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Taking Full Advantage of the Statistical Properties of Commodity Investments

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Introduction

Academic and practitioner research has documented that commodities yield important risk-reduction benefits for a portfolio invested mainly in financial assets. It is perhaps less well known that individual commodity strategies can be so uncorrelated that they can significantly dampen the risk of a commodity-only portfolio. In this article we discuss how an investor can take full advantage of the unique statistical properties of this asset class.

The Benefits of Adding Commodity Assets to a Financial-Only Portfolio

In the past decade researchers have shown that when commodity-related assets are added to a financial-only portfolio, the portfolio's risk-adjusted return improves, as will be covered below. This result holds even when the commodity investment makes up only a small proportion of an overall portfolio.

Theoretical Basis

Theoretically, there are two reasons to expect why commodities should improve the risk-adjusted return of the portfolio when combined with a financial-only portfolio. First, systematic positive returns should be expected from a passively constructed, long-only commodity basket on average. This is because commodity futures prices tend to be at a discount to spot prices in order to induce speculators to bear the price risk of commodity inventory holders. In other words, investors in commodity futures essentially earn a risk premium for bearing the volatile commodity price risk that inventory holders and producers wish to lay off. Thus, the positive returns from a commodity futures investment do not rely on a secular increase in *spot* commodity prices but rather rely on earning a risk premium over time.

Second, the lack of correlation between commodities and financial assets reduces portfolio risk and hence improves the risk-adjusted return. This lack of correlation derives from each asset class' different response to inflation. Financial assets respond to inflation negatively while commodity investments respond positively.

There is a bit more to this argument as discussed in Froot [1995]:

“Is it possible that commodities futures positions can reduce as much or even more risk than unexpected inflation hedges? The answer is yes, especially if stocks respond negatively to commodity price movements when inflation remains unchanged. That is, if the relative price of industrial inputs to outputs is more important to businesses than overall inflation, then commodity inflation will be more effective than CPI inflation for hedging stocks. Indeed, it is even plausible that the well-known negative correlation between stocks and inflation is actually driven by changes in relative input prices, which, after all, are highly correlated to inflation.”

The idea is that companies and hence their stocks are more sensitive to an instability in relative prices than overall prices since relative prices determine their profits. The net result is that high commodity prices (or high input prices relative to sticky output prices) will lead to lower profits and therefore lower equity prices.

As a matter of fact, one could argue that this is what is currently happening in today’s benign inflationary environment. *Grant’s Interest Rate Observer* recently quoted from Moody’s:

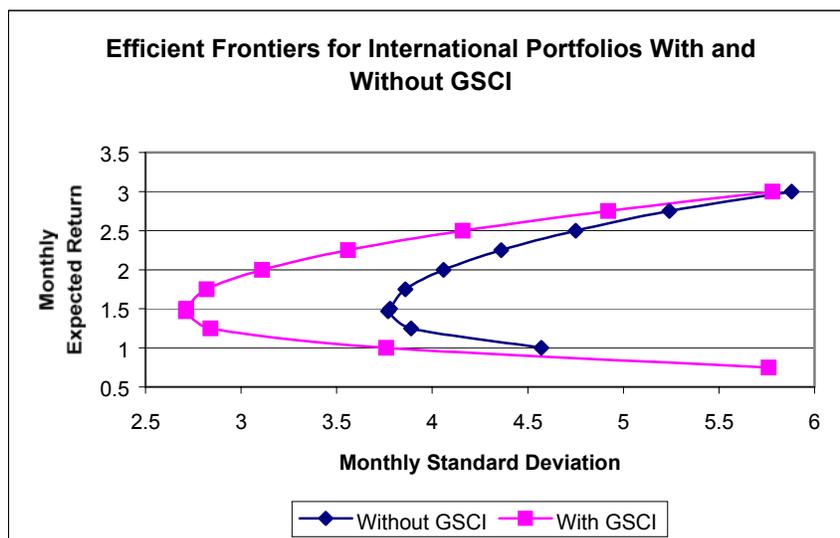
“Intense competition is preventing companies from raising prices without suffering an overly steep decline in unit sales. Corporate earnings and credit worth have been hurt by the squeeze on margins produced by higher costs for energy and raw materials without an accompanying increase in product prices.”

The result of the above observations is that commodity assets can act as a macro hedge for investors’ equity portfolios.

Empirical Findings

Empirically, commodity futures investments have also been found to have positive returns and negative correlations with equity investments as shown, for example, in a World Bank paper by Satyanarayan and Varangis [1994]. As a result, portfolio optimizers consistently call for substantial allocations to this asset class. The two World Bank researchers demonstrate that minimum-risk international portfolios include a significant proportion of investment in commodities as proxied by the Goldman Sachs Commodity Index (GSCI). This proportion ranges from at least 30% at most reasonable levels of risk to as high as 42%. They show that the efficient frontier with commodity assets dominates the international portfolio without commodity assets. For the same levels of return (risk), portfolios with commodity assets provide less risk (higher return) to investors. (See Exhibit 1)

Exhibit 1



Source: Satyanarayan and Varangis [1994]

The finding that commodities improve a financial portfolio's risk-adjusted returns has not depended on which commodity index is used. Huberman [1995] reports qualitatively similar results when using the JP Morgan Commodity Index (JPMCI) as the diversifier for a portfolio which is 60% invested in the S&P 500 and 40% invested in the Lehman Aggregate Bond Index.

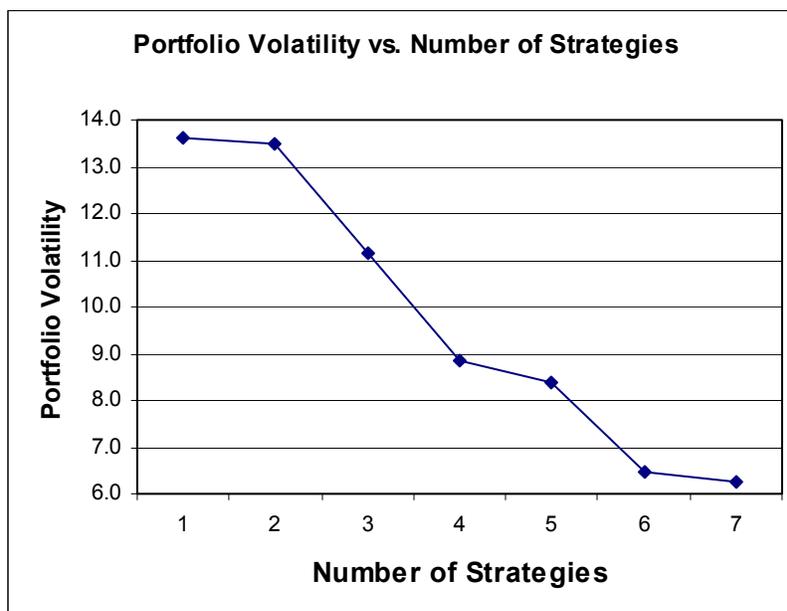
More recently, Greer [2000] used another commodity index, the Chase Physical Commodity Index (CPCI), to demonstrate the historical advantages of commodity investing. During the timeframe of his work, the CPCI delivered 12.2% annual returns while being negatively correlated to the S&P 500 (-14%) and positively correlated to the Consumer Price Index (+23%.)

Taking Advantage of the Correlation Properties of Commodity Strategies within a Commodity-Only Portfolio

When constructing a portfolio of commodity strategies, one finds that commodity investing provides further advantageous statistical properties. This is because very often strategies across different commodity sectors are almost uncorrelated. This enables an investor to set up low-risk portfolios of commodity strategies.

In Till [2000] we provide an example of combining commodity strategies which have correlations ranging from -20% to +20% amongst each other. Given these low correlations, we illustrate how a particular portfolio's volatility is effectively dampened as each commodity strategy is added to the commodity-only portfolio.¹ (See Exhibit 2.)

Exhibit 2



Source: Till [2000]

The best opportunities for reducing the risk in a commodity portfolio are when an investor combines energy futures strategies with non-energy futures strategies. This is because energy-sector commodities are frequently *negatively* correlated to non-energy-sector commodities. The reason for this negative correlation is due to the fact that an energy spike can dampen economic growth, which in turn, dampens demand for other less economically essential commodities. The referenced negative correlation has been documented, for example, in Schneeweis and Spurgin [1997].

Using Due Care in Taking Advantage of Commodity Correlation Properties

One must be careful, though, in taking advantage of commodity correlation properties. For example, Humphreys and Shimko [1997] caution how correlations amongst commodities can fluctuate between seasons.

In our own work, we have found that seemingly unrelated commodity markets can temporarily become highly correlated during extreme events. This poses a problem for a commodity portfolio manager who allocates risk capital according to the expected risk and correlation of the strategy. The portfolio manager may be inadvertently doubling up on risk if two commodity strategies have become unexpectedly correlated.

There are two ways to mitigate the problem. The first is to understand what the key factors are that drive the performance of a strategy. If two trades share common fundamental drivers, then it can be assumed that their respective performances will at times be similar. The second is to use short-term recent data in computing correlations. Recent data can frequently capture the time-varying nature of correlations that long-term data tend to average out.

Exhibits 3 and 4 illustrate an example of how seemingly unrelated markets can temporarily become highly correlated. Normally, natural gas and corn prices are not highly correlated. Using a sampling period of every three days during the seven months preceding July 1999, the correlation between the percent changes in corn and natural gas prices was 12%. (See Exhibit 3.) But during the month of July, the two commodities can become highly correlated. For instance, during a three-week period in July 1999, the correlation between the changes in the price of natural gas and corn was 85%. (See Exhibit 4.) Thus, when these two seemingly unrelated commodities are put together in a portfolio in the month of July, an investor will be inadvertently doubling up on risk.

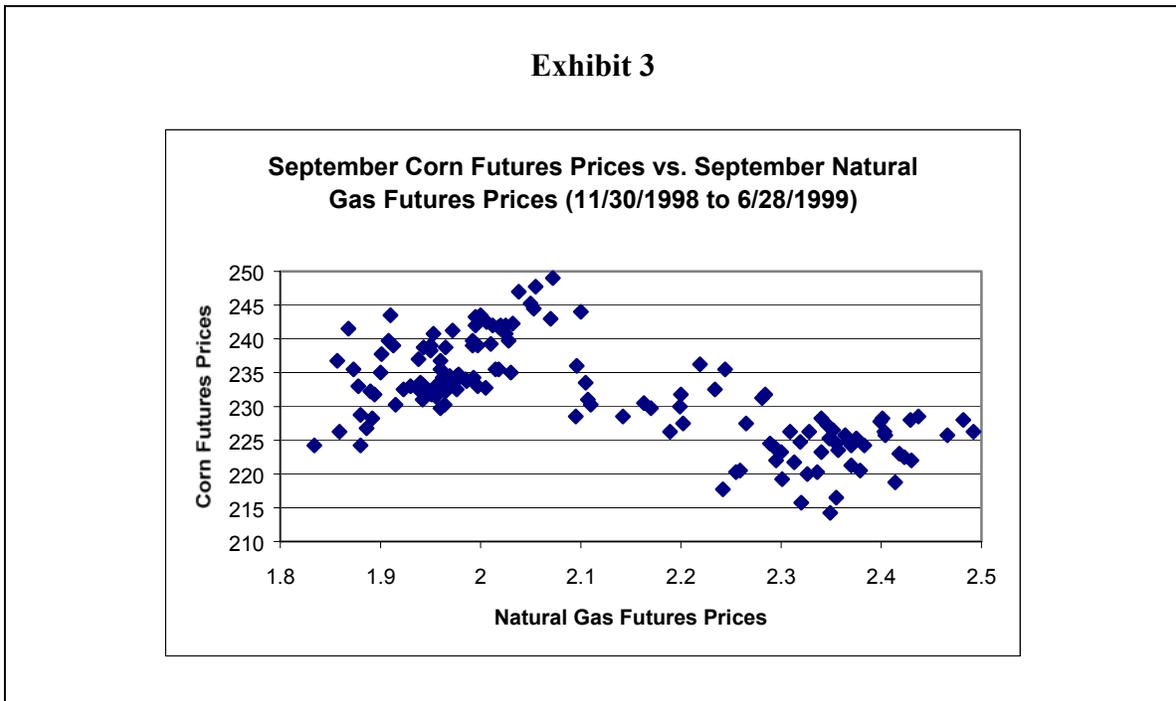
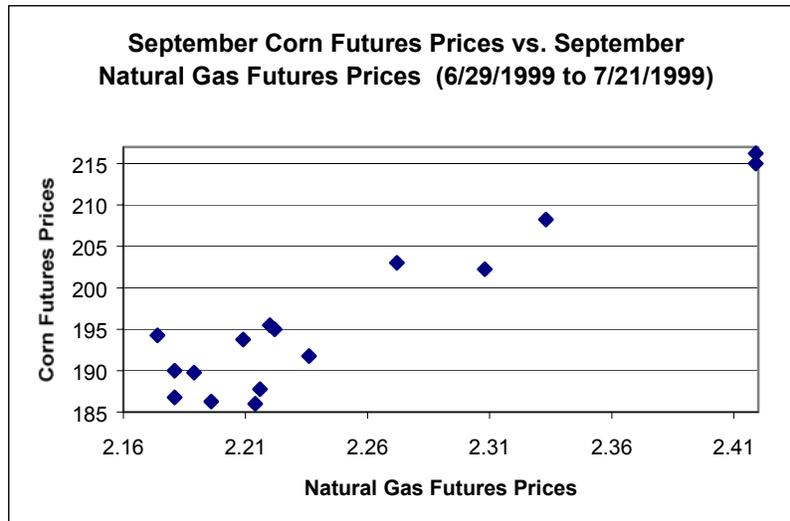


Exhibit 4



To avoid inadvertently increasing portfolio risk, one needs to understand what makes these commodity strategies work. In this example, these trades are part of a class of trades called “weather fear premium” trades. We explain this class of trades in Di Tomasso and Till [2000]:

“A futures price will sometimes embed a fear premium due to upcoming, meaningful weather events. One cannot predict the weather, but one can predict how people will systematically respond to upcoming weather uncertainty.

In this class of trades, a futures price is systematically too high, reflecting the uncertainty of an upcoming weather event. We say the price is too high when an analysis of historical data shows that one can make statistically significant profits from being short the commodity futures contract during the relevant time period. And further, that the systematic profits from the strategy are sufficiently high that they compensate for the infrequent large losses that occur when the feared extreme weather event does in fact occur.”

In Till [2000], we provide several examples of weather-premium trades, including those from the corn and natural gas markets:

Corn

“Its key pollination period is about the middle of July. If there is adverse weather during this time, new-crop corn yields will be adversely affected. This means that the new-crop supply would be substantially lessened, dramatically increasing prices.

A systematic trade is to short corn futures from June through July. There is systematically too high a premium embedded in corn futures contracts during the pre-pollination time period.”

Natural Gas

“In July, there is fear of adverse hot weather in the US Northeast and Midwest. Air conditioning demand can skyrocket then. From June to mid-July, a systematic trade is to short natural gas futures contracts at the height of a potential weather scare.”

Both the July corn and natural gas trades 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 realizations.

Since weather is different in different parts of the world, one can easily put simultaneous (uncorrelated) weather-premium trades together in a commodity portfolio. For example, in June, one can have grain trades and coffee trades that rely on the washing out of the weather premium in their respective markets. While the grain trades are driven by summer weather in the U.S., the coffee trade is driven by winter weather in Brazil.

Conclusion

While much has been written on the correlation properties of commodities versus financials rather less has been written on the correlation properties amongst commodity strategies which lend themselves to portfolio risk reduction. With due care, we find that the lack of correlation among commodity markets means that one can set up diversified commodity portfolios with surprisingly low risk. These commodity-based portfolios can then further reduce the risk of portfolios comprised primarily of financial asset classes.

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¹ The seven strategies included in Exhibit 2 are from June 2000 and include:

1. A deferred corn futures spread;
2. An intermarket wheat futures spread;
3. A soybean product futures spread;
4. An outright coffee futures trade;
5. A deferred lean-hog futures spread;
6. A deferred soybean oil spread; and
7. A live cattle futures spread.