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Absolute Returns in Commodity (Natural Resource) Futures Investments
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In this chapter, we introduce readers to commodity (natural resource) futures programs. We begin the chapter by describing the present investment landscape as one where return compression in a number of popular hedge fund strategies has led absolute-return investors to investigate other promising return sources. This includes the highly volatile natural-resource markets, which Lammey (2004) describes as a "paradise for speculators."

The second section of the chapter discusses how (real) *spot* commodity prices have been in a long-term secular decline, which has meant that in the past, most arguments for investing in commodities have had to rely on one of the two following rationales. An investment in a commodity *futures* program has had to (1) capture cyclical opportunities, or (2) provide an inherent risk premium that has only been available in certain futures markets. This latter concept is admittedly esoteric and will be explained later in this chapter.

In the chapter's third section we will argue that current commodity investment programs, which are designed to either capture cyclical opportunities or monetize risk premia, are still valid in the current environment. But we will further note that one can also make a plausible case for investing in commodities based on increases in *spot* commodity prices. The 1990's were marked by "a series of unusually favorable supply shocks," which may *not* be the case going forward, as O'Neill of Goldman Sachs *et al.* (2004) have warned.

In the concluding section of the article, we will outline the risk management requirements for a commodity investment program, given that absolute-return investors require that hedge funds control downside risk rather than just "capture the premium of the asset class," as Ineichen of UBS (2003) has explained.

Return Compression in Hedge Funds Has Led to Interest in Investing in Commodities

Over the past ten years, not only has the number of hedge funds quadrupled but the assets under management have also grown exponentially. There are currently an estimated 8,000 hedge funds, which in aggregate manage about $1 trillion. As hedge fund assets grow, one wonders whether the inefficiencies that initially brought them success will still be available to exploit. "Performance in general seems to be deteriorating. In the late 1990's, … no one would touch a fund that did not claim to be able to make 15% a year. Now investors seem happy with a promise of high single-digit returns," noted the Economist (2004).

Exhibit 1 illustrates how in general hedge funds have underperformed the U.S. equity market and, for that matter, commodities over the two-year timeframe, March 2003 through March 2005.

<Insert Exhibit 1 about here>

The high fees available to hedge fund managers have caused traditional managers to migrate to the hedge fund space. Unfortunately for existing hedge fund managers, those moving into hedge funds are the same investors that were on the opposite side of the trade to supply hedge funds with inefficiencies in the first place. In that case, who is going to provide the inefficiencies that hedge funds have been able to monetize? As more of the "inefficiency suppliers" move into hedge funds themselves, a natural consequence is for these inefficiencies to diminish or disappear.

As covered in Till (2004), there is nothing new about the concept of superior investment strategies proving to be fleeting. As Siegel (2003) has noted, "High-beta stocks beat low-beta stocks until William Sharpe discovered beta in 1964; small stocks beat large ones until Banz and Reinganum discovered the size effect in 1979…"

Another example has been provided by Gatev *et al.* (1999). Over the period 1962 to 1997, they "find average annualized excess returns of up to 12 percent for a number of self-financing [equity] portfolios of top pairs." But they also find, "Pairs trading has declined in profitability dramatically from the 1970's and the 1980's to a low point at the end of our sample when the returns were sometimes negative." They hypothesize that after the strategy's discovery in the early 1980's, "competition has decreased opportunity."

Further, Agarwal, Daniel, and Naik (2003) provide evidence of the capacity-constrained nature of the hedge fund industry. Using data from January 1994 through December 2000, they find, "large hedge funds with large inflows display poor future performance and a lower probability of exhibiting persistence. This finding is consistent with decreasing returns to scale in the hedge fund industry."

Loeys and Fransolet of JP Morgan (2004) provide a framework for understanding which hedge fund strategies are likely to perform well in the future. Generally, the fewer hedge funds pursuing the same strategy, the less deep the derivatives market, and the more advanced the technology and trading rules, the more likely a strategy will perform well.

Of note is that at this time, the dominant financial opportunities have been in the financial rather than commodity markets. The exponential rise in financial derivatives since the late 1970's has (until recently) crowded out academic *and* practitioner interest in the commodity futures markets, leading to the present opportunities for those investment managers who have chosen to specialize in commodities.

Opportunities in the commodity (natural resources) futures markets appear to be available because of cyclical *and* secular factors. In the next two sections of this article, we will discuss the traditional case for commodity investing, which is still valid, followed by the updated case for commodity investing, which, while still unproven, is quite plausible.

The Traditional Case for Commodity Investing: The Structural Returns Available in the Futures Markets

The traditional argument for investing in commodities could not rely on the historical performance of the spot price of commodities. Reinhart and Wickham (1994) write that "during 1992 the prices of commodities relative to those of manufactures reached their lowest levels in over 90 years."

Instead, absent predictions of inflation, the argument for investing in commodities has had to be based on one of the two following factors. A commodity manager has had to be able to exploit cyclical opportunities *or* has had to be able to take advantage of opportunities in the *futures* markets, which are different from those available in the *physical* commodity markets.

Cyclical Opportunities

As discussed in Till and Eagleeye (2005), if there are inadequate inventories for a commodity, only its price can respond to equilibrate supply and demand, given that in the short run, new supplies of physical commodities cannot be mined, grown, and/or drilled. When there is a supply/usage imbalance in a commodity market, its price trend may be persistent, which, in turn, systematic trend-following programs may be able to capture.

In Burghardt *et al.* (2004), researchers at Calyon Financial provided empirical evidence that trend-following systems may indeed be able to capture dynamic returns in the commodity futures markets.[2]

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[2] Regarding their results, the Calyon researchers caution that "commodity markets tend to be less liquid than financial markets. Many [futures] managers, to get around the constraint that illiquid commodities markets would place on their trading capacity, continue to expand by decreasing the weight that commodities play in their portfolio."

We will now turn to a summary of arguments concerning other structural sources of return available in the commodity futures markets, as originally developed in Till (1997).

Systematic Opportunities

The Futures Markets Exist to Facilitate Hedging, Not to Forecast Prices

The likely reason for the persistent returns in long-only commodity futures programs, such as those benchmarked to the Goldman Sachs Commodity Index (GSCI) or the Dow Jones AIG Commodity Index (DJ-AIGCI), has to do with the economic function performed by commodity futures markets. These markets exist to facilitate hedging, not to forecast future spot prices.

As will be further explained below, there tends to be an excess of commercial entities who are short hedgers across a number of commodity futures markets. Therefore, in order to balance the market, investors must be willing to take up the slack of the long side of these markets. And in order to be persuaded to enter these markets, investors need a return for their risk-bearing. "In effect the hedgers offer ... [investors] an insurance premium for this service," as Bodie and Rosansky (1980) put it.

In other words, investors earn an "insurance premium" for being systematically long commodity futures contracts.

In the following, we will explain the theory underlying the rationale for commodity futures' persistent returns as it was initially proposed, and then later developed, expanded and tested.

Keynes

It was John Maynard Keynes who first proposed the hypothesis that a passive investment in commodity futures should be profitable. He first published this theory, which became known as the "normal backwardation[3] hypothesis," in 1930 in A Treatise on Money.

One can summarize Keynes' hypothesis as follows.

Commodity prices tend to be highly volatile. This is because:

     (a) Demand is difficult to predict;
     (b) In the short-run, the supply response for most commodities is inelastic; and
     (c) Redundant inventories are prohibitively expensive to hold.

This means that if there is a miscalculation in demand, only the commodity's price can adjust in order to balance supply and demand.

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[3] In the commodity markets, when a futures contract's price trades at a discount to the spot price, this relationship is referred to as "backwardation." When a futures contract's price trades at a premium to the spot price, this relationship is referred to as "contango."

With commodity prices so subject to violent fluctuations, producers will in effect pay speculators an insurance premium to lay off this unpredictable risk. Producers do so through the futures markets. Keynes (1930) explained that "[even] if supply and demand are balanced, the spot price must exceed the forward price by the amount which the producer is ready to sacrifice in order to 'hedge' himself, i.e., to avoid the risk of price fluctuations during his production period."

In other words, in order to induce speculators to assume the price risk of forward production, producers tend to sell their production forward at a discount to expected future spot returns. Commodity futures prices, therefore, tend to be downwardly biased. This is the key insight underlying both the rationale for an indexed investment in commodities as well as the main fundamental driver for a number of active commodity investment programs.

Hicks

JR Hicks further developed the hypothesis that commodity futures prices tend to be downwardly biased estimates of future spot prices in 1939 in his book, <u>Value and Capital: An Inquiry into Some Fundamental Principles of Economic Theory</u>.

A key element of Keynes' hypothesis is that it is producers who desire to use the futures markets to hedge unpredictable, volatile spot price risk. But what about consumers? Wouldn't they be long hedgers? If one has both long hedgers and short hedgers, why should the futures price be downwardly biased?

In essence, Hicks' theory is that undiversified producers are in a more vulnerable position than consumers, who can choose amongst alternatives as well as time their purchases. Given that producers are more vulnerable to commodity price fluctuations, they will consequently be under more pressure to hedge than consumers. This leads to a "congenital weakness" on the demand side of a number of commodity futures markets.[4]

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[4] In 1939, Hicks used the intuition underlying the commodity futures contracts' "normal backwardation" hypothesis to develop his more widely known "liquidity premium" hypothesis for bonds. In this latter hypothesis, he notes that all things being equal, a lender would rather lend in short maturities since they are less volatile than longer-term-maturity bonds. On the other hand, an entrepreneur would rather borrow in a long maturity in order to fix his costs and better plan for the future. In order to induce borrowers to lend long, they must be offered a "liquidity premium" to do so. The result is that bond yield curves tend to be upwardly sloping. (Whereas, with a number of commodity futures contracts, the normal curve shape is downwardly sloping, i.e., in "backwardation.")

The common idea behind both the "normal backwardation" hypothesis and the "liquidity preference" hypothesis is that commercial entities are willing to pay risk premiums from the profits of their ongoing businesses to hedge away key volatile price risks.

This latter point was further reinforced by Holbrook Working in 1948 in his "Theory of the Inverse Carrying Charge in Futures Markets." In using futures markets, commercial hedgers have wider business considerations in mind than expressing opinions on where future spot rates will be:

Returns Have Not Historically Relied on a Secular Increase in Spot Commodity Prices

The returns from commodity *futures* investments have often been confused with the returns from *physical* commodity investments. For example, Biggs (1994) wrote that "real commodity prices have been in a slow, gradual secular downturn, interrupted by cyclical disturbances." His article questioned the validity of commodity indexed investments.

But, as Bodie and Rosansky (1980) showed and Gorton and Rouwenhorst (2004) later confirmed, long-only commodity *futures* investments have tended to be profitable over long periods of time with equity-like returns. How can this be the case if (real) spot commodity prices have tended to decline? It is because commodity futures prices, in order to facilitate forward hedging, have historically embedded a risk premium. Over time, one monetizes this risk premium by owning commodity *futures* contracts.

Nash and Shrayer of Morgan Stanley (2004) have shown that the historical returns for a number of futures contracts have been quite different from their spot price changes. Their calculations are shown in Exhibit 2.

<Insert Exhibit 2 about here>

Nash and Shrayer's calculations appear to confirm the hypothesis that the returns from investing in commodities have *not* been due to changes in spot prices, at least over the period, April 1983 to April 2004. The spot prices in Exhibit 2 all changed by at most +/- 3% per year. Correspondingly, the total returns from passively owning and rolling a number of the futures prices have been 10%+ per year. This latter calculation includes the interest income earned from fully collateralizing one's investment in each of the commodity futures contracts.

Whereas an investment in a commodity index has generally benefited from bearing risk that commercial hedgers desire to lay off, an active commodity program will seek to identify those times and those commodities where one is particularly well compensated for bearing this risk.

"The hedger, whose arbitrage is incidental to merchandising or processing, tends to be satisfied to take profits from his major operation and to require [futures] price relations only that they be such as not threaten him with [overall] loss."

Active Commodity Strategies That Benefit from Structural Returns in the Commodity Markets

Exhibit 2 shows that the most fertile ground for looking for profitable opportunities has been in the energies, base metals, and livestock markets. Each of these sectors has had healthy returns over extended periods of time. (Of note is that the GSCI is majority-weighted in these three sectors.)

As explained in Till (2000), a common feature of each of these commodity futures contracts is that their underlying commodity has a difficult storage situation. For these commodities, either storage is impossible, prohibitively expensive, or producers decide it is much cheaper to leave the commodity in the ground than store above ground. As a result these commodities have relatively low inventories relative to demand.

The existence of storage can act as a dampener on price volatility since it provides an additional lever with which to balance supply and demand. If there is too much of a commodity relative to demand, it can be stored. In that case, one does not need to rely solely on the adjustment of price to encourage the placement of the commodity. If too little of a commodity is produced, one can draw on storage; price does not need to ration demand.

Now, for commodities with difficult storage situations, price has to do a lot (or all) of the work of equilibrating supply and demand, leading to very volatile spot commodity prices, which in turn leads to the classic Keynesian effects described below.

Producers and holders of commodity inventories will turn to the commodity futures markets to control or manage uncertain forward price risk. The price pressure resulting from commercial hedging activity causes a commodity's futures price to become biased downward relative to its future expected spot rate. In that situation, a long commodity futures position will have a positive expected return.

An active commodity manager will focus on those commodity markets that have produced consistently positive returns over time. Historically, those markets have included the energies, base metals, and livestock sectors. The active manager will then attempt to distill the returns in these markets even more so than an indexed program through entry and exit rules, trade construction, and downside risk management.

Since the driver of returns for the energies, metals, and livestock sectors appears to have been due to their difficult storage situations, an active manager needs to also continually monitor whether these factors are still in place. At present, this still appears to be the case. In summary, for the petroleum complex, the financing of inventories remains prohibitively expensive. For metals, the cheapest place to store them is still in the ground. And finally, livestock, by their very nature, are not storable. Once an animal becomes market weight, it needs to be brought to market immediately since further feedings are costly while simultaneously degrading the quality of the animal.

There is anecdotal evidence that pension fund investors are beginning to examine the structural sources of return in the commodity markets in order to add value to their core exposure in commodities, which in turn has been obtained by investing in commodity indices. For example, MARHedge (2005) reports that the leading Finnish pension plan, Ilmarinen Mutual Pension Insurance Company, has been examining actively managed allocations to "specialist clusters or sectors using sub-indices such as energies and livestock."

The final section of this chapter will address some of the unique risk management challenges that an absolute-return manager faces when designing an investment process around monetizing risk premia in the commodity markets. But before that, we will cover an updated case for commodities, which focuses on *spot* price increases as being a driver of returns in the commodity markets.

The Updated Case for Commodities: The Potential for Global Supply Shocks and Inflation

Although the weakness in spot commodity prices has been "primarily of a secular, persistent [downward] nature," as noted by Reinhart and Wickham (1994), there are stirrings that we may be an entering a new era of adverse supply shocks and perhaps inflation.

For example, O'Neill of Goldman Sachs *et al.* (2004) warn how the experience of the 1990's may have been unique with "crises in emerging markets and weakness in Japan and Asia … put[ting] downward pressure on [commodity] prices and … [increasing] the supply of savings to other markets, creating a safety valve for inflation and interest rate pressures globally." The Goldman Sachs researchers note that the "recovery in Japan and Asia has already reduced slack and begun to generate inflationary pressures."

In the following section, we will summarize the arguments for potential increases in the spot prices of the petroleum complex and base metals. Lastly, we will touch upon an inflationary analogy to the 1970's, given current monetary policy.

Petroleum Complex: Aging Energy Infrastructure and Asian Demand

A Super Spike in Oil

Murti of Goldman Sachs *et al.* (2005) write that investors should recognize that the "major differences between the current cycle and the [benign] 1990s cycles include the lack of spare capacity throughout the energy supply chain … [and] the fact that Asian economies have recovered from a 'once a generation' economic crisis that occurred in the late 1990s."

The Goldman analysts explain that the global "energy supply infrastructure has barely kept up with demand. Insufficient spending over the past two decades, coupled with

natural growth in oil demand alongside global economic growth, has led to a steady erosion of spare capacity in crude oil production that was built up during the energy boom years of the 1970s," according to Murti *et al.* (2004).

After the energy boom of the 1970s, OPEC built their deliverable spare capacity up to almost 12 million barrels per day (mln b/d). Today it has been diminished to just about an estimated 1 mln b/d.

"Further complicating the energy supply chain is the fact that growth in global refining capacity has also been limited in the past two decades…. Refining capacity growth has been limited to Asia-Pacific and, to a lesser degree the Middle East… with extra barrels likely to stay in Asia-Pacific due to surging demand in the region as well as product specifications that likely do not meet US and European standards," continue Murti *et al* (2004).

No new refineries have been built in the US and Western Europe for three decades, according to Morrison (2005). Exhibit 3 illustrates the decline in spare global refining capacity.

<Insert Exhibit 3 about here>

Given the strength in demand for crude oil by the United States and China, and the lack of spare capacity in the production of crude and in refining capacity, Murti *et al.* (2005) attempt to estimate the range of crude oil prices that would sufficiently reduce energy consumption to balance supply and demand. The analysts note that it has to be a demand reduction that balances supply and demand since the "addition of meaningful new quantities of supply" would take five to ten years.

The Goldman analysts predict that the range of prices required to meaningfully reduce demand is between $50 and $105 per barrel, which they refer to as a "super spike" range. The analysts look to the experience of the late 1970's and early 1980's to see what price spikes are required to create demand destruction.

The Goldman argument for the possibility of oil price spikes partly relied on continued economic growth in China and other Asian economies. This is also the underpinning for a bullish view of base metals by Citigroup.

Base Metals: A New Industrial Revolution in China

A Super Cycle in Copper

The intensive industrialization in China may not only drive a super spike in oil prices but may also create a super cycle in copper prices.

The key drivers of China's metals demand are fixed capital formation, urbanization, and domestic consumption. Writes Heap of Citigroup (2005), "Fixed capital formation is an

important driver of metals demand in China. Fixed capital formation has increased to 40% of GDP. ... Urban migration is an important driver of fixed capital formation and super cycles. In China, 10 million people per year are moving from the countryside to the cities, according to World Bank estimates, and this may increase four fold as restrictions on the movement of labor are relaxed as required by the WTO…. At least 50%, and perhaps 75%, of China's copper demand is for domestic consumption…. China's copper demand is not export driven, nor is a result of a relocation of manufacturing capacity from other countries…. This is … an important characteristic of past super cycles."

Heap (2005) defines a super cycle as "a prolonged (decades) trend rise in real commodity prices, driven by the urbanization and industrialization of a major economy."

Booming industrialization from emerging countries has historically been a super-cycle catalyst. "Super cycles [in metals] occurred in the late 1800s-early 1900s (driven by urbanization and industrialization in the USA), and in the late 1940s-early 1970s (driven by post war reconstruction in Europe and Japan, and subsequently the Japanese economic renaissance)," explains Heap (2005).

Heap illustrates two past super cycles in Exhibit 4.

<Insert Exhibit 4 about here>

Excessive Monetary Stimulus: The 1970's Revisited

Finally, in addition to the issues discussed above, Howell of Schroders (2005) points out how excessive monetary stimulus has contributed to the high returns of commodities in the past. "Negative real interest rates in the 1970's contributed to a commodity boom." Real short-term interest rates are now negative in the USA again and in China, which is illustrated in Exhibit 5.

<Insert Exhibit 5 about here>

Risk Management in Commodity Investing

If an absolute-return investor finds that the arguments for a potential increase in spot commodity prices are plausible, then that investor should consider either a commodity-index investment or an actively managed long-only commodity vehicle as part of their overall portfolio.

For further value-added, the investor should also consider including strategies that take advantage of both cyclical opportunities and the risk premia that is embedded in certain commodity futures markets. These latter strategies do not rely on a secular boom in commodity prices.

The Need for Downside Risk Protection

If a hedge fund investor elects to invest in an index product, then that investor realizes that he or she will earn the inherent return of the asset class, will be able to do so cheaply, but will not be provided with any downside risk protection. It will be the responsibility of the investor to time their investments in commodity indices so as to avoid downside risk.

Instead, if the investor chooses an actively managed commodity program, then that investor expects the potential downside of this investment to be carefully managed. For example, Ineichen of UBS (2003) notes that long-short equity sector hedge funds have opportunity sets that are correlated to their respective sectors, resulting in the active sector funds having returns that are correlated to their sector indices. But even so, these hedge funds control their downside risk so that ultimately their returns compound at a higher rate than their respective sector indices. The same expectations hold for active commodity programs in controlling downside risk.

In designing a risk management program for a commodity investment, one needs to address both idiosyncratic risks and macro risks. Idiosyncratic risks include those unique to a specific commodity market. Examples include simulating the impact of the discovery of Mad Cow disease in the U.S. on live cattle futures positions as well as examining the impact of the New York harbor freezing over on the price of near-month heating oil futures positions. Macro risks include discovering those risks in the portfolio that can create inadvertent correlations amongst seemingly uncorrelated positions. Examples include simulating the impact of a 9/11/01 event on a portfolio that is long economically sensitive commodities as well as examining the impact of surprisingly cold weather at the end of the winter on a portfolio of energy positions.

Trade Construction and Sizing

Historically, hedge fund investors have expected a long-option-like payoff profile from their futures investments. If instead these investors wanted consistent returns with the rare chance of very large losses, they can already do so by investing in arbitrage strategies.

Some opportunities in the commodity futures markets have short-option-like payoff profiles. One example is weather-fear premia strategies. In these trades, which can be found in the grain, tropical, and natural gas futures markets, a future price is systematically priced too high relative to where it eventually matures. This occurs before a time of unpredictable weather such as the Brazilian winter or summer-time in the U.S. Midwest and Northeast. In the case of the Brazilian winter, an extreme frost can damage Brazil's coffee trees. In the case of the U.S. summer-time, an exceptional heat-wave can impair corn pollination prospects as well as stress the delivery of adequate natural gas supplies for peak air-conditioning demand.

Over long periods of time, it has been profitable to be short these commodity markets during the time of maximum weather uncertainty. But during rare instances, these strategies can have very large losses, which create classic short-option-like profiles.

If one includes short-option-like strategies in an absolute-return futures program, then the sizing of these trades needs to be reduced compared to the sizing of trades with long-option-like profiles in order to preserve the program's overall long optionality.

In a previous section, we discussed commodity markets that were difficult-to-store. These markets have a tendency to experience periodic mini-price spikes since their inventories tend to be relatively low compared to demand. If there is any miscalculation in demand or supply, one cannot draw from negative storage so the only lever that can balance supply and demand is price, which can move violently upwards. As a result, long positions in difficult-to-store commodities tend to have long-option-like payoff profiles. These are markets whose sizing needs to be sufficiently large to provide the overall portfolio with its long optionality.

Conclusion

As there has been in the past, there are opportunities to earn an insurance premium for being long of certain commodity futures contracts (which the Goldman Sachs Commodity Index is majority-weighted in), which do not rely on a secular increase in spot commodity prices.

That said, the current environment is one of risks of adverse supply shocks because of aging U.S. and European energy infrastructure as well as expanding Chinese demand. This may boost the potential returns of investing in a commodity futures program due to increases in spot commodity prices.

Hedge fund investors expect the downside of each of their actively managed investments to be carefully managed. As a result, an active commodity manager needs to be alert to potential scenarios that could create inadvertent correlations within his or her portfolio, which could thereby unexpectedly increase risk.

Historically, hedge fund investors have also expected their futures investments to provide a great deal of long optionality. One way of achieving this is to choose to invest in those sectors that have typically had difficult storage situations, including the energies, base metals, and the livestock sectors.

As opportunities have eroded in a number of hedge fund strategies, absolute return investors have started to consider investing in (natural resource) commodity futures programs. One may expect this interest to intensify if we are indeed in "a major bull market sustainable for many years," as predicted by Fusaro (2005).

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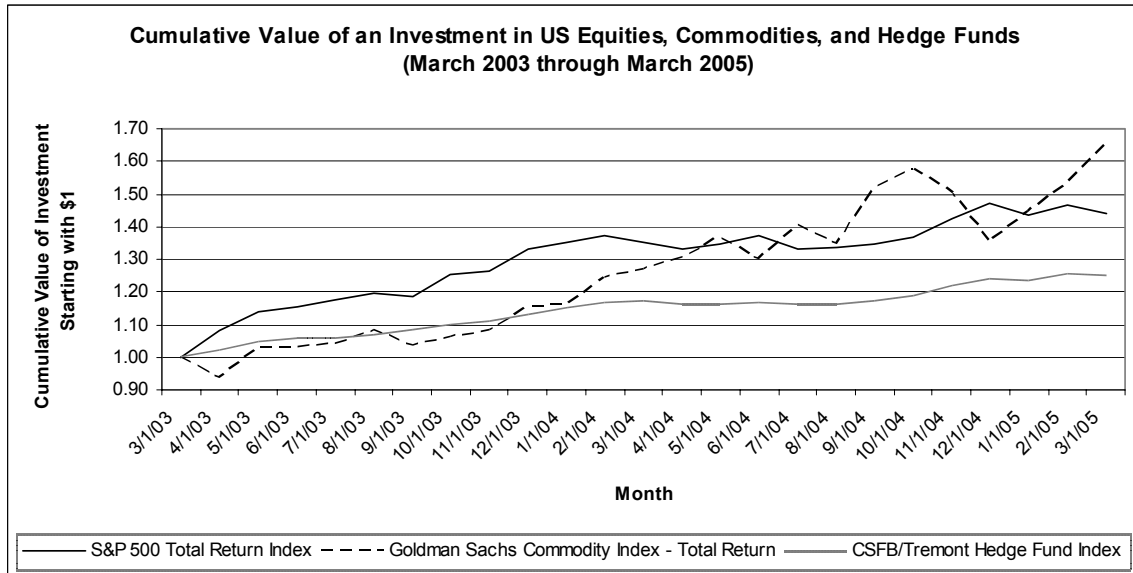
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**Exhibits for
Absolute Returns in Commodity (Natural Resource) Futures Investments**

Exhibit 1

**Cumulative Value of an Investment in US Equities, Commodities, and Hedge Funds
(March 2003 through March 2005)**

Data Source for S&P 500 and Goldman Sachs Commodity Index: Bloomberg.

Data Source for CSFB/Tremont Hedge Fund Index: http://www.hedgeindex.com.

CSFB stands for Credit Suisse First Boston.

Exhibit 2

Annualized Return of Individual Commodity Futures Markets

## (April 1983 to April 2004)

	Annualized Return of Futures Contract (includes Interest Income)	Annualized Change in Spot Price
Crude Oil	**15.8%**	1.1%
Heating Oil	**11.1%**	1.1%
Gasoline (since 1/85)	**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 Oil	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%

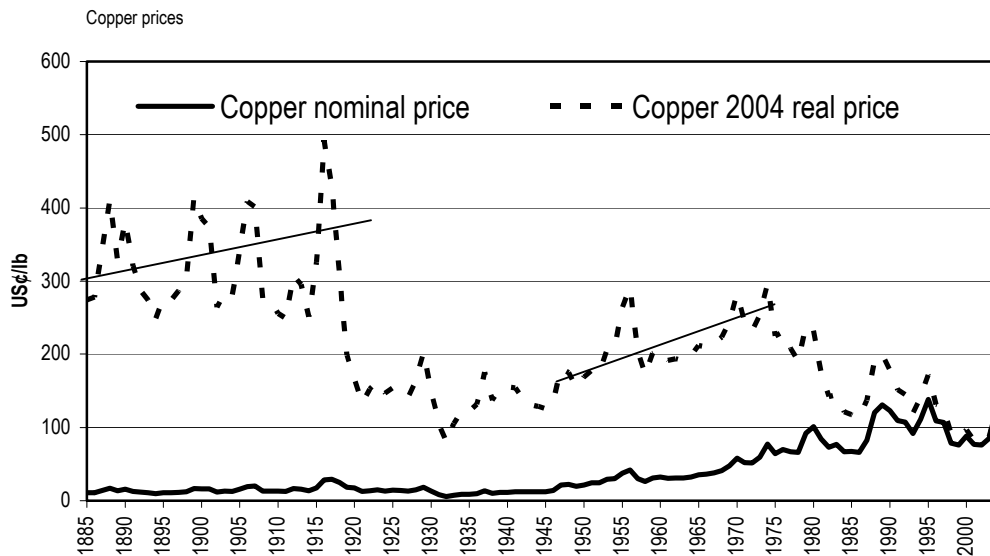*Source: Based on Nash and Shrayer (2004).*

Exhibit 3

Spare Global Oil Refining Capital (mm/bpd)
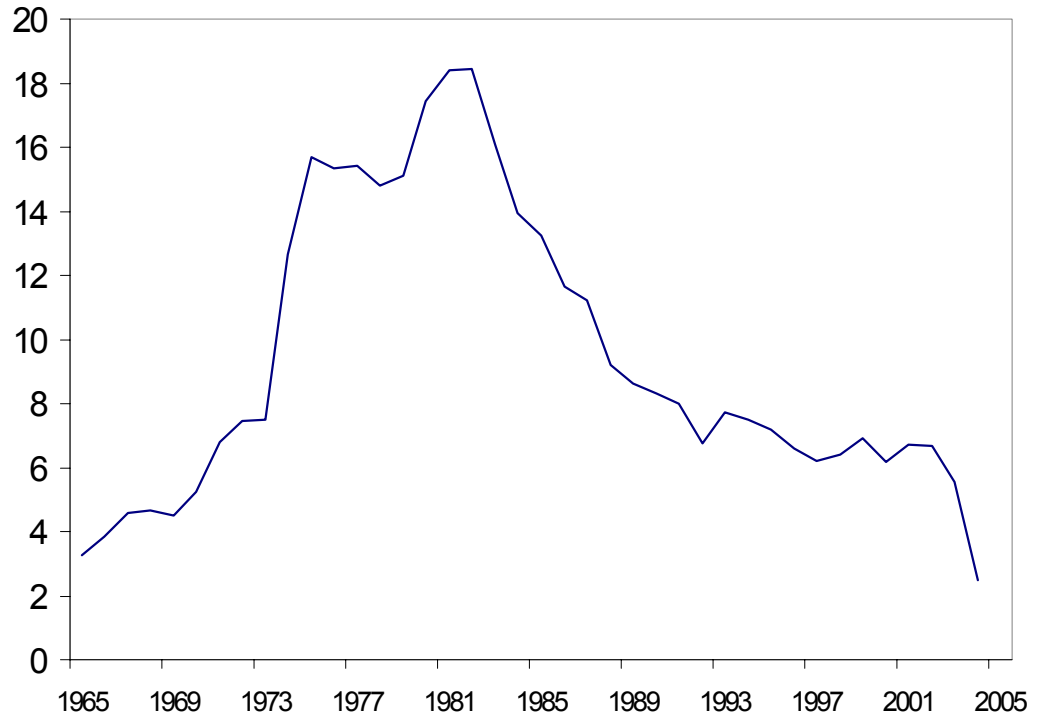
Source: Howell (2005), which was derived from an analysis by Paul Horsnell of Barclays Capital.
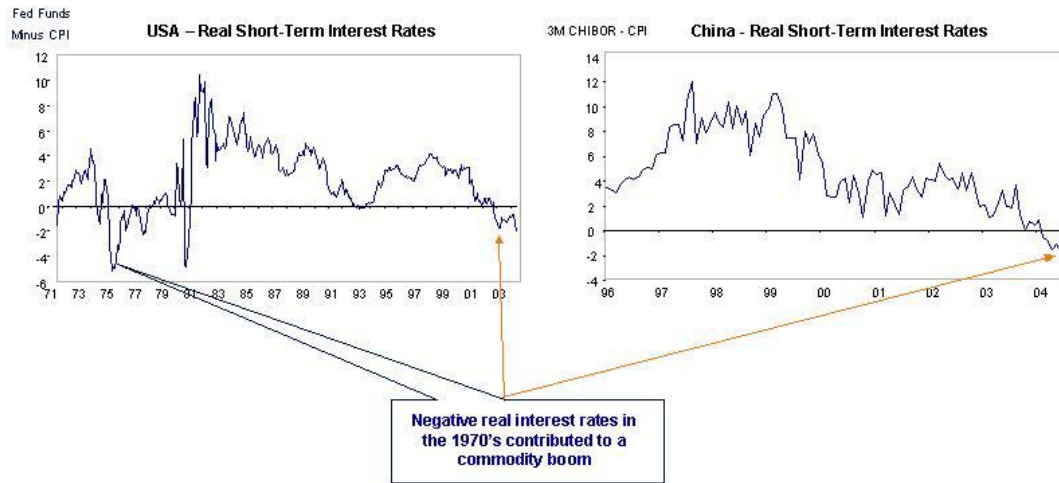
Exhibit 4

Copper Super Cycles

Copper prices

Author's Source: US Geological Survey; Platts; US Department of Labor.

Source: Heap (2005).

Exhibit 5

Excessive Monetary Stimulus

Source: Howell (2005), which was derived from an analysis by Geoff Blanning of Schroders Alternative Investments.