



**ALTERNATIVE
INVESTMENT ANALYTICS**

THE BENEFITS OF COMMODITY INVESTMENT

AIA RESEARCH REPORT

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THE BENEFITS OF COMMODITY INVESTMENT

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THE BENEFITS OF COMMODITY INVESTMENT

1. Introduction

Direct commodity investment has historically been a small part of investors' overall asset allocation. Owning equity or debt issued by firms specializing in commodity markets was the principal means of obtaining commodity exposure. In recent years, however, the number and variety of commodity-linked investments that offer direct exposure to commodity markets has increased.

The purpose of this study is to briefly review the theoretical arguments for the risk and return advantages of commodity investment. In addition, we offer empirical results on the relative performance of three investable commodity indices: the Bache Commodity index (BCI), the Dow Jones-AIG Commodity Index (DJAIG), and the S&P GSCI Commodity Index (SPGSCI), and the performance of these commodity indices compared with traditional and alternative investments. Results indicate that commodity indices have sources of risk and return that are distinct from traditional assets like stocks and bonds, or alternative investments such as hedge funds and commodity trading advisors (CTAs), and therefore offer investors an important additional area of diversification.

We report on the relationship between the commodity indices and inflation, and the relationship between commodity indices and commodity-based equity investments. Results indicate a positive correlation between the commodity indices and inflation, as well as with changes in inflation. Results also show that direct investment in the equity of commodity-based firms does not offer a direct alternative to commodity index investment. Lastly, commodity indices are shown to offer benefits in periods of extreme negative equity returns. Recent performance of commodity indices and traditional and alternative investments is discussed in the final section.

2. Commodity Indices

Commodity indices are designed to capture the returns to holding long positions in agriculture, metals, energy, or livestock. In the past decade, a number of investable commodity indices have been created which are based on commodity futures market prices, rather than the prices of the underlying commodities. The cost of storage for commodities can be substantial, so using futures markets to gain exposure to commodity markets enables investors to avoid these carrying costs. Additionally, only a few investment products hold and store physical commodities, primarily in the precious metals markets. There are, of course, some limitations in investable commodity indices. For instance, not all commodities have futures markets, so it is not possible to construct a fully

representative commodity index using only futures markets. However, the benefit of using futures markets outweighs the restrictions in most cases.

Commodity indices also differ in a number of ways. These include variations in commodity selection criteria and weighting schemes, as well as operational issues such as rolling mechanism and rebalancing strategy. Three investable benchmark commodity indices were selected for analysis.¹ A brief description of each follows.

Dow Jones-AIG Commodity Index: The DJAIG is a quantity-based commodity index that predefines a set of criteria to prevent any sector from being dominant in the index. It limits the maximum weight of any commodity to 15% of the index, any sector to 33% of the index, and any commodity along with its downstream products to 25% of the index. In 2008, this index held 19 commodity futures of which six are agricultural products, four are energy products, three are industrial metals, two are precious metals, and two are livestock products. A combination of liquidity and production measures is used to assign weights to individual commodities. Liquidity has twice as much influence as production in deciding the overall weights. Use of the production data has the drawback of underweighting commodities like gold that are storable over a longer time horizon. DJAIG data prior to 1998 are pro forma.

S&P GSCI: The SPGSCI is a quantity-based world production-weighted index that in 2008 held six energy products, five industrial metals, eight agricultural products, three livestock products and two precious metals. The index has the flexibility to hold any number of contracts as long as the particular contract meets the liquidity criteria. Contracts are weighted by the average worldwide production in the last five years of available data. The SPGSCI is dominated by energy with around 75% of its weight assigned to the energy sector at the beginning of the year 2008. There is also a series of indices that use the same convention and hold the same components as the SPGSCI but vary allocation to the energy sector. SPGSCI data prior to 1991 are pro forma.

Bache Commodity Index: The primary objective of the BCI is to provide broad-based exposure to global commodity markets, with low turnover and strong risk-adjusted returns resulting from multiple return factors. The BCI employs dynamic asset allocation strategy based on the price momentum of individual commodity markets. This approach to index construction may help reduce transaction costs and turnover, and may increase the risk-adjusted return. This index also incorporates a relative roll strategy that is similar to a synthetic spread trade, which will be profitable if the price of the contract closest to expiration falls in price relative to the longer maturity contracts. With the addition of Gas Oil in Feb 2008, the BCI comprises 19 commodities that are traded on seven major futures exchanges located in the United States and the United Kingdom. Commodities in the index are chosen based on their importance to the global economy, and on the basis of liquidity measures. The BCI also focuses on commodity markets that have been determined to have potential as a hedge against inflation, and low correlation with traditional assets. The BCI is designed so that the index does not become dominated by a single commodity sector or by several commodities, through employing upper and lower bounds on the market and commodity weights, and by frequent rebalancing. BCI data prior to 2007 are pro forma.

¹ For a review of the characteristics of commodity indices, see Schneeweis et al., 2007.

3. Source of Returns to Commodity Investment

Academic research has examined the economic determinants of returns to commodity investment. For example, Fama and French (1988) and Schneeweis, Spurgin, and Georgiev (2000) identified a strong business cycle component in the variation of spot and futures prices of industrial metals. Fama and French (1987, 1988) perform tests of the theory of storage and present empirical evidence that shows that in periods of increasing volatility and risk, convenience yields increase for metals prices. The theory of storage describes the difference between the futures price and the spot price of a commodity as having three main components: storage costs, interest costs, and the convenience yield on the inventory. Convenience yield reflects an embedded consumption option. The theory further predicts an inverse relationship between the level of inventories and convenience yield: At low inventory levels convenience yields are high, and vice versa.² A related implication is that the volatility of contracts that are close to expiration is higher than the volatility of long-maturity contracts. This variation in volatility, which is sometimes called the Samuelson effect, is due to the expectation that supply and demand forces for the underlying commodity will fall into equilibrium at longer horizons.³

Litzenberger and Rabinowitz (1995) observe that oil futures prices are often below spot prices, or that oil futures markets are backwardated. Litzenberger and Rabinowitz explain this phenomenon by assuming the existence of real options. They show that production occurs only if discounted futures prices are below spot prices. Backwardation emerges if the volatility of prices is sufficiently high. A major consequence of a declining term structure of forward prices for investment in commodity futures is the opportunity to capture a positive roll return as investment in expiring contracts is moved, or rolled, to lower-priced new outstanding contracts.⁴

4. Historical Performance of Commodity Indices

Results in Exhibit 1 show the risk and return performance of three commodity indices and a number of asset-class benchmarks over the period 1991-2008. Benchmarks for traditional investments include the S&P 500 Index (S&P 500), the MSCI World Equity Index (MSCI), the Lehman U.S. Aggregate Bond Index (Lehman U.S. Bond), and the Lehman Global Bond Index (Lehman Global Bond). Alternative investment benchmarks are the CASAM/CISDM Equally Weighted Hedge Fund Index (CISDM Hedge Fund) and the CASAM/CISDM Equally Weighted CTA Index (CISDM CTA) published by the Center for International Securities and Derivatives Markets (CISDM) at the University of Massachusetts. Performance measures in Exhibit 1 include the annual return and standard deviation, the Sharpe ratio, the largest peak-to-trough drawdown during the period, and the correlation with the three commodity indices.

Results indicate that there is a wide variation in returns for the commodity indices (BCI 10.3%, SPGSCI 2.8%, DJ-AIG 4.9%), although the returns are highly correlated (the SPGSCI and the DJAIG have correlations with the BCI of 0.94 and 0.92, respectively). Results in Exhibit 1 also show that

² For a recent discussion on commodity return decomposition and expectations see Erb and Harvey (2005).

³ For a discussion of the impact of storage on commodity futures pricing see Williams and Wright (1991).

⁴ For a recent discussion of pricing and modeling commodities and commodity derivatives returns, see Geman (2005).

the correlation of the three commodity indices with traditional (stock and bond indices) and alternative (hedge fund and CTA) asset benchmarks are between 0.01 and 0.27. Exhibit 2 shows the risk/return tradeoff for each of the indices. This exhibit shows that the SPGSCI had the lowest return over this period, and the DJAIG returned less than the bond indices. The BCI had a higher return but lower risk than the S&P 500 equity index.

Exhibit 1

Index Performance Jan 1991 to Dec 2008						
Commodity Index Performance	BCI	SPGSCI	DJ-AIG			
Annualized Total Return*	10.3%	2.8%	4.9%			
Annualized St. Dev.	12.8%	21.0%	14.5%			
Sharpe Ratio	0.49	0.03	0.10			
Maximum Drawdown	-31.4%	-62.2%	-49.4%			
Correlation with BCI	1.00	0.94	0.92			
Correlation with SPGSCI	0.94	1.00	0.90			
Correlation with DJ-AIG	0.92	0.90	1.00			

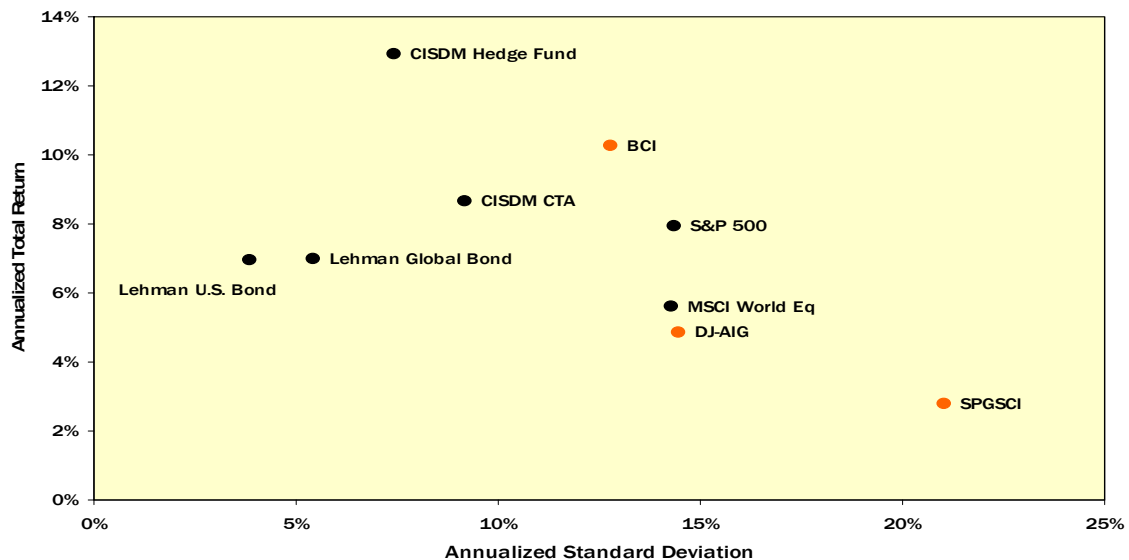
U.S. and Global Stock and Bond Index Performance	S&P 500	Lehman U.S. Bond	MSCI World Eq	Lehman Global Bond	CISDM Hedge Fund	CISDM CTA
Annualized Total Return**	7.9%	7.0%	5.6%	7.0%	12.9%	8.7%
Annualized St. Dev.	14.4%	3.9%	14.3%	5.4%	7.4%	9.2%
Sharpe Ratio	0.30	0.65	0.15	0.47	1.10	0.48
Maximum Drawdown	-44.7%	-5.1%	-46.8%	-10.1%	-21.1%	-9.4%
Correlation with BCI	0.09	0.01	0.19	0.11	0.27	0.22
Correlation with SPGSCI	0.12	0.03	0.21	0.12	0.31	0.14
Correlation with DJ-AIG	0.19	0.05	0.29	0.18	0.36	0.20

* Total Return Indices include the return of 91-day Treasury Bill yield.

** Includes reinvestment of dividends and interests. CISDM Indices are net of manager fees.

Exhibit 2

Risk and Return for Asset Class Benchmarks 1991-2008

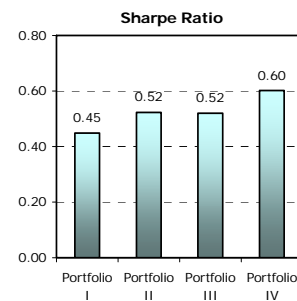


Analysis of these portfolios indicates the benefit of adding the commodities to portfolios of traditional assets or traditional/alternative investments. For U.S. investments, in each case in which the commodity index is added, the return-to-risk ratio (Sharpe ratio) increased and the maximum drawdown decreased. Of the four U.S.-based portfolios, the portfolio with the highest return and lowest volatility is Portfolio IV. Portfolio IV also experienced the smallest peak-to-trough drawdown. The lower panel of Exhibit 3 shows the impact of adding commodities to a global stock and bond portfolio and to a global traditional/alternative investment portfolio. The resulting return and risk benefits are similar to the U.S. results.

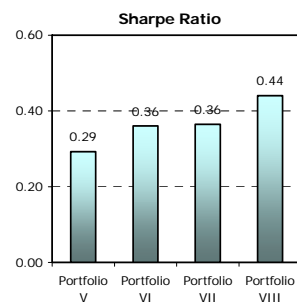
Exhibit 3

Multiple Asset Class Portfolio Performance Jan 1991 to Dec 2008

	<i>Portfolio I</i>	<i>Portfolio II</i>	<i>Portfolio III</i>	<i>Portfolio IV</i>
U.S. Portfolios	Equal Weights S&P 500 and Lehman U.S. Bond	90% Portfolio I and 10% BCI	90% Portfolio I, 5% HF, 5% CTA	80% Portfolio I, 10% BCI, 5% HF, 5%CTA
Annualized Returns	7.7%	8.1%	8.1%	8.4%
Annualized St. Dev	7.6%	7.1%	7.1%	6.6%
Sharpe Ratio	0.45	0.52	0.52	0.60
Maximum Drawdown	-21.0%	-19.5%	-19.1%	-18.2%
Correlation BCI	0.09	0.26	0.11	0.30



	<i>Portfolio V</i>	<i>Portfolio VI</i>	<i>Portfolio VII</i>	<i>Portfolio VIII</i>
Global Portfolios	Equal Wt MSCI and Lehman Global	90% Portfolio V and 10% BCI	90% Portfolio V, 5% HF, 5% CTA	80% Portfolio V, 10% BCI, 5% HF, 5%CTA
Annualized Returns	6.6%	7.0%	7.0%	7.5%
Annualized St. Dev	8.1%	7.7%	7.6%	7.2%
Sharpe Ratio	0.29	0.36	0.36	0.44
Maximum Drawdown	-25.4%	-24.3%	-23.2%	-22.6%
Correlation BCI	0.20	0.36	0.22	0.39



5. The Relationship between Commodity Indices and Inflation

A significant part of the benefit of direct commodity investment is said to derive from unique fluctuations in commodity values as a function of shifting economic forces. One such aspect of the return process of commodities is that commodity cash prices may benefit during periods of inflation as well as changes in inflation, whereas stocks and bonds may suffer. This is demonstrated by calculating the correlation of index returns with U.S. inflation⁵ and changes in inflation. Using quarterly data, Exhibit 4 suggests that there is a positive correlation between commodity indices and inflation, as well as changes in inflation. The correlation between the commodity indices and inflation ranges between 0.57 and 0.64. The correlation between the commodity indices and changes in inflation ranges between 0.50 and 0.54. Investors seeking

⁵ The inflation rate is based on the percentage change of the U.S. All-Urban Consumer Price Index (CPIU).

inflation protection should understand that broad commodity indices are not the only method of hedging inflation exposure. It should be noted that some commodity sectors may also offer better protection against inflation than others. In Exhibit 4, the commodity sector with the greatest correlation with inflation and with changes in inflation is energy. There is little evidence of a significant correlation between the agriculture, precious metals, or industrial metals components and inflation. There is also no evidence that stocks or alternative investments offer inflation protection. None of the alternative investment indices report significant correlations with inflation or changes in inflation, and the S&P 500 and Lehman bond indices report low or negative correlations.

Exhibit 4

Inflation Factor Correlations (1995 to 2008)

	Quarterly Inflation Rate	Change in Quarterly Inflation Rate
Commodity Indices		
BCI Total Return Index	0.57	0.50
SPGSCI Total Return Index	0.64	0.54
DJ-AIG Total Return Index	0.59	0.51
Asset Class Benchmarks		
S&P 500	0.13	0.18
Lehman Gov./Corp. Bond	(0.35)	(0.27)
Lehman High Yield	0.31	0.34
CISDM Hedge Fund	0.24	0.30
CISDM CTA	(0.20)	(0.19)
Agriculture		
BCI Agriculture Sector	0.22	0.18
S&P 500 Agricultural Products Index	(0.15)	(0.01)
Energy		
BCI Energy Sector	0.54	0.48
S&P 500 Energy Index	0.39	0.44
Industrial Metals		
BCI Industrial Metals Sector	0.27	0.20
S&P 500 Diversified Metals & Mining Index	0.27	0.30
Precious Metals		
BCI Precious Metals Sector	0.13	0.13
S&P 500 Gold Index	0.02	0.06

The correlation between commodity sector indices and inflation is generally higher than for commodity-based equity sector indices. This indicates that owning commodity-based equities may not provide the same degree of inflation protection as owning the underlying commodities.

6. Direct Equity Investment

It is often argued that the benefits of commodity investment may also be accessed through direct investment in commodity-related securities, like stocks or bonds. Exhibit 5 shows that direct investments into equity securities that specialize in particular commodity sectors generally have only moderate correlations with the commodity index. For instance, the correlation between the energy component, and the S&P 500 Energy Index, the S&P 500 Oil and Gas Drilling Index, and the S&P 500 Oil & Gas Exploration & Production Index are below 0.60. Similarly, the correlation between the metals components and the related S&P sector indices are below 0.60. Lastly, the correlation between the agriculture component and S&P 500 food and agriculture sector indices are below 0.10. This correlation is especially low because the returns of the S&P 500 food and agriculture sector indices result primarily from direct sales of manufactured products rather than the underlying commodities themselves. The less-than-perfect correlation between the commodity sectors and comparable equity indices indicates that equity investment provides less-than-full exposure to direct commodity investment.

Exhibit 5

Commodity Sector Returns vs Equity Sector Returns (1995 to 2008)

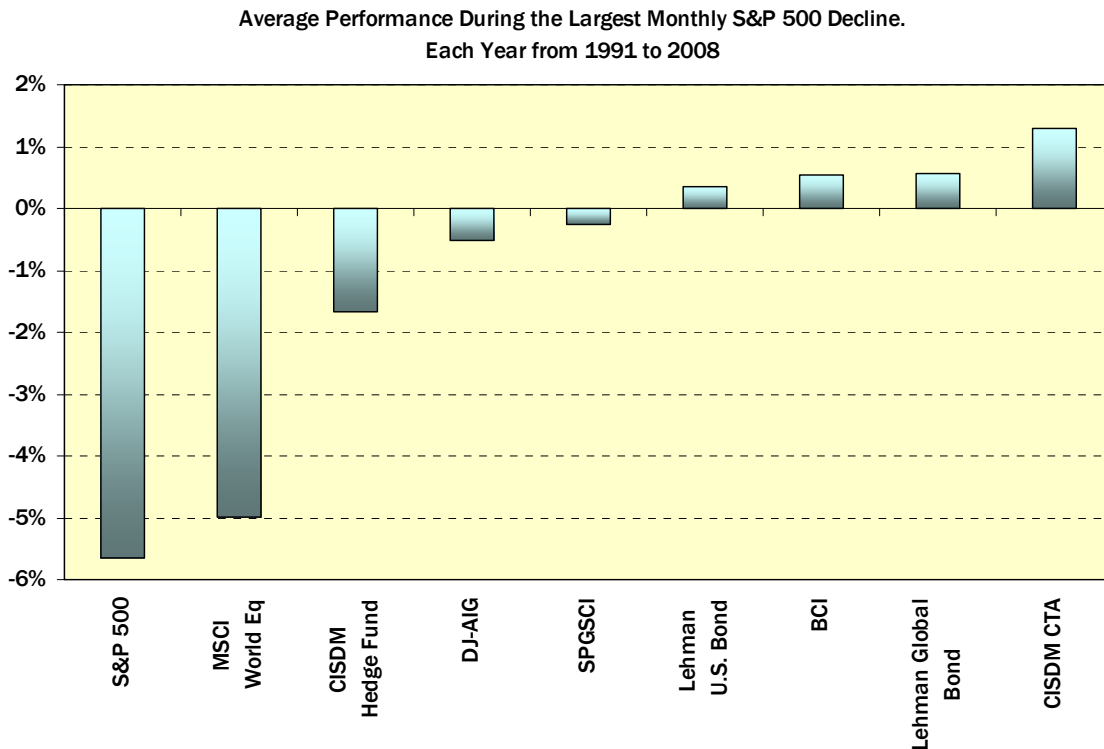
	Annual Return	Standard Deviation	Sharpe Ratio	Maximum Drawdown	Correlation with BCI Sector
Energy					
BCI Energy Sector	17.0%	24.9%	0.58	-40%	1.00
S&P 500 Energy Index	10.1%	19.2%	0.38	-41%	0.47
S&P 500 Oil & Gas Drilling Index	8.3%	40.6%	0.29	-71%	0.48
S&P 500 Oil & Gas Exploration & Production Index	9.1%	30.2%	0.30	-52%	0.55
Base Metals					
BCI Industrial Metals Sector	10.2%	19.0%	0.38	-33%	1.00
S&P 500 Diversified Metals & Mining Index	2.8%	39.3%	0.17	-79%	0.57
Agriculture					
BCI Agriculture Sector	4.2%	10.4%	0.03	-27%	1.00
S&P 500 Food Retail Index	-0.3%	19.8%	(0.13)	-66%	0.04
S&P 500 Food Distribution Index	7.5%	20.5%	0.25	-42%	0.08
S&P 500 Agriculture Products Index	12.2%	30.5%	0.39	-55%	0.09
Precious Metals					
BCI Precious Metals	4.7%	11.9%	0.08	-27%	1.00
S&P 500 Gold Index	-0.3%	38.0%	0.06	-71%	0.62
AMEX Gold Bugs Index	4.7%	39.9%	0.20	-82%	0.71

7. Performance in Extreme Market Environments

Commodity indices may provide diversification benefits during periods of stress in global equity markets. In Exhibit 6, the largest monthly decline for the S&P 500 during each calendar year is identified from the sample period 1991-2008. The average performance of each of the three commodity indices is calculated during those months. As shown in Exhibit 6, each of the three commodity indices and the CISDM CTA index, the Lehman U.S. Bond index, and the Lehman Global Bond index outperformed on average during the month in each year that the S&P 500 had its worst performance.

In contrast, global equities and hedge funds declined significantly more on average during the month in which the S&P 500 experienced the greatest decline in each year. This is consistent with previous research that indicates that asset classes that have exposure to equity markets perform relatively well when equity markets perform well, and perform relatively poorly when equity markets perform poorly.

Exhibit 6



8. Recent Performance of Commodity and Sector Indices

Results in Exhibit 7 show the risk and return performance of three commodity indices and a number of asset-class benchmarks over the most recent eight-year period 2001-2008, as well as analysis of the benefit of adding commodities to portfolios of traditional assets and alternative investments.

Similar to the results shown in Exhibit 1, portfolios that contain commodities have the highest Sharpe ratios. Again, similar to the results in Exhibit 1, the correlations among the BCI, SPGSCI, and DJAIG investable commodity indices are at or above 0.90.

Exhibit 7

Index Performance Jan 2001 to Dec 2008						
Commodity Index Performance	BCI	SPGSCI	DJ-AIG			
Annualized Total Return*	8.9%	-0.5%	3.0%			
Annualized St. Dev.	14.8%	25.6%	17.7%			
Sharpe Ratio	0.43	-0.01	0.08			
Maximum Drawdown	-31.4%	-62.2%	-49.4%			
Correlation with BCI	1.00	0.95	0.93			
Correlation with SPGSCI	0.95	1.00	0.90			
Correlation with DJ-AIG	0.93	0.90	1.00			

U.S. and Global Stock and Bond Index Performance	S&P 500	Lehman U.S. Bond	MSCI World Eq	Lehman Global Bond	CISDM Hedge Fund	CISDM CTA
Annualized Total Return**	-2.9%	5.7%	-1.8%	6.9%	5.6%	9.2%
Annualized St. Dev.	15.0%	4.0%	15.7%	6.1%	6.6%	8.8%
Sharpe Ratio	-0.33	0.63	-0.24	0.60	0.38	0.69
Maximum Drawdown	-40.7%	-3.8%	-45.6%	-10.1%	-21.1%	-8.7%
Correlation with BCI	0.15	-0.04	0.27	0.16	0.42	0.32
Correlation with SPGSCI	0.18	-0.02	0.29	0.15	0.45	0.22
Correlation with DJ-AIG	0.28	0.04	0.40	0.26	0.55	0.27

* Total Return Indices include the return of 91-day Treasury Bill yield.

** Includes reinvestment of dividends and interests. CISDM Indices are net of manager fees.

Multiple Asset Class Portfolio Performance Jan 2001 to Dec 2008				
	<u>Portfolio I</u>	<u>Portfolio II</u>	<u>Portfolio III</u>	<u>Portfolio IV</u>
U.S. Portfolios	Equal Weights S&P 500 and Lehman U.S. Bond	90% Portfolio I and 10% BCI	90% Portfolio I, 5% HF, 5% CTA	80% Portfolio I, 10% BCI, 5% HF, 5%CTA
Annualized Returns	1.7%	2.5%	2.3%	3.1%
Annualized St. Dev	7.5%	7.1%	7.0%	6.6%
Sharpe Ratio	-0.16	-0.06	-0.10	0.02
Maximum Drawdown	-21.0%	-19.5%	-19.1%	-18.2%
Correlation BCI	0.14	0.34	0.18	0.39

Exhibit 8 shows the performance statistics for the BCI, DJAIG, and SPGSCI indices and component sectors for the 2001-2008 period. In addition, in Exhibit 8, the correlations are also reported at the commodity sector level. At the sector level (e.g., agriculture, energy, industrial metals, precious metals, livestock, grains, and softs), the correlations between the various commodity indices are at or above 0.86. At the commodity sector level, the energy and metals sectors reported the highest relative returns. This is consistent with the economic argument that an underlying long-term positive return is more likely to exist for commodities sectors such as energy and metals for which supply may be constrained in the short run.

Exhibit 8

Performance of BCI, SPGSCI & DJ-AIG Commodity Indices (2001-2008)

	Annual Returns	Standard Deviation	Sharpe Ratio	Maximum Drawdown	Correl. BCI Sectors	Correl. GSCI Sub-Indices	Correl. DJ-AIG Sub-Indices
BCI	8.9%	14.8%	0.43	-31%	1.00	0.95	0.93
SPGSCI	-0.5%	25.6%	(0.01)	-62%	0.95	1.00	0.90
DJ-AIG	3.0%	17.7%	0.08	-49%	0.93	0.90	1.00
Agriculture							
BCI Agriculture	4.4%	11.8%	0.16	-24%	1.00	0.89	0.92
SPGSCI Agriculture	-3.2%	20.8%	(0.20)	-46%	0.89	1.00	0.96
DJ-AIG Agriculture	0.8%	20.7%	(0.01)	-45%	0.92	0.96	1.00
Energy							
BCI Energy	9.2%	25.6%	0.34	-40%	1.00	0.95	0.96
SPGSCI Energy	-1.1%	33.8%	0.05	-69%	0.95	1.00	0.96
DJ-AIG Energy	-2.6%	34.5%	0.01	-69%	0.96	0.96	1.00
Industrial Metals							
BCI Industrial Metals	16.5%	21.1%	0.68	-33%	1.00	0.87	0.89
SPGSCI Industrial Metals	5.8%	23.7%	0.22	-60%	0.87	1.00	0.99
DJ-AIG Industrial Metals	6.2%	24.4%	0.24	-60%	0.89	0.99	1.00
Precious Metals							
BCI Precious Metals	9.5%	14.4%	0.48	-27%	1.00	0.96	0.94
SPGSCI Precious Metals	14.5%	17.9%	0.68	-30%	0.96	1.00	0.98
DJ-AIG Precious Metals	14.1%	19.2%	0.62	-34%	0.94	0.98	1.00
Livestock							
BCI Livestock	5.0%	10.8%	0.22	-25%	1.00	0.93	0.94
SPGSCI Livestock	-4.3%	15.5%	(0.41)	-40%	0.93	1.00	0.98
DJ-AIG Livestock	-5.4%	16.1%	(0.46)	-41%	0.94	0.98	1.00
Grains							
BCI Grains	6.6%	17.1%	0.28	-32%	1.00	0.95	0.96
SPGSCI Grains	-1.6%	23.8%	(0.08)	-47%	0.95	1.00	0.97
DJ-AIG Grains	1.4%	24.4%	0.05	-47%	0.96	0.97	1.00
Softs							
BCI Softs	-5.0%	16.9%	(0.40)	-34%	1.00	-	0.86
DJ-AIG Softs	-5.2%	22.1%	(0.27)	-46%	0.86	-	1.00

9. Conclusions

This paper has shown that direct commodity investment through investable indices can provide significant portfolio diversification benefits. Adding a commodity component to a diversified portfolio of stocks, bonds, and alternative assets has been demonstrated to result in enhanced risk-adjusted performance. Moreover, results also show that direct commodity investment provides risk and return opportunities not available from investment in the equity of commodity companies. Further, results indicate that direct commodity investment provides a significant hedge against inflation, but that commodity-based equities do not provide a similar hedge. Lastly, a review of commodity performance over the past six-year period reflects the continued benefit of investable commodity indices to enhance the risk-adjusted performance of traditional asset as well as traditional/alternative asset portfolios.

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