.56	15.79	−16.572
VW All CTAs	*NA*	*0.79*	*7.46*	*9.55*	*0.218*
Standard Assets					
S&P 500 Index	NA	0.77	10.19	13.30	NA
US Small Stock	NA	0.46	7.90	17.24	−4.114
Int.-Term Govt. Bonds	NA	0.73	3.08	4.31	−0.555
Long-Term Govt. Bonds	NA	0.73	5.99	8.25	−0.495
Long-Term Corp. Bonds	NA	0.79	4.90	6.32	0.191

EW and VW are equal-weighted and value-weighted portfolios. The average annual excess return is the annualized average of the monthly returns minus the monthly T-bill rates. The Sharpe ratio is average annual excess return divided by the standard deviation of monthly returns. M² is the absolute excess return in excess of the S&P 500 index return for the same level of returns volatility as the S&P 500 index.

EXHIBIT 2
PORTFOLIO ANALYSIS OF HEDGE FUNDS AND
COMMODITY FUNDS BY INVESTMENT STYLE 1990:01-1998:08

	Rank by Increase in Sharpe Ratio	Change in Sharpe Ratio of Optimal Portfolio	Percentage Increase in Sharpe Ratio of Optimal Portfolio	Weight in Optimal Portfolio
Hedge Funds				
EW Market-Neutral Funds	1	2.16	234.78%	96%
EW Event-Driven Funds	2	0.93	101.09%	72%
EW Global Macro Funds	3	0.81	88.04%	74%
EW Sector-Specific Funds	4	0.59	64.13%	51%
EW Short-Sell Funds	5	0.58	63.04%	35%
EW Long-Only Funds	6	0.45	48.91%	36%
EW Funds of Funds	7	0.33	35.87%	64%
EW Global Funds	8	0.30	32.61%	45%
EW All Hedge Funds	*NA*	*0.67*	*72.83%*	*68%*
VW Market-Neutral Funds	1	1.09	118.48%	83%
VW Event-Driven Funds	2	0.87	94.57%	73%
VW Global Macro Funds	3	0.61	66.30%	45%
VW Funds of Funds	4	0.38	41.30%	63%
VW Global Funds	5	0.32	34.78%	44%
VW Short-Sell Funds	6	0.24	26.09%	26%
VW Sector-Specific Funds	7	0.16	17.39%	28%
VW Long-Only Funds	8	0.15	16.30%	29%
VW All Hedge Funds	*NA*	*0.68*	*73.91%*	*66%*
Commodity Funds				
EW Financial CTAs	1	0.51	55.43%	58%
EW Agriculture CTAs	2	0.47	51.09%	38%
EW Diversified CTAs	3	0.31	33.70%	34%
EW Currency CTAs	4	0.28	30.43%	33%
EW Stock CTAs	5	0.25	27.17%	50%
EW Private Pools	6	0.08	8.70%	22%
EW Public Funds	7	0.02	2.17%	8%
EW Energy CTAs	8	0.01	1.09%	3%
EW All CTAs	*NA*	*0.32*	*34.78%*	*38%*
VW Private Pools	1	0.67	72.83%	57%
VW Agriculture CTAs	2	0.35	38.04%	37%
VW Diversified CTAs	3	0.33	35.87%	38%
VW Financial CTAs	4	0.28	30.43%	33%
VW Stock CTAs	5	0.16	17.39%	27%
VW Currency CTAs	6	0.14	15.22%	24%
VW Public Funds	7	0.12	13.04%	25%
VW Energy CTAs	8	0.00	0.00%	0%
VW All CTAs	*NA*	*0.29*	*31.52%*	*38%*

EW and VW are equal-weighted and value-weighted portfolios. The optimal benchmark portfolio consists of 23% S&P 500 index stocks, 3% U.S. small stock index, 70% intermediate-term government bonds, and 4% long-term government bonds, and has a Sharpe ratio of 0.92. Sharpe ratio changes are the difference between the Sharpe ratio of the optimal benchmark portfolio and the Sharpe ratio of the same portfolio after the respective hedge fund and commodity fund styles are included in the portfolio. Sharpe ratios and the optimal portfolio weights are obtained using a numerical algorithm because the objective function that maximizes the Sharpe ratio of the portfolio is non-linear. The percentage increase in the Sharpe ratio is calculated relative to the Sharpe ratio of the optimal benchmark portfolio.

EXHIBIT 3
SHARPE RATIOS, AVERAGE ANNUAL RETURNS, AND CORRELATIONS WITH S&P 500 INDEX RETURNS IN BULL AND BEAR MARKETS 1990:01-1998:08

	Bull Markets				Bear Markets			
	Rank by Sharpe Ratio	Sharpe Ratio	Average Annual Return(%)	Correlation with S&P 500	Rank by Sharpe Ratio	Sharpe Ratio	Average Annual Return(%)	Correlation with S&P 500
Hedge Funds								
EW Mkt.-Neutral Funds	1	3.71	14.22	0.350**	2	0.61	6.46	0.558**
EW Event-Driven Funds	3	3.03	24.18	0.216*	3	−1.43	−4.19	0.792**
EW Global Macro Funds	4	2.88	23.71	0.344**	4	−1.44	−4.52	0.317
EW Sector-Specific Funds	2	3.06	40.28	0.361**	7	−2.28	−21.48	0.611**
EW Funds of Funds	7	2.07	15.88	0.223*	5	−1.60	−3.61	0.657**
EW Long-Only Funds	6	2.24	40.02	0.419**	6	−1.91	−25.02	0.636**
EW Global Funds	5	2.56	28.88	0.466**	8	−2.73	−20.71	0.834**
EW Short-Sell Funds	8	−1.46	−19.13	−0.453**	1	3.44	61.39	−0.698**
EW All Hedge Funds	*NA*	*2.90*	*22.06*	*0.406** *	*NA*	*−2.11*	*−7.62*	*0.792** *
VW Mkt.-Neutral Funds	1	2.56	9.59	0.113	2	0.27	5.46	0.665**
VW Event-Driven Funds	4	2.46	18.66	0.058	4	-0.59	1.62	0.751**
VW Global Macro Funds	7	2.05	32.28	−0.013	3	-0.33	0.44	0.302
VW Funds of Funds	2	2.51	20.71	0.323**	7	-2.17	-8.82	0.651**
VW Global Funds	3	2.49	29.03	0.428**	8	-2.49	-19.22	0.822**
VW Sector-Specific Funds	5	2.19	35.04	0.273**	6	-1.97	-22.20	0.311
VW Long-Only Funds	6	2.12	39.92	0.487**	5	-1.90	-26.48	0.608**
VW Short-Sell Funds	8	−0.92	−7.61	−0.375**	1	2.65	40.79	−0.641**
VW All Hedge Funds	*NA*	*2.48*	*25.67*	*0.068*	*NA*	*-1.04*	*-3.85*	*0.556** *
Commodity Funds								
EW Financial CTAs	3	1.18	14.89	0.383**	1	1.45	17.26	−0.435**
EW Stock CTAs	1	1.97	16.97	0.304**	8	−1.17	−2.27	0.266
EW Agriculture CTAs	2	1.32	19.16	−0.137	7	0.42	9.44	−0.333
EW Currency CTAs	6	0.32	8.28	0.227*	2	1.40	19.64	0.183
EW Diversified CTAs	4	0.62	11.30	0.161	3	1.34	18.90	−0.438**
EW Private Pools	5	0.42	8.90	0.188	4	0.75	12.14	−0.514**
EW Public Funds	7	0.13	6.12	0.245*	6	0.51	9.64	−0.446**
EW Energy CTAs	8	−0.65	−3.16	0.173	5	0.55	11.66	−0.261
EW All CTAs	*NA*	*0.54*	*11.77*	*0.231* *	*NA*	*1.31*	*17.18*	*−0.390* *
VW Private Pools	1	1.05	13.43	0.194	1	1.88	20.16	−0.521**
VW Financial CTAs	2	0.75	14.47	0.330**	3	1.31	21.64	−0.409**
VW Diversified CTAs	3	0.62	11.41	0.180	2	1.39	19.58	−0.491**
VW Agriculture CTAs	5	0.49	8.41	0.007	7	0.81	10.81	−0.067
VW Public Funds	4	0.52	9.94	0.282**	6	0.83	12.90	−0.318
VW Currency CTAs	6	0.05	5.44	0.189	5	1.00	15.36	0.004
VW Stock CTAs	7	−0.45	1.21	−0.037	4	1.30	15.42	−0.032
VW Energy CTAs	8	−0.67	−5.76	0.066	8	−0.36	−0.77	0.248
VW All CTAs	*NA*	*0.55*	*10.63*	*0.227* *	*NA*	*1.45*	*19.66*	*−0.443** *
Standard Assets								
S&P 500 Index	NA	2.90	43.49	1.000**	NA	−3.81	−45.80	1.000**
US Small Stock	NA	2.01	47.12	0.353**	NA	−2.87	−44.62	0.692**
Int.-Term Govt. Bonds	NA	1.57	11.63	0.320**	NA	−1.40	−1.13	−0.166
Long-Term Govt. Bonds	NA	1.68	18.74	0.405**	NA	−1.57	−8.03	−0.107
Long-Term Corp. Bonds	NA	1.88	16.74	0.439**	NA	−1.85	−6.79	0.106

The order of the hedge fund and commodity fund styles is the same as in Exhibit 1, and is based on the Sharpe ratios in Exhibit 1. Bull market months are those in which the returns on the S&P 500 index rise by 1% or more, and bear-market months are those in which the returns on the S&P 500 index fall by 1% or more. Sharpe ratios for bull and bear markets are calculated using the standard deviation of returns for all months, and the respective mean returns for bull and bear market months. The test statistic for the correlation coefficients is $t(n - 2) = r / [(1 - r^2)/(n - 2)]^{(0.5)}$.

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

market months and minus 45.80% in bear market months (see Exhibit 3).

Returns for hedge funds in bear markets are generally negative, and almost all styles exhibit significantly higher *positive* correlations with stock returns in bear markets than in bull markets (see Exhibit 3). This is just the opposite from what an investor seeking diversification would hope for.

Market-neutral funds and short-selling funds are the exceptions. Market-neutral funds continue to have positive returns even in bear markets, although their correlation with stock returns rises. Short-selling funds produce very high returns in bear markets and have an inverse correlation with stock returns in both bull and bear markets.

Although event-driven, global macro, and funds of funds all have negative returns in bear markets using EW returns (−4.19%, −4.52%, and −3.61%, respectively), these negative returns are far better than the 45.80% average annualized decline in S&P 500 stocks during those months. This partially explains why market-neutral, event-driven, and global macro funds are generally ranked among the top four styles in *both* bull and bear markets.

Commodity funds provide greater downside protection than hedge funds in bear markets. In general, commodity funds have *higher* returns in bear markets, and have an inverse (or lower positive) correlation with stock returns in bear markets. In addition, when a VW return measure is used (which weights larger funds more heavily), the same styles are ranked in the top three in both bull and bear markets: private pools, financial, and diversified (see Exhibit 3). Similarly, when EW returns are used, financial and diversified rank among the top four styles in both bull and bear markets.

Thus, while commodity funds do not produce as high returns in bull markets as do hedge funds (11.77% versus 22.06% a year), they generally provide better diversification against a declining stock market than do hedge funds.

Exhibit 4 ranks investment styles according to their contribution to a diversified asset portfolio in bull and bear markets (as in Exhibit 2). Once again, market-neutral, event-driven, and global macro funds appear as the top-ranked hedge fund styles in both bull and bear markets, and, when VW return measures are used, private pools again appear as a top-ranked commodity style in both bull and bear markets. Other top-ranked commodity styles in bear markets, when either EW or VW returns are used, are financial, diversified, and currency. The top-ranked hedge funds and commodity funds also receive much higher portfolio allocations in bear markets than in bull

markets, which is further evidence of their diversification potential (see Exhibit 4).

Four general conclusions emerge from these findings. First, commodity funds generally provide greater downside protection than hedge funds. Second, the best-performing hedge fund and commodity fund styles when ranked as stand-alone assets (or by individual asset Sharpe ratios) are also the best-performing styles when ranked as portfolio assets. Third, the best-performing styles in bull stock markets are generally also the best-performing styles in bear stock markets.

Thus, the rankings in Exhibit 1 are surprisingly robust, both as to how these rankings are compiled and to bull and bear stock markets. This robustness with respect to bear stock markets is undoubtedly why some hedge fund and commodity fund styles are referred to by practitioners as "absolute return" strategies—the ability to provide a positive return in down-markets as well as in up-markets.

Finally, the optimal portfolio weights given to the top-ranked hedge funds and commodity funds are much greater in bear markets than in bull markets (see Exhibit 4). An investor who anticipates a declining stock market, therefore, would want to increase the proportion of the portfolio devoted to hedge funds and commodity funds.

SAFETY-FIRST PERFORMANCE CRITERIA

An alternative way to evaluate the performance of hedge funds and commodity funds in bull and bear markets is to use performance (or selection) criteria that place a heavier weight on avoiding bad outcomes. These criteria typically use "safety-first" decision rules, which put more emphasis on limiting the risk of poor performance than does the Sharpe ratio (our first performance criterion).

Two of the best-known safety-first criteria are those of Roy and Kataoka.[3] Roy's criterion considers the best asset or portfolio as the one that has the smallest probability of producing a return below some specified lower return level (R_L). For a portfolio, this can be stated as:

$$\text{Minimize Prob. } (R_p < R_L) \tag{1}$$

where

R_p = return on the portfolio; and
R_L = specified return below which investor does not want to fall.

EXHIBIT 4
PORTFOLIO ANALYSIS OF HEDGE FUNDS AND COMMODITY FUNDS
IN BULL AND BEAR MARKETS 1990:01-1998:08

	Bull Markets			Bear Markets		
	Rank by Increase in Sharpe Ratio	Change in Sharpe Ratio of Optimal Portfolio*	Weight in Optimal Portfolio	Rank by Increase in Sharpe Ratio	Change in Sharpe Ratio of Optimal Portfolio**	Weight in Optimal Portfolio
Hedge Funds						
EW Market-Neutral Funds	2	0.35	58%	2	1.75	100%
EW Event-Driven Funds	1	0.96	55%	3	1.50	100%
EW Global Macro Funds	4	0.17	24%	NA	0.00	0%
EW Sector-Specific Funds	3	0.33	34%	NA	0.00	0%
EW Short-Sell Funds	5	0.16	12%	1	4.70	76%
EW Long-Only Funds	8	0.03	8%	NA	0.00	0%
EW Funds of Funds	6	0.08	18%	NA	0.00	0%
EW Global Funds	7	0.07	22%	NA	0.00	0%
EW All Hedge Funds	*NA*	*0.24*	*43%*	*NA*	*0.00*	*0%*
VW Market-Neutral Funds	3	0.18	42%	NA	0.00	0%
VW Event-Driven Funds	1	0.89	49%	3	0.81	100%
VW Global Macro Funds	2	0.48	16%	2	0.86	100%
VW Funds of Funds	4	0.15	25%	NA	0.00	0%
VW Global Funds	6	0.06	14%	NA	0.00	0%
VW Short-Sell Funds	5	0.11	12%	1	4.12	100%
VW Sector-Specific Funds	NA	0.00	0%	NA	0.00	0%
VW Long-Only Funds	NA	0.00	0%	NA	0.00	0%
VW All Hedge Funds	*NA*	*0.43*	*25%*	*NA*	*0.00*	*0%*
Commodity Funds						
EW Financial CTAs	NA	0.00	0%	2	2.52	100%
EW Agriculture CTAs	1	0.42	14%	5	1.86	100%
EW Diversified CTAs	NA	0.00	0%	3	2.42	100%
EW Currency CTAs	NA	0.00	0%	1	2.71	100%
EW Stock CTAs	2	0.11	19%	8	0.21	100%
EW Private Pools	NA	0.00	0%	4	1.90	100%
EW Public Funds	NA	0.00	0%	6	1.67	100%
EW Energy CTAs	NA	0.00	0%	7	1.63	100%
EW All CTAs	*NA*	*0.00*	*0%*	*NA*	*2.38*	*100%*
VW Private Pools	2	0.01	3%	1	2.95	100%
VW Agriculture CTAs	1	0.04	9%	6	2.20	100%
VW Diversified CTAs	NA	0.00	0%	3	2.48	100%
VW Financial CTAs	NA	0.00	0%	2	2.51	100%
VW Stock CTAs	NA	0.00	0%	5	2.22	100%
VW Currency CTAs	NA	0.00	0%	4	2.29	100%
VW Public Funds	NA	0.00	0%	7	2.00	100%
VW Energy CTAs	NA	0.00	0%	8	0.92	100%
VW All CTAs	*NA*	*0.00*	*0%*	*NA*	*2.62*	*100%*

The order of the hedge fund and commodity fund styles is the same as in Exhibit 2. Bull market months are defined as those in which the S&P 500 index return is 1% or more, and bear market months are those in which the S&P 500 index return is negative 1% or more.

* *Change in the Sharpe ratio of the optimal portfolio is calculated as the difference between the Sharpe ratio of the optimal benchmark portfolio and the Sharpe ratio calculated after the EW and VW portfolios of hedge funds and commodity funds are added into the optimal benchmark portfolio. The optimal benchmark portfolio in the bull markets consists of 56% S&P 500 index, 17% U.S. small stock index, and 27% intermediate-term government bonds, and has a Sharpe ratio of 5.31.*

** *Change in the Sharpe ratio of the optimal portfolio is calculated the same way: it is the difference between the Sharpe ratios before and after the EW and VW portfolios of hedge funds and commodity funds are added to the optimal benchmark portfolio. The optimal benchmark portfolio in the bear markets consists of 100% allocated in intermediate-term government bonds. It has a Sharpe ratio of −1.21.*

Assuming that R_L lies below the mean return of the portfolio $E(R_p)$, this criterion implies that the best portfolio is the one for which R_L is the maximum number of standard deviations away from the mean return on the portfolio (see Elton and Gruber [1995, ch. 11]). Algebraically, this can be represented as:

$$E(R_p) = R_L + k\sigma_p \qquad (2)$$

where

$E(R_p)$ = mean return on the portfolio;
k = number of standard deviations that R_L lies below the mean return of the portfolio; and
σ_p = standard deviation of returns on the portfolio.

The objective function for this criterion reduces to maximizing k:

$$k = \frac{E(R_p) - R_L}{\sigma_p} \qquad (2')$$

The larger the k, the more desirable the portfolio.

An investor, therefore, must specify an "absolute return" below which she does not want to fall. This criterion is identical to the Sharpe ratio criterion if R_L is defined to be the riskless rate of return (or the T-bill rate). If R_L is set higher than the T-bill rate, which seems likely, a different result can occur. In the analysis that follows, we use an annual return of 10% as the specified lower return (R_L).

The second safety-first criterion, Kataoka's, considers the best asset or portfolio to be the one that maximizes R_L subject to the constraint that the probability of obtaining a return less than, or equal to, the specified lower return is not greater than some predetermined probability value. This can be represented for a portfolio as:

Maximize R_L
Subject to Prob. $(R_p < R_L) \leq \chi$ $\qquad (3)$

where χ = the predetermined probability value (in this analysis a probability value of 5%).

The likelihood of obtaining a portfolio return below the specified probability value depends on the number of standard deviations by which the lower limit lies below the mean return of the portfolio. With $\chi = 5\%$, the lower limit

for a portfolio lies 1.645 standard deviations below the mean portfolio return (see Elton and Gruber [1995, ch. 11]).

Thus, maximizing the lower limit R_L is equivalent to maximizing:

$$E(R_p) - 1.645\sigma_p \qquad (4)$$

Thus, a more desirable portfolio (a higher R_L) results from either a higher mean return or a lower standard deviation.

Exhibits 5 and 6 provide rankings of the different hedge fund and commodity fund styles according to the Sharpe, Roy, and Kataoka criteria. Exhibit 5 provides these rankings when hedge funds and commodity funds are viewed as stand-alone assets, and Exhibit 6 provides the rankings when hedge funds and commodity funds are viewed as assets in a diversified stock and bond portfolio. Exhibit 6 also provides optimal portfolio weights under the alternative performance criteria when these objective functions are maximized.

In Exhibits 5 and 6, both Roy's and Kataoka's criteria produce rankings that are very similar to those produced by the Sharpe ratio. An exception is market-neutral, which no longer ranks highly under Roy's criterion when returns are measured as VW returns. This occurs because market-neutral does not provide a VW return greater than the required 10% (see Exhibit 1). When EW returns are used, however, market-neutral is ranked first by Roy's criterion as well as by the other criteria. It is also notable that the portfolio allocations given to the top-ranked hedge funds and commodity funds are generally greater under Roy's criterion, which seeks to minimize the probability of incurring a return less than 10%.

This suggests that hedge funds and commodity funds are useful diversification assets when the objective is limiting downside risk and obtaining a specified minimum absolute return.

SUMMARY AND CONCLUSIONS

This study examines the performance of various hedge fund and commodity fund investment styles during periods of both rising and falling stock prices. Since a primary motivation for investing in hedge funds and commodity funds is to diversify against falling stock prices, it is important to understand how the different investment styles perform in bear stock markets. Past studies of both hedge fund and commodity fund performance generally do not examine this issue.

EXHIBIT 5
STAND-ALONE ANALYSIS OF HEDGE FUNDS AND COMMODITY FUNDS
USING ALTERNATIVE SELECTION CRITERIA 1990:01-1998:08

	Sharpe Ratio	Roy's Criterion with 10% Minimum Annual Return*	Kataoka's Criterion with $\chi = 5\%$** (%)	Ranking by Sharpe Ratio	Ranking by Roy's Criterion	Ranking by Kataoka's Criterion
Hedge Funds						
EW Market-Neutral Funds	3.06	1.03	8.44	1	1	1
EW Event-Driven Funds	1.77	0.96	5.66	2	3	2
EW Global Macro Funds	1.69	0.90	5.14	3	4	3
EW Sector-Specific Funds	1.42	0.97	2.21	4	2	4
EW Funds of Funds	1.11	0.14	2.03	5	7	5
EW Long-Only Funds	1.09	0.77	−3.76	6	5	7
EW Global Funds	1.05	0.50	−0.76	7	6	6
EW Short-Sell Funds	0.13	NA	−20.05	8	NA	8
VW Market-Neutral Funds	1.83	NA	5.25	1	NA	1
VW Event-Driven Funds	1.64	0.73	4.86	2	2	2
VW Global Macro Funds	1.42	1.04	1.91	3	1	4
VW Funds of Funds	1.22	0.41	2.19	4	6	3
VW Global Funds	1.08	0.55	−0.63	5	3	5
VW Sector-Specific Funds	0.89	0.52	−5.50	6	5	6
VW Long-Only Funds	0.84	0.53	−8.48	7	4	7
VW Short-Sell Funds	0.16	NA	−15.23	8	NA	8
Commodity Funds						
EW Financial CTAs	1.19	0.58	0.96	1	1	1
EW Stock CTAs	0.97	0.14	0.74	2	5	2
EW Agriculture CTAs	0.93	0.46	−2.80	3	2	3
EW Currency CTAs	0.79	0.30	−4.18	4	3	4
EW Diversified CTAs	0.77	0.27	−4.35	5	4	5
EW Private Pools	0.43	NA	−6.84	6	NA	6
EW Public Funds	0.20	NA	−8.60	7	NA	7
EW Energy CTAs	−0.06	NA	−16.13	8	NA	8
VW Private Pools	1.21	0.58	1.36	1	1	1
VW Financial CTAs	0.85	0.45	−5.34	2	2	4
VW Diversified CTAs	0.83	0.35	−3.73	3	3	3
VW Agriculture CTAs	0.71	0.01	−1.92	4	6	2
VW Public Funds	0.56	0.03	−5.67	5	4	5
VW Currency CTAs	0.51	0.02	−6.90	6	5	7
VW Stock CTAs	0.27	NA	−6.26	7	NA	6
VW Energy CTAs	−0.48	NA	−28.61	8	NA	8

The order of the hedge fund and commodity fund styles is the same as in Exhibit 1.

* *Roy's criterion values are computed for a 10% annual return. That is, 10% annual return is assumed to be the level of return below which the investors do not want to fall. To compute Roy's criterion, the minimum return should lie below the mean return of the portfolio. Any hedge fund portfolio that has an annual return below 10% is omitted from the analysis.*

** *Kataoka's criterion values are derived according to the predetermined probability value of $\chi = 5\%$.*

EXHIBIT 6
PORTFOLIO ANALYSIS OF HEDGE FUNDS AND COMMODITY FUNDS USING ALTERNATIVE SELECTION CRITERIA 1990:01-1998:08

	Sharpe Ratio			Roy's Criterion			Kataoka's Criterion		
	Rank by Sharpe Ratio of the Optimal Portfolio	Sharpe Ratio of the Optimal Portfolio*	Weight in the Optimal Portfolio	Rank by Roy's Criterion of the Optimal Portfolio	Roy's Criterion of the Optimal Portfolio**	Weight in the Optimal Portfolio	Rank by Kataoka's Criterion of the Optimal Portfolio	Kataoka's Criterion of the Optimal Portfolio*** (%)	Weight in the Optimal Portfolio
Hedge Funds									
EW Mkt.-Neutral Funds	1	3.08	96%	1	1.03	100%	1	8.45	98%
EW Event-Driven Funds	2	1.85	72%	3	0.96	100%	2	5.96	83%
EW Global Macro Funds	3	1.73	74%	4	0.90	100%	3	5.30	78%
EW Sector-Specific Funds	4	1.51	51%	2	0.97	100%	5	3.98	42%
EW Short-Sell Funds	5	1.50	35%	7	0.41	24%	4	4.33	33%
EW Long-Only Funds	6	1.37	36%	5	0.74	88%	8	2.76	23%
EW Funds of Funds	7	1.25	64%	NA	0.38	0%	6	3.35	54%
EW Global Funds	8	1.22	45%	6	0.50	90%	7	2.89	33%
VW Mkt.-Neutral Funds	1	2.01	83%	NA	0.38	0%	1	5.57	89%
VW Event-Driven Funds	2	1.79	73%	2	0.73	92%	2	5.53	78%
VW Global Macro Funds	3	1.53	45%	1	1.04	90%	3	4.08	37%
VW Funds of Funds	4	1.30	63%	6	0.44	74%	4	3.32	53%
VW Global Funds	5	1.24	44%	3	0.55	95%	5	2.92	33%
VW Short-Sell Funds	6	1.16	26%	NA	0.38	0%	6	2.91	23%
VW Sector-Specific Funds	7	1.08	28%	4	0.53	75%	8	1.97	17%
VW Long-Only Funds	8	1.07	29%	5	0.52	76%	7	2.01	16%
Commodity Funds									
EW Financial CTAs	1	1.43	58%	1	0.69	71%	1	3.71	47%
EW Agriculture CTAs	2	1.39	38%	2	0.60	56%	2	3.64	29%
EW Diversified CTAs	3	1.23	34%	3	0.50	49%	3	2.97	27%
EW Currency CTAs	4	1.20	33%	4	0.49	50%	5	2.83	24%
EW Stock CTAs	5	1.17	50%	NA	0.38	0%	4	2.96	40%
EW Private Pools	6	1.00	22%	NA	0.38	0%	6	2.06	18%
EW Public Funds	7	0.94	8%	NA	0.38	0%	7	1.71	11%
EW Energy CTAs	8	0.93	3%	NA	0.38	0%	8	1.70	7%
VW Private Pools	1	1.59	57%	1	0.74	70%	1	4.61	55%
VW Agriculture CTAs	2	1.27	37%	4	0.39	12%	2	3.49	34%
VW Diversified CTAs	3	1.25	38%	3	0.55	54%	3	2.91	28%
VW Financial CTAs	4	1.20	33%	2	0.59	55%	5	2.53	21%
VW Stock CTAs	5	1.08	27%	NA	0.38	0%	4	2.83	25%
VW Currency CTAs	6	1.06	24%	4	0.39	11%	6	2.33	19%
VW Public Funds	7	1.04	25%	4	0.39	16%	7	2.12	18%
VW Energy CTAs	NA	0.92	0%	NA	0.38	0%	NA	1.51	0%

The order of the hedge fund and commodity fund styles is the same as in Exhibit 2.

* *The optimal benchmark portfolio consists of 23% S&P 500 index, 3% U.S. small-stock index, 70% intermediate-term government bonds, and 4% long-term government bonds, and has a Sharpe ratio of 0.92. Portfolios of hedge funds and commodity funds that do not enter the optimal portfolio and hence are not able to enhance the portfolio's Sharpe ratio are indicated by NA.*

** *The optimal benchmark portfolio consists of 100% allocated to S&P 500 index and has a Roy's criterion measure of 0.38. Portfolios of hedge funds and commodity funds that do not enter the optimal portfolio and hence are not able to enhance the portfolio's Roy's criterion measure are indicated by NA. Roy's criterion values are computed for a 10% annual return. That is, 10% annual return is assumed to be the level of return below which investors do not want to fall. To compute Roy's criterion, the minimum return should lie below the mean return of the portfolio.*

****The optimal benchmark portfolio consists of 3% S&P 500 index, 8% U.S. small-stock index, and 89% intermediate-term government bonds. It has a Kataoka's criterion measure of 1.51. Portfolios of hedge funds and commodity funds that do not enter the optimal portfolio and hence are not able to enhance the portfolio's Kataoka's criterion measure are indicated by NA. Kataoka's criterion values are derived according to the predetermined probability value of $\chi = 5\%$.*

Using data on the monthly returns of 1,665 hedge funds and 2,345 commodity funds during the period 1990:01 through 1998:08, we conclude that commodity funds provide greater downside protection than hedge funds. Commodity funds have higher returns in bear markets than hedge funds, and generally have an inverse correlation with stock returns in bear markets. Hedge fund returns are generally negative in bear markets, and almost all hedge fund styles exhibit significantly higher positive correlation with stock returns in bear markets than in bull markets.

Four hedge fund styles, however—market-neutral, event-driven, global macro, and short-selling—perform reasonably well in bear markets, depending upon how returns are measured (as either EW or VW returns). Further, except for short-selling, these styles also are top performers in bull stock markets, and over all markets their performance far exceeds that of all commodity funds.

Thus, while commodity funds may offer better downside protection than hedge funds, market-neutral, event-driven, and global macro hedge funds provide fairly good downside protection while providing more attractive returns than commodity funds over all markets.

The conclusions of this study are based on only eight and a half years of monthly data, a relatively small sample in terms of financial markets and instruments. Further, we are able to observe only 25 months in which stock prices declined by 12% or more (on an annualized basis), and are not able to observe any periods during which stock prices fell over an extended period of time. Thus, only the future can tell if our conclusions will be robust to either more severe or more sustained periods of declining stock prices.

APPENDIX
MAR HEDGE FUND INVESTMENT STYLE CLASSIFICATIONS AND DEFINITIONS

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

—continued

MAR COMMODITY FUND INVESTMENT STYLE CLASSIFICATIONS AND DEFINITIONS

Investment Style	Definition
Public Funds	Similar to conventional stock or bond mutual funds, except that public fund managers buy and sell commodity futures, forward, and option contracts rather than stocks and bonds. Have low minimum-investment requirements, which make them accessible even to small (retail) investors.
Private Pools	Private investment partnerships organized and operated by a commodity pool operator (CPO). The CPO pools investor funds into a common portfolio and employs one or more professional traders or Commodity Trading Advisors (CTAs) to manage the pooled funds. Usually have high minimum-investment requirements, and are therefore generally available only to high-net worth individuals and institutional investors.
Currency CTAs	Trade futures, forwards, and options on currencies. Investors choose a particular CTA with an investment strategy that suits their risk preferences and have their funds managed by that CTA on an individual basis. Investments with CTAs are typically available only to investors with substantial net worth.
Agriculture CTAs	Trade futures, forwards, and options on agricultural commodities.
Financial CTAs	Trade futures, forwards, and options on fixed-income instruments.
Stock CTAs	Trade futures, forwards, and options on equity indexes.
Energy CTAs	Trade futures, forwards, and options on energy commodities.
Diversified CTAs	May trade futures, forwards, and options on all types of commodities and financial instruments.

ENDNOTES

[1]See Elton, Gruber, and Rentzler [1987] and Frost and Savarino [1988] for a discussion of this methodology and the underlying assumptions.

[2]Sharpe ratios for bull and bear markets are calculated using the standard deviation of returns for the entire 104 months, and the respective mean returns for bull and bear market months.

[3]For a discussion of the conditions under which safety-first criteria are consistent with expected utility maximization and with mean-variance analysis, see Elton and Gruber [1995].

REFERENCES

Ackermann, Carl, Richard McEnally, and David Ravenscraft. "The Performance of Hedge Funds: Risk, Return, and Incentives." *Journal of Finance*, 54 (1999), pp. 833-874.

Agarwal, Vikas, and Narayan Y. Naik. "On Taking the Alternative Route: Risks, Rewards, and Performance Persistence of Hedge Funds." *The Journal of Alternative Investments*, 2 (2000), pp. 6-23.

Brown, Stephen J., William N. Goetzmann, and Roger G. Ibbotson. "Offshore Hedge Funds: Survival and Performance 1989-1995." *Journal of Business*, 72 (1999), pp. 91-118.

Edwards, Franklin R., and Mustafa O. Caglayan. "Hedge Fund Performance and Manager Skill." *Journal of Futures Markets*, 2001, forthcoming.

Edwards, Franklin R., and Jimmy Liew. "Hedge Funds versus Managed Futures as Asset Classes." *The Journal of Derivatives*, 6 (1999a), pp. 45-64.

———. "Managed Commodity Funds." *Journal of Futures Markets*, 19 (1999b), pp. 377-411.

Elton, Edwin J., and Martin J. Gruber. *Modern Portfolio Theory and Investment Analysis, 5th ed.* New York: John Wiley & Sons, 1995.

Elton, Edwin J., Martin J. Gruber, and Joel C. Rentzler. "Professionally Managed, Publicly Traded Commodity Funds." *Journal of Business*, 60 (1987), pp. 175-199.

Frost, Peter A., and James E. Savarino. "For Better Performance: Constrain Portfolio Weights." *The Journal of Portfolio Management,* Fall 1988, pp. 29-34.

Fung, William, and David A. Hsieh. "Survivorship Bias and Investment Style in the Returns of CTAs." *The Journal of Portfolio Management,* Fall 1997, pp. 30-41.

Liang, Bing. "On the Performance of Hedge Funds." *Financial Analysts Journal*, 55 (1999), pp. 72-85.

Schneeweis, Thomas, and Richard Spurgin. "Alternative Investments in the Institutional Portfolio." Working paper, CISDM Isenberg School of Management, University of Massachusetts, 1998.

———. "The Benefits of Hedge Funds." Working paper, CISDM Isenberg School of Management, University of Massachusetts, 1999.