



---

**ABSTRACT**

*Commodity futures are likely to continue to exhibit low correlation with traditional asset classes while delivering positive returns, making them valuable diversifiers for plan sponsors' portfolios. The most appropriate way for most plan sponsors to invest in commodities is through futures, whose returns derive from roll return, price return, and collateral return. Our research indicates that the best approach is to invest in a transparent long-oriented trend-following or momentum strategy that is fully collateralized in U.S. government bonds and diversified across a wide variety of commodities. If deviation from a benchmark return is a concern, investors might consider the Dow Jones-UBS Commodities Index. However, benchmark investors should be aware that they may experience higher volatility and lower overall returns than a trend-following or momentum strategy. Overall, we believe that the average pension plan would benefit by investing between 3% and 7% of plan assets in commodities.*

**COMMODITIES**

In a financial context, commodities are generally physical goods for which deep trading markets exist. Trading in commodities takes place in futures markets, which provide a mechanism by which commodity producers and consumers can enter a contract stipulating both delivery date and price. Of course "speculators" – or those who have no interest in taking physical delivery of a given commodity – participate in futures markets as well.

Historically, common investable commodity indexes have exhibited a low to negative correlation with traditional asset classes.<sup>1</sup> This correlation behavior suggests that commodity futures may be attractive to the asset allocator seeking additional diversification. Furthermore, commodity indexes have delivered returns well in excess of the risk-free rate: both the S&P Goldman Sachs and the Dow Jones-UBS Commodity Indexes<sup>2</sup> delivered an annualized return of approximately 7.5% from January 1991 through August 2008.

Investor interest in commodities intensified during the most recent commodity bull market, a period characterized by average annualized returns of nearly 15% and continued low correlations with traditional asset classes. Indeed, the question had largely changed from whether to include commodities in an asset allocation to how and to what degree.

This paper outlines the possible advantages of adding a commodities-related investment to a typical asset allocation. To this end, it explains vehicles available for investing in commodity futures, examines commodity futures indexes and their shortcomings, and addresses future expected returns. Furthermore, it discusses whether active manager strategies are appropriate in this space. The paper concludes with a recommendation regarding commodity futures exposure.

---

<sup>1</sup> See Appendix for graphical examples.

<sup>2</sup> Formerly the Dow Jones-AIG Commodity Index

## Exposure to Commodities

Including assets whose returns are uncorrelated with existing asset class returns should improve a portfolio's expected risk-adjusted return. But before drawing conclusions about the diversification benefits of commodity futures, it is necessary to briefly examine the three primary ways an investor may gain exposure to commodities.

### Commodity Futures

A buyer of a commodity futures contract agrees to purchase at a given price a set number of units of the commodity to be delivered by the futures seller on a predetermined future date. The details of the contract vary by commodity and the exchange on which it is traded. Furthermore, many buyers can enter a contract with little up-front cost – in effect, margin requirements are low (often 10%) and leverage can be high.

A futures buyer need not take delivery of the commodity on the stipulated date. Instead, the buyer can sell the contract to another willing party at any time prior to delivery. In fact, a futures investor usually has no desire to own the actual commodity. In these cases, a common technique as the delivery date approaches is for this investor to sell his contract to a buyer interested in taking delivery, then subsequently investing the proceeds in another, further-out contract. This process is called “rolling” a futures position and is the basis for many commodity investment strategies.

### Direct Ownership

Some investors may choose to take delivery of a given commodity. The amounts stipulated by standard futures contracts are large: one crude oil futures contract is denominated in 1,000 barrel lots, while one wheat futures contract is traded in 5,000 bushel lots. Note that physical ownership of commodities involves attendant transportation, insurance, and storage costs, together known as carrying costs. In addition, such investing requires extraordinary market and regulatory expertise, because making money often involves having lower carrying costs than the marginal producer. Also, the upside to direct ownership is often limited by capacity constraints: there are only so many supertanker storage facilities for oil, for example.

### Commodity Equities

Other investors gain exposure to commodities through ownership of a firm whose earnings largely depend on the buying or selling of commodities. Owning Texaco, for instance, might be viewed in part as a play on the price of crude oil since a significant portion of Texaco's earnings are derived from the refining and sale of oil-based products. However, commodity-intensive companies tend to be more sensitive to market and idiosyncratic factors than to commodity prices.

In part this may be because of the nature of these firms' commodity exposure. Many firms use the long-end of the futures curve to hedge their exposure to price gyrations at the short-end. And, if prices rise (fall) across the futures curve, many purchasing

firms will alter their practices to decrease (increase) consumption. Therefore, movement across the futures curve of a commodity will not be wholly captured by the price movement of a relevant stock or sector: a study indicates that energy futures and energy equities have an historical correlation of 0.47; metal futures and equities, 0.56; agricultural futures and equities, 0.01 (Dunsby et al., 2008).

### Commodity Futures Contracts

Because of the advantages of futures investing (liquid markets, high exposure to commodity price movements, opportunity for leverage) and the disadvantages of both direct ownership (expertise, capacity constraints) and commodity-related equity investing (low exposure to commodity price movements, high exposure to overall market movements), Meketa Investment Group recommends gaining exposure to commodities primarily through futures investing.

This section introduces the fundamentals of commodity futures. The main contentions are as follows: first, supply-side shocks should increase the value of futures; second, hedging pressure may provide an economically justified return to a futures investor; third, futures have a term structure like bonds.

### Pricing

From a no-arbitrage perspective, the difference in the price of a commodity futures contract on date  $t$  for delivery on date  $T$ ,  $F_{t,T}$ , and the spot contract on date  $t$ ,  $S_t$ , is equal to the spot price times the risk-free return on a dollar from  $t$  until  $T$ ,  $S_t r_t$ , plus the marginal cost of storage from  $t$  until  $T$ ,  $w_t$ :

$$F_{t,T} - S_t = S_t r_t + w_t \quad (1)$$

This equation appears more complicated than it is. If the left-hand side were greater than the right-hand side, then it would imply an arbitrage opportunity: an investor could profit by taking delivery of the commodity at time  $t$  (e.g., today), selling the futures contract  $F_{t,T}$ , and holding the commodity until time  $T$  (e.g., next month) in the future. Through this operation, the investor would reap a greater risk-free return than if he had invested the money in a risk-free instrument, even after accounting for the storage costs. On the other hand, if the right-hand side were greater than the left-hand side, then it would imply the opposite arbitrage opportunity: an investor could profit by selling the commodity at time  $t$ , investing the proceeds in a risk-free instrument, and then purchasing the commodity at some future time  $T$ . These competing forces should force the equation to generally hold. When they do, the futures contract is said to be priced at “full carry.”

Unfortunately, observers have noticed that this relationship was found not to hold over longer time frames. This led scholars to propose the existence of a “convenience yield” at time  $t$ ,  $c_t$ , which is the dollar value of holding the commodity over the time period from  $t$  to  $T$ . This value derives from the holder’s option to sell

during momentary spikes in the spot price. As such, it must be subtracted from the right-hand side of the above equation:<sup>3</sup>

$$F_{t,T} - S_t = S_t r_t + w_t - c_t \quad (2)$$

The convenience yield may be inversely related to inventory levels (Fama and French, 1988; Gorton et al., 2007). For example, if inventories are low, supply-side shocks will have a bigger transient impact on the spot price which the holder of the commodity can sell into.

A related theory of futures pricing is the theory of normal backwardation, originally articulated by Keynes (1930). Keynes argues that futures prices deviate from the spot price because of an imbalance in the number of parties less willing to assume the spot price risk compared with the number of parties more willing to assume the risk. This imbalance gives rise to a risk premium. In most cases, Keynes theorized that sellers less willing to assume spot price risk outnumbered buyers willing to assume spot price risk, thereby giving rise to “backwardation” – a situation in which futures prices were less than spot prices. If spot prices are expected to stay constant, then a futures buyer in a backwardated market expects to be compensated for assuming the spot price risk.

Both theories only partially explain the pattern of futures prices over time. In the case of the no-arbitrage perspective, this is because the no-arbitrage condition is unlikely to hold in commodities. Short selling a commodity is difficult if not impossible, and a short seller does not receive storage costs. Therefore, the no-arbitrage condition is more likely to hold in markets with considerable excess supply. In the case of the theory of normal backwardation, it is hard to measure whether the imbalance exists on the side of the sellers or buyers of risk at any given time. At best, both may be rough guides.

### Term Structure of Commodity Futures Contracts

Like many fixed income markets, commodity futures also have a term structure. That is, futures for a given commodity extend forward in time: contracts for every month extending out an entire year are not uncommon.<sup>4</sup> Each of these contracts usually has a different price; a graph of the price against the date of the contract draws a curve. If futures prices decrease as the delivery date increases, this creates a downward sloping curve. In these cases, the commodity is said to be in backwardation. If futures prices increase as delivery date increases, this creates an upward sloping curve. In these cases, the commodity is said to be in contango. Note that a single curve may contain both backwardated and contangoed features.

As equation (2) above indicates, a market in contango generally indicates that the market is willing to pay the net carrying costs (in excess of any convenience yield) of the commodity holder. This is often the case in commodities with excess supply, such as the grains. On the other hand, a market in backwardation generally

<sup>3</sup> Note that the convenience yield is unobservable and, econometrically, could be considered the residual in the model.

<sup>4</sup> In fact, many commodities have yearly contracts extending out several years.

indicates that the market is chronically short a needed commodity (such that either the convenience yield is high or arbitrage is impossible). This is often the case in commodities in short supply, such as the energy products.

### **Returns to Commodity Futures Investing**

Returns to the commodity futures investor derive from three sources: roll return, price return, and collateral return.

#### **Roll Return**

Roll return is the amount the investor receives through the process of rolling, or substituting a future position approaching settlement date for one further out the curve. In backwardated curves, rolling will yield a positive (negative) return for long (short) investors because futures contracts increase in value as settlement date approaches. In contangoed curves, rolling will yield a negative (positive) return for long (short) investors because futures contracts decrease in value as settlement date approaches.

#### **Price Return**

Price return is the amount the futures investor receives through the overall movement of the curve on which he trades. If the relevant portion of the curve rises, then the long (short) investor will realize a positive (negative) price return. If the relevant portion of the curve falls, then the long (short) investor will realize a negative (positive) price return.

#### **Collateral Return**

Collateral return is the amount the futures investor receives by investing the cash collateral used to collateralize futures contracts. Any margin posted may be invested; the precise return depends on the investment vehicle used (e.g., government bonds).

### **Expected Returns to Commodity Futures**

Recently, the impressive returns to passive commodity investment vehicles may arguably be attributed to price return—not roll return or collateral return (Dunsby et al., 2008). That is, spot prices of most commodities have risen considerably over the last several years, swamping the return to collateral or any benefit (cost) from rolling in a backwardated (contangoed) market. Therefore, any argument regarding expected returns of commodities futures markets should first address expected price returns.

#### **Expected Price Return**

In support of continued extraordinary price return, some observers have recently cited increasing (and inelastic) demand from newly industrializing nations and the

inelasticity of supply.<sup>5</sup> To the extent that industrialization continues apace and supply stays constrained, it is not unreasonable to expect that price growth will continue. However, it is important to realize that this price growth may not be evenly distributed across the entire commodity universe. While energy, industrial metals, and livestock may benefit, some agricultural commodities may suffer. Too much allocation on possible losers could impact future results considerably; diversification is crucial. Furthermore, high prices on certain commodities will themselves act as a brake on economic growth—ultimately capping the price return at some point.

Another common argument in favor of continued price increases is that the U.S. and the world likely face an inflationary future, driven by intentional devaluation of global currencies. This is essentially a monetary argument that starts with the observation that many countries' central banks and fiscal authorities are increasing their monetary bases to offset the current period of de-leveraging or to "jump start" their economies. It is then hypothesized that their monetary bases will not shrink as rapidly as they grew, and leverage (once it returns) in the future will raise the nominal prices of all goods absent a rapid increase in production. Therefore, the prices of commodities should rise (as supply will be largely unaffected). This argument has some theoretical and empirical merit; however, world governments explicitly plan to sterilize (or shrink) their money and credit bases once risk-taking and private leverage return. Nevertheless, the failure to adequately control the supply of money and credit is a constant risk. Commodity prices may indeed benefit in such a case.

Countering these claims are various utopian and dystopian predictions. First, the primary utopic case: continued improvements in production (a la the Green Revolution) will increase the supply of—or offer substitutes for—many commodities, leading to only modest price changes. There appears to be some support for this argument in certain sectors, like agricultural commodities, but less so for others, such as energy. Since this argument largely depends on the likelihood of unknown technological advances, it is hard to evaluate. But we know that such events do happen.

Note that the utopian case draws much support from history—if commodities prices over time had risen at a rate significantly above the price of a common basket of goods and services, then our standards of living in the U.S. would be drastically lower today than in the past.<sup>6</sup> In fact, expecting continued price increases well in excess of the price increases of a common basket of goods and services is tantamount to expecting that our standards of living will fall in the future. Not only does reason suggest that recent high price increases are not normal, Dunsby et al. (2008) find that since 1870 the *nominal* price increase of a basket of commodities has increased at an

---

<sup>5</sup> The "peak oil" argument fits nicely into this category as well.

<sup>6</sup> If the prices of basic commodities had risen faster than a basket of goods and services, eventually the entire basket would be comprised of these basic commodities. This implies that *all* income would go to service our consumption needs for wheat, soybeans, cotton, oil, et cetera. That is the very definition of a subsistence society.

annualized rate of 1.6%, while they find that the *nominal* price of wheat has increased only four-fold since 1500 A.D.

The primary dystopian case is that an imbalanced, overleveraged world faces a lengthy period of economic stagnation. Such an outcome should diminish aggregate demand and cause prices to stagnate or decline. Though this outcome is now conventional wisdom, predicting world economic growth is exceedingly difficult.

Nevertheless, even if the world experiences a prolonged period of stagnation or contraction, it is reasonable to expect that both aggregate demand and inflationary pressures will eventually lead to price increases.

### **Expected Roll Return**

Although roll return has historically not been as important as price return, from a forecasting perspective it benefits from having an economically justifiable risk premium. Specifically, speculators contribute to an efficient market by hedging the risks of suppliers or consumers in a given commodity market. For this assumption of risk, the speculators are theoretically compensated. The trick is to find markets that are significantly out of balance in the Keynesian Theory of Backwardation sense. Historically, investors who assumed rolling long positions at the short end of the curve of a broad basket of commodities have experienced a negative roll return (Dunsby et al., 2008), because most common commodities markets are usually contangoed. There may be some validity, however, in taking long and short positions in commodity futures markets that are usually backwardated and contangoed, respectively. If history is any guide, the annual premium to this strategy should average approximately 250 basis points.

### **Expected Collateral Return**

The collateral can be invested in almost any security. However, in most instances, the collateral will be invested in low-risk bonds. Hence, the collateral return can usually be assumed to be the short-term risk-free rate. Because of the risks of leverage, all contracts should be fully collateralized.

### **Summary**

An investment vehicle that invests in a broad set of commodity futures markets, assuming long positions in typically backwardated markets and/or short positions in typically contangoed markets, and invests the collateral in cash could reasonably expect bond-like returns or better. Note that the two common indexes do *not* adhere to this approach, as they are long regardless of the shape of the futures curve. Therefore, these index strategies are primarily dependent on expected spot price return for their performance—a dubious approach given that commodity prices have not kept pace with broad inflation historically.

## Commodity Futures Strategies

A commodity futures strategy is essentially a set of *three* strategies, one for each source of returns. Simultaneously, the investor must determine the universe of commodities in which these three component strategies will be employed. Therefore, when evaluating the attractiveness of a commodity futures investment product, it is helpful to focus on the relative merit of its component strategies both on its own and within the context of the commodity universe chosen. A description of the most popular component strategies follows.

### Roll Return Strategies

#### *Fixed Roll Position*

One roll strategy is simply to mechanically roll a futures position at a set point in the curve. For example, the trading program may be instructed to close out all positions that are within two months of settlement and open similar positions four months out. This strategy is generally most effective in markets whose term structures are relatively stable and known, such as energy products (backwardated; rolling longs) and grains (contangoed; rolling shorts).

The fixed roll position strategy is sometimes used to take advantage of the popularity of certain other fixed roll position strategies. Many well-funded fixed roll position strategies close out positions that are within two months of settlement and open similar positions three or four months out. Because of the size of some of these transactions, this can cause deformations of the curve which can be exploited either by offsetting the roll position by a few months or briefly taking the other side of the trade. This version of the strategy is generally most effective in markets covered by the major commodity indexes, as it takes advantage of passive index funds that follow the same rules for rolling as their underlying indices. However, evidence suggests that this precise use of the fixed roll position strategy has become less effective recently.<sup>7</sup>

#### *Variable Roll Position*

Another roll strategy involves actively varying the roll position across the curve. This is often used to take advantage of deformations in the traditional shape of the curve. For example, if the market is surprised (e.g., by a transitory glut of product), a normally backwardated curve may go contangoed at the near end. The long investor may then opt to roll outward; that is, assume a long position further out on the curve to avoid the contangoed portion. Or, the investor may try to predict the future shape of the curve at various points based on supply and demand data. Using this information, the investor chooses the entry and exit points on the curve.

---

<sup>7</sup> In order to prevent this type of opportunistic investing strategy, major commodity indexes now employ a roll period that attempts to spread out the market impact of its rolling and obfuscate its trading operations.

*Hybrid Roll Position*

Some strategies enter futures position at a variable point on the curve and always roll at a set point at the near end. This is a common technique for spread strategies (described later), which seek to exploit mis-pricings between two substitute commodities' curves.

**Price Return Strategies***Trend-following*

Trend-following (or momentum<sup>8</sup>) strategies attempt to exploit the persistence of supply or storage shocks in particular commodities. There is evidence to suggest that, given the unique nature of the commodity markets, trend-following strategies can add value (Gorton et al., 2007; Schneeweis et al., 2007).<sup>9</sup> Simply, volatility at the short-end persists, and strategies that go long the short end when it is rising and go short when it is falling can add value. These strategies may work best in commodities known for frequent supply or storage disruptions, such as crude oil.

*Fundamental*

Fundamental strategies attempt to forecast broad price movements in given commodities, usually by attempting to construct the supply and demand curves. When an imbalance is forecast, this strategy attempts to take the appropriate position by buying commodities where demand is expected to exceed supply and shorting commodities where supply is expected to exceed demand.<sup>10</sup> For short term forecasts, this strategy relies on extraordinary access to proprietary supply and demand data. For longer-term forecasts, this strategy is essentially forecasting macroeconomic growth over the relevant time periods—an exceedingly difficult task.

*Spread*

Spread strategies seek to exploit apparent mis-pricings between two substitute commodities' curves. For example, crude oil and natural gas are seen as rough substitutes for some consumer markets. Therefore, if the spread between two comparable oil and natural gas futures departs from its historical average, the strategy will assume positions to profit from a compression. These strategies are

---

<sup>8</sup> A distinction is often drawn between trend-following and momentum strategies. Trend-following strategies focus on the first derivative of price movement: that is, an increase in price today will presage an increase in price tomorrow. Momentum strategies focus on the second derivative of price movement: that is, an increase in the rate of change of price today will presage an increase in the rate of change of price tomorrow. Both are likely to work in a commodities context, and some commentators do not draw as fine a distinction. Throughout this paper, the terms will be used interchangeably.

<sup>9</sup> As opposed to the conflicting evidence over whether momentum strategies add value in equity, currency, and fixed income markets.

<sup>10</sup> A largely deprecated theory of *nonrenewable* commodity pricing is that of Hotelling (1931). It holds that prices across the curve should rise at the rate of interest, since producers make a choice about whether to hold or to sell. In general, the evidence does not support this theory.

only viable in commodity markets historically related by substitution on either the production or consumption side. Other strategies of this type involve trading calendar spreads and geographical spreads.

*None*

Some strategies are price movement agnostic, in that they seek to add value through their rolling strategies. The lack of a price return strategy is especially common among commodity funds that attempt to outperform the popular commodity indexes.

### **Collateral Return**

*Government Debt*

One strategy is to place the collateral in T-bills or a U.S. Treasury with the appropriate maturity to the trade. This is the most conservative strategy possible. It is worth noting that investing in government debt provides some inflation benefits, since the yields on short-term government instruments will generally correlate with changes in inflation.

*Enhanced Return*

Another general strategy is to place the collateral in more risky instruments, such as short-term commercial paper, in order to garner a higher return on the collateral. Or, the investor can invest the collateral in physical delivery or other commodity-related strategies.

Any combination of the above component strategies constitutes a commodity futures strategy. Nevertheless, some component strategies are more likely to go together—such as the hybrid roll position and the spread return strategies.

Leverage may also be employed: managers can use the inherent structure of futures contracts to lever a small amount of capital. In these cases the strategy types are the same, but the actual collateral will be less than the value of the futures position. Usually, leverage is used in arbitrage price return strategies whereby the manager levers a trade to capitalize on minor mispricings.

Given these component strategies, it is unclear which combination of strategies should be considered passive. Nevertheless, the field generally considers passive strategies those that combine the fixed (or fixed period) roll position, price agnostic, and fully collateralized government debt component strategies. The rationale offered is that this combination of component strategies requires no skill to implement and represents the simplest exposure to commodity futures possible. These passive strategies are usually long-only, but occasionally involve shorting as well.

---

**Commodity Indexes**

Commodity indexes are passive strategies as defined above: they fix their roll position toward the short end, have no strategy to profit from price movements, and invest the full collateral in cash. The most popular, the S&P Goldman Sachs Commodity Index (S&P GSCI) and the Dow Jones-UBS Commodity Index (DJ-UBSCI), are long only. They are described below, and their respective futures market weightings are shown in the succeeding table.

**S&P Goldman Sachs Commodity Index**

The S&P GSCI invests in 24 highly liquid futures markets in proportion to each commodity's world production over a five-year period. It rolls forward during the first week of the expiration month, substituting the next furthest out future for the expiring one. It is fully collateralized and holds the collateral in U.S. T-bills.

Because the amount allocated to each of its 24 component futures markets is determined by the underlying commodity's share of world production, the S&P GSCI is heavily weighted toward energy products. For many investors, this may overly expose them to an extremely volatile sector. Furthermore, the index's production-centric orientation ensures that it tracks world usage closely, suggesting that the index's returns may be more correlated with world growth than might be desirable from a diversification standpoint.<sup>11</sup> Finally, what may be most desired may also be what is least produced, but the structure of the S&P GSCI systematically underweights commodities that may be in short supply. For example, gold has seen flat production over the last several years, yet demand has pushed up the price fourfold.

**Dow Jones-UBS Commodity Index**

The DJ-UBSCI invests in nineteen futures markets primarily in proportion to each market's liquidity and, secondarily, to each commodity's world production over a five-year period. It rolls forward during the first week of the expiration months, substituting the next furthest out future for the expiring one. It is fully collateralized and holds the collateral in U.S. T-bills. In addition, the DJ-UBSCI limits the representation of any one commodity group to 33% and any individual commodity to 15% of the index to ensure diversification.

Because the amount allocated to each of its nineteen component futures markets is primarily determined by relative liquidity, the DJ-UBSCI generally tracks long-term investor interest more closely. This endogenous weighting system ensures that the index is not as closely correlated with world growth as the S&P GSCI.

---

<sup>11</sup> Some exposure to world growth is attractive from a diversification standpoint, but this can be achieved by having some net long exposure to a broad basket of commodities.

## Weights by Sector

|                   | S&P GSCI | DJ-UBSCI |
|-------------------|----------|----------|
| Energy            | 74%      | 33%      |
| Agricultural      | 13%      | 30%      |
| Industrial Metals | 8%       | 20%      |
| Precious Metals   | 2%       | 10%      |
| Livestock         | 3%       | 7%       |

For the investor inclined to use these common investment vehicles, it is not at all clear which is preferable. Ultimately, a passive investor should consider these indexes and their methodologies in a total portfolio context. Both have been (modestly) positively correlated with inflation as measured by the CPI-U and low or negatively correlated with other major asset classes. The S&P GSCI is more likely to be correlated to world growth than the DJ-UBSCI; this may or may not be desirable. Furthermore, the S&P GSCI is effectively a proxy on the energy sector. On the other hand, the DJ-UBSCI is more exposed to historically contangoed markets like agriculture and metals. Of these two popular indexes, Meketa Investment Group generally prefers the DJ-UBSCI because of its endogenous weighting methodology and inherent diversification. However, note that our expectations for our asset study are not based on our expectations of these indexes' performance—in particular, our roll return assumption may be too generous. Therefore, the illustrative results in this brief paper may not be applicable to an index allocation, which undermines the case for investing in one of these popular vehicles.

### Active Management

Notwithstanding the above definition of passive management, all commodity futures management strategies could be considered active—it is only a matter of strategic complexity. Products that assume long (or short) positions with no price return strategy and role at a fixed point on the curve are generally the most simple and are thus considered passive. Common indexes fit this description, as may other basic strategies. However, active managers may employ a variety of strategies that depart considerably from those of the major indexes—so much so that using popular indexes as performance benchmarks is often irrelevant.

Several studies suggest that trend-following strategies may add value (for a review, see Schneeweis et al., 2007). Trend-following seems to be effective because inventory shocks tend to be serially correlated, implying that a supply/storage shock to the curve lingers for months—long enough for a shock to be detected and profitably traded. Furthermore, trend-following strategies generally assume long positions in backwardated markets and short positions in contangoed markets. Therefore, these strategies pick up both price return and roll return, which can generate an additional 500 basis points of return without substantially increasing volatility (compared to a passive, long-only index). More effective evaluation periods are usually on the order of a year, with short holding periods (as short as one month). Note that some trend-following strategies are simple enough to be considered passive: for example, several strategies rely on the 12-month moving average of the front

month contract—if the 12-month moving average is below the front month contract’s price, then the index goes long, otherwise it stays in cash.

Of course, fundamental analysis effectively tries to do what trend-following appears to do – find markets experiencing lingering shortages (excesses) and go long (short) at some point on the relevant futures curve. Access to private inventory and trading information may provide an edge here; however, it is not clear that it is worth the increased cost. Trend-following strategies can be simple to implement, while fundamental analysis requires much more effort and skill. Furthermore, there is no evidence that fundamental analysts are consistently able to predict incipient shocks or price movements.

Though theory may justify them, spread strategies are inappropriate for a commodities allocation from a total portfolio perspective. By their very nature, spread strategies in the commodity space are market neutral. However, a portfolio arguably includes commodities because of the diversification benefits of having some long price exposure. To get around this shortcoming, many managers overlay these strategies on a passive replication of the DJ-UBSCI or the S&P GSCI index. In effect, this is a hedge fund on top of a passive commodities index.

Active managers are all but impossible to evaluate in the standard fashion because no true benchmark exists. Alpha is traditionally defined relative to benchmark risk, and its measurement becomes less reliable in the absence of appropriate benchmarks. Until sources and persistence of skill in commodity futures investing are better understood, more straightforward rules-based (systematic) exposure is recommended.

*For reasons discussed heretofore, Meketa Investment Group recommends the following commodities investment: a transparent long-oriented trend-following or momentum strategy, fully collateralized in U.S. government bonds, and diversified across a wide variety of commodities.<sup>12</sup>*

### **Capacity**

Capacity is generally not an issue, given the size and liquidity of the futures markets.<sup>13</sup> However, concerns about commodities speculation and its effect on prices may prompt regulating bodies to further limit the total dollar value of speculative positions. The particulars of any such legislation are unclear, and the likelihood of this happening when commodities are cheap is low.

### **Timing**

Regarding the possibility of avoiding bubbles, it may be difficult to argue that commodity prices as a whole can become overvalued relative to any fundamental measure, though cyclicity within specific commodities does seem to be commonplace. Nevertheless, it is worth noting that if demand and supply are relatively constant and world growth is steady, major price increases in all commodity futures may be fleeting. Remember that unlike equity

---

<sup>12</sup> A long-oriented strategy may require a minimum level of long exposure to be effective from a total portfolio diversification standpoint.

<sup>13</sup> This is not true for some spread strategies.

prices, commodity prices are not a leading indicator of growth; instead, they are a coincident indicator.

Generally, the best time to invest in commodities is during the depths of a worldwide slowdown. The worst time to invest is at the apex of worldwide production. Since business cycles are on the order of seven to ten years, investors should be able to have a rough notion of the world economy's position in the business cycle.

### **Expected Diversification Benefits**

The primary reason for a plan sponsor to include a quasi-passive commodity futures investment is for diversification. As stated earlier, commodity futures returns do not often move in tandem with broad equity and bond markets (see appendix). This behavior is partly a result of the role of commodities as inputs to the process of production (or as the final product, as in the case of consumable commodities), rather than a claim on future cash flows through dividends or coupon payments. Thus, as opposed to traditional assets, commodities respond differently with changes in interest rates, inflation, and other characteristics of the economic environment.

In times of rising inflation (as defined by consumer price indices), commodity prices also tend to rise.<sup>14</sup> This observation does not necessarily imply causality. In fact, commodity price increases (perhaps because of supply and demand imbalances) are often thought to precipitate these inflationary episodes. Furthermore, during inflationary episodes, cash yields tend to rise, increasing collateral returns and providing further inflation protection. At the same time, inflationary episodes are generally negative for both stocks and bonds.

During the business cycle, commodity spot and futures prices generally rise with economic activity, peak at the high point of the cycle when demand reaches its summit, and fall as growth and demand falter. On the other hand, stock prices are usually anticipatory, falling before peak business activity and rising shortly before the trough. Government bonds are usually countercyclical, falling as demand rises and rising when demand falls. Higher quality corporate bonds are modestly pro-cyclical.<sup>15</sup>

Finally, events customarily viewed as unfavorable for stocks, such as shocks caused by weather, war, or monetary instability, frequently cause commodity prices to spike. Commodities' positive response to these so-called "event risks" provides further favorable diversification properties.

Since commodities and commodity futures are not likely to react similarly to stocks and bonds to changes in economic circumstances, their addition to a typical portfolio may improve risk-adjusted performance. It is important, however, to ensure that any investment maintains a net long exposure to commodity futures. The easiest way to achieve this goal is to only invest in products that are long-only or long/flat.<sup>16</sup>

---

<sup>14</sup> The opposite is true during deflationary episodes.

<sup>15</sup> In contrast, lower quality bonds are usually strongly pro-cyclical.

<sup>16</sup> Long/flat strategies move between long positions and cash.

## Strategic Allocation

History offers little guidance when forecasting the expected return, volatility, and correlation relationships for long-oriented, broadly diversified trend-following strategies. One index from Morningstar closely approximates this strategy, but has only been backtested since 1991 (Kaplan, 2007). Nevertheless, backtesting indicates that such a strategy will have low-to-negative correlations with stocks and bonds (therefore preserving the diversification properties), as well as returns and volatility slightly between bonds and equities (as a result of improving on the roll return by picking up some price return). The investment manager Mount Lucas also manages a long-oriented commodity trend-following index strategy: as of October, 2008, its realized 10 year annualized return/std. dev. was 7.5%/2.9% compared with 9.0%/7.1% for the S&P GSCI, 7.7%/5.0% for the DJ-UBS, 0.4%/4.4% for the S&P 500, and 5.1%/1.0% for the Barclays Aggregate.

The following tables highlight the benefits of a modest commodities allocation within a 60/40 U.S. equity/investment grade bond portfolio.<sup>17</sup> The first table assumes that a commodity strategy's expected return and volatility are located at the midpoint of the expectations for equities and bonds. Using more conservative assumptions, the second table assumes that a commodity strategy's expected return is equal to our expectation for that of bonds and its expected volatility is equal to our expectation for that of equities. In both cases, we assume a -0.1 correlation between a commodity strategy's return and those of bonds and stocks.<sup>18</sup>

| Midpoint            | 0%     | 5%    | 10%   |
|---------------------|--------|-------|-------|
| Domestic Equities   | 60%    | 57%   | 54%   |
| Domestic Inv. Bonds | 40%    | 38%   | 36%   |
| Commodities         | 0%     | 5%    | 10%   |
| Exp. Return         | 7.28%  | 7.26% | 7.24% |
| Exp. Std. Dev.      | 10.10% | 9.54% | 9.03% |
| Return/Std. Dev.    | 0.72   | 0.76  | 0.80  |

| Bond Ret./Eq. Vol.  | 0%     | 5%    | 10%   |
|---------------------|--------|-------|-------|
| Domestic Equities   | 60%    | 57%   | 54%   |
| Domestic Inv. Bonds | 40%    | 38%   | 36%   |
| Commodities         | 0%     | 5%    | 10%   |
| Exp. Return         | 7.28%  | 7.17% | 6.82% |
| Exp. Std. Dev.      | 10.10% | 9.53% | 8.34% |
| Return/Std. Dev.    | 0.72   | 0.75  | 0.82  |

In both cases, adding a modest commodity allocation improves the portfolio's efficiency: the expected return decreases less than the expected standard deviation does. Note that because

<sup>17</sup> When increasing the commodity allocation from zero, I preserved the proportion of equities to bonds.

<sup>18</sup> The correlation number was inspired by the work of Dunsby, et al. (2008), using the historical correlations of the S&P GSCI and the DJ-UBS indices.

commodities are not expected to return more than equities over long periods of time, any allocation away from equities into commodities (as in this example) will result in a diminishment of expected returns. Therefore, in some cases it may make more sense to draw the commodity allocation directly from fixed income. The following tables illustrate this point.

| <b>Midpoint</b>     | <b>0%</b> | <b>5%</b> | <b>10%</b> |
|---------------------|-----------|-----------|------------|
| Domestic Equities   | 60%       | 60%       | 60%        |
| Domestic Inv. Bonds | 40%       | 35%       | 30%        |
| Commodities         | 0%        | 5%        | 10%        |
| Exp. Return         | 7.28%     | 7.38%     | 7.47%      |
| Exp. Std. Dev.      | 10.10%    | 9.97%     | 9.87%      |
| Return/Std. Dev.    | 0.72      | 0.74      | 0.76       |

| <b>Bond Ret./Eq. Vol.</b> | <b>0%</b> | <b>5%</b> | <b>10%</b> |
|---------------------------|-----------|-----------|------------|
| Domestic Equities         | 60%       | 60%       | 60%        |
| Domestic Inv. Bonds       | 40%       | 35%       | 30%        |
| Commodities               | 0%        | 5%        | 10%        |
| Exp. Return               | 7.28%     | 7.28%     | 7.28%      |
| Exp. Std. Dev.            | 10.10%    | 9.95%     | 9.89%      |
| Return/Std. Dev.          | 0.72      | 0.73      | 0.74       |

In this case, the efficiency gains are much smaller, primarily because substituting bond volatility for commodity volatility works against the benefits of a commodity allocation's slightly negative correlation properties. However, by substituting for bonds and accepting a smaller efficiency gain, an investor does not sacrifice the expected return (and may even increase returns during certain economic cycles).

---

---

### SUMMARY AND RECOMMENDATION

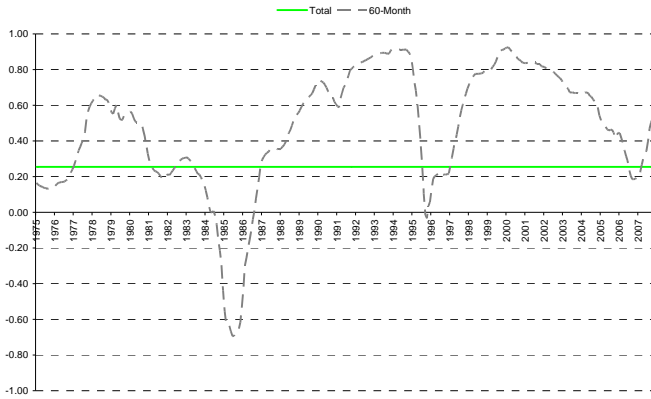
Commodity futures are likely to continue to exhibit low correlation with traditional asset classes while delivering positive returns, making them valuable diversifiers for plan sponsors' portfolios. The most direct way to invest in commodities is through futures, whose returns derive from roll return, price return, and collateral return. Indexes, such as the S&P GSCI and DJ-UBSCI, may be considered passive strategies in the sense that they take the simplest systematic approach to commodities investing. There is some evidence, however, that futures products that incorporate trend-following or momentum strategies may add value by assuming long positions in backwardated markets and short positions in contangoed markets.

Considering the difficulty in assessing manager skill in the commodity space, *Meketa Investment Group recommends the following commodities investment: a transparent long-oriented trend-following or momentum strategy, fully collateralized in U.S. government bonds and diversified across a wide variety of commodities.* Because of the uncertainty surrounding this strategy's future returns, volatility, and correlation properties, we recommend that any allocation to it equals 3%-7% of a client's total portfolio. This allocation is preferably carved out equally from those of other traditional asset classes. Note that these price-based strategies will not necessarily closely mimic the popular indexes. If deviation from a benchmark return is a concern, investors might consider the Dow Jones-UBS Commodities Index because of its relative diversification. However, benchmark investors should be aware that they may experience higher volatility and lower overall returns than a trend-following or momentum strategy. Finally, plan sponsors should be aware that the best (worst) time to invest in these vehicles is usually near the trough (peak) of the business cycle.

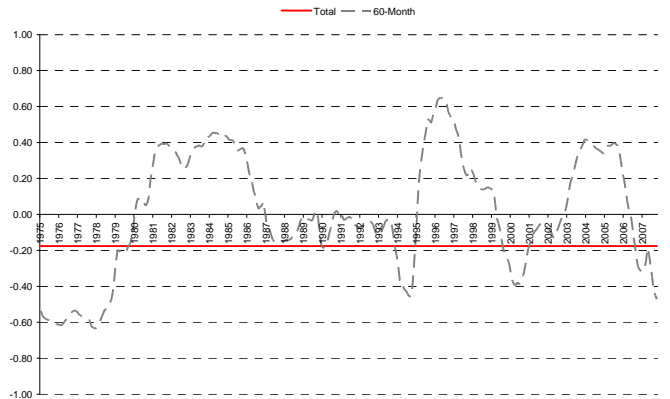
APPENDIX

Correlations, S&P GSCI. Charts use annual returns on an overlapping monthly basis.

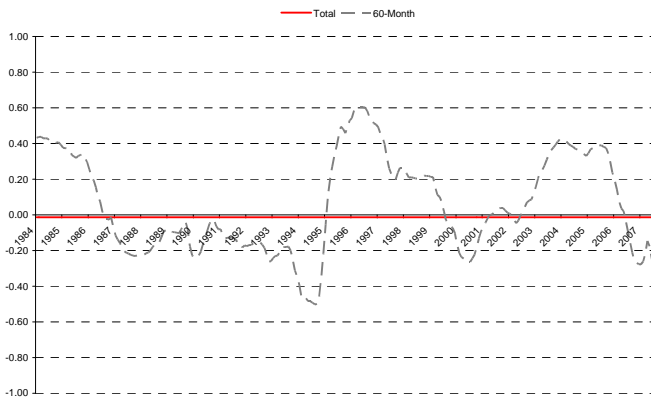
S&P GSCI and CPI-U, 11/75-8/08



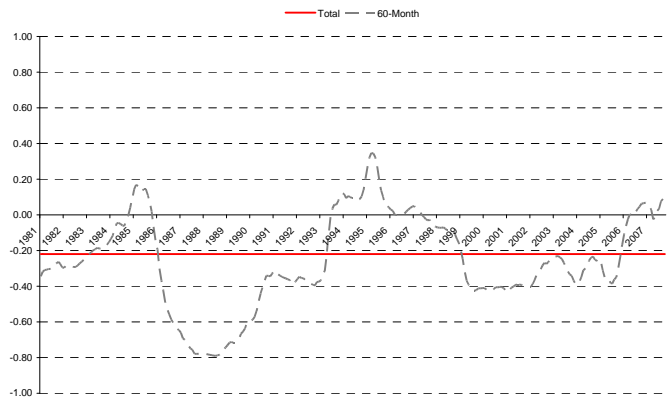
S&P GSCI and S&P 500, 11/75-8/08



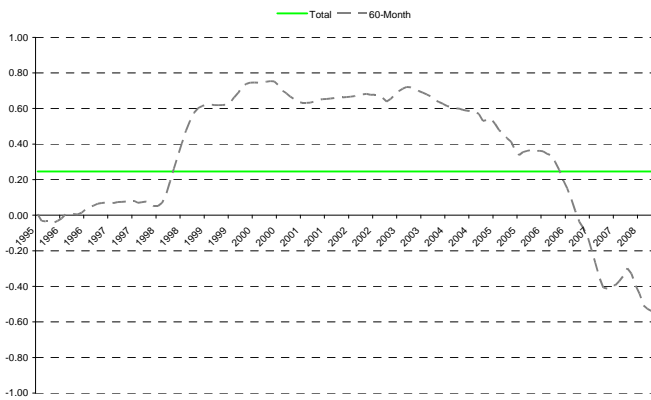
S&P GSCI and Russell 3000, 11/84-8/08



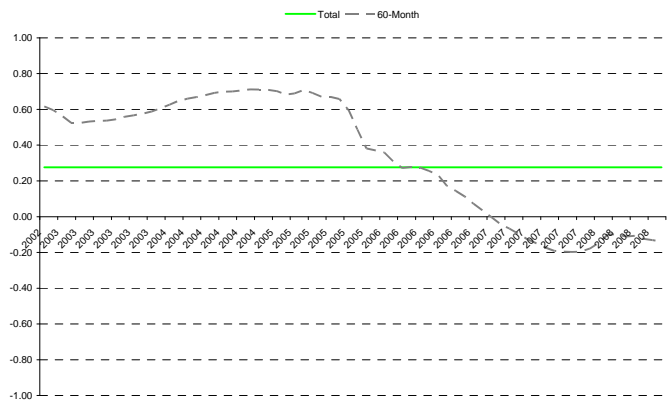
S&P GSCI and Barclays Aggregate, 11/81-8/08



S&P GSCI and HFI Fund of Funds, 11/95-8/08



S&P GSCI and Private Equity, 11/02-8/08



## REFERENCES

- Dunsby, Adam, John Eckstein, Jess Gaspar, and Sarah Mulholland. *Commodity Investing: Maximizing Returns Through Fundamental Analysis*. Hoboken, New Jersey: John Wiley & Sons, Inc., 2008.
- Fama, Eugene F. and Kenneth R. French. "Business Cycles and the Behavior of Metals Prices." *Journal of Finance* 43 (1988): 1075-1093.
- Gorton, Gary B., Fumio Hayashi, and K. Geert Rouwenhorst. "The Fundamentals of Commodity Futures Returns." NBER Working Paper 13249, 2007.
- Kaplan, Paul D. "The Next Generation of Commodity Indexes." Morningstar Research, 2007.
- Keynes, John M. *A Treatise on Money, Vol. 2*. London: Macmillan, 1930.
- Schneeweis, Thomas, Hossein Kazemi, and Richard Spurgin. "Momentum in Asset Returns: Are Commodity Prices a Special Case?" CISDM Working Paper 4-2007, 2007.