Alpha, Beta, and Commodities: Can a Commodities Investment be Both a High Risk-Adjusted Return Source and a Portfolio Hedge?

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Abstract

Our previous work [Akey (2005)] focused upon making a case for an active approach to commodities exposure. This focus may suggest that our allegiance to commodity exposure falls on the side of a purely active approach. However, recognizing that many investors are less concerned with absolute or risk-adjusted returns than they are with the diversification properties of commodities introduces a new question: Can an investor combine commodities beta and commodities alpha to achieve an attractive risk/return profile while maintaining the diversification benefits of the asset class? That is, Can a Commodities Investment be Both a High Risk-Adjusted Return Source and a Portfolio Hedge?

Introduction

Passive commodity investments have enjoyed four years of impressive returns and asset growth. The largest of the commodity indexes (the Goldman Sachs Commodity Index or GSCI with an estimated $50-$55 billion in assets linked to it) has produced a compound annual return of 23.78% from January 2002 – December 2005. While, in the short term, the current attraction to commodities is certainly linked to returns like these, the longer-term viability of commodities as an asset class has been bolstered by an increase in intellectual discourse on the subject – namely a combination of academic papers touting the benefits of hard assets as a portfolio diversifier and the proliferation of The China Story (a soundbite amalgamate of the many decade-plus demand/supply forecasts that suggest an extended secular bull run in commodities).

While the short-term versus long-term distinction is an important consideration for investors attempting to answer the "Why Commodities?" question, we feel that the time horizon disconnect is perhaps more important for those investors who have embraced the asset class but now find themselves asking *"How* Commodities?". Long-term cases for commodities highlight the benefits of commodities beta: Roll yield returns (a risk premium embedded in commodities futures contracts) and the asset class' diversification benefits and whole portfolio hedging characteristics. Shorter-term cases for commodities are more focused on spot price changes, where the alpha opportunities available to active, tactical managers can create an absolute return profile with vastly improved risk/return characteristics, even in a bull commodities market.

As interest and assets in commodities grow, these issues are important for investors who are either considering the asset class for the first time or taking a new look at their approach to the space.

This paper begins by re-visiting commodities beta sources with updated data through the continued bull market of 2005, identifying key limitations of passive commodity investments. It then outlines why and how an active commodity portfolio may earn superior absolute or risk-adjusted returns relative to passive commodity investments. The paper concludes by outlining a variety of diversification characteristics investors may find important from exposure to commodities beta, and then questions whether adding incremental amounts of alpha to a selected beta source will allow the investor to achieve returns that maintain portfolio hedging characteristics but with an enhanced risk/return profile.

I. Commodities Beta: Index Performance and Limitations

Commodity markets satisfied resource bulls in 2005, adding impressive gains to their now four-year run-up and continuing to solidify the asset class as one of few bright spots for diversified portfolios (along with emerging markets) that continue to suffer from anemic returns in traditional asset classes and more mainstream alternative investments like hedge funds and managed futures. Exhibit 1 illustrates how six of the most recognized commodity indexes performed in 2005 and over the four-year commodity bull market that began in 2002 and a 15-year period beginning in 1991, relative to selected traditional asset class benchmarks.

Exhibit 1*

Annualized Commodity Index Returns versus Other Asset Classes

	2005	2002-2005	1991-2005
DeutscheBank Liquid Commodity Index (DBLCI)	17.54%	25.70%	10.57%
Dow Jones - AIG Total Return Index (DJ-AIG)	21.36%	19.90%	7.78%
GSCI Total Return Index (GSCI)	25.55%	23.78%	6.88%
Reuters Jefferies CRB Index (RJCRB)	18.86%	15.21%	4.27%
Rogers International Commodity Index (RICI)	19.55%	26.45%	10.70%
S&P Commodity Index (SPCI)	30.79%	24.84%	10.22%
S&P 500 Total Return Index	4.91%	3.92%	11.53%
Lehman Brothers Long Term Treasury Index	6.71%	8.35%	9.09%
HFR Fund of Funds Index	7.51%	6.76%	10.48%
Barclay CTA Index	1.66%	6.42%	5.67%

**Index data here and throughout this paper is from a variety of sources, including The Barclay Group, Goldman Sachs, Dow Jones, Commodities Research Bureau, Standard and Poor's, and Hedge Fund Research (HFR).*

The extended commodity bull market has continued to attract investor interest. Assets linked to passive commodity indexes surged to an estimated $84 billion at the end of the first quarter of 2006, nearly doubling the estimated $40 billion from just one year earlier. While precise figures are difficult to come by in a marketplace where most of the activity is in over-the-counter transactions, industry participants suggest that Goldman Sachs continues to dominate the space with approximately $50-$55 billion linked to the GSCI; Dow Jones – AIG-linked assets are approximately $20-$25 billion.

While it may be difficult to argue against the recent unilateral out-performance of the commodity indexes relative to other asset classes, a singular focus on these returns masks some of the commodity index limitations outlined in Akey (2005), namely the performance disparity among the indexes, downside volatility, and the understanding of return sources in total return commodity indexes.

Index Disparities

For example, while these indexes all share roughly the same objective – to construct a basket of commodity futures that measure broad commodity price changes – the construction and calculation methodology (the execution of this objective) varies widely from one to another. These commodity indexes include vastly different markets, market and sector weightings, and roll methodologies; differences that can have a substantial impact on how each index performs. To wit, nearly 1500 basis points separated 2005's highest and lowest performer; four-year

annualized returns varied by more than 1100 basis points. While a thorough review of the nuances of index exposures and methodologies may be intimidating to investors who are new to the asset class, it is clear that an investor's experience with an indexed commodities investment may vary significantly based upon how the exposure is configured. Erb and Harvey (2006) go so far as to suggest that commodity indices are strategies; the make-up of each a distinct approach to the asset class that incorporates subjectivity by way of construction methodology. While the variance in execution of a commodities index may make direct performance comparisons challenging, it gets at the root of the question that is so difficult for many investors: What *is* commodities beta?

For a comparative review of commodity index structures, Appendix A provides a matrix of key index construction methodology.

Downside Volatility

As with prior years, commodity index returns were lumpy and gains were made amid downside volatility. Exhibits 2 & 3 illustrate the volatility and drawdowns of the indexes during 2005 and over the four-year period beginning in 2002.

Exhibit 2

Annualized Volatility of Commodity Indexes

	2005	2002-2005	1991-2005
DeutscheBank Liquid Commodity Index (DBLCI)	17.17%	18.25%	18.41%
Dow Jones - AIG Total Return Index (DJ-AIG)	14.64%	13.43%	12.06%
GSCI Total Return Index (GSCI)	24.31%	22.27%	18.59%
Reuters Jefferies CRB Index (RJCRB)	12.12%	9.78%	8.71%
Rogers International Commodity Index (RICI)	13.82%	13.90%	14.04%
S&P Commodity Index (SPCI)	20.00%	17.83%	15.46%

Exhibit 3

Worst Drawdowns of Commodity Indexes

	2005	2002-2005	1991-2005
DeutscheBank Liquid Commodity Index (DBLCI)	-10.53%	-16.78%	-46.11%
Dow Jones - AIG Total Return Index (DJ-AIG)	-6.57%	-8.12%	-36.20%
GSCI Total Return Index (GSCI)	-13.78%	-19.66%	-48.25%
Reuters Jefferies CRB Index (RJCRB)	-5.01%	-5.93%	-28.37%
Rogers International Commodity Index (RICI)	-6.48%	-10.63%	-36.94%
S&P Commodity Index (SPCI)	-10.98%	-12.21%	-37.57%

While we may be in the middle of a long-term secular bull market for commodities, investors should be conscientious of these markets' notorious volatility, a function of their response to short-term supply/demand disconnects moreso than any longer term macroeconomic conditions. Faber [2004], for example, notes that investors betting on commodity price increases due to rising demand from China should be aware that significant downside volatility for individual commodities – even in the context of a long-term commodities bull market – is almost a certainty. He cautions that these markets can reach all-time highs and subsequently new lows within a brief period of time, and that investors should be prepared to see occasional 50%

declines in the prices of individual commodities, regardless of general commodity market trends. Natural gas provided one recent real-time example of this phenomenon, trading above $15/btu briefly in December but retracing to around $7/btu currently. *See Exhibit 4.*

Exhibit 4

Near Month Natural Gas Futures Price

Source: www.futuresource.com

Passive, long-only indexes have little protection from these downward spikes or trends. They have no stops, no ability to sell short, and many only re-balance once a year. While investors may choose indexed exposure to commodities in order to benefit from a bullish macroeconomic view, passive exposure may come at a greater cost than with index exposure in other asset classes, as interim moves against even a prolonged trend may be both more frequent and severe within this sector.

For example, as illustrated in Exhibit 1, an investor in the GSCI for all of 2005 earned an impressive 25.55% return. However, one who initiated an investment at the beginning of the second quarter earned just 2.93% from April through December 2005 (and -3.46% through February 2006, including two periods where monthly drawdowns exceeded -10%). Of course, commodities are not the only asset class to produce lumpy return patterns, but these nine- and eleven-month returns weren't achieved during any old timeframe: Recall that we are still widely believed to be in the middle of a bull market. Given the total return index performance since April 2005, investors may ask if the commodity bull market has waned.

Segmentation of Return Sources

The vast majority of investors (particularly speculators or non-commercial market participants) are not equipped to invest directly in spot commodities. That is, they are not in a position to hold and store oil, grain, copper, etc. Their investment, instead, is made via proxy holdings in global

futures markets. An investment via a futures proxy shifts the return source of the commodities investment, and in fact exposes the investor to three different return components: change in price of the commodity, roll yield, and interest on collateral. Till (2003) provides a thorough summary of the interplay among these components, which we summarize here.

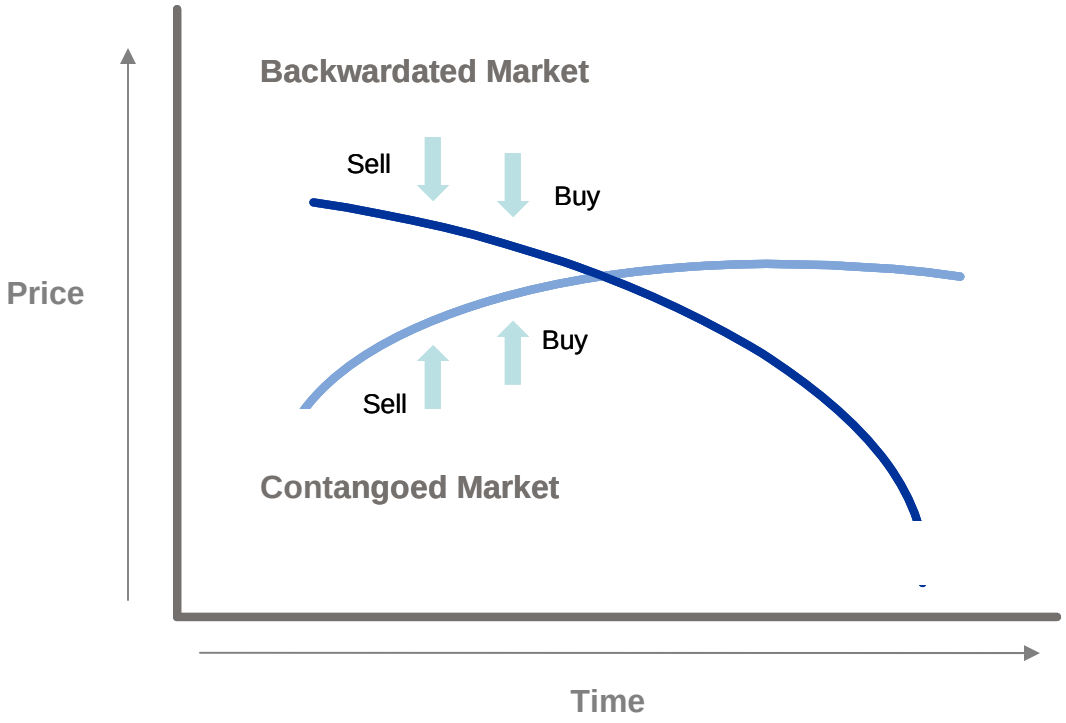
The source of return from change in spot prices is the most straightforward for commodity investors to understand – this is the directional exposure to commodities many are looking for, particularly if their interest is based on a bullish outlook. If an index has long exposure to natural gas and the price of natural gas increases, the position is profitable (in this basic example).

The collateral returns are similarly straightforward. A collateralized commodity futures program is unleveraged. That is, for every desired US$1 in commodity futures exposure, an investor sets aside US$1 in money-market funds or similar cash equivalents, making the futures program fully collateralized. When calculating the returns to a collateralized commodity futures program or total return index, one typically includes the collateral returns (interest on the cash equivalent) as well.

Understanding the portion of return attributable to roll yield requires a bit more effort. Our first step is to review the concepts of backwardation and contango as they apply to pricing of commodity futures. 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.

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 as the delivery date approaches. This is the roll yield that an investor 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 contangoed market, the reverse occurs: an investor continuously locks in losses from the futures contracts converging to a lower spot price. *See Exhibit 5.*

Exhibit 5
Commodity futures term structure



The dynamics of positive and negative roll yield

Over time, it is important to note that this roll yield is not related to direct exposure to actual commodities. Rather, in the long term, it is largely believed to be a risk premium priced into the futures contract to compensate the holder for bearing the commodity price risk. Till and Eagleeye (2003) and Nash (2001), among others, find that 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 concepts can be difficult to grasp. For some clarity, Anson (2002) provides an explanation that distinguishes between markets that provide a hedges for producers (backwardated markets), and markets that provide a hedge for consumers (contangoed markets). He points out that a commodity producer such as Exxon, whose business requires it to be long oil, can reduce exposure to oil price fluctuations by being short crude oil futures. Hedging by risk averse producers causes futures prices to be below the expected spot rate in the future. Alternatively, a manufacturer such as Boeing is a consumer of aluminum, it is short aluminum, and it can reduce the impact of aluminum price fluctuations by purchasing aluminum futures. Hedging by risk averse consumers causes futures prices to be higher than the expected spot rate in the future. For example, Exxon is willing to sell oil futures at an expected loss and Boeing is willing to purchase aluminum futures at an expected loss.

Nash cites gold, specifically, as a point of interest:

> Often when people think of investing in commodities, they think of buying Gold. The problem with this strategy is that typically there is plenty of Gold around and plenty of people willing to lend it. The result is that, in general, the fee paid by the market to borrow Gold is appreciably less than the borrowing costs of dollars (this means that Gold is almost always in a steep contango). Hence a strategy of buying Gold and lending it to the market should lose money. Since 1983, the price of Gold has fallen by 2.6% annually, yet a long position in Gold that is rolled every three months has lost 7.8% annually over the same period. [Nash, pages 29-30]

Over the long term, as illustrated by the gold example, most observers find the difference between typically backwardated versus typically contangoed markets to be storability of the specific resource, and the effect on the balance between risk-averse producers and consumers. Gold, for example is easy and cheap to store; it is therefore typically in contango because producers are not compelled discount future inventory because it can be stored if prices are not satisfactory. Oil, on the other hand, is more difficult and expensive to store; it may therefore be more frequently backwardated as producers hedge their commodity exposure to consumers (and speculators) who are willing to assume the price risk in exchange for the expected roll yield premium.

In the long term, Erb and Harvey (2006) find that roll return explains 91% of the cross-sectional variance in the performance of different commodity futures investments over a single 21-year horizon. Nash and Smyk (2003) present similar results graphically based on the percentage of time a commodity trades in backwardation.

It is important to emphasize that expectations for positive or negative roll yield vary not only by market, but also by time horizon. Just like commodity prices, the term structure of any single commodity futures market is subject to the prevailing outlook for supply and demand at any given time and is accordingly dynamic. While in the long term of these decades-long studies roll yield may be the main, reliable return source of a commodity index, shorter-term timeframes suggest more variance.

Feldman and Till (2006), for example, find high that levels of explanatory power for backwardation and roll return in describing the performance of soybean, corn and wheat futures decreases as time horizon narrows. Considering all crops together, over the period 1950 to 2004, the share of return variance explained by backwardation decreases from 77% at an eight year time horizon to 63% at a five-year time horizon, and to just 25% at a one-year horizon (excluding 1970-1974, a period of sharp spot price increases, the share of excess return variance explained at the five-year horizon increases to 87%). The results for individual crops are similar.

The risk premium embedded in backwardated futures markets is typically discussed in the context of its positive impact on commodity index total returns, particularly relative to the energy markets and their historically persistent backwardated term structure (a favorite of investors who have favored the GSCI as the index with the highest allocation to the energy sector). Beenen (2005), for one, notes that "Over the long term price movements have contributed little to the return, as commodities tend to mean revert to inflation/cost of production. Long-term passive investing in energy therefore receives a yield for providing risk capital to the market via the roll return rather than speculating on price movements."

The phenomenon of the positive roll yield embedded in the energy markets is so widely understood that index providers have engineered commodity indexes in order to take advantage of these properties. The DBLCI, for example, rolls different sectors at different times: Energy exposure is rolled monthly into the nearby futures contract in order to lock in the anticipated positive roll yield, while metals and agricultural exposure (markets that are more likely to be contangoed and experience roll yield losses) is rolled annually each November.

Commodity indexes, then, have generally benefited from positive roll returns from backwardated futures markets – and in some cases are even engineered explicitly to capitalize on this risk premium – while changes in spot prices have been only a tertiary source of return, with perhaps the exception of periods of sharp spot price increases.

What happens, then, in exception periods – those times when spot prices increase? And furthermore, what happens when there is a change in the term structure of commodity futures markets? The current environment provides such a scenario. As of March 2006, markets (including WTI Crude, Brent Crude, heating oil, US natural gas, UK gasoil, gold, and wheat) representing more than two-thirds of the GSCI Index were trading in contango.

For commodity indexes, the biggest impact of these contangoed markets comes within the energy sector, for two reasons: First, because the sector is generally highly weighted among the indexes; and second, because energy markets have historically been among the most stubbornly persistent earners of positive roll yield.

Ironically, many point to "fund buying" of the long-only indexes – a longtime beneficiary of the positive roll yield from backwardated futures markets – as a primary contributor to the contangoed term structure currently facing many commodity markets.

Heap (2006) writes, "Peculiar characteristics continue to evolve in the base metal markets. Recently, prices surged well beyond what could be sensibly forecast using fundamental analysis. Now we see an unusual narrowing of backwardations – even a shift into contango – when spot prices are at record highs and most supplies are constrained. Both circumstances are, of course, the work of the funds," and further noting "the funds will need spot oil prices to continue rising strongly in order to mitigate the growing cost of rolling long positions forward during the contango."

While many attribute the move from backwardation to contango as a fund-driven phenomenon (ie, the long-biased investor money flowing into the asset class through index-linked products

have disrupted a balance in the term structure), others find such analysis ignores the backwardation in many other commodity markets.

A prevailing assessment of the crude market contango specifically focuses on the very limited excess capacity of crude oil throughout the entire supply chain, forcing refiners need to carry more inventory. The multi-year outlook for excess capacity is similar, so that the futures curve has inverted as an indicator of a shift in risk profile. Rather than producers like Exxon offering discounted future capacity as a means to lay off some price risk, there are expectations that crude will, in fact, have a long-option-like profile going forward: Futures buyers are paying away the negative carry (the option premia) to in order to gain exposure to the periodic price spikes (see Murti, et al, and Till [2006]).

The impact of contangoed commodity markets generally – and energy markets specifically – on commodity index returns can be substantial. Consider the GSCI commodity index. While the GSCI Total Return Index includes all three return sources discussed previously (spot, roll yield, and collateral) and is generally considered to be the investable index, the GSCI Spot Index tracks only the price of the nearby futures contracts, and the GSCI Excess Return Index tracks the return from investing in nearby GSCI futures and rolling them forward each month. While you cannot make direct comparisons among these indexes because they are measuring very different kinds of investments (simple change in spot prices vs. a rolling futures investment vs. a collateralized futures investment that reinvests the collateral returns), you can compare performance to help understand the interplay of return sources like roll yield and spot price changes in an environment like 2005. *See Exhibit 6*

Exhibit 6

GSCI Total Return Index, GSCI Excess Return Index, and GSCI Spot Return Index Performance

	2005	April 2005 - December 2005
GSCI Total Return Index	25.55%	2.93%
GSCI Excess Return Index	21.61%	0.32%
GSCI Spot Return Index	39.06%	12.54%

It is clear from reviewing the performance of the GSCI Spot Index that 2005 continued to be a strong year for commodity prices, even throughout the last three quarters of the year. It is also clear from comparing the performance of the spot index to the Excess Return and Total Return Indexes that negative roll yields dragged commodity total return performance in 2005. In fact, in every month since August 2004 (and extending to February 2006), the GSCI Excess Return Index has lagged the GSCI Spot Return Index. Cumulative total return for the Spot Index from August 2004 – February 2006: 35.25%; for the Excess Return Index: 8.50%.

The point here is not to debate whether the current environment of roll yield losses in passive commodity indexes will continue. Rather, we want to emphasize that a passive long-only commodity index may not be an investor's best choice to capitalize on changes in commodity *prices*, even in a bull market. Over the long term, commodity indexes ride price spikes up only to give back the gains as prices revert to the inflation/cost of production mean. Even in a bull market, price gains may be mitigated by roll yield losses if the futures term structure is not favorable. For investors considering exposure to commodities based upon a macroeconomic

outlook that suggests continued commodity price increases, this may come as a surprise. The famous industry book by Jim Rogers (2004) was called *Hot Commodities!* and not *Hot Backwardation!* for a reason: investors jumping into commodities investments in response to the current bull market environment are more likely looking to capitalize on price increases than futures risk premium.

II. Active Commodity Management Performance

Akey (2005) speculated that an active approach to commodities may provide investors with superior absolute or risk-adjusted returns. The nature of the asset class creates inefficiencies and alpha opportunities that are potentially both more abundant and rich than in other asset classes. Tactical trading, market selection, timing, short-selling, and arbitrage and spread trades may offer skilled traders opportunities to mitigate some of the downside volatility associated commodities.

He further suggested that expanding the universe of commodities investment opportunities to include global securities markets (ie, actively managed hedge funds that specialize in commodity and natural resource sectors) could both broaden and deepen the scope of a commodities investment (by including markets like water, forestry products, and commodities infrastructure in the former case and by introducing the more liquid securities markets in the latter). This is important for an investor looking to create a diversified portfolio – futures traders in the energy sector are plentiful and can manage a meaningful volume of assets in the deep energy markets; metals, agricultural, softs, and exotics traders, in descending order, are both more difficult to find and can effectively trader smaller amounts of capital.

An equally weighted portfolio of non-financial commodity trading advisors (CTAs) and natural resources hedge funds suggested that the alpha opportunities present in commodities trading can indeed offer superior absolute and risk-adjusted returns than those of commodity indexes. *See Exhibit 7*

Exhibit 7

Commodities: Active Futures Traders, Active Futures and Hedge Funds versus Passive Indexes, January 1991 – December 2004

Index or Portfolio	Compound Annual Return	Annualized Standard Deviation	Sharpe Ratio	Worst Draw Down
Active Commod. Traders & HF	18.44%	8.19%	1.78	-16.58%
RJCRB	3.30%	8.34%	-0.07	-28.37%
DBLCI	10.09%	18.49%	0.34	-46.11%
DJ-AIG	6.98%	11.82%	0.26	-36.20%
GSCI	5.66%	18.06%	0.1	-48.25%
RICI	10.10%	14.04%	0.44	-36.94%
SPCI	4.79%	13.04%	0.07	-37.95%

This paper updates the equally weighted portfolio of active CTAs and natural resources hedge funds to include 2005 data, and also expands the universe of available active commodity managers, creating a proprietary data set of all known Commodities Trading Advisers (CTAs)

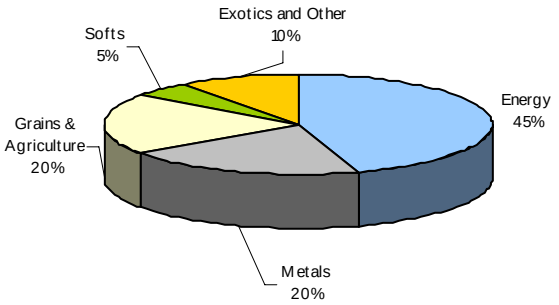
and natural resource sector hedge funds, active in the last five years, who trade exclusively in non-financial commodities or within the natural resources sector. This universe now includes 189 distinct programs.

Once we identified this universe, we created an equally weighted portfolio that includes all traders and hedge funds for any given monthly period to create a monthly data stream from April 1982 – December 2005. To limit survivor bias, the equally weighted portfolio includes both active and inactive programs (although we were not able to include traders or hedge funds who existed prior to but not after 1999 due to data availability) and excludes no trader or hedge fund based on size, methodology, tenure, or any subjective factor. The equally weighted portfolio includes at its minimum one manager (April 1982 – June 1984) and at its maximum 140 managers (May 2005), nearly double that of the previous portfolio. **We continue to believe this data set to be among the most comprehensive and accurate sources of known commodity traders and natural resources hedge funds in the world.**

We estimate that the aggregate assets linked to strategies in the Active Portfolio are in the range of $18-$20 billion, with approximately two-thirds of the assets linked to the energy sector. To limit the impact of the energy component, we chose to equally weight the portfolio rather than applying asset-based weightings. The estimated breakdown of the portfolio in non-dollar terms appears as Exhibit 8. Lastly, the Active Portfolio is composed of approximately 60% non-financial CTAs and 40% natural resource hedge funds.

Exhibit 8

Estimated Sector Breakdown of Active Portfolio



While the quantity of active managers included in the portfolio increased dramatically, the characteristics of this updated data set remain consistent with those within our previous work, in both the longer term 15-year period looking back to 1991 and in the more bullish commodities environment from 2002 – 2005. *See Exhibits 9 and 10*

Exhibit 9

Commodities: Active Futures Traders and Hedge Funds versus Passive Indexes, January 1991 – December 2005

Index or Portfolio	Compound Annual Return	Annualized Standard Deviation	Sharpe Ratio	Worst Draw Down
Active Commod. Traders & HF	18.62%	8.21%	1.8	-16.58%
RJCRB	4.27%	8.71%	0.05	-28.37%
DBLCI	10.57%	18.41%	0.37	-46.11%
DJ-AIG	7.78%	12.06%	0.33	-36.20%
GSCI	6.88%	18.59%	0.16	-48.25%
RICI	10.70%	14.04%	0.49	-36.94%
SPCI	10.22%	15.46%	0.41	-37.57%

Exhibit 10

Commodities: Active Futures Traders and Hedge Funds versus Passive Indexes, January 2002 – December 2005

Index or Portfolio	Compound Annual Return	Annualized Standard Deviation	Sharpe Ratio	Worst Draw Down
Active Commod. Traders & HF	20.99%	6.70%	2.86	-3.50%
RJCRB	15.21%	9.78%	1.37	-5.93%
DBLCI	25.70%	18.25%	1.31	-16.78%
DJ-AIG	19.90%	13.43%	1.35	-8.12%
GSCI	23.78%	22.27%	0.99	-19.66%
RICI	26.45%	13.90%	1.77	-10.63%
SPCI	24.84%	17.83%	1.29	-12.21%

In the longer term, the actively managed portfolio unilaterally out-performs passive indexed exposure on both an absolute and risk-adjusted basis. Even in the bullish environment of the last four years, active management has produced returns that provide 80% or more of the upside of a passive index, while protecting the portfolio on the downside to produce substantially better risk-adjusted returns.

The return profile of the Active Portfolio may suggest a collar-like profile for an active approach to commodities, potentially giving up some of the upside but have a lot lower downside. This view is not unique to commodities. Fung and Hsieg (1999), for example, demonstrate that a global macro hedge fund strategy profile "underperforms equities in up markets and outperforms equities in down markets, behaving as if it owned collars (short calls/long puts) on US equities."

In summary, then, the ongoing bull market in commodities has not altered three of the biggest limitations in passive commodity investing: 1) Passive commodity investment options are very different from one to the next and investors must conduct a nuanced review of the differences to understand how various exposure and construction methodologies will impact their performance; 2) Even in a bull market environment, passive commodity investments face periods of significant downside volatility as markets ignore long-term macroeconomic fundamentals and respond to short-term supply and demand disconnects; and 3) Interplay among the various return sources further complicates the return equation as roll yield returns may either contribute positively or negatively to spot price returns. Active commodities management demonstrates the ability to supersede passive commodity performance on a risk-adjusted basis, even in a bull markets. On an absolute basis, active commodities may out-perform passive commodity investments over the long term, and produce similar returns in a bull market environment.

III. What is the Cost of Active Commodity Exposure? Cases for Commodities Beta

Typical arguments about the costs of active management relative to passive involve fee discussions. While noting that the return streams used to construct our actively managed portfolio are from return figures that are net of fees (while the index returns are gross of fees), let us ignore here the traditional sense of costs associated with active versus passive management. Instead we want to focus on certain benefits of the commodities asset class as a diversifier to traditional investments, namely equities and fixed income.

Recent interest in commodities has not been merely a result of bullish macroeconomic views, but also of emerging understanding of the diversification benefits commodities can contribute to a traditional portfolio. These benefits are of great interest to investors who are less concerned with absolute returns and more concerned with the interplay of commodities within the whole portfolio.

Foresti and Toth (2005), for example, demonstrate that a portfolio comprised of 50% equities, 30% bonds, and 20% commodities from July 1959 to March 2003 improved the risk/return ratio of the portfolio from 0.95 to 1.26 when compared to a more traditional 60% equity and 40% bond portfolio, while actually increasing the annual returns from 9.4% to 11.2%.

More explicit diversification benefits have been demonstrated in market environments that have negative impact on traditional assets. Gorton and Rouwenhorst (2005) demonstrated limited to negative correlation of commodity returns relative to stocks and bonds and an overall correlation of commodities to stocks to be -0.06 and to bonds -0.28. Furthermore, they also found that equities demonstrated more left tail observations in the return distribution than commodities; the study isolates the 5% and 1% of worst equity market months, observing that these diversification benefits persist during crashing equity markets, when non-correlation may be especially valuable (see Exhibit 11).

Exhibit 11:

Commodity Returns During Worst Equity Periods, July 1959 – March 2004

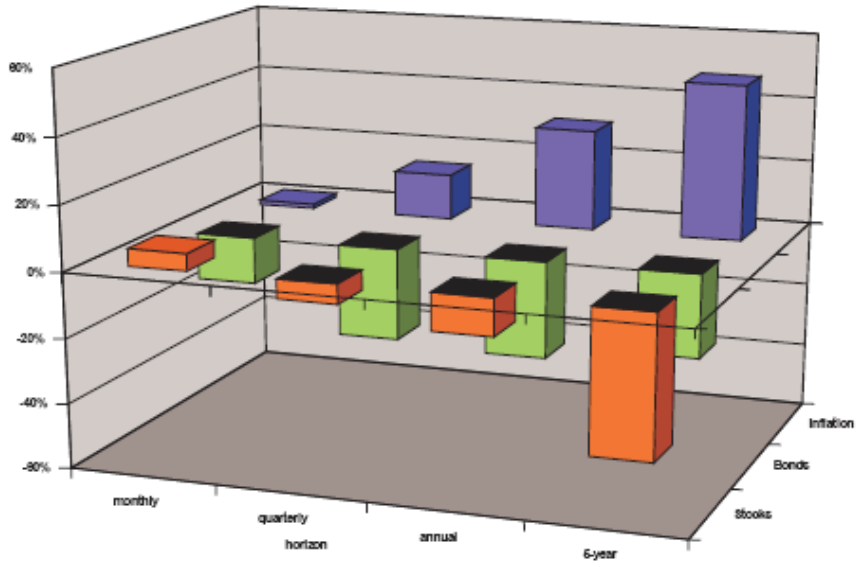
	Overall Mean Return	5% of Worst Equity Market Periods	1% of Worst Equity Market Periods
S&P	0.88%	-9.18%	-13.87%
Commodities	0.88%	1.43%	2.32%

Source: Gorton and Rouwenhorst (2004)

The potential benefits of commodities as an inflation hedge are also handled empirically by Gorton and Rouwenhorst. The study finds commodity returns demonstrate a positive correlation to periods of inflation, in contrast to a negative correlation for both stocks and bonds. Both of these observations are found to be more pronounced (higher degree of positive correlation for commodities and higher degree of negative correlation for stocks and bonds) when periods of unexpected inflation are isolated from overall periods of inflation (noting that commodity futures will typically have already factored expected inflation into their prices). In addition, when further

isolating periods to evaluate response to changes in expected inflation, bond returns appear to be particularly negatively influenced by revisions about future expected inflation.

Exhibit 12:
Correlation with Inflation Components,
Overlapping Quarterly Return Data from July 1959 – March 2004



Source: Gorton and Rouwenhorst [2004]

The out-performance of the active portfolio that we saw in Exhibits 9 and 10 does indeed come with a higher correlation to equities. Exhibit 13 illustrates the correlation of the active commodity portfolio and the passive indexes to the S&P 500. Akey (2005) did find, however, that much of this equity correlation was mitigated if the active portfolio included only non-financial CTAs and not natural resources hedge funds (though that construct limited the amount of assets that could be managed in a portfolio that was not concentrated in energy, and also limited the natural resource opportunities available outside of developed futures markets).

Exhibit 13:
Correlation of Passive and Active Commodities to S&P 500, 1991 – 2005 and 2002 – 2005

	1991-2005	2002-20025
Active Commod. Traders & HF	0.27	0.38
RJCRB	0.14	0.06
DBLCI	0.00	-0.17
DJ-AIG	0.08	0.02
GSCI	-0.01	-0.17
RICI	0.04	-0.07
SPCI	0.01	-0.08

Commodities beta, as achieved through passive exposure to a long-only commodities index, provides investors with defined exposure that has demonstrated diversification benefits and portfolio hedging characteristics. While active commodity strategies may produce better absolute or risk-adjusted returns, the concern for many investors is that there is no guarantee that a tactical commodity investment will provide these same diversification benefits. As noted by Beenen (2005), "[While] Commodities markets have properties that should make them more suitable for finding interesting alpha opportunities than other, more efficient, markets…The alpha positions should never be allowed to undermine the primary reason for the strategic investment to commodities – the diversification with other assets."

IV. Can combining passive and active commodity strategies maintain asset class characteristics while improving risk-adjusted returns?

It is clear that some investors want commodities beta within their whole portfolio, whether as a general diversifier to stock and bond holdings, a more specific hedge against market shocks or inflation, or even based on a macroeconomic outlook that anticipates commodity price increases. Despite the clear case that alpha opportunities exist in the asset class and that active commodities management can improve absolute or risk-adjusted returns, pure active exposure may not make sense for these investors. In this case, we wonder whether a combination of passive and active exposure can preserve the beneficial characteristics of the asset class while improving the risk/return profile.

Is passive commodities exposure compatible with active commodities exposure?

We think it first makes sense to assess the compatibility of passive and active commodities exposure as a hypothetical exercise in thinking about how different exposures between the two will interact.

In Exhibit 14, we see that monthly correlation between the active commodities portfolio and passive indexes over the 15 year period from 1991 – 2005 is fairly consistent among the indexes at approximately 0.50. More importantly, we find that the monthly correlation during positive periods for the indexes is generally in a similar range, but that it drops significantly during negative periods for the indexes. The tendency, then, is that active commodities exposure participates more in positive months than in negative months (similar to the collar-like profile discussed previously). This suggests some benefit may be achieved by adding an actively managed component to a passive commodities investment.

Exhibit 14:

Monthly Correlation Characteristics of Active Commodities Portfolio to Passive Commodity Indexes, 1991 - 2005

Index	Overall Correlation	Correlation When Index Up	Correlation When Index Down
DBLCI	0.43	0.55	0.23
DJ-AIG	0.54	0.44	0.29
GSCI	0.45	0.45	0.25
RJ-CRB	0.41	0.24	0.25
RICI	0.47	0.5	0.24
SPCI	0.5	0.47	0.32

While these correlation characteristics are favorable, we also speculate that active commodity returns are more linked to price changes than to roll yield. That is, we suspect that much of the positive correlation we see between the active portfolio and the indexes is a correlation to the price component of the index rather than the roll yield.

Intuitively, this makes sense, as active commodity traders tend to make tactical buy and sell decisions based upon short-term analysis of supply and demand fundamentals and the impact on commodity prices, both positive and negative. Term structure is, of course, a consideration (and even a primary driver in cases of relative value positions), but shorter-term trading is more likely to capitalize on directional price moves than static rolling of futures contracts. If this is true, it contributes to the compatibility of a combined passive and active approach, as passive exposure is ill-equipped to capitalize on price changes within the mean-reverting commodity markets and may have difficulty capturing price-based returns even in a bullish environment depending upon the shape of the futures curve.

What Beta Source is Best . . . for Me?

While differences among the various commodity indexes are discussed at length in Akey (2005), the selection of a commodity beta source may be simplified by deciding between an energy-concentrated index (namely the GSCI) and a more diversified index (all others). 2006 sector base weights appear in Exhibit 15. For comparative review, 2006 individual market weightings appear in Appendix B.

Exhibit 15:

Approximate Sector Base Weightings of Commodity Indexes, 2006

	DBLCI	DJ-AIG	GSCI	RJ-CRB	RICI	SPCI
Metals	22.50%	26.31%	8.89%	20.00%	21.10%	7.06%
Energy	55.00%	33.00%	74.57%	39.00%	44.00%	53.34%
Agriculturals	22.50%	31.62%	13.26%	20.00%	22.94%	25.93%
Softs	0.00%	9.06%	3.32%	21.00%	9.66%	13.69%
Exotics	0.00%	0.00%	0.00%	0.00%	2.30%	0.00%

With nearly three-fourths of its exposure to energy markets, the GSCI has a clear bias toward this sector. As the dominant market force in terms of assets, many investors obviously find the energy exposure to be beneficial.

Beenen (2005) summarizes much of the sentiment for those who favor the GSCI: "Many consider [the energy bias] as a major disadvantage of the GSCI. If the indices are viewed as stand-alone investments, they have a point… in the context [of the whole portfolio] we preferred the higher volatility of the GSCI. The paradox is that the GSCI, although more volatile in itself, reduced the volatility of the overall portfolio."

Beenen (2005) further clarifies his interest in energy, noting that energy has the clearest link to the global economy, and therefore implicitly supplies the best diversification with traditional assets; the roll return in energy is the highest when the market expects supply disruptions which often coincide with periods during which financial assets are not doing well and therefore adding to diversification; and that energy is a better hedge against geopolitical crises, among other reasons.

While we do not dispute the assessment of the energy sector as a better whole-portfolio diversifier, there are drawbacks to energy exposure as well. Passive exposure to energy in a geopolitical crisis may be positive on the upside, but recall the tendency for commodity prices to mean revert. The build-up of "war premium," in an energy-linked geopolitical crisis may be favorable to a passive energy investor, but the subsequent collapse may be far less pleasant (Looney [2003]). Kat and Oomen (2006) note that on January 17, 1991, crude oil dropped 40%, heating oil 39.1%, propane 38.9%, and gasoline 31% in a single day, following the US invasion of Iraq in Operation Desert Storm.

In addition, the preference for energy is in many cases based upon the historical tendency to contribute positive roll yields. As noted previously, the term structure of the crude market has recently inverted and is currently generating roll yield losses. While history suggests that energy markets will return to backwardation over time, some researchers have questioned whether the outlook for limited spare capacity has generated a structural break in these markets that will persist indefinitely.

While some may find that the GSCI provides a better commodity beta source for investors concerned with whole-portfolio characteristics and explicit hedging properties, an investor seeking improved risk characteristics or investing in commodities to capitalize on anticipated global consumption increases may find value in a more balanced index.

For example, if we compare the sector diversification of the indexes (Exhibit 15) with their volatility characteristics (Exhibits 2 and 3), we find that the more diversified the index, the lower its volatility and drawdown.

A diversified approach may also be suitable for investors seeking participation in the anticipated global consumption increases. The most widely noted rationale for a bullish commodity outlook is a prolonged, anticipated increase in demand from emerging economies like China and India. China's combination of population (1.3 billion people – approximately 300 million under age 30) and dearth of resources means that increasing demand for consumer goods and rapid industrialization will prompt a dizzying increase in raw materials consumption, in everything from lead and oil to corn and coffee.

Rogers (2004) uses automobiles as one example. In 2004, only 4% of the Chinese population had automobiles, but production of automobiles has increased from 750,000 in 2002 to 4 million in 2003. With 1.3 billion people, each 1% increase in per capita automobile ownership brings an additional 13 million automobiles to China. If automobile ownership in China grows to just 12% of the population, China will have more automobiles than the US (where cars number approximately 50% of the 290 million population). Any meaningful increase in automobile ownership in China will impact a wide range of commodities, from oil and corn (fuel and fuel additives) to lead (batteries), platinum (catalytic converters), and others.

The upshot is that consumption increases are not anticipated to be limited to the energy sector, so that a bias toward that sector in a beta source may ignore substantial gains to be made in other commodity markets.

While the leading diversified index in terms of assets is the Dow Jones-AIG Index, investors choosing from among the more balanced indexes have a wide array of product choices. The nuances among them are discussed at length in our previous work. However, for the sake of brevity, we will focus the balance of our discussion on the effects of combining passive and active commodities exposure using the GSCI and the DJ-AIG indexes.

V. Combined Passive and Active Commodities Portfolios

After choosing a beta source, the next step for investors considering combining passive and active commodities exposure is to determine the best mix of exposure. As with choosing a beta source, however, the *right* answer will vary from one investor to another depending upon reasons for investing in commodities, risk/return targets, etc. The following sections attempt to illustrate the effects of some sample combined portfolios that may be favorable in a given scenario, using the GSCI and DJ-AIG Indexes as the sources of passive exposure. The analysis generally considers the two standard timeframes used previously, the 15-year period from 1991 – 2005, and the more bullish period from 2002 – 2005.

Optimized Portfolios

Over the longer term timeframe, where the Active Commodity Portfolio out-performs the passive indexes on both an absolute and risk-adjusted basis (as outlined in Exhibit 6), mean variance optimization provides limited assistance in determining a mix of passive and active exposure. Over this timeframe, the Active Commodity Portfolio dominates any combined portfolio that is optimized for any factor (Sharpe ratio, lowest volatility, maximum return for any target volatility), garnering 100% of the allocation in every case but one. *See Exhibit 16*

Exhibit 16:

Optimized Passive/Active Portfolios, 1991 - 2005

	Sharpe Ratio	Lowest Volatility	Highest Return for 12% Annual Volatility
GSCI / Active	100% Active	100% Active	100% Active
DJ-AIG / Active	100% Active	33% Passive / 67% Active	100% Active

**In an asset class study on incorporating commodities into its portfolio, CalPERS (2006) uses 12% as an expected risk level for a commodity futures allocation*

For the shorter timeframe, as commodity index returns have increased in the bull market, the active portfolio continues to dominate combined portfolios that are optimized for risk factors. In this case the only exception to a 100% active allocation comes when maximizing returns for 12% annualized target volatility. *See Exhibit 17*

Exhibit 17:

Optimized Passive/Active Portfolios, 2002 - 2005

	Sharpe Ratio	Lowest Volatility	Highest Return for 12% Annual Volatility
GSCI / Active	100% Active	100% Active	40% Passive / 60% Active
DJ-AIG / Active	100% Active	100% Active	100% Active

Given the active commodity portfolio's clear out-performance of the passive indexes on a risk-adjusted basis, the dominance of active exposure in the optimized portfolios should come as no surprise. While the optimized portfolio samples offer little guidance to investors concerned with the hedging properties of the asset class (since they give no indication of portfolio performance relative to inflation or market shocks), they should provide some direction to investors seeking the best risk-adjusted or absolute return exposure to commodities independent of the whole portfolio: In these cases, a minimum of 60% active exposure may yield optimal results for a commodities allocation.

Combined Passive and Active Commodities Portfolios – Incremental

Our objective here is not to debate whether passive exposure is better than active, or vice versa, but rather to determine whether some degree of combined passive and active commodity exposure can maintain the favorable characteristics of the asset class but produce a better return profile. This is, after all, the concern of investors who do not have the luxury of thinking about commodities in isolation but instead must consider them within the context of the whole portfolio

In this case, the combined portfolios generated by mean-variance optimization (that favor the active component) are of little value. Our next step, then, is to create a series of combined portfolios that incrementally adjust the amounts of passive and active exposure. Our subsequent analysis will then consider the performance of these incremental passive/active portfolios in the context of a selection of portfolio hedging scenarios.

As discussed previously, we limit our passive exposure options to the GSCI and DJ-AIG Indexes. These indexes provide our 100% passive benchmarks. Our active commodities portfolio services as the 100% active component. To each of the passive indexes, we add active exposure in incremental amounts of 25%, so that our series of portfolios gradually moves from 100% passive to 100% active. Exhibits 18-19 demonstrate the risk and return characteristics of each of these portfolios over our selected 15-year timeframe. Exhibits 20-21 demonstrate the same characteristics over the shorter-term bullish period.

Exhibit 18:

Passive/Active Portfolios using GSCI, 1991 - 2005

Portfolio	Compound Annual Return	Annualized Standard Deviation	Sharpe Ratio	Worst Draw Down	Correlation to S&P 500
100% GSCI	6.88%	18.59%	0.16	-48.25%	-0.01
75% GSCI / 25% Active	10.23%	14.96%	0.43	-39.25%	0.03
50% GSCI / 50% Active	13.28%	11.72%	0.81	-29.69%	0.09
25% GSCI / 75% Active	16.07%	9.24%	1.32	-22.41%	0.17
100% Active	18.62%	8.21%	1.8	-16.58%	0.27

Exhibit 19:

Passive/Active Portfolios using DJ-AIG, 1991 - 2005

Portfolio	Compound Annual Return	Annualized Standard Deviation	Sharpe Ratio	Worst Draw Down	Correlation to S&P 500
100% DJ-AIG	7.78%	12.06%	0.33	-36.20%	0.08
75% DJ-AIG / 25% Active	10.63%	10.25%	0.66	-29.09%	0.13
50% DJ-AIG / 50% Active	13.39%	8.91%	1.07	-22.61%	0.18
25% DJ-AIG / 75% Active	16.04%	8.18%	1.49	-19.33%	0.23
100% Active	18.62%	8.21%	1.8	-16.58%	0.27

The incremental addition of active commodities exposure to each index produces similar results: Returns increase while risk characteristics decrease; however, correlation to equities also increases. Adding 50% active exposure to the DJ-AIG Index, for example, increases return by more than 70%, decreases volatility by 25%, decreases drawdown by almost 40%, and maintains limited correlation to equities.

Exhibit 20:

Passive/Active Portfolios using GSCI, 2002 - 2005

Portfolio	Compound Annual Return	Annualized Standard Deviation	Sharpe Ratio	Worst Draw Down	Correlation to S&P 500
100% GSCI	23.78%	22.27%	0.99	-19.66%	-0.17
75% GSCI / 25% Active	23.14%	17.92%	1.19	-15.53%	-0.13
50% GSCI / 50% Active	22.46%	13.56%	1.52	-11.05%	-0.06
25% GSCI / 75% Active	21.75%	9.47%	2.1	-6.17%	0.09
100% Active	20.99%	6.70%	2.86	-3.50%	0.38

Exhibit 21:

Passive/Active Portfolios using DJ-AIG, 2002 - 2005

Portfolio	Compound Annual Return	Annualized Standard Deviation	Sharpe Ratio	Worst Draw Down	Correlation to S&P 500
100% DJ-AIG	19.90%	13.43%	1.35	-8.12%	0.02
75% DJ-AIG / 25% Active	20.24%	11.30%	1.63	-6.40%	0.07
50% DJ-AIG / 50% Active	20.53%	9.35%	2	-5.10%	0.14
25% DJ-AIG / 75% Active	20.78%	7.72%	2.45	-3.80%	0.25
100% Active	20.99%	6.70%	2.86	-3.50%	0.38

During the bullish environment, the results of the incremental addition of active commodities exposure to each index are more mixed. In the case of the GSCI, absolute returns decrease a small amount when adding active exposure, but the commensurate reduction in volatility

improves risk-adjusted returns nearly threefold and decreases drawdown significantly. A portfolio that is comprised of 50% GSCI and 50% Active captures 95% of the upside but just 60% of the downside of a 100% passive portfolio, while maintaining negative correlation to the S&P 500.

In the case of the DJ-AIG, there is actually a minimal increase in returns when adding active exposure; reduction in volatility is less dramatic but the risk-adjusted returns still double.

The combined passive and active portfolios continue to support the idea that active exposure can improve a commodity portfolio's absolute or risk-adjusted returns. Performance of these combined portfolios will help to assess how a combined passive and active commodity portfolio performs in a whole-portfolio context.

Commodity Portfolios as a Hedge Against Equity Market Shocks

Recall that among others, Gorton and Rouwenhorst (2005) demonstrated limited to negative correlation of commodity returns relative to stocks and bonds and an overall correlation of commodities to stocks to be -0.06. These findings are consistent with those of the 100% passive portfolios illustrated above, and even with some of the combined portfolios. Perhaps more importantly for investors seeking relief from difficult equity markets, they also found that the diversification benefits persist during crashing equity markets, when non-correlation may be especially valuable (see Exhibit 8).

Exhibits 22 and 23 below consider the worst 5% of equity months for the period from 1991 - 2005; a total of nine months, though in three cases the months were consecutive so we consider a total of six periods, ordered by degree (rather than chronologically). The tables consider how the passive, active, and combined portfolios performed during these equity market crashes.

Exhibit 22:

Performance of Passive/Active Commodity Portfolios During Top 5% Worst Months of S&P 500, January 1991 – December 2005: GSCI Portfolios

	Aug-98	Sep-02	Feb-01 - Mar-01	Aug-01 - Sep-01	Nov-00	Jun-02 - Jul-02	Total
S&P 500	**-14.46%**	**-10.87%**	**-15.46%**	**-14.14%**	**-7.88%**	**-14.92%**	**-77.73%**
100% GSCI	-5.90%	4.57%	-5.32%	-10.00%	9.21%	4.01%	-3.43%
75% GSCI / 25% Active	-5.37%	3.53%	-3.63%	-7.78%	7.62%	2.34%	-3.29%
50% GSCI / 50% Active	-4.88%	2.43%	-2.01%	-5.80%	5.96%	0.65%	-3.65%
25% GSCI / 75% Active	-4.42%	1.26%	-0.14%	-4.01%	4.25%	-1.05%	-4.11%
100% Active	-3.99%	0.01%	1.03%	-2.40%	2.47%	-2.76%	-5.64%

Exhibit 23:

Performance of Passive/Active Commodity Portfolios During Top 5% Worst Months of S&P 500, January 1991 – December 2005: DJ-AIG Portfolios

	Aug-98	Sep-02	Feb-01 - Mar-01	Aug-01 - Sep-01	Nov-00	Jun-02 - Jul-02	Total
S&P 500	**-14.46%**	**-10.87%**	**-15.46%**	**-14.14%**	**-7.88%**	**-14.92%**	**-77.73%**
100% DJ-AIG	-6.34%	3.77%	-4.68%	-6.79%	8.04%	1.39%	-4.61%
75% DJ-AIG / 25% Active	-5.73%	2.88%	-2.21%	-5.56%	6.54%	0.36%	-3.72%
50% DJ-AIG / 50% Active	-5.14%	1.96%	-1.76%	-4.42%	5.12%	-0.68%	-4.92%
25% DJ-AIG / 75% Active	-4.16%	1.01%	-0.34%	-3.38%	3.76%	-1.71%	-4.82%
100% Active	-3.99%	0.01%	1.03%	-2.40%	2.47%	-2.76%	-5.64%

Looking first at the 100% passive portfolios the results here demonstrate, foremost, that commodities are *non-correlated* to difficult equity environments, as opposed to *negatively* correlated. In some periods, like November 2000, commodity exposure provided a hedge to equities; in others, like August 1998, it did not. This distinction is an important one to make, because it indicates that commodities are not a perfect hedge to equity shocks. In the aggregate, passive commodity exposure significantly out-performed equities during these periods, yet still produced negative total return.

We also note that the diversified DJ-AIG Index performs substantially similar to the energy-biased GSCI over the course of these months. This challenges the broad idea that the dominance of energy exposure in the GSCI makes it a better hedge for general equity market crises. While a GSCI allocation may out-perform in environments where the geopolitical crisis is energy-linked, the results in Exhibit 23 caution investors against making the unilateral assumption that an energy-biased commodity investment will provide a materially better hedge in periods when equity markets struggle.

That said, the combined active/passive portfolios produce mixed results in terms of enhancing or detracting from pure passive exposure during these equity shocks. In June-July 2002, adding active exposure incrementally worsened results; in February-March 2001, incremental additions of active exposure improved results. In the aggregate, adding incremental amounts of active exposure had only a small impact on the hedging characteristics of the commodities portfolios during these equity market environments.

Isolated equity market shocks are one area of concern to investors, but they may also worry about performance during extended equity market downturns. In Exhibit 24, we consider the combined active/passive commodity portfolios during the worst S&P 500 drawdown since 1991, an extended period of more than two years when the S&P 500 produced a total return of -42.22%.

Exhibit 24:
Performance of Passive/Active Commodity Portfolios During Worst S&P 500 drawdown, January 1991 – December 2005

	Total Return, September 2000 - September 2002
S&P 500	**-44.73%**
100% GSCI	-7.88%
75% GSCI / 25% Active	2.90%
50% GSCI / 50% Active	12.70%
25% GSCI / 75% Active	21.50%
100% Active	29.29%
S&P 500	**-44.73%**
100% DJ-AIG	5.25%
75% DJ-AIG / 25% Active	12.04%
50% DJ-AIG / 50% Active	18.31%
25% DJ-AIG / 75% Active	24.06%
100% Active	29.29%

Over this extended period, we find that while the passive commodity indexes did substantially out-perform equity markets, adding incremental amounts of active exposure produced a dramatically better hedge, adding significant returns to each passive index. We also note that the diversified DJ – AIG Index out-performed the energy-biased GSCI during the period, further challenging the idea that a commodity investment dominated by energy is the best solution for those investors seeking an equity hedge.

Commodity Portfolios as a Hedge Against Inflation

The impact of adding active commodity exposure to passive and its effect on inflation hedging characteristics is bit more difficult, for two reasons. First, we have not experienced an inflationary environment of any magnitude in the last quarter-century and we do not have the luxury of backfilling our active data set to include information from the 1970s. Second, the very nature of passive commodities' ability to hedge against inflation is somewhat in dispute.

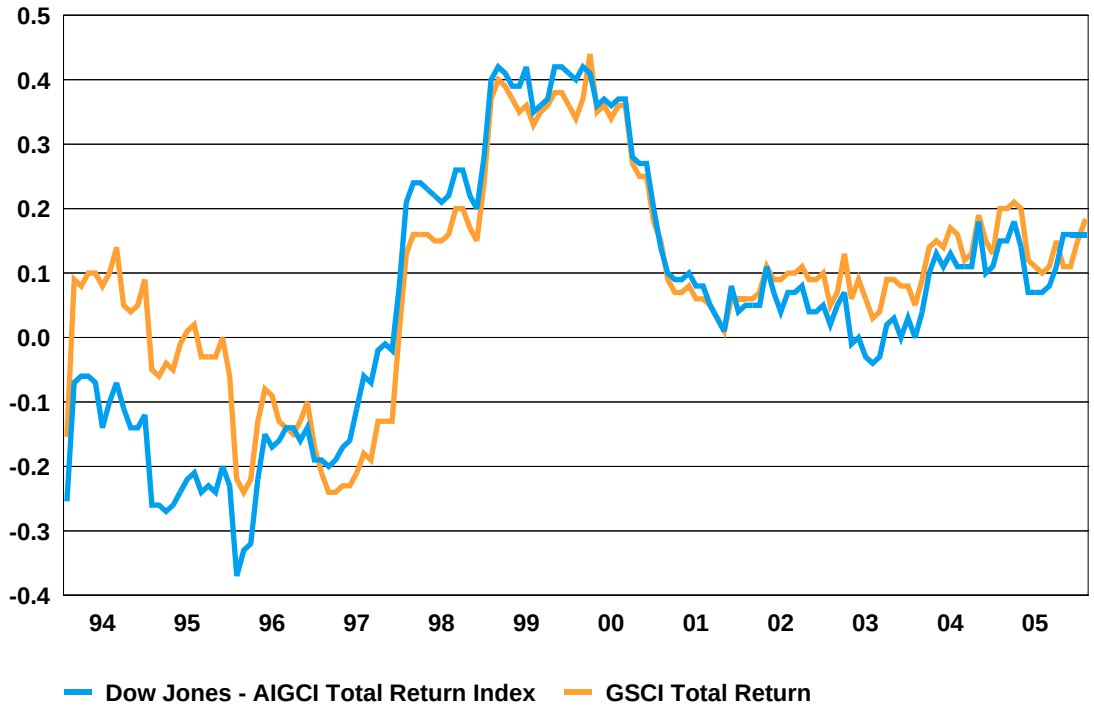
Those promoting the inflation hedging properties of commodities tend to cite Gorton and Rouwenhorst (as we did in Exhibit 9), demonstrating that over a 5-year rolling period their passive commodity futures portfolio demonstrated a correlation to inflation of just over 0.40. While this relationship is clearly more meaningful (and beneficial) than the negative correlation between stocks or bonds and inflation, we find the enthusiasm for a 0.40 correlation a bit mystifying; particularly when other researchers, among them Erb and Harvey (2006), suggest "it is hard to find empirical evidence that all commodity futures are good inflation hedges or that the average commodity futures is a good inflation hedge."

Singer (2006) notes that conventional wisdom suggests commodities investments provide a hedge against inflation, but finds that in reality they are a very inexact and unstable hedge. The hedge is inexact due to the mismatch between the basket of wide-ranging goods and services that make up a measurement of inflation and the relatively small basket of raw materials that make up the typical commodity index. While he notes a link between the two – at times – the differences

between the two baskets contribute to a nexus that is inconsistent at best. Singer demonstrates this by illustrating the rolling 3-year correlation of the GSCI to the CPI. At times, the correlation is high; at other times, the two are non- or negatively correlated.

Exhibit 25 illustrates the rolling 3-year correlation of the GSCI and DJ-AIG indexes to the CPI.

Exhibit 25:
Rolling 3-Year Correlation of GSCI and DJ-AIG Commodity Indexes to CPI, 1991 – 2005



While we find that the caveats that exist for investors looking to commodities as an inflation hedge are material, we proceed in reviewing how correlation characteristics between commodities and inflation may change through the incremental addition of actively managed commodities exposure. Exhibits 26 and 27 compare the correlation of passive, active, and combined portfolios to the CPI over our selected 15-year and bullish commodity market periods.

Exhibit 26:

Correlation of Passive/Active Commodity Portfolios During to Consumer Price Index, 1991-2005 and 2002-2005, GSCI Portfolios

	1991 - 2005			2002 - 2005		
Portfolio	**Correlation to Inflation (CPI)**	**Correlation When CPI Positive**	**Correlation When CPI Negative**	**Correlation to Inflation (CPI)**	**Correlation When CPI Positive**	**Correlation When CPI Negative**
100% GSCI	0.12	0.12	0.21	0.19	0.17	0.44
75% GSCI / 25% Active	0.11	0.12	0.21	0.17	0.17	0.44
50% GSCI / 50% Active	0.09	0.13	0.22	0.13	0.18	0.43
25% GSCI / 75% Active	0.06	0.12	0.2	0.06	0.19	0.4
100% Active	0	0.1	0.14	-0.09	0.17	0.25

Exhibit 27:

Correlation of Passive/Active Commodity Portfolios During to Consumer Price Index, 1991-2005 and 2002-2005, DJ-AIG Portfolios

	1991 - 2005			2002 - 2005		
Portfolio	**Correlation to Inflation (CPI)**	**Correlation When CPI Positive**	**Correlation When CPI Negative**	**Correlation to Inflation (CPI)**	**Correlation When CPI Positive**	**Correlation When CPI Negative**
100% DJ-AIG	0.11	0.18	0.18	0.18	0.28	0.36
75% DJ-AIG / 25% Active	0.09	0.18	0.18	0.15	0.28	0.35
50% DJ-AIG / 50% Active	0.07	0.17	0.18	0.1	0.26	0.33
25% DJ-AIG / 75% Active	0.04	0.14	0.16	0.02	0.23	0.3
100% Active	0	0.1	0.14	-0.09	0.17	0.25

Looking at the overall correlation characteristics, the data shows that adding incremental amounts of active exposure does decrease the correlation of each passive index to inflation, in both the long- and short-term timeframes. We would emphasize again that data here illustrates that commodities are *non-correlated* to inflation, and continue to be *non-correlated* with the addition of active exposure.

When we break out correlation by positive and negative inflationary periods, the data suggests that correlation characteristics between passive and active exposure remain more constant in periods of positive inflation, and decreases during periods of negative inflation. This distinction is important for investors seeking positive correlation during periods of positive inflation.

In summary, adding incremental amounts of active management to passive commodity exposure has only a small effect on commodities' overall correlation to inflation; however, much of the decrease in correlation appears to come in negative inflation periods. Positive correlation to inflation during positive inflation months largely persists when adding incremental amounts of active exposure.

Summary and Conclusions

Commodity indexes continue to grow in popularity as the asset class enjoys a bull market for a wide array of natural resources. Furthermore, academic interest in the asset class continues to promote the suitability of commodities for investor portfolios – as a stand-alone return source, diversifier, or both. But with increased popularity comes increased scrutiny.

In this paper we outline some of the limitations facing commodity investors who may access the asset class via a passive, long-only index approach. We further demonstrate that many of these limitations persist, even within the present secular bull market.

We find that a tactical approach to commodities (demonstrated through an index of active commodity trading advisors and natural resources hedge funds) may enable investors to achieve commodity returns that are superior to those of passive investments, on both an absolute and risk-adjusted basis.

In addition, we demonstrate that an active approach may provide exposure that complements a long-only, passive investment in commodities. This complementary exposure may allow investors to not only enhance the absolute or risk-adjusted return profile available from their commodities exposure, but to do so without meaningful degradation of key whole portfolio diversification characteristics of a passive-only approach. Investors may find that adding incremental amounts of active exposure to a passive commodity investment – or committing entirely to active management – may produce a commodity allocation that is both a high risk-adjusted return source and a portfolio hedge.

Appendix A: Comparative Matrix of Key Commodity Index Construction Methodology

	Reuters - CRB	DBLCI	Goldman Sachs	Dow Jones - AIG	Rogers' Raw Materials	Standard & Poors
Inception of Backfilled Data	Jan-82	Dec-88	Jan-69	Jan-91	Jan-84	Jan-70
Inception of Investable Component	1986 (Month not noted)	Feb-03	Jul-92	Jul-98	Aug-98	Aug-01
Number of Underlying Markets	17	6	24	19	35	17
How Underlying Markets are Selected	Attempts to create broad measure of overall commodity price trends	Selects the most liquid markets from each respective sector	Based on world production. Must meet liquidity requirements	Relies primarily on liquidity data, along with dollar-adjusted production data	Attempts to create a true "worldwide commodity index"	Only "consumed" commodities so excludes gold
How Underlying Markets are Weighted	Evenly Weighted	Attempts to be broadly consistent with global production, usage, and stocks	World-production weighted; determined by average quantity of production in last five years	Primarily based on liquidity over most recently available five years ... considers U.S.dollar-weighted production data and other factors	Based generally on world consumption patterns for raw materials	Based on commercial open interest; adjusts for double counting upstream/downstream commodities (Eg, Corn - Cattle)
Domestic / International Commodities	International	International	International	International	International	Domestic Only
Diversification Constraints	None	None	None	33% sector max; 2% market minimum	None	None
Most Recent Change in Markets / Weightings	1995	2004	2005	2005	2004	2005
Futures Price Considered for Index Calculation	Arithmetic average of contract months expiring w/in 6 months of current date; min. 2, max. 5 contracts	Nearest month for Metals and Ags; following December for Energy	Nearest month with adequate liquidity	Nearby futures contract	Nearby futures contract, not in delivery or notice period	Average of the 2 nearest active contract months that are not in delivery
How Index is Calculated	Geometric average of each market's average price	Arithmetic average of each market's price	Arithmetic average of each market's price	Arithmetic average of each market's price	Arithmetic average of each market's price	Geometric average of each market's price
Key Uniquenesses	Equal Weighting; Considers 'farthest out' futures; Geometric Averaging	Energy rolled monthly; metals and ags rolled annually each December; only 6 markets	Production based average brings energy bias; can be 75% or more of portfolio	Emphasis on liquidity for weighting; diversification rules	Most diversified; most subjective; most "exotics"; highest exposure to a single market (35% in crude oil)	Excludes Gold; adjustment for "double counting"

Appendix B: Comparative Matrix of 2006 Commodity Index Market Base Weightings

		CRB	DBLCI	DJ-AIG	GSCI	RRM	S&P
Metals	Aluminum		12.50%	7.06%	3.31%	4.00%	
	Copper	5.88%		5.89%	2.42%	4.00%	3.50%
	Gold	5.88%	10.00%	5.98%	2.12%	3.00%	
	Lead				0.31%	2.00%	
	Nickel			2.61%	0.93%	1.00%	
	Palladium					0.30%	
	Platinum	5.88%				1.80%	
	Silver	5.88%		2.00%	0.23%	2.00%	3.78%
	Tin					1.00%	
	Zinc			2.69%	0.57%	2.00%	
Sector Total		**23.52%**	**22.50%**	**26.23%**	**9.89%**	**21.10%**	**7.28%**
Energy	Brent Crude Oil				11.75%		
	Crude Oil	5.88%	35.00%	12.81%	25.79%	35.00%	9.74%
	GasOil				3.83%		
	Heating Oil	5.88%	20.00%	3.85%	7.14%	3.00%	11.49%
	Natural Gas	5.88%		12.28%	10.29%	3.00%	17.65%
	Unleaded Gas			4.05%	7.90%	3.00%	10.32%
Sector Total		**17.64%**	**55.00%**	**32.99%**	**66.70%**	**44.00%**	**49.20%**
Ags	Azuki					1.00%	
	Barley					0.77%	
	Canola					0.67%	
	Corn	5.88%	11.25%	5.94%	4.11%	4.00%	4.96%
	Feeder Cattle				0.90%		
	Lean Hogs	5.88%		4.39%	2.39%	1.00%	1.78%
	Live Cattle	5.88%		6.15%	3.74%	2.00%	5.03%
	Oats					0.50%	
	Rice					2.00%	
	Soybean Meal					0.15%	3.81%
	Soybean Oil			2.67%		2.00%	3.90%
	Soybeans	5.88%		7.60%	3.01%	3.00%	4.79%
	Wheat	5.88%	11.25%	4.87%	5.28%	7.00%	5.05%
Sector Total		**29.40%**	**22.50%**	**31.62%**	**19.43%**	**24.09%**	**29.32%**
Softs	Orange Juic	5.88%				0.66%	
	Cocoa	5.88%			0.30%	1.00%	3.27%
	Coffee	5.88%		3.02%	0.68%	2.00%	3.36%
	Cotton	5.88%		3.23%	1.74%	3.00%	4.18%
	Sugar	5.88%		2.93%	1.26%	1.00%	3.39%
Sector Total		**29.40%**	**0.00%**	**9.18%**	**3.98%**	**7.66%**	**14.20%**
Exotics	Lumber					1.00%	
	Rubber					1.00%	
	Silk					0.15%	
	Wool					1.00%	
Sector Total		**0.00%**	**0.00%**	**0.00%**	**0.00%**	**3.15%**	**0.00%**
TOTALS		**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

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