Structural Sources of Return & Risk
In Commodity Futures Investments

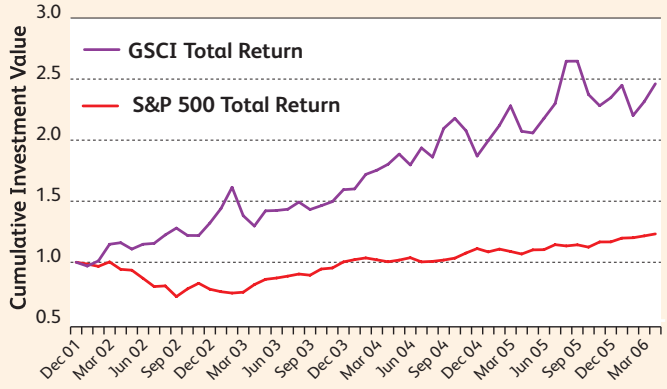
This article provides a 'nuanced' view of commodity futures investing. We discuss how commodity returns have, in the past, mainly relied on portfolio effects and term-structure properties of individual commodity futures contracts. But we also note that rare trend shifts – as occurred in the early 1970s – can also be a meaningful source of returns for a commodity investor. We further discuss some of the dynamic correlation properties of active commodity investing. These properties are also quite 'nuanced'. Finally, we examine the prospects for the main constituent of the dominant commodity index – oil – and provide a framework for understanding what could potentially drive future returns.

By Hilary Till

BECAUSE COMMODITY INDEX investing has grown from an obscure, niche strategy to a more widely accepted investment, there has been a need to better understand the drivers of historical commodity returns and risks. An investor would presumably then be in a better position to make informed judgments on the future prospects of a commodity investment. This article will provide the busy reader with a summary of the new research on this topic.

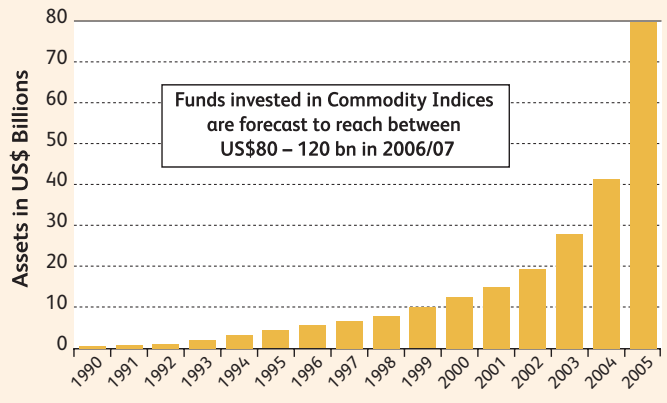
By now it has become well known that commodities have had superior performance over the past four and a half years. Figure 1 reviews just how superior that performance has been: from December 2001 – April 2006, the Goldman Sachs Commodity Index (GSCI) has returned 23.1 % per year while the S&P 500 has returned a more modest 4.9 % per year.

Figure 1: Cumulative Value of an Investment in Commodities & US Equities



Source: Bloomberg

Figure 2: Commodity Index Funds (US$, bn)



Source: Meir & Demler (2006)

Given these returns, commodity investing has become a sign of sophistication. Commodities can give "...turbo returns if things go wrong for equities and bond markets," stated the Chief Investment Officer of a large British pension fund, as quoted in Rees (2006). The significant growth in commodity index investing is shown in Figure 2.

> ... commodity investing has become a sign of sophistication

New commitments from pension funds have fuelled some of this growth. "Even normally cautious British pension funds are following the more adventurous US precedents and are allocating assets to commodities: the Sainsbury fund has targeted a 5 % exposure, the British Telecom fund just under 3 %. Global pension funds are estimated by investment consultants Watson Wyatt to be worth US$16 trillion and if they, like the BT fund, were to allocated 3 % to commodities, this would amount to US$500 bn, cascading into what have been quite narrow markets," noted a *Financial News* (2006) story.

Historical Returns

A recent edition of the prestigious *Financial Analysts Journal* (FAJ) included two articles which explored the historical returns of commodity futures indices. Gorton of the University of Pennsylvania and Rouwenhorst of Yale recently studied the properties of commodity futures over the period 1959 though 2004 in *Facts and Fantasies about Commodity Futures.* They created a monthly time series, starting in 1959, of an equally-weighted index of commodity futures, rebalanced monthly. They found that over the time period

of their study that fully collateralised commodity futures, historically, had offered the same return and Sharpe ratio as US equities. (The Sharpe ratio is calculated as an investment's excess returns over Treasury bills divided by the investment's standard deviation).

Table 1 below summarises the historical excess returns of their commodity futures index versus the returns of stocks and bonds. Stocks are represented by the S&P 500 index, and bonds are represented by the Ibbotson US corporate bond index. Again, 'excess returns' means that these are the returns over an investment in risk-less Treasury bills.

They also found that commodity futures returns were negatively correlated with equity and bond returns. This means that over the time period of their study, a commodity futures investment would have added a new source of returns for an investor, not accessible through stock and bond investments.

TABLE 1: ANNUALISED EXCESS RETURNS OVER TREASURY BILLS, JUL 1959 – DEC 2004

	Commodity Futures	Stocks	Bonds
Average (%)	5.23	5.65	2.22
Standard Deviation (%)	12.10	14.85	8.47
Sharpe Ratio	0.43	0.38	0.26

Source: Gorton and Rouwenhorst (2006)

TABLE 2: ANNUALISED RETURN OF INDIVIDUAL COMMODITY FUTURES, APR 1983 – APR 2004

	Annualised Return of Futures Contracts (inc. Collateral)	Annualised Change in Spot Contracts
Crude Oil	15.8%	1.1%
Heating Oil	11.1%	1.1%
Gasoline (since Jan '85)	18.6%	3.3%
Copper	12.0%	2.3%
Live Cattle	11.0%	0.7%
Corn	-1.9%	0.0%
Wheat	-0.4%	0.2%
Soybeans	5.7%	2.3%
Gold	-0.2%	-0.5%
Silver	-3.3%	-2.8%
Platinum	8.2%	3.1%
Soy Meal	8.8%	2.5%
Bean Meal	4.6%	2.9%
Sugar	1.8%	-0.4%
Coffee	-2.9%	-2.8%
Cocoa	-4.7%	-1.0%
Cotton	4.1%	-1.1%
Max	*18.6%*	*3.3%*
Min	*-4.7%*	*-2.8%*

Source: Based on Nash & Shrayer (2004)

Decomposition of Historical Returns: Rebalancing, Term-Structure Characteristics & Paradigm Shifts

The Gorton and Rouwenhorst study is very valuable in providing investors with a carefully updated examination of historical commodity returns. An additional area of fertile research has been to understand what the drivers of those historical returns were.

One highly nuanced point about commodity futures investing is that historically their long-term returns did not rely on broad-based rallies in spot commodity prices. For example, the second column in Table 2 shows how the spot prices of a number of commodities only ranged between -2.8 % to +3.3 % per year from 1983 to 2004. The first column in Table 2 shows for each commodity, how much a commodity's futures returns can be different from its spot returns. The source of these substantial differences will be explained below in the *Term-Structure Characteristics* section of this article.

Another highly nuanced point is that when one combines individual commodity contracts into an index and then actively rebalances their weights periodically, that rebalancing can also be an additional source of return for a commodity investor. This effect is not obvious when only examining individual commodity futures contract returns since this is a portfolio-level effect. This effect, in turn, will be discussed below in the *Rebalancing* section.

We will also discuss another source of returns, which has scant historical evidence, but nonetheless may have relevance for commodity investors going forward, and that is a rare trend shift in spot commodity prices, as occurred during 1970 to 1974. This scenario will be discussed below in the *Paradigm Shift: The 1970s Revisited* section.

Rebalancing

In a second March/April 2006 FAJ article, Erb of Trust Company of the West and Harvey of Duke University very carefully dissect the historical drivers of commodity returns in the article, *The Strategic and Tactical Value of Commodity Futures.*

They examine the returns of sixteen commodity futures contracts over the period, 1982 to 2004. The average correlation of individual commodities with one another was quite low: only about 9 %. The average standard deviation of the commodities that they studied was 25 %. It turns out that combining lowly correlated, highly volatile instruments can result in additional *index-level* returns.

Erb and Harvey show mathematically that "...when asset variances are high and correlations are low," the diversification return from rebalancing can be high. For example, "...for an equally weighted portfolio of 30 securities with average *individual* security standard deviations of 30 % a year and average security correlations ranging from 0.0 to 0.3, the diversification return [alone] ranges from 3.05 % to 4.35 %". This return is separate from any returns due to each individual commodity within the index.

Note that, by specifying that the portfolio is equally-weighted, this implicitly means one will be actively rebalancing the portfolio to maintain its equal weights across instruments. The returns from rebalancing a commodity portfolio could have been quite meaningful (historically) because of their constituent's low mutual correlation and high volatility. This return-enhancing effect has not been obvious to equity index investors because of the typically high mutual correlations amongst equities.

One should also add that a typical investment in a commodity futures portfolio is 'fully collateralised'. A *collateralised* commodity futures programme is unleveraged. That is, for every desired $1 in commodity futures exposure, an investor must set aside $1 in money-market funds, making the futures programme *fully* collateralised. When calculating the returns to a collateralised commodity futures programme, one typically includes the collateral returns as well.

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So even if the *individual* futures contracts in an equally-weighted index have returns that oscillate around zero, the rebalancing effect plus collateral returns can add up to meaningful numbers.

Before the Erb and Harvey article was published, the importance of the potential return due to rebalancing the constituents of a commodity index was not widely appreciated.

Term –Structure Characteristics

Another source of returns in commodity futures investing is due to the arcane concept of 'roll yield', which we originally explained in Till (2006b). In the past, even if *spot* commodity prices declined, there was an additional way that a commodity investor could have a positive statistical expectation of profit, and that was through the roll yield embedded in certain commodity *futures* contracts.

Over very long time frames, a number of authors have shown how the term-structure of a commodity futures curve has been the dominant driver of returns in futures investing. In other words, trends in the spot price of a commodity have generally not been a meaningful driver of returns over long periods of time.

In particular, Nash and Shrayer of Morgan Stanley (2004) have illustrated how over a single 21 year time frame, the returns of a commodity futures contract have been linearly related to how backwardated the contract has been. This empirical observation is shown in Figure 3. Over the period 1984 – 2004, the commodity futures contracts that have had the highest returns are those in which the front-month contract traded at a premium to the deferred-delivery contracts; that is, those contracts that had the highest levels of backwardation had the highest returns. Correspondingly, the contracts that have had the most negative results are those that typically traded at a discount to the deferred-delivery contracts. Again, those contracts that had the highest levels of contango on average had the lowest returns.

More recently, in an EDHEC-Risk Publication, Feldman and Till (2006) extend the framework originated by Nash of Morgan Stanley. Feldman and Till find that the power of backwardation to explain commodity futures returns is indeed valid, but requires the investor to have a long investment time horizon when relying on this indicator. Specifically, Feldman and Till examine the soybean, corn and wheat futures markets over the period 1950 to 2004. They find that a contract's average level of backwardation only explains 25% of the variation in futures returns over one year time frames and 42% of variation over two year time frames. One must extend the evaluation period to five years, and then at that time horizon, average levels of backwardation explain 63% of the variation in futures returns.

Figure 4 illustrates the latter result. Further, at eight year time frames, average backwardation explains a more robust 77% of the variance in futures returns. Figure 5 provides a related analysis: this graph shows that over five year time horizons, the relationship of annualised return to a contract's average-time-in-backwardation is again highly linear.

Short-term variability in commodity prices is high, which should make the spot-price return the dominant factor over shorter horizons. Over longer periods, Feldman and Till find that prices tend to be mean-reverting. This suggests that the importance of the spot return should decline as time frames increase.

The foregoing suggests that there should be a gradual increase in the fraction of price variability explained by backwardation with increasing time horizon. This relationship is similar in spirit to the increasing importance of dividend yield as a predictor of equity market return with the lengthening of the time horizon documented by Cochrane (1999). With a

Term-Structure & Roll Yield

By term-structure, we mean one should examine the relative price differences of futures contracts across delivery months. When a near-month contract is trading at a premium to more distant contracts, we say that a commodity futures curve is in 'backwardation'. Conversely, when a near-month contract is trading at a discount to more distant contracts, we say that the curve is in 'contango'.

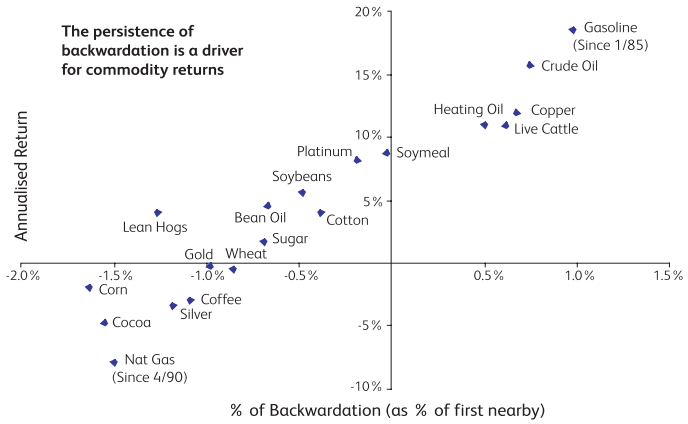
Typically when there are low inventories for a commodity, its commodity futures contract trades in backwardation: consumers are willing to pay a premium for the immediately deliverable contract relative to deferred-delivery-month contracts.

When a commodity futures contract is in backwardation, an investor has two potential sources of returns. Since backwardation typically indicates scarcity, one is on the correct side of a potential price spike in the commodity by being long at that time.

The other source of return involves a bit more explanation. In a backwardated futures market, a futures contract converges (or rolls up) to the spot price. This is the 'roll yield' that a futures investor captures. The spot price can stay constant, but an investor will still earn returns from buying discounted futures contracts, which continuously roll up to the constant spot price. A bond investor might liken this situation to one of earning 'positive carry'. In a contango market, the reverse occurs: an investor continuously locks in losses from futures contracts converging to a lower spot price. Correspondingly, a bond investor might liken this scenario to one of earning 'negative carry'.

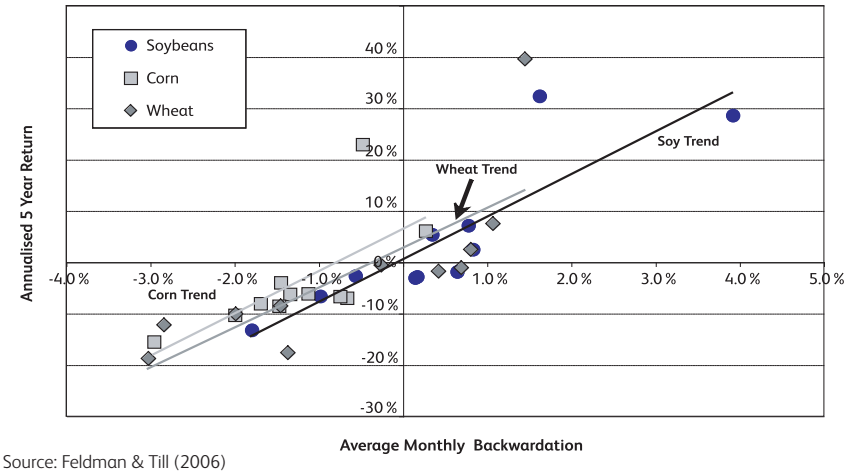
Figure 3: Annualised Return vs Average Backwardation*

** The contracts that typically trade in backwardation (gasoline, crude oil, copper, heating oil and live cattle) had the highest average returns, (1984 – 2004).*



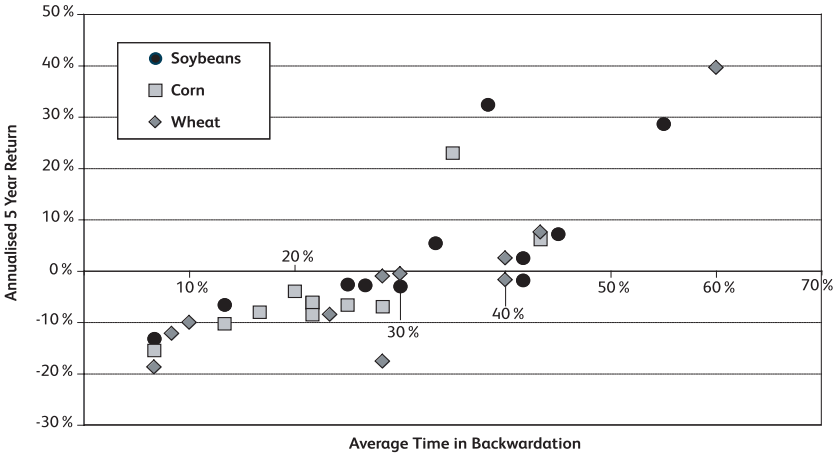
Source: Nash & Shrayer (2004)

Figure 4: Five Year Annualised Return, as a Function of Average Monthly Backwardation



Source: Feldman & Till (2006)

Figure 5: Five Year Annualised Return, as a Function of Average Time in Backwardation



Source: Feldman & Till (2006)

one year horizon, the R^2 value of the regression of dividend yield on excess return is 17%, but at five years the R^2 value becomes 59%. These results are over the sample period 1947 to 1996. Cochrane explains this as the result of the cumulative effects of the slight short-term predictability of a slow moving variable.

Paradigm Shift: The 1970s Revisited

While Feldman and Till find that backwardation has been a driver of returns over long time horizons for three agricultural futures markets, there is another noteworthy feature of their historical results (as touched upon in Till, 2006b). While normally, over five year periods, an agricultural futures contract's curve shape has been the driver of returns, there is one exception – the 1970 – 1974 period. These are the data points in Figure 5 that do not fit the nearly linear trend-lines of annualised returns as a function of monthly backwardation.

What this means for an investor is that there can be an additional fundamental rationale for a long-term, passive investment in a commodity futures contract besides predicting structural backwardation for the contract. The second rationale would be to predict that the factors are in place to repeat the 1970 to 1974 experience. For example, Howell of Schroders (2005) points out how excessive monetary stimulus had contributed to the high returns of commodities in the past. Specifically, Howell notes that negative real interest rates in the 1970s contributed to a commodity boom at the time. And real short-term interest rates had become negative in the US and in China during early 2005. Further, Roach of Morgan Stanley (2006) discusses the current economic environment as a 'super liquidity cycle', which is pushing the "Asset Economy to its limit", of which one manifestation is the boom in prices of certain commodities.

Now obviously one needs to be very care-

Facts & Fantasies About Commodity Futures

In their seminal paper on investing in commodity futures, Gary Gorton and K. Geert Rouwenhorst constructed an equally-weighted index of commodity futures monthly returns over the period July 1959 to December of 2004 in order to study simple properties of commodity futures as an asset class. The authors sought to produce "stylised facts" about commodity futures to address commonly raised questions.

In examining the correlation of commodity futures returns with stocks and bonds over various investment horizons, the authors found that:

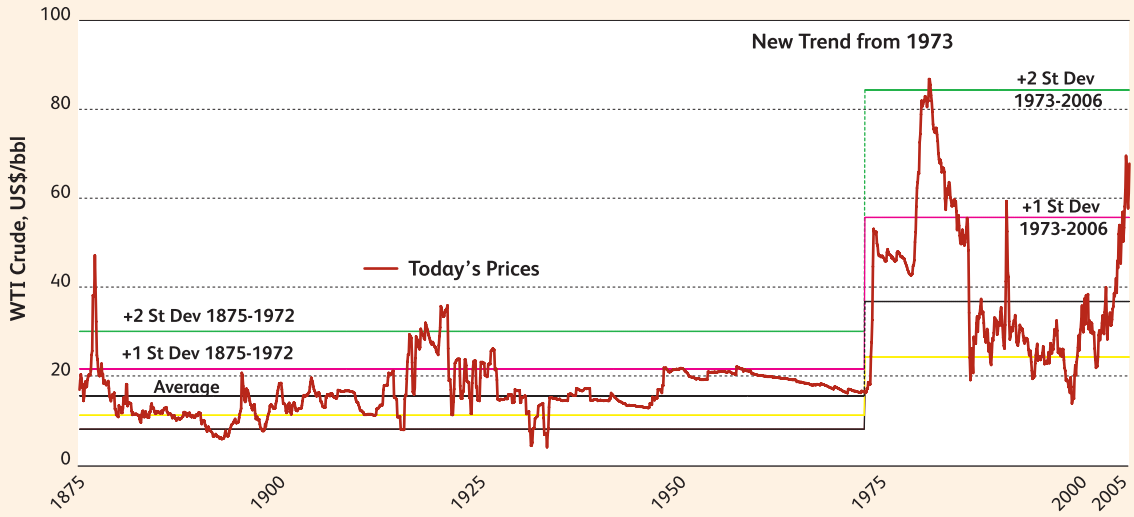
1) Over all horizons – except monthly – the equally-weighted commodity futures total return is negatively correlated with the return on the S&P 500 and long-term bonds. These findings suggest that commodity futures are effective in diversifying equity and bond portfolios.
2) The negative correlation of commodity futures with stocks and bonds tends to increase with the holding period. This suggests that the diversification benefits of commodity futures tend to be larger at longer horizons.
3) Commodity futures returns are positively correlated with inflation and the correlation is larger at longer horizons. Because commodity futures returns are volatile relative to inflation, longer-term correlations better capture the inflation-hedging properties of a commodity investment.

"It seems that the diversification benefits of commodity futures work well when they are needed most. Consistent with a negative correlation, commodity futures earn above average returns when stocks earn below average returns."

So commodity futures might be a better inflation hedge than stock and/or bonds because they represent a bet on prices, are directly linked to the components of inflation and include information about foreseeable trends in commodity prices. The opposite exposure to (unexpected) inflation may help to explain why futures do well when stocks and bonds perform poorly.

This means that commodity futures are useful in creating diversified portfolios, with respect to the idiosyncratic [non-systematic] component of returns. But, importantly, there is also evidence of another "diversification effect." Commodity futures have a feature quite unique to this asset class, namely, commodity futures have some power at diversifying the systematic component of risk – the part that is not supposed to be diversifiable!

Figure 6: At Last, a Paradigm Shift



Source: Updated from Grantham (2005)

ful about predicting trend shifts in asset prices. Grantham (2005) notes that his firm has completed research on "...30 completed [asset price] bubbles … all of which came back to the pre-existing trend." But he states, "Of these, we now believe 29 were genuine bubbles, and one – oil – was a paradigm shift …" that occurred in 1973. This is illustrated in Figure 6. Grantham, as a well known dedicated 'mean reverter' who under-weighted Japanese equities in the late 1980s and later under-weighted US technology stocks in the late 1990s, is pausing in calling for oil to mean revert. Even if oil becomes US$80 per barrel, "...given the unique features of oil, we cannot be sure it has not ratcheted up again with another trend shift."

Risk Considerations

Thus far, this article has focused on the drivers of returns for commodity indices and individual commodity futures contracts. This required a thor-

ough discussion because two of the sources of return – rebalancing and roll yield – are definitely not obvious. We also noted that rare trend shifts in commodity prices can also be a meaningful source of return. Another area of interest for investors is obviously the flipside of return: *risk*.

The following section will draw from Till (2006a) in discussing portfolio-level risk considerations for an active commodity manager. This discussion will focus on risk considerations, which, like the return-driver discussion, are not obvious to the neophyte in commodity investing.

Risk management at the portfolio level is fundamentally different from risk management at the strategy level. At the portfolio level, an investor is concerned with how dynamic correlations among strategies may affect portfolio-level risk. An investor is further concerned with how the commodity portfolio may perform during financial shocks since commodity products are frequently expected to be uncorrelated to the dominant financial asset classes. This section will describe appropriate portfolio-level analyses that address these concerns.

Diversified Portfolio Goal

Erb and Harvey had discussed how, to a large degree, commodity futures are uncorrelated with one another. A commodity portfolio manager will use this property of commodity futures contracts to attempt to create a portfolio of diversified commodity strategies with dampened risk. Commodity hedge fund manager Paul Touradji affirms this view, "One of the best things about being a commodity manager is the natural internal diversification." And, "While even unrelated equities have a beta to the overall market, many commodities, such as sugar and aluminum, traditionally have no correlation at all," according to Teague (2004) in his interview with the hedge fund manager.

> ... a commodity investor needs to include scenario analyses, which show a portfolio's sensitivity to meaningful events

One difficulty with using historical correlations to evaluate portfolio risk is that correlations amongst commodities vary both seasonally and during eventful periods. There are times when a common factor can affect seemingly unrelated positions, causing a seemingly diversified portfolio to have inadvertent concentration risk to the common factor. Therefore, a commodity investor needs to include scenario analyses, which show a portfolio's sensitivity to meaningful events, in his or her risk management toolkit. Example scenario analyses are provided below.

Extreme Weather Events

Normally, natural gas and corn prices are unrelated, but during the summer, they can be highly correlated. During a three week period in July 1999, for example, natural gas and corn prices were +85 % correlated. Both corn and natural gas trades are heavily dependent on the outcome of weather in the US 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.

What this means for commodity managers is that they should measure how much sensitivity their portfolio has to extreme summer weather in the Midwest. The manager would want to ensure that in the event of a heatwave in the US Midwest, his or her portfolio would not perform exceptionally poorly. Other potentially extreme weather shocks to include in ongoing scenario analyses include the chance of an end-of-February cold shock on energy positions as well as the possibility of a damaging hurricane season in the fall.

Sharp Shocks to Business Confidence

Futures products are typically marketed as equity investment diversifiers. Therefore, one job of risk management is to attempt to ensure that a futures investment will not be too correlated with the equity market during periods of dramatic equity losses.

Although a commodity futures portfolio may contain no financial futures contracts, the portfolio can still have systematic risk to the stock market. For example, Bessembinder (1992) found that live cattle, soybeans, silver and platinum futures contracts had statistically significant *betas* to the US stock market using data from January 1967 to December 1989 (the data for platinum started in January 1968). More recently, Erb and Harvey state that, "...the non-energy sector has a statistically significant, but small equity risk premia beta" using data from 1982 to 2004.

Given the potential of a commodity portfolio to perform poorly during financial shocks, a manager should therefore examine: *what the portfolio's performance would have been during the October 1987 stock market crash, the 1990 Gulf War, the Fall 1998 bond debacle, and during the immediate aftermath of September 11th 2001.* If the commodity portfolio would have done poorly during these events, then the manager may consider either de-leveraging his or her portfolio or buying option protection against one of the damaging scenarios.

Caveat on Dynamic Correlations:
The Relationship Between Commodities & Interest Rates

A number of commodity futures strategies have a long commodity bias since they rely on taking on inventory risk that commercial participants wish to lay off. One consequence is that these strategies are at risk to sharp shocks to business confidence. And during sharp shocks to business confidence, as occurred in the aftermath of September 11th 2001, not only did the stock market perform quite poorly, but economically sensitive commodities also performed poorly.

The Greenspan Federal Reserve Board responded to financial shocks by cutting interest rates, which has resulted in the stock market stabilising. As long as this type of policy continues, one way to hedge a portfolio that has exposure to shocks to business confidence or shocks

to the availability of credit is to include a fixed income hedge. The hedge could take the form of either a Eurodollar futures contract overlay or purchases of out-of-the-money fixed income calls. The post 9/11 experience validated that a long fixed income position was an effective hedge for a portfolio that is primarily long economically sensitive commodities.

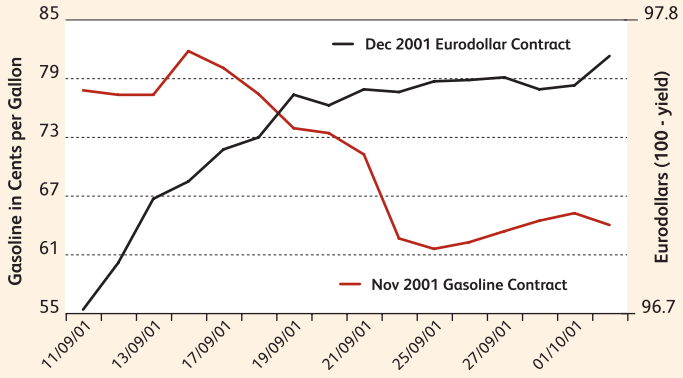
Figure 7 reviews the performance of gasoline futures contracts and short-term interest rate contracts in the aftermath of the 9/11 attacks. While gasoline prices plummeted due to the expectation of an economic slowdown, short-term interest rate contracts rallied as the Fed cut interest rates to calm the financial markets.

One caveat to this lesson is that the relationship between commodities and interest rates varies according to the type of meaningful event. For example, during the aftermath of Hurricane Katrina in late August through the middle of September 2005, gasoline and short-term interest rates reacted similarly to the prospect of scarce gasoline supplies, as shown in Figure 8. During the initial explosive rise in gasoline prices, due to the shut-down of crucial Gulf Coast refineries, interest rate market participants concluded that the Fed would pause in its interest rate tightening cycle, which then caused deferred month interest rate contracts to rally.

According to a Dow Jones Newswire report (2005) of the time, "[Hurricane] Katrina shut nearly all of oil and gas production in the Gulf of Mexico … The large scale supply disruption and fear of an economic shock triggered a massive government response. The outages prompted the Bush administration to release Strategic Petroleum Reserve oil, waive air-pollution rules on fuels, and ease restrictions on use of foreign-flagged vessels to carry fuel in US waters." Further, "Members of the OECD agreed … to [release] 2 million barrels a day of crude oil and petroleum products from their strategic stocks for 30 days."

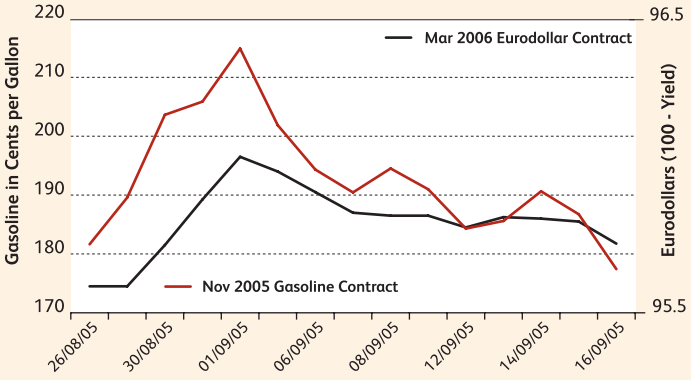
This unprecedented governmental response caused gasoline prices to decline from their post-Katrina peak, and with that response, fears of an economic slump diminished, which in turn caused deferred interest rate contracts to also decline as the market resumed pricing in the expectation that the Fed would continue tightening interest rates.

Figure 7: Gasoline & Short-Term US Interest Rates During 9/11 Attacks (2001)



Source: Till (2006a)

Figure 8: Gasoline & Short-term US Interest Rates During Hurricane Katrina (2005)



Source: Till (2006a)

In the scenario just described, changes in daily gasoline prices and short-term interest rates became +75 % correlated during the aftermath of Hurricane Katrina. This is in sharp contrast to the negative relationship between changes in gasoline prices and short-term interest rates that occurred in the aftermath of the 9/11 attacks.

In the aftermath of Hurricane Katrina, long positions in interest rates did not serve as an event hedge for long positions in gasoline; instead these two positions became the same trade, both on the upside and the downside. The lesson here is that risk management at the portfolio level is a constant and dynamic process.

Final Note: Prospective Returns

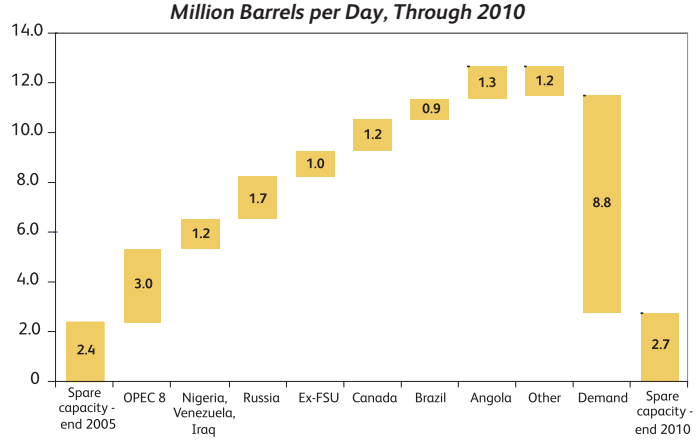
It is obviously useful to have a well informed view on what the source of commodity indices' equity-like returns were. And in addition, if one were considering an actively managed commodity programme instead of an indexed investment, it is a good idea to have a well informed view of what the sources of risk in such a programme are.

But clearly, what is most of interest to an investor is a prospective view of returns. At this time, the commodity index with the largest share of investor assets is the GSCI. As of 11th May 2006, this index was weighted 73.4 % in the energy sector. So it would likely be useful for us to examine the prospects for oil.

One challenging aspect of investing in oil futures at this time is that they appear to have shifted into 'structural contango'. As noted above, this means that an investor will have to absorb 'negative carry' with their oil-based investments. This is analogous to investing in gold futures contracts where there has been a historical cost in synthetically paying

Figure 9: Oil Spare Capacity Growth of 'Next to Nothing'

Million Barrels per Day, Through 2010



Source: Stuart (2006)

for the storage costs of this commodity. Historically, the behaviour of oil prices has been one of 'structural backwardation', consistent with the notion of crude oil inventories generally being scarce.

That crude oil futures have shifted into structural contango seems to contradict the tightness that is implied by this commodity's continuous spot price rally. What has changed?

One theory from a prominent hedge fund is that the true inventories for crude oil should be represented as above-ground stocks *plus* excess capacity. Historically, the markets could tolerate relatively low oil inventories because there was sufficient swing capacity that could be brought on stream relatively quickly in the case of any supply disruption. This excess supply cushion has dropped to sufficiently low levels that there have been two market responses: (1) there have been continuously high spot prices to encourage either consumer conservation or the development of alternative energy supplies, and (2) the market has undertaken precautionary stock building, which has led to the steep contangos that the crude oil market has been experiencing recently.

Stuart of UBS (2006) has examined the predicted supply and demand growth through 2010, and it appears that on trend, there will be no meaningful increase in oil spare capacity over the next four years, as shown in Figure 9. In addition the IEA stated, "Our impression is that the increased [oil supply] capacity will just be more or less equal to the increase in demand, [with the result that] spare capacity will not increase before 2009 or 2010," (as quoted in Meir, 2006).

As briefly discussed in Till (2006b), in the absence of oil producers building up a spare capacity cushion and in the absence of alternative energy sources effectively replacing oil usage, the only lever to eventually balance supply and demand is demand destruction, as reasoned by Murti *et al.* of Goldman Sachs (2005a). The Goldman analysts examine the experience of the late 1970s and early 1980s to see what price spikes are required to create demand destruction and refer to their predictions as a 'super spike' range.

The implication of this structural change for oil markets is that the returns to energy-focused commodity investments could become ever more long option-like. The investor will pay away option-like premia in the form of the negative carry from the persistent contango in the oil markets, but will simultaneously be positioned for periodic (and entirely unpredictable) price spikes until an adequate supply cushion re-emerges.

That said, as Murti *et al.* (2005b) predict, one would expect that eventually a supply cushion will re-emerge, either through behavioural changes on the part of consumers or through new infrastructure finally being constructed by producers. These changes may not occur until after the end of the decade, given the very long lead time for large scale energy projects. It is at that point one may see oil spot prices dramatically mean reverting, which would confirm Feldman and Till's study that a curve indicator can only be expected to be reliable at very long time frames ●

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