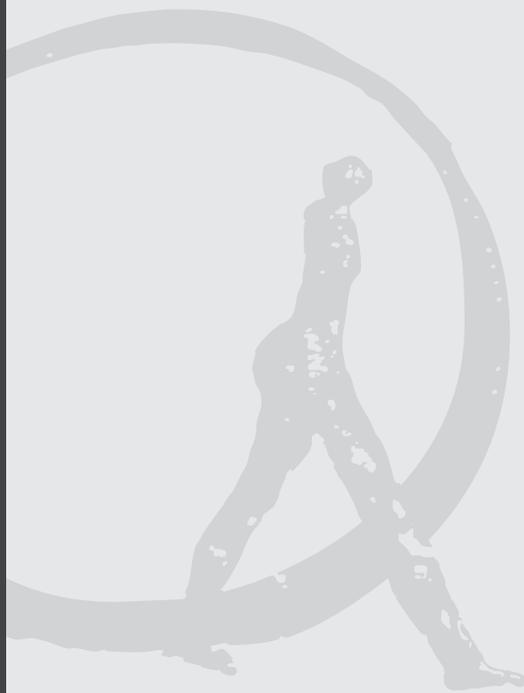


How to Design a Commodity Futures Trading Program

January 2011



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Abstract

We provide a step-by-step primer on how to design a commodity futures trading program. A prospective commodity manager must not only discover trading strategies that are expected to be generally profitable, but must also be careful regarding each strategy's correlation properties during different times of the year and during eventful periods. One must also ensure that the resulting product has a unique enough return stream that it can be expected to provide diversification benefits to an investor's overall portfolio.

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EDHEC pursues an active research policy in the field of finance. EDHEC-Risk Institute carries out numerous research programmes in the areas of asset allocation and risk management in both the traditional and alternative investment universes.

When designing a commodity futures trading program, one needs to create an investment process that addresses the following issues:

- Trade discovery,
- Trade construction,
- Portfolio construction,
- Risk management,
- Leverage level, and
- How the program will make a unique contribution to the investor's overall portfolio.

This article will cover each of these subjects in succession.

I. Trade Discovery

The first step is to discover a number of trades in which it is plausible that the investor has an "edge" or advantage. In our experience, a number of futures trading strategies can be well-known and publicised, which, nonetheless, does not prevent them from continuing to exist. We will provide three examples of such trades below.

A. Grain Example

In discussing consistently profitable grain futures trades, Cootner (1967) stated that the fact that they:

"persist in the face of such knowledge indicates that the risks involved in taking advantage of them outweigh the gain involved. This is further evidence that ... [commercial participants do] not act on the basis of expected values; that ... [these participants are] willing to pay premiums to avoid risk."

Cootner's article discussed detectable periods of concentrated hedging pressure by agricultural market participants that lead to "the existence of ... predictable trends in future prices." His article provided several empirical examples of this occurrence, including "the effect of occasional long hedging in the July wheat contract." Noting the tendency of the prices of futures contracts to "fall on average after the peak of net long hedging," Cootner stated that the July wheat contract should "decline relative to contract months later in the crop year which are less likely to be marked by long hedging."

Figure 1 summarises Cootner's empirical study on the July versus December wheat futures spread.

1948-to-1966 Average of July versus December Wheat Futures Price on the Indicated Dates	
January 31	-5.10c
February 28	-5.35c
March 31	-5.62c
April 30	-5.69c
May 31	-6.55c
June 30	-7.55c

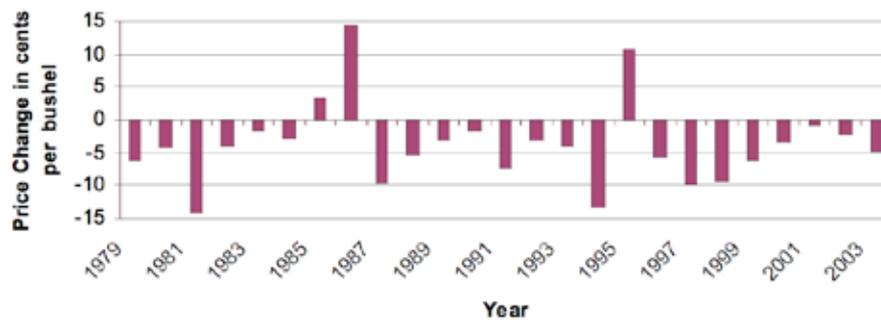
Source: Cootner, Paul, "Speculation and Hedging." Food Research Institute Studies, Supplement, 7, (1967), p. 100.

The spread on average declined by about 2.5c over the period.

The significant issue for us is that this phenomenon, which is linked to hedging activity, was published in 1967. Does this price pressure effect still exist today? The short answer appears to be yes.

From 1979 to 2003, on average this spread has declined -3.8c with a Z-statistic of -3.01. Figure 2 illustrates the yearly performance of this spread.

Figure 2 – Cootner’s Example Out-of-Sample - July Wheat - December Wheat Price Change from 1/31 to 6/30, 1979-2003

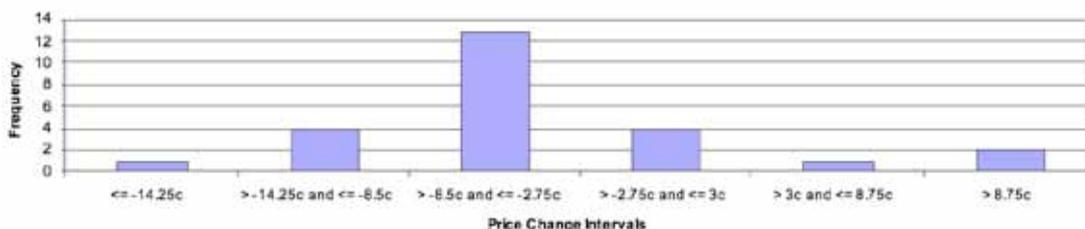


Source: Premia Capital Management, LLC

Now this trade is obviously not riskless. To profit from this trade, one would generally “short” the spread, so it is the positive numbers in Figure 2 that would represent losses. Note from Figure 2, the magnitude of potential losses that this trade has incurred over the past 25 years. That said, Cootner’s original point from 1967 that a profitable trade can persist in the face of knowledge of its existence seems to be borne out 36 years later.

Figure 3 summarises the information in Figure 2 differently in order to emphasise the “tail risk” of a July-December wheat spread strategy. If one took a “short” position in this spread, the possible outcomes incorporate losses that are several times the size of the average profit. Again, in a short position, one wants the price change to be negative so the historical losses on this trade are represented by the positive numbers in Figure 3. One might conclude that this trade can continue to exist because of the unpleasant “tail risk” one would need to assume when putting on this trade.

Figure 3 – Histogram of the Frequency Distribution for the July Wheat - December Wheat Price Changes (1979-2003)



Source: Premia Capital Management, LLC

B. Petroleum Complex Example

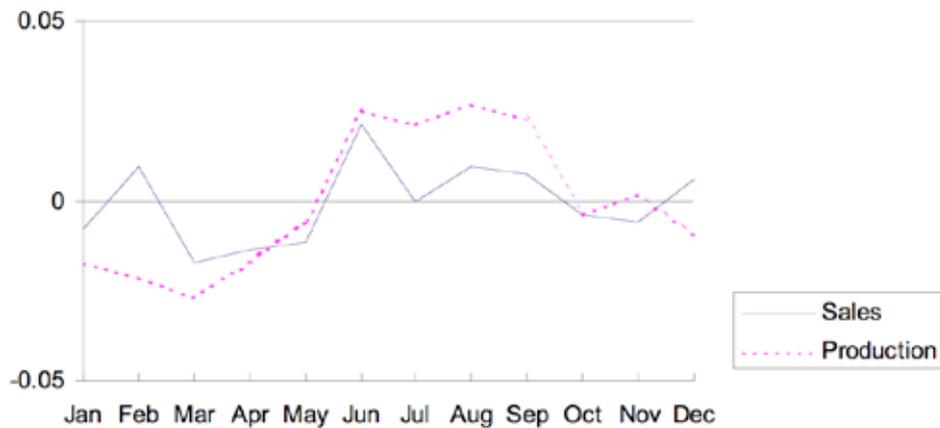
One can also examine the petroleum market to see if there are any persistent price tendencies that can be linked to structural aspects of this market.

When one examines the activity of commercial participants in the petroleum futures markets, it appears that their hedging activity is bunched up within certain timeframes. These same timeframes also seem to have detectable price trends, reflecting this commercial hedging pressure.

Like other commodities, the consumption and production of petroleum products are concentrated during certain times of the year, as illustrated in Figure 4. This is the underlying reason for why commercial hedging pressure is also highly concentrated during certain times of the year.

One may think of the predictable price trends that result from concentrated hedge pressure as a type of premium the commercial market participants are willing to pay. That commercial participants will engage in hedging during predictable timeframes and thus pay a premium to do so may be compared to individuals willing to pay higher hotel costs to visit popular locations during high season. They are paying for this timing convenience.

Fig 4 - Petroleum - Seasonal Sales and Production Patterns



The seasonal coefficient plotted for each month is the average percentage difference for that month from a logarithmic time trend.
Source: Miron, Jeffrey, *The Economics of Seasonal Cycles*, MIT Press, 1996, p. 118.

C. Corn Example

In addition to concentrated hedging pressure, another example of a persistent price pressure effect is as follows. It appears that the futures prices of some commodity contracts will sometimes embed a fear premium due to upcoming, meaningful weather events. Corn is one example. According to a Refco commentary [2/5/00]:

"The grain markets will always assume the worst when it comes to real or perceived threats to the food supply."

The result is that coming into the U.S. growing season, grain futures prices seem to systematically have a premium added into the fair-value price of the contract. The fact that this premium can be easily washed out if no adverse weather occurs is well-known by the trade. According to notes from a Salomon Smith Barney commentary [2/5/00]:

"The bottom line is: any threat of ridging this summer will spur concerns of yield penalties. That means the market is likely to keep some 'weather premium' built into the price of key markets. The higher the markets go near term, the more risk there will be to the downside if and when good rains fall."

By the end of July, the weather conditions that are critical for corn yield prospects will have already occurred. At that point, if weather conditions have not been adverse, the weather premium in corn futures prices will no longer be needed. According to the Pool Commodity Trading Service [29/7/99]:

"In any weather market there remains the potential for a shift in weather forecasts to immediately shift trends, but it appears as though grains are headed for further losses before the end of the week. With 75% of the corn silking, the market can begin to get comfortable taking some weather premium out."

Again, this example shows that the commercial trade can be well aware of a commodity futures price reflecting a biased estimate of future valuation, and yet the effect still persists.

II. Trade Construction

As one gains experience in commodity futures trading, one finds that a trader can have a correct commodity view, but how one constructs the trade to express the view can make a large difference in profitability.

In order to express a commodity view, one can employ outright futures contracts, options or spreads on futures contracts.

At times one may find that futures spreads are more analytically tractable than trading outright. There is usually some economic boundary constraint that links related commodities, which can (but not always) limit the risk in position-taking. Also, one hedges out a lot of first-order, exogenous risk by trading spreads. For example, with a heating-oil-vs.-crude-oil futures spread, each leg of the trade is equally affected by unpredictable OPEC shocks. Instead, what typically affects the spread is second-order risk factors like timing differences in inventory changes among the two commodities. It is sometimes easier to make predictions regarding these second-order risk factors than the first-order ones.

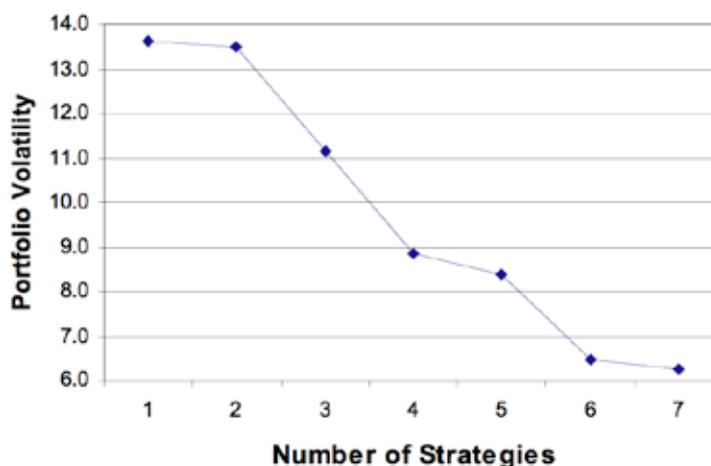
III. Portfolio Construction

Once an investor has discovered a set of trading strategies that are expected to have positive returns over time, the next step is to combine the trades into a portfolio of diversified strategies. The goal is to combine strategies that are uncorrelated with each other so that one ends up with a dampened-risk portfolio.

A. Diversification

Figure 5 illustrates a commodity futures portfolio from June 2000, which combined hedge-pressure trades with weather-fear-premium trades. The figure shows the effect of incrementally adding unrelated trades on portfolio volatility.

Figure 5 - Portfolio Volatility vs. Number of Strategies



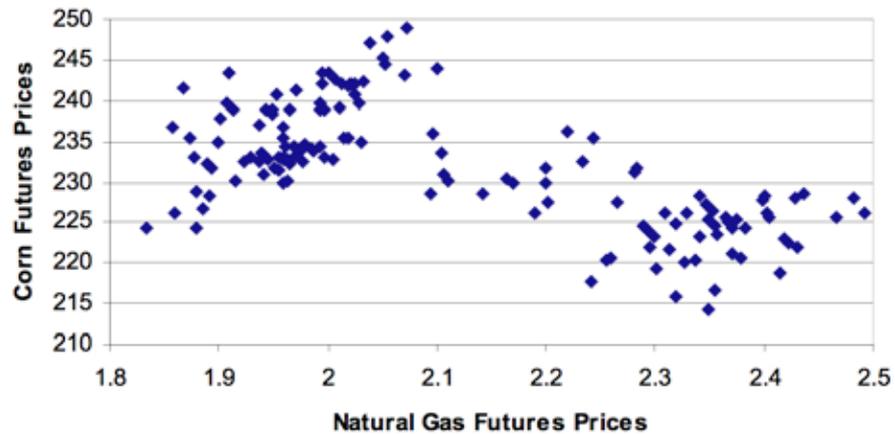
This graph shows annualised portfolio volatility versus number of commodity investment strategies during June 2000. Source: Till, Hilary, "Passive Strategies in the Commodity Futures Markets," Derivatives Quarterly, Fall 2000, Exhibit 5.

B. Inadvertent Concentration Risk

Now for all types of leveraged investing, a key concern is inadvertent concentration risk. In leveraged commodity futures investing, one must be careful with commodity correlation properties. Seemingly unrelated commodity markets can become temporarily highly correlated. This becomes problematic if a commodity manager is designing their portfolio so that only a certain amount of risk is allocated per strategy. The portfolio manager may be inadvertently doubling up on risk if two strategies are unexpectedly correlated.

Figures 6 and 7 provide examples from the summer of 1999 that show how seemingly unrelated markets can temporarily become quite related.

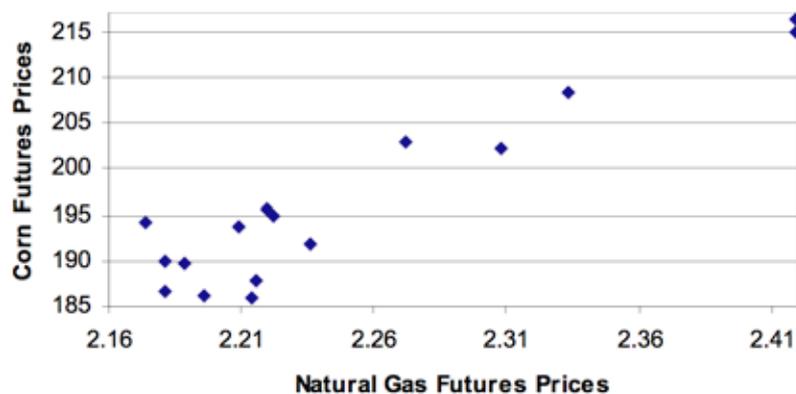
Figure 6 – September Corn Futures Prices vs. September Natural Gas Futures Prices (30/11/98 to 26/6/99)



Over the timeframe, 30/11/98 to 28/6/99 and using a sampling period of every three days, the correlation of the percent change in corn prices versus the percent change in natural gas prices was 12%.
Source: Till, Hilary, "Taking Full Advantage of the Statistical Properties of Commodity Investments," Journal of Alternative Investments, Summer 2001, Exhibit 3.

Figure 7 – September Corn Futures Prices vs. September Natural Gas Futures Prices (29/6/99 to 21/7/99)

Over the timeframe, 29/6/99 to 21/7/99 and using a sampling period of every three days, the correlation of the percent change in corn prices versus the percent change in natural gas prices was 85%.



Source: Till, Hilary, "Taking Full Advantage of the Statistical Properties of Commodity Investments," Journal of Alternative Investments, Summer 2001, Exhibit 4.

Normally, natural gas and corn prices are unrelated, as shown in Figure 6. But during July, they can become highly correlated. During a three-week period in July 1999, natural gas and corn price changes became +85% correlated, as illustrated in Figure 7.

Both the July corn and natural gas futures contracts are heavily dependent on the outcome of weather in the U.S. Midwest and in July 1999, the Midwest had blistering temperatures (which even led to some power outages). During that time, both corn and natural gas futures prices responded in nearly identical fashions to weather forecasts and realisations.

If a commodity portfolio manager had included both natural gas and corn futures trades in their portfolio during this timeframe, then that investor would have inadvertently doubled up on risk.

We note then that in order to avoid inadvertent correlations, it is not enough to measure historical correlations. Using the data in Figure 6, one would have concluded that corn and natural gas price changes are only weakly related. An investor needs to have an economic understanding for why a trade works in order to best appreciate whether an additional trade will act as a portfolio diversifier. In that way, the investor will avoid doubling up on the risks that Figure 7 illustrates.

IV. Risk Management

The fourth step in designing a commodity futures trading program is risk management. One wants to ensure that during both normal and eventful times that the program's losses do not exceed a client's comfort level.

A. Risk Measures

On a per-strategy basis, it is useful to examine each strategy's:

- Value-at-Risk based on recent volatilities and correlations;
- Worst-case loss during normal times;
- Worst-case loss during well-defined eventful periods;
- Incremental contribution to Portfolio Value-at-Risk; and
- Incremental contribution to Worst-Case Portfolio Event Risk.

The latter two measures give an indication if the strategy is a risk reducer or risk enhancer.

On a portfolio-wide basis, it is useful to examine the portfolio's:

- Value-at-Risk based on recent volatilities and correlations;
- Worst-case loss during normal times; and
- Worst-case loss during well-defined eventful periods.

Each measure should be compared to some limit, which has been determined based on the design of the futures product. So for example, if clients expect the program to lose no more than say 7% from peak-to-trough, then the three portfolio measures should be constrained to not exceed 7%. If the product should not perform too poorly during say financial shocks, then the worst-case loss during well-defined eventful periods should be constrained to a relatively small number. If that worst-case loss exceeds the limit, then one can devise macro portfolio hedges accordingly, as will be discussed below.

For the purposes of extraordinary stress testing, we would recommend examining how a portfolio would have performed during the four eventful periods listed in Figure 8.

Figure 8

Meaningful Eventful Periods
October 1987 stock market crash
Gulf War in 1990
Fall 1998 bond market debacle
Aftermath of the September 11, 2001 attacks

If one's commodity portfolio would do poorly during these timeframes, this may be unacceptable to clients who are investing in a non-traditional investment for their diversification benefits. Therefore, in addition to examining a portfolio's risk based on recent fluctuations using Value-at-Risk measures, one should also examine how the portfolio would have performed during the eventful times listed in Figure 8.

Figures 9 and 10 provide examples of the recommended risk measures for a particular commodity futures portfolio. Note for example, the properties of the soybean crush spread. It is a portfolio event-risk reducer, but it also adds to the volatility of the portfolio. An incremental-contribution-to-risk measure based solely on recent volatilities and correlations does not give complete enough information about whether a trade is a risk reducer or risk enhancer.

Figure 9 – Strategy-Level Risk Measures

Strategy	Value-At-Risk	Worst-Case Loss	
		During Normal Times	During Eventful Period
Deferred Reverse Soybean Crush Spread	2.78%	-1.09%	-1.42%
Long Deferred Natural Gas Outright	0.66%	-0.18%	-0.39%
Short Deferred Wheat Spread	0.56%	-0.80%	-0.19%
Long Deferred Gasoline Outright	2.16%	-0.94%	-0.95%
Long Deferred Gasoline vs. Heating Oil Spread	2.15%	-1.04%	-2.22%
Long Deferred Hog Spread	0.90%	-1.21%	-0.65%
Portfolio	3.01%	-2.05%	-2.90%

Source: Till, Hilary, "Risk Management Lessons in Leveraged Commodity Futures Trading," *Commodities Now*, September 2002.

Figure 10 – Portfolio-Effect Risk Measures

Strategy	Incremental Contribution to	
	Portfolio Value-At-Risk*	Worst-Case Portfolio Event Risk*
Deferred Reverse Soybean Crush Spread	0.08%	-0.24%
Long Deferred Natural Gas Outright	0.17%	0.19%
Short Deferred Wheat Spread	0.04%	0.02%
Long Deferred Gasoline Outright	0.33%	0.81%
Long Deferred Gasoline vs. Heating Oil Spread	0.93%	2.04%
Long Deferred Hog Spread	0.07%	-0.19%

* A positive contribution means that the strategy adds to risk while a negative contribution means the strategy reduces risk.
Source: Till, Hilary, "Risk Management Lessons in Leveraged Commodity Futures Trading," *Commodities Now*, September 2002.

B. Macro Portfolio Hedging

Understanding a portfolio's exposure to certain financial or economic shocks can help in designing macro portfolio hedges that would limit exposure to these events. For example, a commodity portfolio from the summer of 2002 consisted of the following positions: outright long wheat, a long gasoline calendar spread and short outright silver. When carrying out an event-risk analysis on the portfolio, the worst-case scenario was a September 11, 2001 scenario. This is because the portfolio was long economically sensitive commodities and short an instrument that does well during time of "flights-to-quality." Normally, though, these positions are unrelated to each other. Given that the scenario that would most negatively impact the portfolio was a sharp shock to business confidence, one candidate for macro portfolio insurance was short-term gasoline puts to hedge against this scenario.

V. Leverage Level

Another consideration in designing a commodity futures program is how much leverage to use. Futures trading requires a relatively small amount of margin. Trade sizing is mainly a matter of how much risk one wants to assume. An investor is not very constrained by the amount of initial capital committed to trading.

What leverage level is chosen for a program is a product design issue. One needs to determine: "How will the program be marketed, and what will the client's expectations be?"

According to Barclay Managed Funds Report (2001), a number of top Commodity Trading Advisors (CTAs) have had losses in excess of -40%, which have been acceptable to their clients since these investment programs sometimes produce 100%+ annual returns. Investors know upfront the sort of swings in profits and losses to expect from such managers.

Choosing the leverage level for a futures program is a crucial issue because it appears that the edge that successful futures traders are able to exploit is small. Only with leverage do their returns become attractive. Figure 11 shows how the returns to futures programs, here labelled "managed futures," only become competitive after applying the most amount of leverage of any hedge fund strategy.

Figure 11 - Levered and Delevered Returns by Hedge Fund Strategy 1997 - 2001

Style	Average Levered Return (%)*	Average Delevered Return (%)*
Short Biased	13.7	9.3
Global Macro	16.8	8.9
Emerging Markets	16.9	8.8
Event Driven	14.7	8.3
Merger Arbitrage	14.7	7.0
Long/Short Equity	14.0	6.3
Fixed Income	9.6	4.8
Convertible Arbitrage	10.6	4.2
Managed Futures	10.5	4.2
Distressed Securities	n/a	n/a

*Leverage analysis was done for funds with 5 year Historical Leverage and performance data.

Author's source: Altvest, CSFB/Tremont, EACM, HFR, Institutional Investor (June 2002), and CMRA.

Source: Rahl, Leslie, "Hedge Fund Transparency: Unraveling the Complex and Controversial Debate," RiskInvest 2002, Boston, 10/12/02, Slide 52.

In Patel (2002), Bruce Cleland of Campbell and Company, a pioneer of futures investing, discusses how essential leverage is to his firm's success:

"Campbell's long-term average rate of return compounded over 31 years is over 17.6% net (of fees). No market-place is going to be so inefficient as to allow any kind of systematic strategy to prevail over that period of time, to that extent. 'Our true edge is actually only around 4% per year, but through leverage of between 4-1 and 5-1 you are able to get a much more attractive return,' Cleland says."

This quote from the president of Campbell is very instructive for neophyte futures traders who must determine how much leverage to use in delivering their clients an attractive set of returns.

VI. Unique Contribution to the Investor's Overall Portfolio

A final consideration in creating a futures trading program is to understand how one's program will fit into an investor's overall portfolio. In order for investors to be interested in a new investment, that investment must have a unique return stream: one that is not already obtained through their other investments. More formally, the new investment must be a diversifier, either during normal times or eventful times.

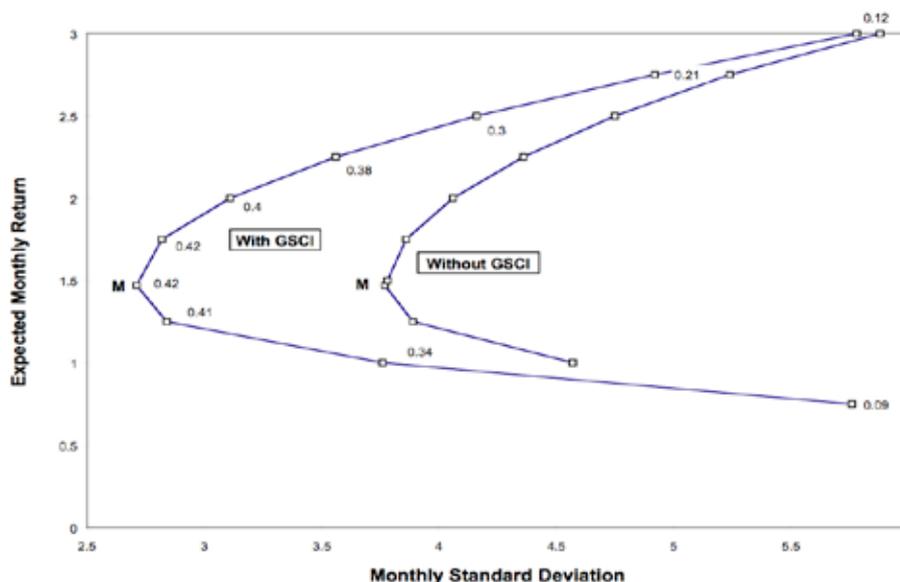
It is up to the investor on how a new investment should fit into their portfolio. A futures trading program may be evaluated on how well it diversifies an equity portfolio. Or it may be judged based on how well it diversifies a basket of veteran Commodity Trading Advisors (CTAs). Finally, a new futures trading program may be evaluated on how well it improves a fund-of-hedge-funds' risk-adjusted returns. The following section will provide examples of each kind of evaluation.

A. Equity Diversification Example

One potential commodity futures investment is based on the Goldman Sachs Commodity Index (GSCI). One way to evaluate its potential benefits for an international equity portfolio is to use a portfolio optimizer to create the portfolio's efficient frontier both with and without an investment in the GSCI. Figure 12 from a 1994 paper by World Bank researchers illustrates this

approach. The efficient frontier with commodity assets lies everywhere higher than the portfolio without commodity assets, implying that for the same levels of return (risk), the portfolio with commodity assets provides lesser (higher) risk (return). This would be regarded as attractive provided that the historical returns, volatilities and correlations used in the optimizer are expected to be representative of future results.

Figure 12 - Optimal International portfolios With and Without Commodity Assets



Note: The numbers on the mean-standard deviation frontier refer to the percentage of the portfolio invested in commodity assets. M stands for the minimum-risk portfolio.

Source: Satyanarayan, Sudhakar, and Panos Varangis, "An Efficient Frontier for International Portfolios with Commodity Assets," Policy Research Working Paper 1266, The World Bank, March 1994, p. 19.

B. CTA Diversification Example

A futures program that solely invests in commodities has a natural advantage in claiming diversification benefits for a portfolio of CTAs. As Figure 13 illustrates, an index of managed futures returns is most strongly related to investment strategies focused on currencies, interest rates and stocks. Commodities are in fourth place.

Figure 13 - Regression of Managed Futures Returns on Passive Indices and Economic Variables (1996-2000)

	Coefficient	Standard Error	T-Statistic
Intercept	0.00	0.00	0.01
S&P 500	0.00	0.07	0.05
Lehman US	0.29	0.39	0.76
Change in Credit Spread	0.00	0.01	0.30
Change in Term Spread	0.00	0.00	0.18
MFSB/Interest Rates	1.27	0.24	5.24
MFSB/Currency	1.37	0.25	5.48
MFSB/Physical Commodities	0.27	0.15	1.79
MFSB/Stock Indices	0.36	0.11	3.17
R-Squared	0.70		

The Managed Futures Securities Based (MFSB) Indices are designed to mimic the performance of CTAs who employ trend-following or counter-trend strategies.

Source: Center for International Securities and Derivatives Markets (CISDM) 2nd Annual Chicago Research Conference, 22/5/02, Slide 48.

One way of demonstrating that a commodity investment strategy is of benefit to a diversified portfolio of CTAs is to calculate how the Sharpe ratio (excess return divided by standard deviation) would change once one adds the new investment to the portfolio. Figure 14 shows how the addition of a particular commodity manager to three diversified portfolios would be improved.

The three diversified portfolios are represented by CTA indices provided by Daniel B. Stark & Co.

Figure 14 - An Example of How the Sharpe Ratio of CTA Indices Changes with the Addition of a Particular Commodity Futures Program

Index	Index Alone			With 10% GA Component		
	CARR	Vol %	Sharpe Ratio	CARR	Vol %	Sharpe Ratio
Stark Fund Index	6.80%	13.60%	0.5	7.80%	11.80%	0.66
Stark 300 CTA Index	8.70%	10.80%	0.8	9.40%	9.60%	0.98
Stark Diversified CTA	9.50%	11.60%	0.82	10.10%	10.30%	0.98

Data: September 1999 to March 2003.

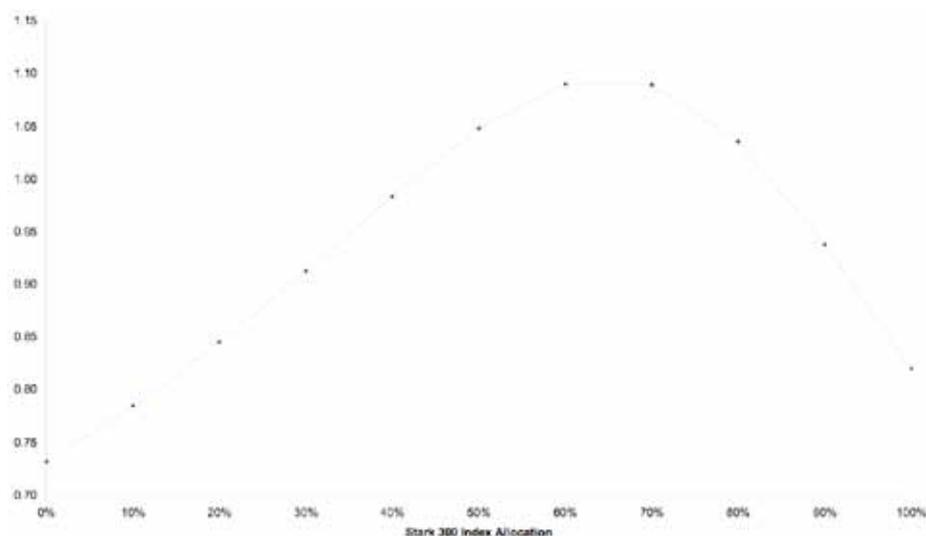
PAST PERFORMANCE IS NOT NECESSARILY INDICATIVE OF FUTURE RESULTS.

CARR is compounded annualized rate of return. GA is the Global Advisors Discretionary Program, a futures trading program.

Source: "The Case for Commodities," Global Advisors, June 2003.

Figure 15 illustrates another way of confirming that one's futures trading program would be a diversifier for an existing investment in a basket of futures traders. Figure 15 shows that the Stark Diversified CTA index alone has a Sharpe ratio of about 0.72. If one allocates 60% to the Stark index and 40% to a specific advisor's program, the Sharpe ratio rises to 1.0 even though the specific advisor's program alone has a Sharpe ratio of below 1.0.

Figure 15 - Efficient Portfolio: GALP + Starck Diversified CTA Index



Data: September 1999 to March 2003.

PAST PERFORMANCE IS NOT NECESSARILY INDICATIVE OF FUTURE RESULTS.

GALP is Global Advisors LP.

The vertical axis is the Sharpe Ratio. The horizontal axis is the amount allocated to the Stark index while the balance is allocated to the GALP trading program.

Source: "The Case for Commodities," Global Advisors, June 2003, Chart 1.

C. Fund-of-Hedge-Fund Diversification Example

Similarly, if the futures program is expected to be a diversifier for a fund-of-hedge-funds portfolio, then one needs to verify that the Sharpe ratio of the enhanced portfolio improves as well. This is illustrated in Figure 16.

Figure 16 - An Example of How the Sharpe Ratio of a Fund-of-Hedge-Funds changes with the Addition of a Particular Commodity Futures Program

Index	Index Alone			With 10% GA Component		
	CARR	Vol%	Sharpe Ratio	CARR	Vol%	Sharpe Ratio
Model Fund-of-Funds Portfolio*	7.80%	5.00%	1.56	8.50%	5.00%	1.7

Data: September 1999 to March 2003.

PAST PERFORMANCE IS NOT NECESSARILY INDICATIVE OF FUTURE RESULTS.

CARR is compounded annualized rate of return. GA is the Global Advisors Discretionary Program, a futures trading program.

*The model fund-of-funds portfolio comprises Edhec Business School indices in the following weights: 40% Long/Short Equity, 10% Convertible Arbitrage, 10% Global Macro, 10% Managed Futures, 5% Equity Market Neutral, 5% Fixed Income Arbitrage, 5% Distressed Securities, 5% Emerging Markets, 5% Merger Arbitrage, and 5% Event Driven.

Source: "The Case for Commodities," Global Advisors, June 2003

VII Conclusion

This article enumerated the considerations involved in creating a commodity futures trading program. A prospective commodity manager must not only discover trading strategies that are expected to be generally profitable, but must also be careful regarding each strategy's correlation properties during different times of the year and during eventful periods. Finally, one must ensure that the resulting product has not only sufficiently attractive returns, but also a unique enough return stream that it can be expected to provide diversification benefits to an investor's overall portfolio.

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