A Brief Primer on Commodity Risk Management

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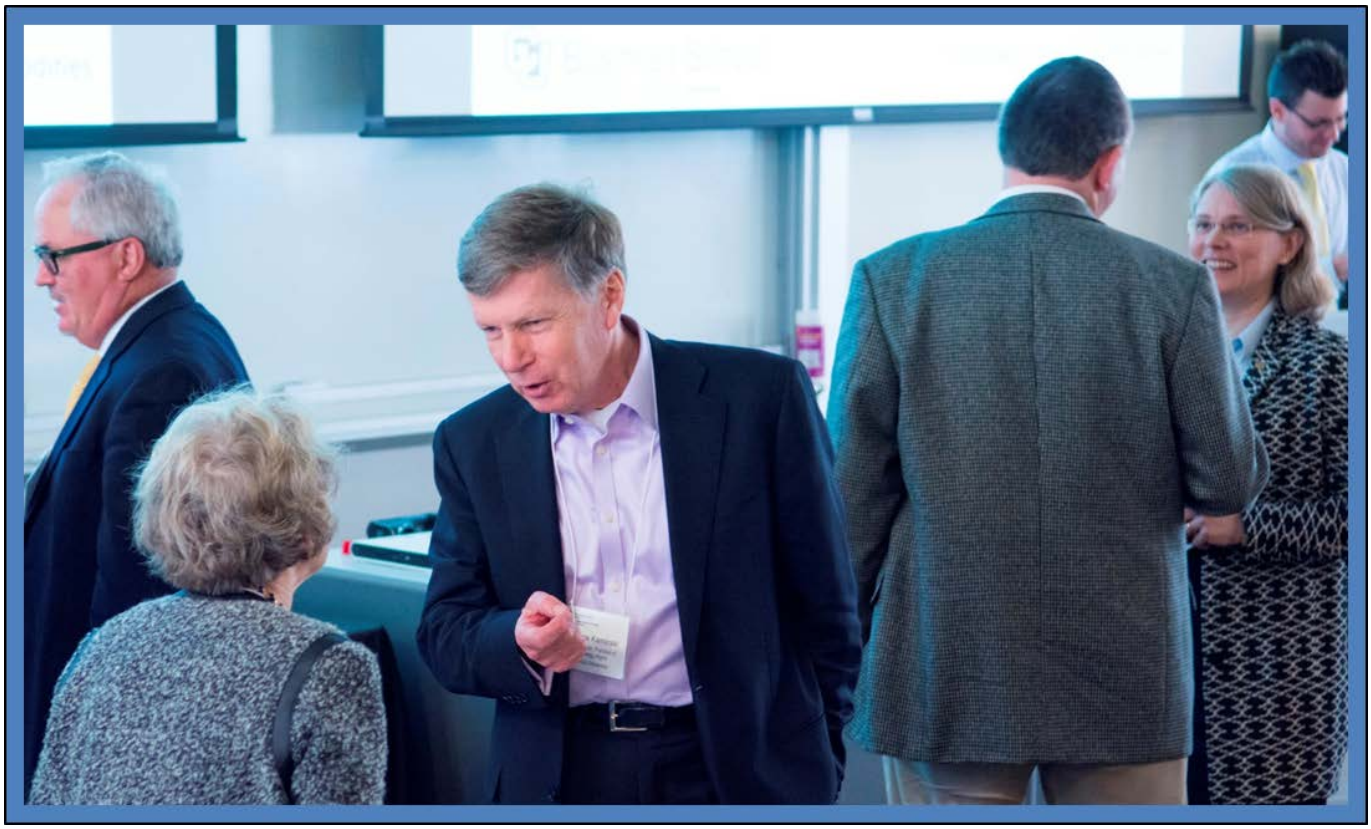
This digest article discusses the practical issues involved in applying a disciplined risk management methodology to commodity futures trading. Accordingly, the paper shows how to apply methodologies derived from both conventional asset management and hedge fund management to futures trading. The article also discusses some of the risk management issues that are unique to leveraged futures trading.

Commodity futures trading is such a niche discipline that discovering how to succeed using disciplined risk-management principles usually only occurs through hard-won experience. This article provides an alternative approach: one can instead review a logical structural framework, as set forth in this digest article.



At the inaugural Research Council meeting in the Center's CoBank Lecture Hall on April 18, 2015, from left-to-right, Professor Colin Carter of University of California, Davis and Chair of the J.P. Morgan Center for Commodities (JPMCC) Research Council; Professor Marcelle Arak, University of Colorado Denver Business School; Professor Vince Kaminski, Rice University; Professor Lutz Kilian, University of Michigan, Ann Arbor (back); and Hilary Till, M.Sc. (Statistics), Solich Scholar, JPMCC, all of whom are members of the JPMCC's Research Council. Enrico Leone, Assistant to the Deans, University of Colorado Denver Business School is on the far right of the photograph.

Risk is the Flipside of Return

A number of derivatives trading strategies are well known and publicized, which does not prevent them from continuing to exist. 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."

In a number of statistically significant futures trades, an individual who implements these trades assumes some specific event risk that others do not want to assume, which is why there is a return to efficiently bearing this risk in the first place.

The Most Important Element of an Investment Process

The key to a successful trading program is not in discovering proprietary strategies: a diligent literature search will turn up a great number of strategies. Instead, the most important element of an investment process may well be how one implements the program's portfolio construction and risk management methodologies so that one can have both smooth performance and stay in business during dramatic market moves.

Product Design Issues

In derivatives trading, one has a lot of flexibility in designing an investment program. Futures trading requires a relatively small amount of margin. The result is that one can easily adjust one's leverage level to magnify gains (and of course, magnify losses, too.) Trade sizing is mainly a matter of how much risk one wants to assume. A trader is not very constrained by the amount of initial capital committed to trading. With the use of options, one can also be very particular about the risks that the trader wishes to hedge away by paying option premia.

CTA investors frequently expect futures trading programs to be equity diversifiers, so clients thereby expect that a trading program will not do too poorly in the face of a large equity decline.

The parameters of a program's risk management policy should directly flow from the return, risk, and correlation expectations of the program's client base. When attempting to adhere to these top-level parameters, the actual implementation of a program's risk management policy will rely heavily on the particular assumptions about the statistical properties of futures prices.

Viability of a Futures Program

As noted earlier, a number of statistically significant trading opportunities exist because of the possibility of rare, but nonetheless large, losses. One can build a business or investment program around these positive expected value opportunities, but the particular leverage level and hedging strategy chosen will determine the ongoing viability of the program.

Standard Risk Management Methodology

The way that risk management is applied at conventional asset managers is typically as follows:

- Translate the client's guidelines into return and risk targets with respect to an index or benchmark;
- Determine the active bets away from a program's benchmark;
- Make assumptions about the expected returns, volatility, and correlation of the active bets;
- Construct the client's portfolio so that the client's return and risk targets will be achieved if one's statistical assumptions are correct; and
- Continually monitor the portfolio's actual return and risk performance for adherence to the established targets.

The conventional asset manager approach to risk management is a useful first step in designing a risk management program for leveraged futures trading. As will be discussed, one still needs to add several layers of risk management to this approach because of the unique statistical properties of commodity futures contracts and because of the different way futures products are marketed.

Understanding Price Behavior

Research from the 1970's showed that diversified portfolios of equities have returns that appear to be symmetrically distributed. It is a different matter for commodity prices.

Commodity prices tend to exhibit positive skewness. During times of ample supplies, there are two variables that can adjust to equilibrate supply and demand: more inventories can be held *and* the price can decrease. But, if there are inadequate inventories, *only* the price can respond to equilibrate supply and demand, given that in the short run, new supplies of physical commodities cannot be instantly mined, grown, and/or drilled.

<u>Value-at-Risk</u>

One should calculate the portfolio's volatility from the recent volatilities and correlations of the portfolio's instruments. This is the standard Value-at-Risk approach. Now, this approach alone is obviously inadequate for a commodity portfolio, which consists of instruments that have a tendency towards extreme positive skewness.

While the Value-at-Risk measure is useful, it has to be used jointly with other measures and actions. The measure is useful since one wants to ensure that under normal conditions, a commodity position has not been sized too large that one cannot sustain the random fluctuations in profits and losses that would be expected to occur, even without a dramatic event occurring.

Scenario Testing

Using long-term data, a trader should also directly examine the worst performance of a commodity strategy under similar circumstances in the past. In practice, such a measure will sometimes be larger than a Value-at-Risk measure based on recent volatility.

If one is relying on historical data to find pockets of predictability in the futures markets, then examining worst-case outcomes can also serve another purpose. If the loss on a particular commodity futures strategy exceeds the historical worst case, this can be an indication of a new regime that is not reflected in the data. This would trigger an exit from a systematic trade since one no longer has a handle on the worst-case scenario.

Deep Out-of-the-Money Options

In a systematic program based on historical data, one can make determinations about its expected return. One result is that a trader can decide to give up a small fraction of this expected return in order to hedge against catastrophic risk. A trader can do so with deep out-of-the-money options.

Exit Strategy

Although strictly speaking not a risk management issue, one should employ an exit strategy that recognizes the mean-reverting properties of commodities. This means examining historical data to determine the typical size of moves during supply/demand imbalances.

Diversification and Concentration Risk

A commodity manager can potentially set up dampened risk portfolios of commodity futures trades, which are very nearly uncorrelated with each other.

In leveraged commodity futures trading, one must be careful with commodity correlation properties. Seemingly unrelated commodity markets can become temporarily highly correlated. This becomes a problem if commodity managers are designing their portfolios 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.

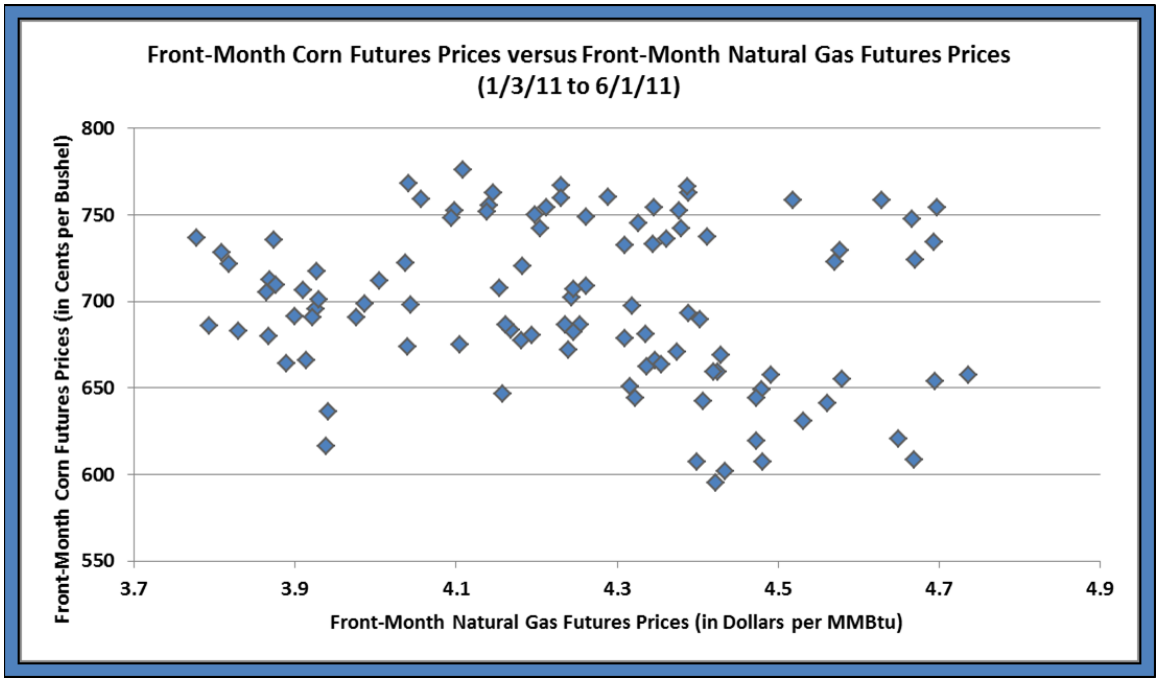
Understanding the Fundamental Drivers of a Strategy

The antidote for this problem is two-fold. One is to understand what the key factors are which drive a strategy's performance, and the other is to use short-term recent data in calculating correlations. If two trades have common drivers, then it can be assumed that their respective performances will be similar. Recent data can frequently capture the time-varying nature of correlations that long-term data average out.

Corn and Natural Gas Example

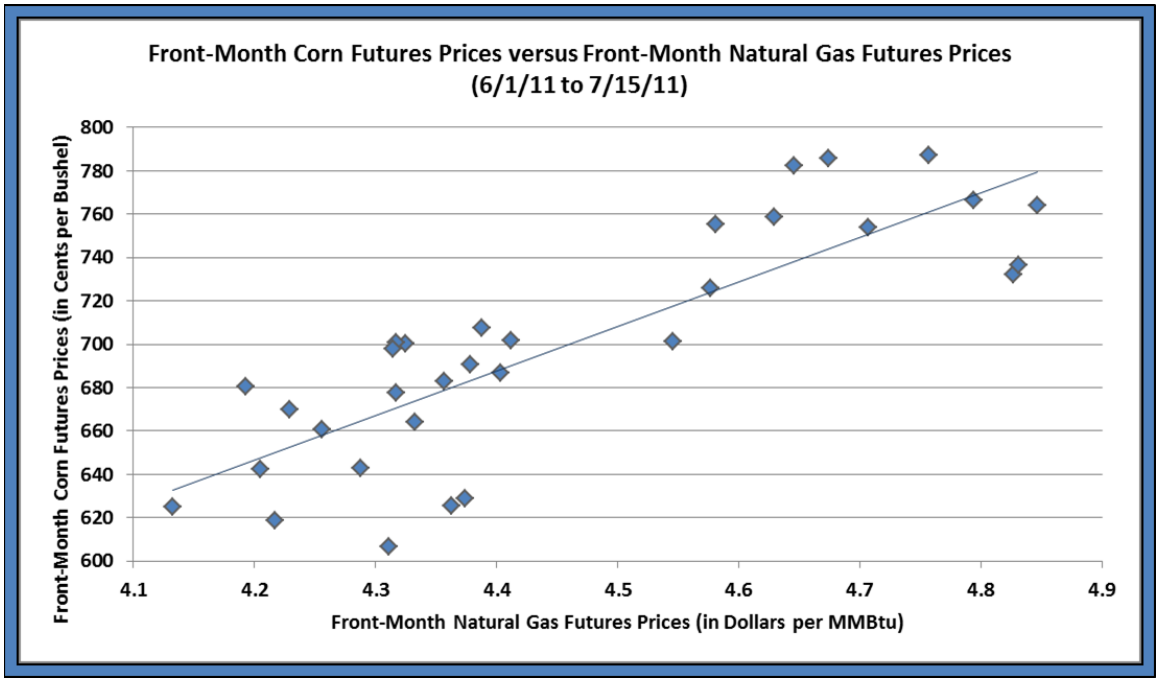
The graphs in Figures 1 and 2 below provide an example from 2011 that shows how seemingly unrelated markets can become temporarily very related.

Figure 1



Source of Data: The Bloomberg.

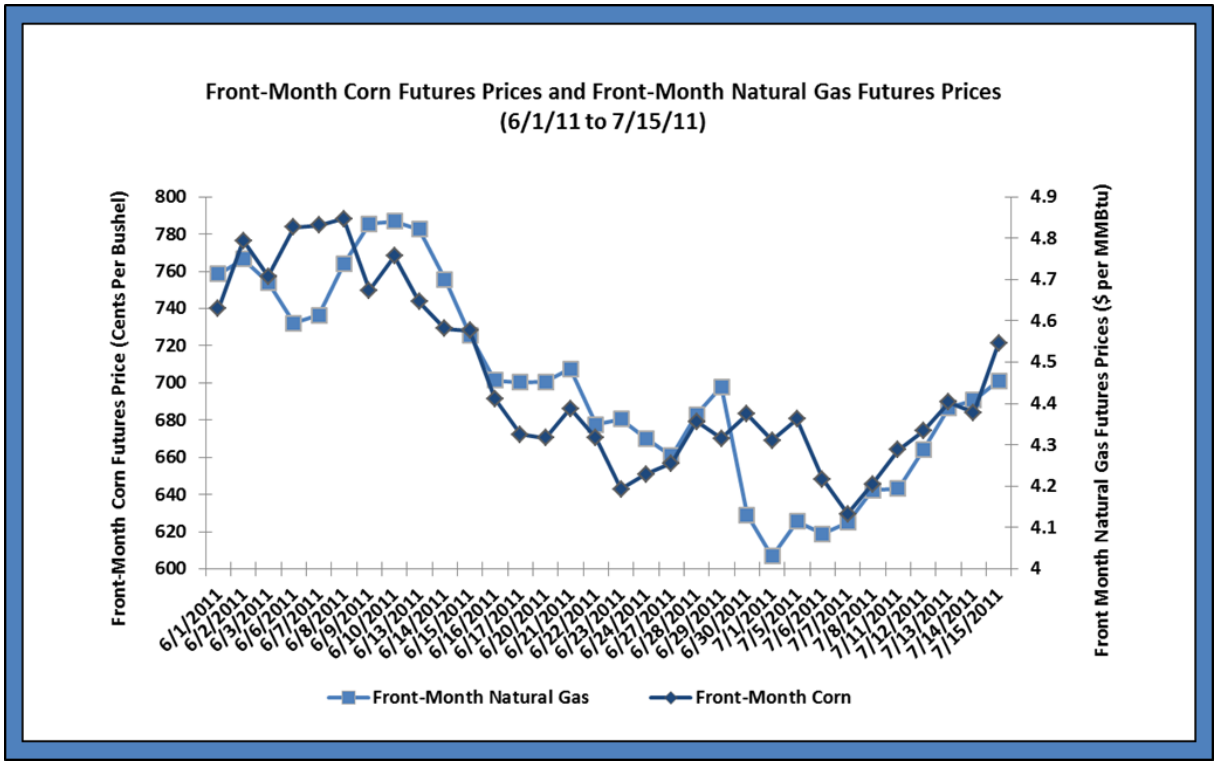
Figure 2



Source of Data: The Bloomberg.

Normally, natural gas and corn prices are unrelated. How could these two seemingly different trades be, in fact, the same trade? Both the July corn and natural gas trades are heavily dependent on the outcome of weather in the U.S. Midwest. Figure 3 on the next page further illustrates how both corn and natural gas had common reactions to the possibility of extreme heat in 2011: their prices frequently waxed and waned at similar times during the summer.

Figure 3



Source of Data: The Bloomberg.

Our conclusion is that in order to avoid inadvertent correlations, it is not enough to measure historical correlations. Instead, a trader needs to have an economic understanding for why a trade works in order to best be able to appreciate whether an additional trade will act as a portfolio diversifier.

Extraordinary Stress Testing

For a commodity futures portfolio, it is also prudent to examine how the portfolio would have performed during various well-defined stock market declines, given that such programs are frequently marketed as equity portfolio diversifiers. If a portfolio shows sensitivity to certain extreme events when the stock market has declined, this does not necessarily mean that the portfolio should be sized differently or constructed differently. It may mean that a macro portfolio hedge would be in order.

Risk Management Reports

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 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 should devise macro portfolio hedges accordingly.

Conclusion

There are a number of derivatives strategies, which earn returns due to assuming risk positions in a risk-averse financial world. The returns are not necessarily due to inefficiencies in the marketplace. How traders design and carry out their risk management policies is key to a program's viability, especially in leveraged commodity futures trading.

GCARD readers whom are interested in a more in-depth discussion on commodity risk management are encouraged to review the longer essay in Till (2016).

Endnote and Acknowledgement

The ideas in this article were jointly developed with Joseph Eagleeye, co-founder of Premia Research LLC.

References

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Keywords

Futures trading, risk management, commodity