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# THE RISKS OF COMMODITY INVESTING

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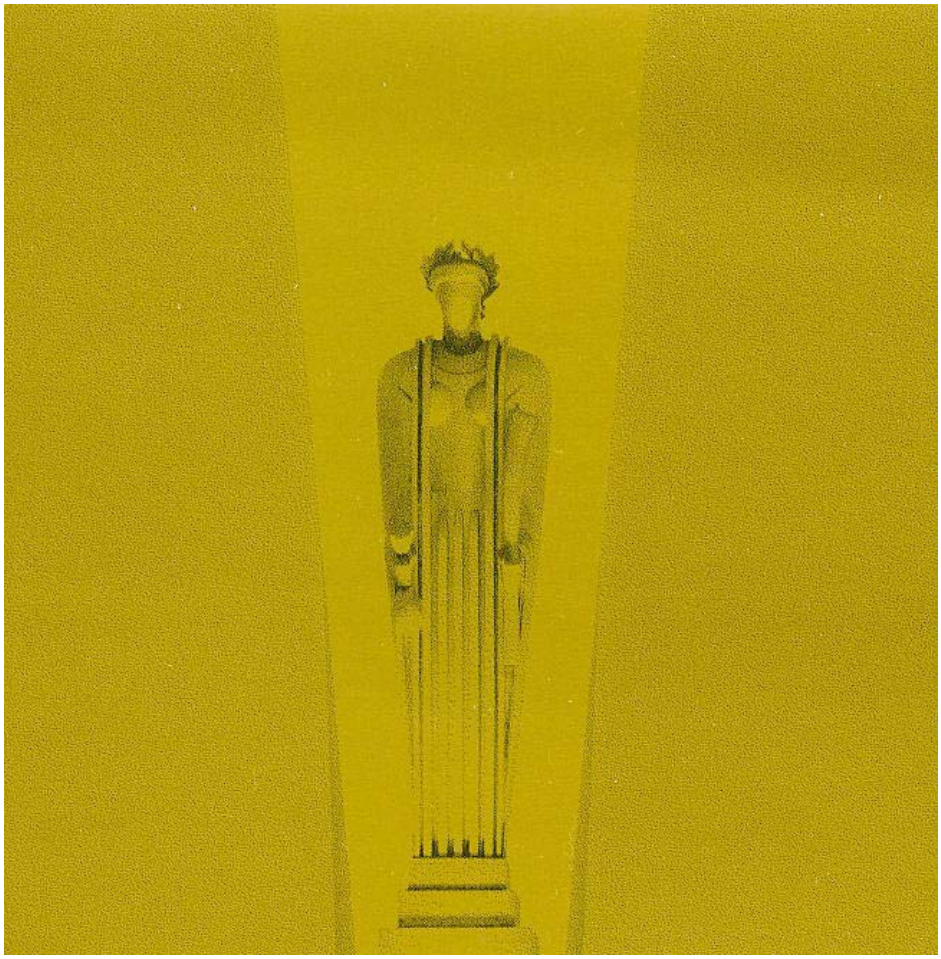


## The Risks of Commodity Investing

I. Risk and Return Sources of Commodities
II. Role in a Traditional Portfolio: Commodity Futures Investments as a Diversifier or Return Driver
III. Idiosyncratic Risk and Systematic Macroeconomic Risk Factors

This chapter will cover investing in commodities through futures contracts. It will note the unique sources of risk and return for such investments. We will also discuss the factors that one should take into consideration before deciding upon how much of their portfolio should be in commodities. We will note how an investment in commodities can be used as either a diversifier for a traditional portfolio or as a source of returns, depending on the market environment. Finally, we will argue that some of the considerations that apply to equity investing are also relevant for commodity investing.

### I. Risk and Return Sources of Commodities

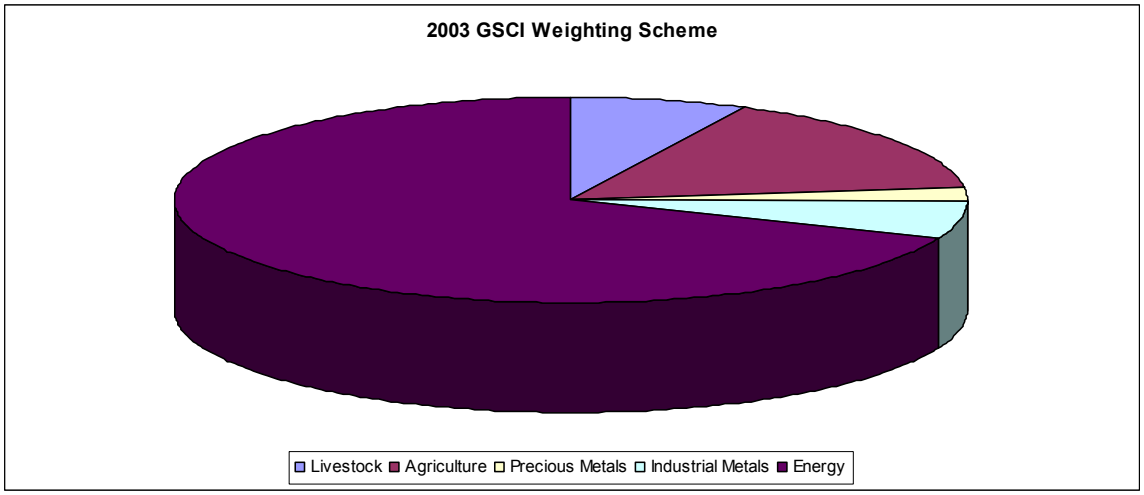
This chapter will focus on systematic investments in the commodity futures markets. We will discuss an index-based approach to commodity investing along with other systematic ways of investing in commodities.

This chapter will *not* cover the managed futures strategy since its returns can be largely explained by financial market strategies. Please see Chapter 26 for a discussion of managed futures, which includes their unique portfolio properties.

### A. Systematic Long Futures Investments

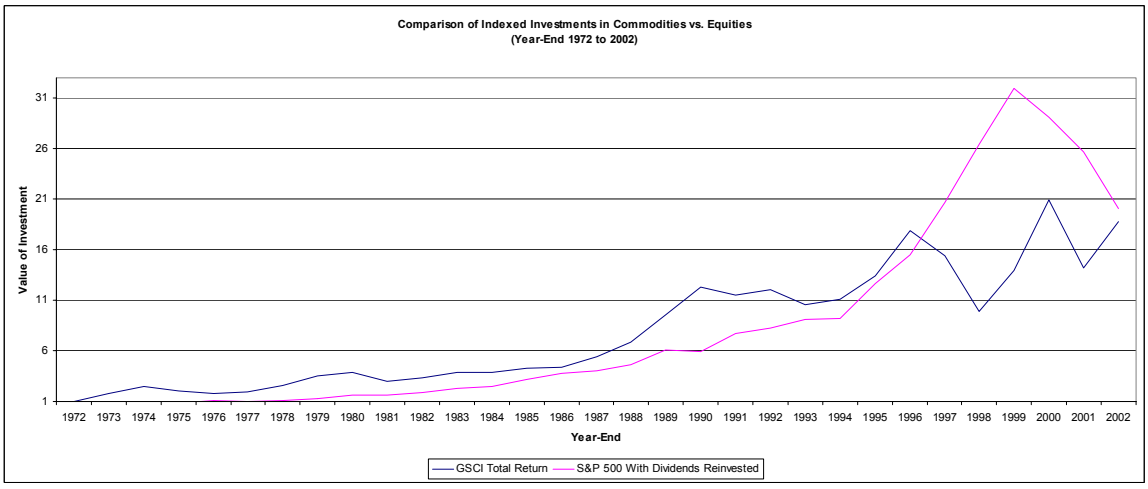
The Goldman Sachs Commodity Index (GSCI) represents one way of obtaining an indexed exposure to commodities. The GSCI is a world-production-weighted commodity index and its weighting scheme is depicted in Figure 1. Because of the broad economic base to its structure, the GSCI has become the dominant commodity benchmark for investors. According to Goldman Sachs, an estimated $12 billion is invested in or benchmarked to the GSCI as of 2003. The GSCI's historical performance versus the S&P 500 is shown in Figure 2.

## Figure 1




*Source: Chicago Mercantile Exchange.*

## Figure 2




*Data Source: Goldman Sachs and Bloomberg.*

1. Summary Explanation

The explanation of the source of returns for a long commodity futures program usually takes the following form. The two factors underlying such a program's returns are the desire of commodity inventory holders to hedge, and the continuation of just-in-time inventory policies. Significantly, the returns to a commodity futures investment do not rely on a predicted increase in *spot* commodity prices.

As was first noted by John Maynard Keynes in 1930, commodity futures prices tend to be priced at a discount to spot prices in order to induce speculators to provide price insurance to commodity inventory holders. 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.

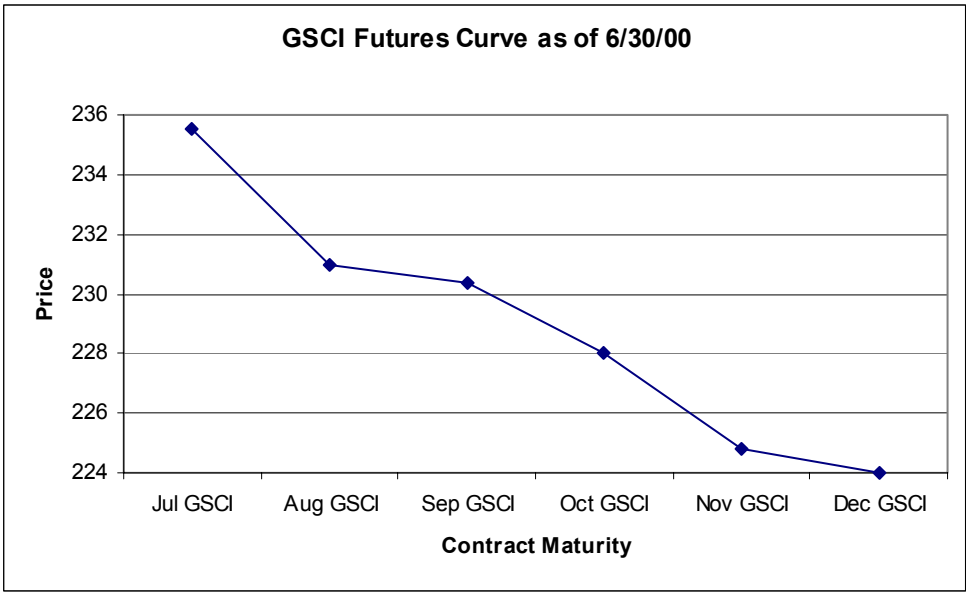
In addition to a long commodity program's collateral returns, this risk premium is the main, reliable source of return for commodity investors, typically accounting for the majority of a long commodity program's futures-only returns.

The other factor driving commodity returns is the continuation of just-in-time inventory policies, which cause temporary shortages in individual commodities, leading to temporary spot commodity price spikes. By continuously investing in front-month futures contracts, one captures these returns.

In order to further explain the sources of returns in a long commodity program, one needs to first explain such arcane commodity concepts such as "backwardation" and "roll yield."

When a futures contract's price is at a discount to the spot price, the shape of the futures curve is called "backwardation." When the futures contract's price is at a premium to the spot price, the shape of the futures curve is called "contango." Figure 3 illustrates a futures curve that is in *backwardation*.

**Figure 3**



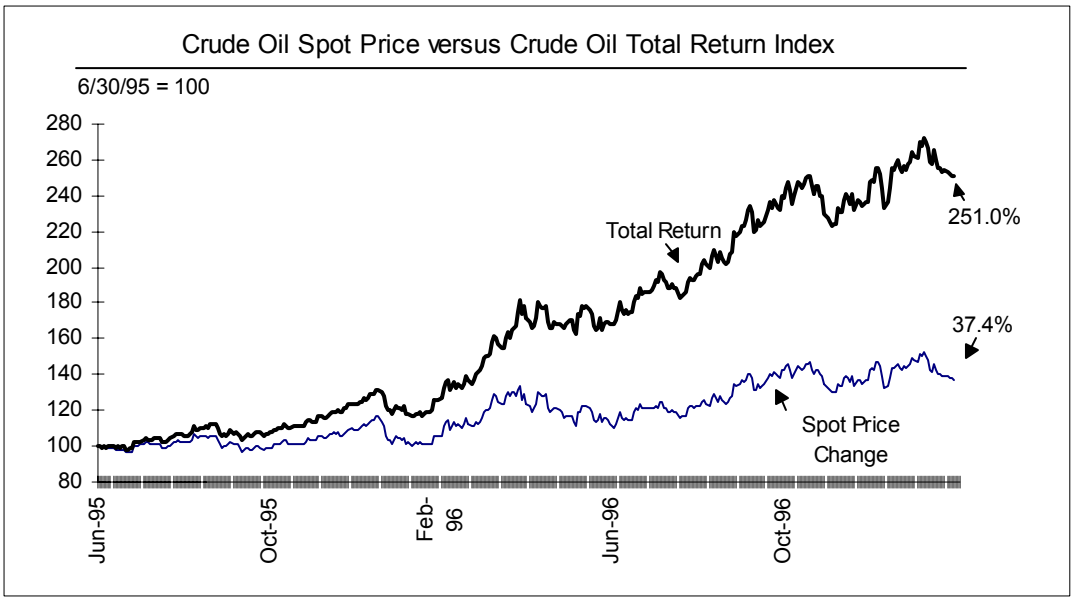

*Data Source: Bloomberg.*

Another early point to make is that futures returns are a combination of spot price returns *plus* the effect of the futures price converging to spot. In a backwardated futures market, a futures contract converges (or rolls up) to the spot price. This is the "roll yield" that one captures. The spot price can stay constant, but one will still earn returns from buying discounted futures contracts, which continuously roll up to the constant spot price. In a contango market, the reverse occurs: an investor continuously locks in losses from the futures contracts converging to a lower spot price.

Earning a roll yield when a futures curve is in backwardation is analogous to the returns a long-term bond investor earns from rolling down a steeply sloped yield curve.

An illustration of how roll yield can be the main return contributor in a long commodity program is shown in Figure 4. In 1997 Goldman Sachs illustrated how the returns from investing in crude oil futures contracts from June 1995 to late 1996 were dominated by roll yield when the crude oil futures contract was persistently in backwardation.

**Figure 4**

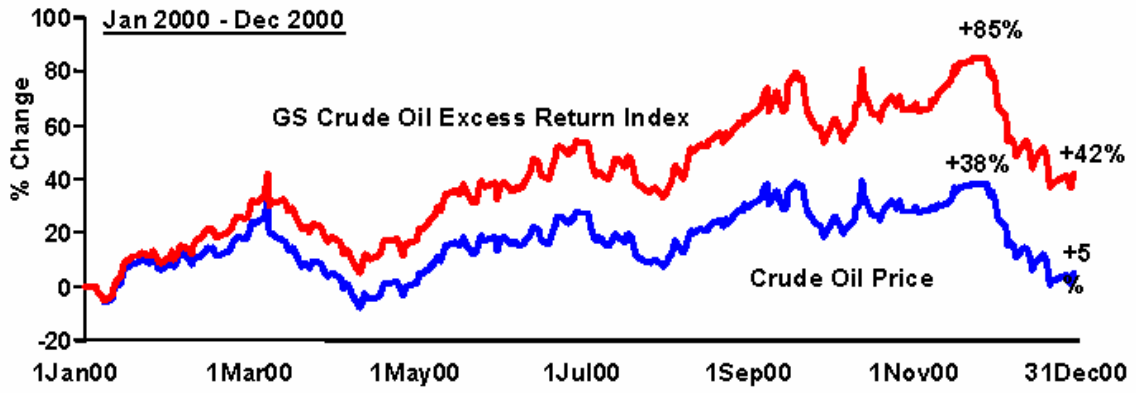



*Data Source: Goldman Sachs, "Commodity Watch," February 6,1997.*

The above graph shows that the spot price of crude oil increased by 37.4% over the period while a collateralized investment in crude oil futures contracts yielded a much more substantial 251%. This difference in returns is largely due to roll yield.

Figure 5 provides a more recent example. This figure shows the returns from continuously investing in front-month crude oil futures contracts during the year 2000. The crude oil futures market was largely in backwardation then. The blue line shows the change in spot crude oil prices while the red line shows the returns from investing in crude oil futures contracts, excluding collateral returns.

**Figure 5**

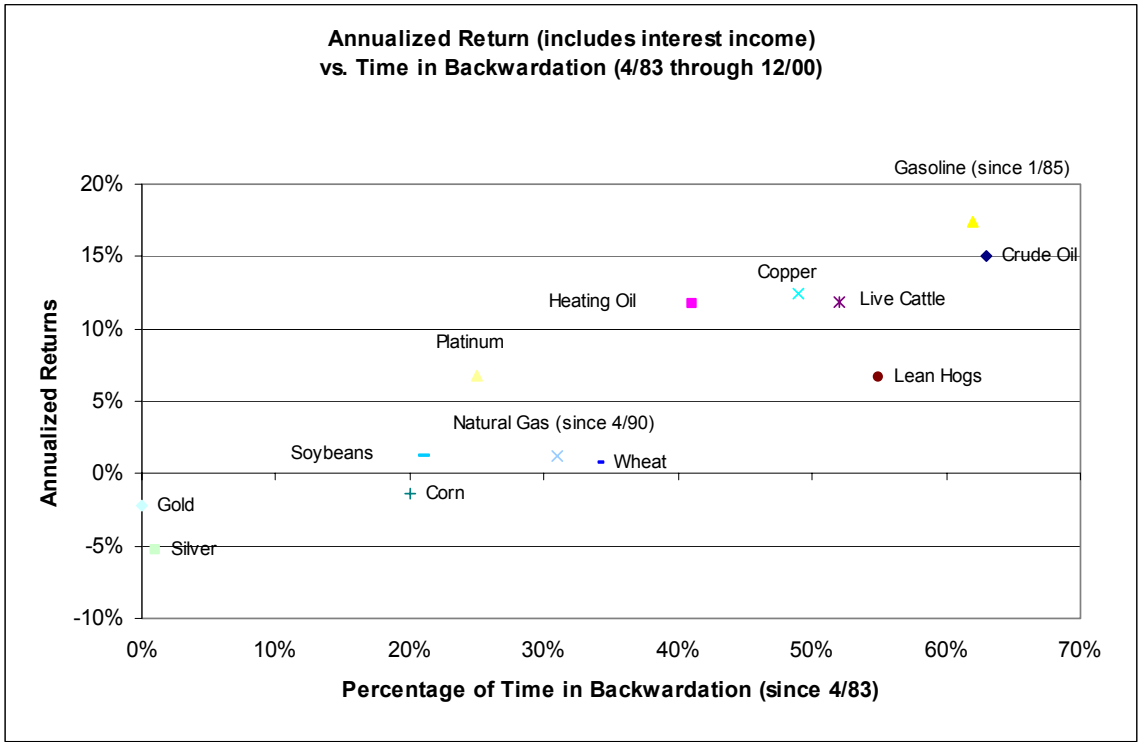



*"GS" stands for Goldman Sachs. "Excess Return" refers to the returns from investing in futures contracts excluding collateral returns.*

*Source: "Backwardation in Commodity Markets," Goldman Sachs, March 2003, p. 6.*

Further evidence that the presence of roll yield is the key factor in a long commodity futures program's returns is provided by the graph in Figure 6. This graph, which is drawn from research by Daniel Nash of Morgan Stanley, shows that commodity futures contracts whose normal curve shape is *backwardation* have historically offered the highest returns.

## Figure 6




*Source: Nash, Daniel, "Long-Term Investing in Commodities," Morgan Stanley Dean Witter, Global Pensions Quarterly, January 2001, Figure 5.*

A final source of returns in a commodity futures program is the program's collateral returns. A *collateralized* commodity futures program is unleveraged. That is, for every desired $1 in commodity futures exposure, an investor sets aside $1 in money-market funds, making the futures program *fully* collateralized. When calculating the returns to a collateralized commodity futures program, one typically includes the collateral returns as well. Unless otherwise noted, the returns shown in this chapter for a commodity investment also include this collateral return.

Returning to Keynes, this economist proposed that it is *normal* for a number of futures contracts to be priced at a discount to the spot price. Keynes reasoned that given the unpredictable fluctuations in commodity *spot* prices, commodity merchants would be willing to hedge commodity production forward at a discount in order to lay off volatile *spot* price risk. This discount is the risk premium they are willing to pay commodity speculators for bearing this risk.

Drawing from a 1939 textbook by the economist J.R. Hicks, commodity consumers are not in as vulnerable a situation as commodity producers. Commodity consumers can

choose the timing of when they want to make their commodity purchases. (We would now say commodity consumers are long "real" options.) Therefore, there is typically a congenital weakness on the demand side of commodity futures markets which must be made up by speculators. Speculators would only be willing to make up this demand shortfall if they are paid a reasonable return for their risk bearing.

The futures markets give a commodity inventory holder the ability to sell their holdings at any time. In order to buy this timing option, which they would otherwise be short, they are willing to pay the speculator his or her risk premium. Drawing from a 1948 paper on the economic function of futures markets by the economist Holbrook Working, a commodity merchant is willing to do so since the merchant derives his or her main profits from merchandising and processing. The hedger only requires futures prices relations to be such that they not threaten the enterprise with overall loss.

If one relied on a secular increase in *spot* commodity prices to justify an investment in a long commodity futures program, that investor would be frequently disappointed. A 1994 IMF study concluded that "real commodity prices have been in a slow, gradual secular downturn, interrupted by cyclical disturbances...."

Instead we are relying on a risk-premium argument for a systematic return to an investment in commodity *futures* contracts. Now, judging from Figure 6, not all commodity futures contracts seem to provide an inherent return. Based on the Keynes-Hicks-Working hypotheses and Nash's empirical study, it seems that one should confine their systematic long investments to those commodity futures contracts that typically trade in backwardation. These are the contracts for which it appears that one is being paid to take on volatile price risk. Given the lack of returns in the other contracts, it does not appear that an investor is serving an economic purpose by being systematically long non-backwardated futures contracts.

Of note is that the GSCI is majority-weighted in commodity futures contracts that are typically in backwardation.

2. Further Explanation

We can delve further into why certain contracts typically trade in backwardation and others do not. The particular commodity futures contracts that have persistent returns and normally trade in backwardation are ones whose underlying commodities have difficult storage situations. 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.

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 balancing supply and demand, leading to very volatile spot prices. A defining feature of commodities is the long lead-time between deciding on a production decision and the actual production of the commodity. It is impossible to exactly foresee what demand will be by the time a commodity is produced. This is why supply and demand will frequently not be in balance, leading to a large amount of price volatility for these commodities.

Producers and holders of commodity inventories will therefore 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.

Robert Kolb effectively verified these theoretical arguments in a *Journal of Futures Markets* study. Kolb examined 45 commodity futures contracts over the timeframe 1969 to 1992 and determined which commodities have statistically significant daily returns using both parametric and non-parametric tests. If a contract did not exist as of 1969, Kolb starts calculating a contract's return series at its inception. Of the non-financial futures contracts, the only commodities that had significant positive returns under both tests were crude oil, gasoline, live cattle, live hogs, soybean meal, and copper. To a contract, each of these commodities has a difficult storage situation. Figure 7 shows the calculated returns of each contract.

**Figure 7**

**Futures Returns from 1969 (or contract inception) to 1992**

| Commodity | Mean Return (Percent per Year) | t-Statistic | Wilcoxon Signed-Rank Test |
|---|---|---|---|
| Soybean Meal | 7.97% | 2.87 | -2.58 |
| Live Cattle | 7.33% | 4.35 | -4.22 |
| Live Hogs | 11.74% | 4.04 | -3.57 |
| Crude Oil | 7.79% | 1.69 | -2.39 |
| Unleaded Gas | 16.40% | 3.30 | -4.09 |
| Copper | 11.15% | 3.17 | -2.56 |

*These returns exclude returns from one's collateral investments.*

*Source: Excerpt from Kolb, Robert, "The Systematic Risk of Futures Contracts," The Journal of Futures Markets, Vol. 16, No. 6 (1996), Table II.*

Various authors have confirmed that each of the six commodities listed in Figure 7 have "difficult storage situations."

Regarding soybean meal and livestock, author Jack Schwager noted:

> "Ending stocks are the key fundamental factor for soybeans and oil, but since soybean meal is not storable, ending stocks of meal tend to be equal to only a few days of supply and are not a meaningful figure. Soybean meal also differs from soybeans and oil in that all production must be sold regardless of price. Hence, in the case of soybean meal, consumption is almost entirely a function of supply, not demand. In this context, soybean meal is similar to other non-storable commodities, such as hogs and cattle, which must be marketed soon after they reach market weight, regardless of price."

Regarding the petroleum complex, an Energy Intelligence Group report explained:

> "From wellheads around the globe to burner tips, the world's oil stocks tie up enormous amounts of oil and capital. The volume of oil has been estimated at some 7-to 8-billion barrels of inventory, which is the equivalent of over 100 days of global oil output or 2½ years of production from Saudi Arabia, the world's largest producer and exporter of crude oil. Even at today's low interest rates, annual financial carrying costs tied up in holding these stocks amount to around $10-billion, which is more than the entire net income of the Royal Dutch/Shell Group, the largest private oil company in the world."

Regarding copper, derivatives researcher Howard Simons has written:

> "Copper is a natural for backwardation. Marginal mines need to guarantee a minimum price level for forward production and are eager to sell forward, but consumers such as brass mills have every incentive to practice just-in-time inventory. The cheapest place to 'store' copper is right in the ground where it has been for millions of years. So if demand surges, there is no way for mines to bring additional supply to market quickly."

Either because the commodity is non-storable or because the commodity is prohibitively expensive to store, the previously mentioned commodities each have "difficult storage situations."

By taking long positions in the particular commodity futures contracts where significant commercial hedging pressure is noted (or in indices which are heavily weighted in these commodities), one is earning a risk premium as defined in a *Journal of Finance* article by Eric Chang:

> "The term 'risk premium' generally refers to an average reward to investors for being willing to assume a risk position in a risk-averse financial world. The reward in this form should not be conditioned on any superior judgment or inside information."

3. Reasoning Chain

In summary, the reasoning chain for there being an inherent return from holding certain commodity futures contracts is as follows:

- For certain commodities, holding inventories is prohibitively expensive.
- The result is firms adopt just-in-time inventory policies.
- With the short-term supply response of commodities inelastic, any miscalculation in demand results in the spot price being the main variable that can balance supply and demand.
- This can lead to violent fluctuations in spot commodity prices.
- Consumers of commodities can time their commodity purchases.
- Inventory holders are more vulnerable to price shocks that consumers.
- In certain commodity markets, there will be an imbalance of short commercial hedgers relative to long commercial hedgers.
- To balance the futures markets, speculators must be offered a risk premium to take up the long side of these markets.
- It is the speculators on the margin who are concerned with their own profits, not those of hedgers, who determine that risk premium.
- The inventory holder will pay this risk premium so long as its magnitude is incidental to the entrepreneur's overall profits.
- The risk premium is related to the risk incurred by the speculator; that is, how volatile the commodity prices are.
- Reflecting this risk premium, certain futures prices tend to be downwardly biased estimators of future spot prices.

- A speculator can monetize this risk premium by taking on long positions in certain commodity futures markets.

In addition to the Nash and Kolb studies, a large volume of empirical studies during the 1990's confirmed each aspect of this reasoning chain.

In concluding this section, we note that the key to earning a positive return from a program that is systematically long futures contracts is for that program to be heavily weighted in commodities that have difficult storage situations. And of note again is that the GSCI is heavily weighted in commodities that have difficult storage situations.

B. Systematic Short Futures Investments

Taking a position on the other side of commercial hedging pressure is only one source of return in the commodity futures markets.

Another source of systematic returns in the futures markets are "weather fear premia" trades. In this class of trades, a futures price will sometimes embed a fear premium due to upcoming, meaningful weather events that can dramatically impact the supply or demand of a commodity. 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 overvalued, reflecting the uncertainty of an upcoming weather event. A price is regarded as "overvalued" 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.

These trades can be mechanically executed and are another way to earn a risk premium. These trades are concentrated in markets that do not exhibit significant returns from commercial hedging pressure. These trades can be found in the grain, tropical, natural gas, and cotton futures markets during particular times of the year.

Our hypothesis for why these empirical regularities exist is as follows. Particularly for the grain and natural gas markets, the economy cannot tolerate threats to either the food or energy supply, so the market adds a premium to the futures price around the time of potential weather shocks to ration demand. Further, the commercial commodity trade can be well aware of this return opportunity with no danger of it disappearing. This is because in order to take advantage of these positive expected-value opportunities, they would have to absorb volatile price risk that would impair their ability to carry out essential business planning.

We would expect that there are other systematic return opportunities in the commodity futures markets besides relying on commercial hedging pressure and weather premia. What Jacobs and Levy had noted in a *Journal of Portfolio Management* article about the stock market is equally true for commodity futures markets:

> "The stock market … is a complex system. … The market is permeated by a web of interrelated return effects."

C. A Futures Market Is Not a Forecasting Agency

It should not be controversial to note that the prices of some commodity futures contracts are biased estimators of future spot commodity prices. After all, a futures market is not a forecasting agency; it also facilitates risk sharing and the efficient allocation of resources. To expect futures prices to only reflect predictions of future prices ignores its other functions.

D. Returns are Equity-Like with Equity-Like Risk

What does the empirical evidence say about the relationship between commodity-market returns and equity-market returns?

A *Financial Analysts Journal* article from 1980 showed that an equally-weighted basket of commodity futures contracts had about the same return as a basket of common stocks from 1950 to 1976. See Figure 8.

**Figure 8**

Annual Return Profile of Commodity Futures versus Common Stocks
(1950-1976)

| | Commodity Futures* | Common Stocks** |
|---|---|---|
| Annual Mean Return: | 13.83% | 13.05% |
| Annual Standard Deviation: | 22.43% | 18.95% |

* *The commodity futures returns include collateral returns.*
** *The source of common-stock returns is from a data series obtained by the authors from Ibbotson and Sinquefield.*

*Source: Bodie, Zvi and Rosansky, Victor, "Risk and Return in Commodity Futures," Financial Analysts Journal, May-June, 1980, p. 30.*

A more recent Morgan Stanley paper updated these results. See Figure 9.

**Figure 9**

April 1983 Through December 2000

| | Annualized Returns (Includes Interest Income) | Annualized Volatility |
|---|---|---|
| S&P 500 Index | 12.9% | 16% |
| GSCI | 10.5% | 16% |

*Source: Nash, Daniel, "Long-Term Investing in Commodities," Morgan Stanley Dean Witter, Global Pensions Quarterly, January 2001, Figure 6.*

These comparisons show that the two asset classes have similar returns. Figure 2, which shows the returns of the GSCI and S&P 500 from the early 1970's onwards, also shows their returns as converging.

II. Role in a Traditional Portfolio: Commodity Futures Investments as a Diversifier or Return Driver

A. Timeline

From the early 1990's to the present, the proposed role of commodities in traditional portfolios has changed over the years, depending on the macroeconomic and financial environment.

In the early 1990's, long-term investors such as pension plans and university endowments were keenly interested in inflation-hedging investments because of the experience of the 1970's where the real value of their investments plummeted. Direct investments in physical commodities were characterized by prohibitively high transaction costs, insurance costs, and storage costs, so an investment such as the GSCI became an attractive alternative.

In 1994, long-only commodity investments were advocated as a return source, given the synchronized global growth story at that time.

In 1996 through mid-1997, long-only commodity investments were again advocated as a return source and specifically as a play on emerging market strength.

In the late 1990's during the equity bubble, commodity returns could not compete with the returns of the equity market, so commodity investments were advocated as a

complement rather than as an alternative to equity investment. Specifically, the diversification aspects of energy-based commodity investments were promoted. For example, one argument for commodity investing showed how one could increase their investment in equities. The argument was that a commodity investment lowers the standard deviation of a portfolio enough to allow for an increased allocation to higher-returning equities without increasing overall risk.

In late 2002 / early 2003, oil-based commodity investments were included in an overall speculative basket of "macroeconomic uncertainty" / "war fear" / "flight-to-quality" trades. This basket included the following positions: short equities, short the dollar, long the Swiss Franc, long gold, long bonds, and long the petroleum complex.

The following section reviews the arguments for including commodities in a traditional portfolio based on diversification principles. Then we briefly review when a commodity investment can be expected to be an absolute-return-generator.

## B. Diversifier

### 1. Theoretical Rationale for the Lack of Correlation to Financial Assets

The theoretical grounds for asserting that commodity investments are not *correlated* with financial assets typically rests on how each asset class responds to increasing inflation; namely, financial assets respond to increasing inflation negatively while commodity investments respond positively.

There is a bit more to this argument as discussed by Professor Kenneth Froot in a *Journal of Portfolio Management* article:

> "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."

It is plausible that companies, and therefore their stocks, would be more sensitive to instability in relative prices than overall prices since relative prices are what determine their profits. The net result is that high commodity prices (or high input prices relative to sticky output prices) would lead to lower profits and therefore lower equity prices.

For investors, this means that commodity assets can act as a macro hedge for their equity portfolios.

## 2. Empirical Findings

The empirical evidence on the statistical properties of commodity investments has confirmed the theoretical case for investing in commodities. Because, empirically, commodity futures investments are found to have both positive returns and negative correlations to equity investments, portfolio optimization studies consistently call for allocations to commodities.

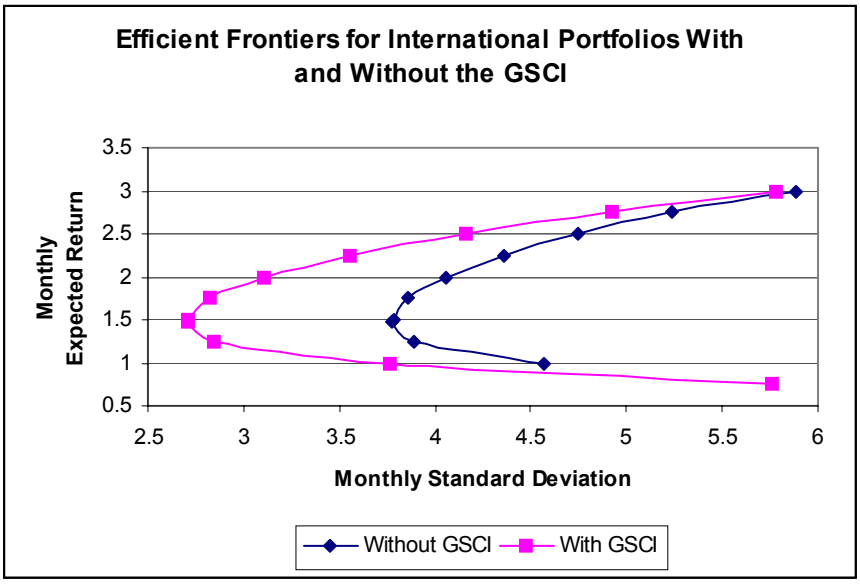
For example, a Harvard Business School case study on Harvard Management Company exhibited an "efficient frontier of optimal portfolios" which was produced by a "computer-based algorithm." The portfolio optimizer sorted through prospective positions in foreign stocks, U.S. bonds, commodity-related assets, U.S. stocks, venture capital, and real estate. The optimizer was allowed leverage of up to 50%. The results of this analysis were unconventional to say the least. Depending on the allowed portfolio risk level, the optimizer called for allocations to commodity investments ranging from 5.8% to 32.0%.

Two World Bank researchers examined what efficient frontier is produced when adding commodity assets to international portfolios. They used the Goldman Sachs Commodity Index (GSCI) as their proxy for investments in commodity assets. The researchers were surprised:

> "to see how heavily the GSCI is represented in the international portfolio. The minimum-risk international portfolio, for instance, implies a 42% investment in the GSCI. This proportion decreases at higher required rates of return but it would seem that at most reasonable levels of risk, the optimal proportion of commodity market investments in the international portfolio would still be at least 30%."

The authors illustrated their findings with the following graph.

**Figure 10**




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

The World Bank researchers note that:

> "…. the efficient frontier with commodity assets lies everywhere higher than the [international] portfolio without commodity assets, implying that for the same levels of return (risk), the portfolio with commodity assets provides lesser (higher) risk (return)."

3. Oil Drives the Equity Diversification Benefits

Unique among commodities, it is the energy complex that exhibits a persistent negative correlation to the equity market. Therefore, a commodity investment that is intended to be a diversifier for an equity investment needs to be heavily weighted in energies.

For hedging bond investments, *all* commodity investments have good hedging properties, according to Kenneth Froot's article.

C. Return Source

Depending on whether particular commodities are in a situation of scarcity and depending on the macro environment, a long-only commodity investment can be a candidate as a standalone, absolute-returning investment. The most favorable macro economic environment for investing in a basket of commodity futures contracts is covered in Section III.

Also, as noted in Section I, there are systematic opportunities for earning a risk premium in being short certain commodities during particular times of weather uncertainty.

III. Idiosyncratic Risk and Systematic Macroeconomic Risk Factors

A. Idiosyncratic Risk Factors

1. Time-Varying Nature of Returns

A number of researchers have questioned the assumption that there are consistent returns from long-only commodity programs. Professors Schneeweis and Spurgin have noted:

> "Unfortunately, due to the stochastic nature of changes in volatility and value of oil, there is evidence of a lack a consistent return to 'long only' futures purchases in order to capture convenience yield in oil or energy futures contracts … In brief, returns to a … crude oil futures contract plus fully invested cash position or futures-based passive indices (e.g., GSCI) may not necessarily incur positive returns unless that position is actively managed in interim investment periods."

From the discussion in Section I of this chapter, we would conclude that the time to invest in commodities is during times of low inventories and when their futures curves are in backwardation.

2. Examination of Inventories

For example, during times of low inventories, a commodity's price can become explosive. This is usually illustrated through "banana" price-versus-inventory graphs such as the ones in Figure 11 and Figure 12.

**Figure 11**

**Coffee**
**Price vs. Inventories**

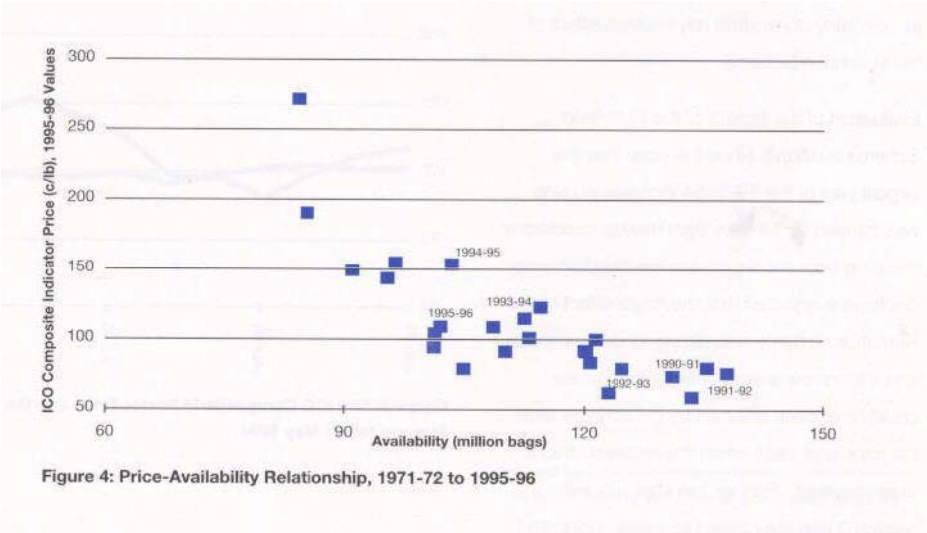


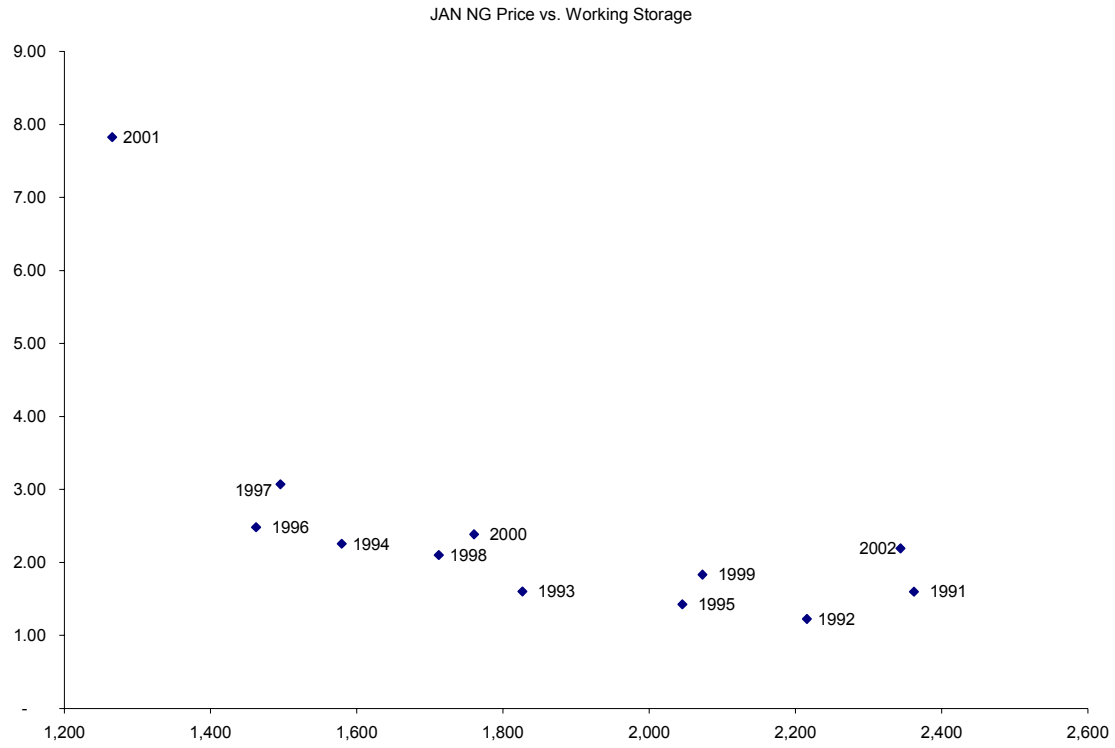
Figure 4: Price-Availability Relationship, 1971-72 to 1995-96

*Source: Gilbert, Christopher and Celso Brunetti, "Speculation, Hedging and Volatility in the Coffee Market, 1993-96," Queen Mary and Westfield College, University of London, Department of Economics, Figure 4.*

**Figure 12**

**Natural Gas**

**Price vs. Inventories**




*Data Source: New York Mercantile Exchange and U.S. Department of Energy.*

*Source: Huggins, Andrew, BP Research, September 2002.*

These charts also illustrate how positively skewed the distribution of commodity prices can be. 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 balance supply and demand, given that in the short run, new supplies of physical commodities cannot be instantly mined, grown, and/or drilled.

3. Backwardation and Contango

Another indicator for deciding whether to invest in commodities is to examine the shape of the relevant futures curve. We will use the GSCI futures curve as an example. In a

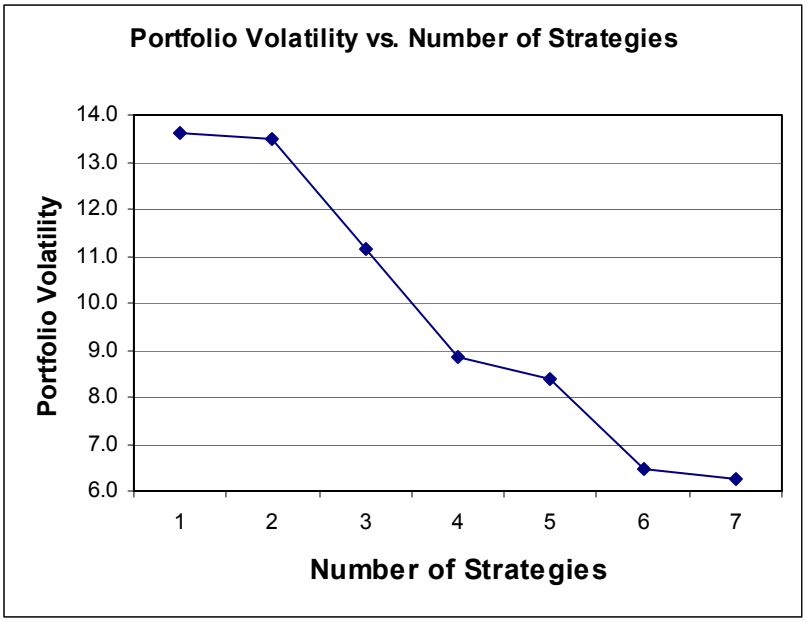
normally supplied market (i.e., a market in *contango*), the maximum price difference between the front and back contracts tends to be determined by carrying charges, which include storage costs, insurance, and interest. For example, this is the normal shape of the futures curve for gold. Backwardation occurs when supplies of commodities are inadequate; therefore, market participants are willing to pay a premium to buy the immediately deliverable commodity. This is precisely the time an investor should be invested in commodities: when scarcity is indicated.

When surplus is indicated, this can be an unprofitable time to invest in commodities. For example, from late 1997 until early 1999, the GSCI futures curve was in contango, and this index-based investment lost about 50% of its value.

4. Reliance on Diversification

When constructing a commodity futures portfolio, one can potentially rely on the lack of correlation of a number of markets to dampen portfolio volatility. See Figure 13.

**Figure 13**




*Source: Premia Capital Management, LLC.*

But if one is relying on diversification, then one must be careful on commodity correlation properties. Correlations amongst commodity markets can vary seasonally.

At times seemingly unrelated markets can become temporarily highly correlated. This becomes problematic if a commodity manager is designing their portfolio so that only a

certain amount of risk is allocated per strategy. The portfolio manager may be inadvertently doubling up on risk if two strategies are unexpectedly correlated.

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.

The following provides an example of the need to be careful with seasonally varying correlations. Normally, natural gas and corn prices are unrelated. But during July, they can be highly correlated. During a three-week period in July 1999, natural gas and corn prices were +85% correlated. Depending on the values of key fundamental drivers, two prospective trades in the summer are to be short these two commodities. Now, the empirical evidence seems to show that these two trades may be the same trade. So, if one puts both of these trades in their portfolio, one would be inadvertently doubling up on risk.

It turns out that both of these trades are instances of weather fear premium trades.

As far as corn is concerned, 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.

As far as natural gas is concerned, 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. Therefore, simultaneously investing in these two trades would have amplified risk.

5. Structural Aspects of Commodity Markets

Structural changes in the commodity markets could adversely impact the returns in a systematic program, which relies on the phenomena described in Section I of this chapter.

For example, changes in the organization of the hog industry could have an impact. There tends to be a downward bias in livestock futures contracts relative to where the contracts eventually mature. This downward bias is likely due to producer hedging

pressure. A systematic long futures investment benefits from being on the other side of concentrated hedging pressure. If the organization of the hog industry changed such that producers were not price-takers and therefore in such a need of forward-price hedging, then this source of risk premia would be lost.

Another class of systematic futures trades is based on the waxing and waning of weather fear premiums, which are frequently embedded in the various agricultural futures contracts. To the extent that improvements in weather forecasting reduced this uncertainty, the risk premiums could be correspondingly reduced. Thus far, though, it does not appear though that weather forecasting has improved sufficiently just yet to reduce the uncertainty surrounding key weather times.

B. Macroeconomic Risk Factors

In addition to idiosyncratic, commodity risk factors, the macroeconomic environment plays a key role in deciding upon commodity allocations.

1. Interest-Rate Environment

Whether one is in a rising-rate or declining-rate environment has been a key determinant of commodity returns. A rising-rate environment may indicate that economic growth is strong. Commodity investments have typically done well coincident with times of economic strength.

Figure 14 illustrates the dichotomy in returns for the GSCI as well as stocks, depending on the U.S. monetary environment.

**Figure 14**

1973-1997

| Index | Mean Monthly Return (%) | Standard Deviation |
|---|---|---|
| | Expansive Monetary Periods | |
| GSCI | 0.335 | 4.321 |
| Stocks | 1.735 | 3.934 |
| | Restrictive Monetary Periods | |
| GSCI | 1.993 | 6.167 |
| Stocks | 0.357 | 5.167 |

*The stock returns are based on the return of the value-weighted CRSP Index for the NYSE/AMEX/NASDAQ combined market, including dividends.*

*Source: Jensen, Gerald, Robert Johnson, and Jeffrey Mercer, "Efficient Use of Commodity Futures in Diversified Portfolios, Journal of Futures Markets, Vol. 20, No. 5, Table II.*

2. Inflationary Environment

Whether one is in an increasing inflation or decreasing inflation environment also has played a role on how well commodities have performed relative to other asset classes. Interestingly, the level of G-7 inflation has not mattered.

Figures 15 and 16 illustrate the performance of the GSCI and S&P 500 during different periods of G-7 Inflation.

**Figure 15**

GSCI Total Returns
(1970Q1 to 1995Q2)

Year-over-Year Change
In G-7 CPI Inflation

| | Rising | Falling |
|---|---|---|
| High | 20.27 (7.68) | 5.54 (5.91) |
| Low | 22.05 (9.37) | 5.47 (5.33) |

*This figure shows the mean annualized returns for the GSCI.*
*The numbers in parentheses are standard errors of the estimates.*

*Source: Strongin, Steve and Melanie Petsch, "Asset Returns and the Economic Environment, Goldman Sachs, Commodity Research, 9/11/95, Figure 1.*

**Figure 16**

S&P 500
(1970Q1 to 1995Q2)

Year-over-Year Change
In G-7 CPI Inflation

| | Rising | Falling |
|---|---|---|
| High | 5.41 (6.79) | 13.17 (4.99) |
| Low | 7.62 (14.20) | 15.98 (4.81) |

*This figure shows the mean annualized returns for the S&P 500.*
*The numbers in parentheses are standard errors of the estimates.*

*Source: Strongin, Steve and Melanie Petsch, "Asset Returns and the Economic Environment, Goldman Sachs, Commodity Research, 9/11/95, Figure 7.*

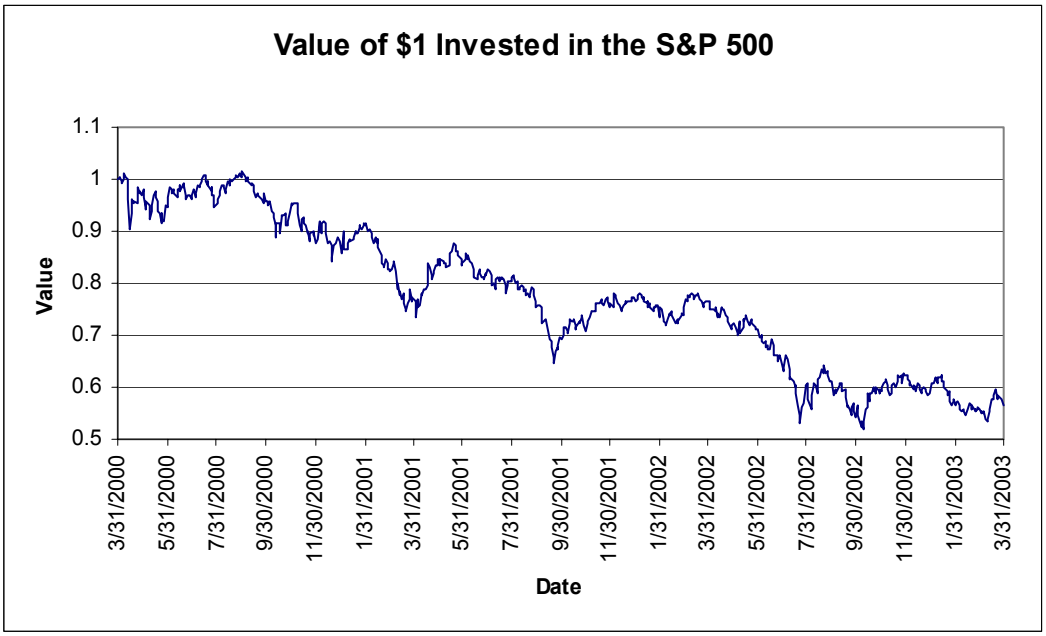
C. Valuation Matters

At the beginning of Section III of this chapter, we had noted that some researchers had questioned the value of passive, long-only commodity investing. Instead, it was argued that one should actively time these investments. We then briefly discussed indicators for when it was a good time to invest in commodities. For individual commodities, the best times are when scarcity is indicated, which can be determined either through examining a commodity's inventory situation or by examining its futures curve shape. For commodities in general, the best times to invest have historically been during rising-rate environments in the U.S. and/or times of increasing G-7 inflation.

We believe that more researchers will similarly question the value of passive, long-only equity investing and will come to similar conclusions that one should actively time these investments as well.

Figure 17 shows the historical performance of the S&P 500 from March 2000 through March 2003.

**Figure 17**




*Data Source: Bloomberg.*

For example quoting recent research, bond investor Bill Gross of PIMCO has noted that the return on stocks has historically depended on their starting valuation. Most of the stock market's real return during the twentieth century was due to the market's initial dividend yield, which priced the stock market rather inexpensively. From a historical standpoint, the current dividend yield still indicates stocks are not cheap.

Just as the S&P declining 40% in the last three years does not invalidate equity investing, the GSCI declining 50% in late 1997 through early 1999 should not invalidate commodity investing. It just means that in choosing what to invest in, one should be careful about passive indexed investing. *Valuation matters*. If an asset is not cheap, not scarce, or one is not in a favorable macroeconomic environment for that asset class, one should be prepared for the possibility of losses in that asset class.

The above line of reasoning is starting to gain some traction in the institutional investment world. For example, the economic historian Peter Bernstein has concluded that "policy portfolios are obsolete." Policy portfolios consist of fixed allocations to asset classes regardless of their valuation. Bernstein notes that the expected risk premium in equities will be so small for the foreseeable future that it is quite dangerous to build a

portfolio with a majority weighting in equities. Just as Professors Schneeweis and Spurgin questioned the wisdom of passive, long-only investing in commodities, it appears that the same questions are starting to percolate about passive, long-only investing in equities.

## IV. Conclusion

There are valid reasons to invest in commodities. Judging by historical results, this asset class can provide attractive absolute and relative returns during appropriate valuation and macroeconomic environments. But like indexed equity investments, due care must be exercised in deciding when and how much to allocate. For example, investing in commodities in 1998 when the GSCI was in deep contango had the same unhappy result as investing in web browsers in early 2000 when those internet companies were valued based on highly optimistic forecasts of future earnings growth. This example emphasizes that the risks with commodity investing are similar to the risks with equity market investing. If one invests in commodities when they are in surplus or during unfavorable macroeconomic environments, one must be prepared for the possibility of unpleasant results.

*Authors' Note: Sections of this chapter were drawn from articles that were previously published in The Journal of Alternative Investments, Derivatives Quarterly, and Commodities Now.*

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