

A Review Of Commodity Indexes

Seeking Exposure In An Asset Class That May Be
Poised For Continuing Strength

By Ranga Nathan



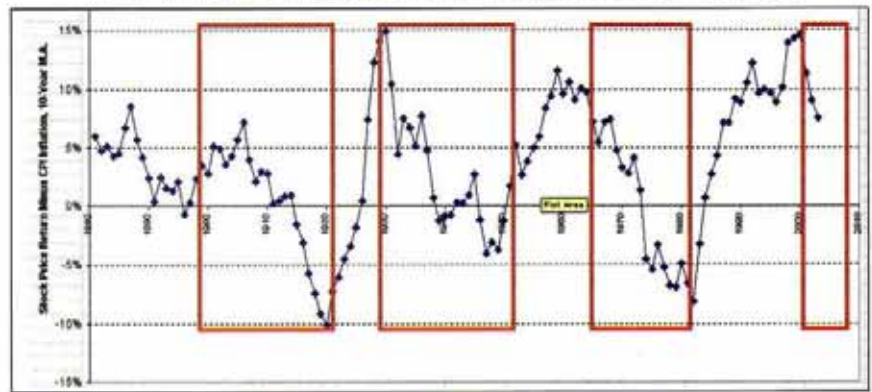
Illustration By Greg Hargreaves

INTRODUCTION

In his research paper¹, Barry Bannister presents eloquent and convincing arguments to support the notion that inflation and commodity prices will increase substantially over the next several years.

One of his arguments is that "for 200 years, paper assets have alternated price leadership with hard assets, corresponding to falling and rising inflation cycles" lasting about 20 years each. See Table 1 for a comparison of the growth rates of the stock market and commodity prices since 1898. Chart A² shows not only the clear cyclical trend of stock returns minus inflation, but

CHART A: CPI inflation cycles in boxes.
Note that stocks follow a +/- 10% real return range



Source: U.S. Department of Commerce, U.S. Bureau of the Census, Standard & Pooors Corp, Legg Mason

TABLE 1: Cycles, Stock Index, Commodity Prices

Period	U.S. Stock Market Composite	PPI for All Commodities Index
1898 - 1920	61%	228%
1920 - 1929	196%	-38%
1929 - 1951*	-12%	-58%
1951 - 1965	256%	6%
1965 - 1981	49%	204%
1981 - 2001	828%	37%

* Includes distortions from the Depression years

Source: Legg Mason, U.S. Department of Commerce, U.S. Census, Standard & Poor's, National Bureau of Economic Research

also the possible start of a new trend in which stock prices could stagnate and inflation rise. Application of this possibility to Table 1 suggests an impending period of commodity price increases leading stock price increases, with occasional reversals within the trend.

Another argument relates to demand for commodities from the faster-than-historical industrial and consumption growth in large emerging economies such as China, India, and others. Taking energy as an example, Chart B shows the per capita oil consumption during the industrialization phase of the U.S., Japan and South Korea. It also shows that increasing China's per capita consumption to the levels reached by Japan and South Korea would require an enormous increase in worldwide production. Unless this increase materializes immediately, energy prices can be expected to increase dramatically.

INVESTIBILITY

Given that there is a fair argument for an

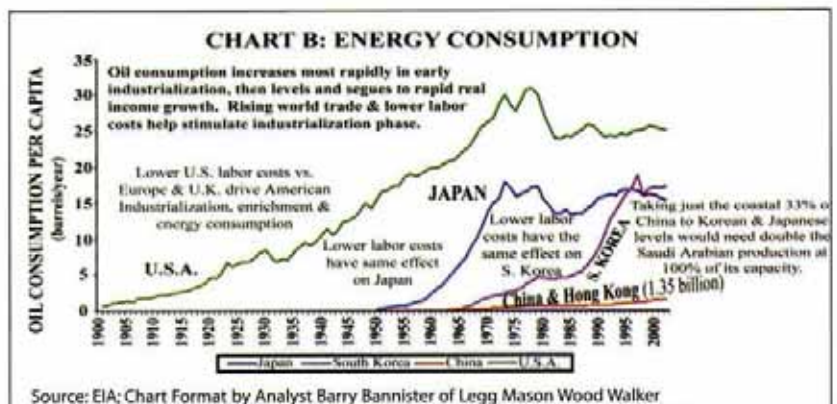
increase in commodity prices over the next several years, should investors take an exposure to commodities? If so, which commodities and in what proportions?

This article discusses five commodity indexes, which can be used as the basis for acquiring exposure to commodities. They are somewhat different from one another in the commodities they comprise and their relative weights. An investor can choose one of these indexes, and replicate it by adhering to the related Rule Book. As an alternative, an investor can invest in a fund that replicates the chosen index. In addition some firms, including InvestMatrix, are developing exchange-traded funds (ETFs) based on commodity indexes. When available, these ETFs could be convenient vehicles for investments in commodities.

But before delving into the index methodology of commodities benchmarks, it is first necessary to understand certain peculiarities of this distinct asset class.

Comparison To Equity And Fixed income

Similarities and differences between this asset class and equity and fixed-income securities are worth noting. Equity and fixed-income securities can be easily purchased, and while equity securities may yield an income in the form of dividends the primary objective is capital gains. With fixed-income securities, the primary objective generally is income (interest) and capital gains are secondary. By holding physical commodities, the investor looks entirely for capital gains, and expects no income at all (except for pos-



sible asset-lending income in rare cases, which can be ignored for the purposes of this discussion).

An important distinction with commodities as an asset class is storage, including transportation, insurance, warehousing and incidentals. Whereas equity and fixed-income securities can be easily stored as bits of paper or electronic entries after purchase, storage of physical commodities involves complications; for example, consider storing crude oil and wheat as part of one's investment.

Proxy Using Futures

Due to commodities storage costs, an investor acquiring an exposure to commodities could purchase contracts that provide for a right (and the obligation) to purchase the commodities at a future date, rather than the physical commodities. Before the date on which delivery of the physical commodities would occur, the investor disposes of the contracts, and simultaneously purchases contracts requiring delivery at a later date. Through a continuous "rolling" of these future-delivery contracts, the investor is able to experience the change in the value of the commodities (reduced by the cost of carry³, see below), without ever taking delivery of them. The contracts can be purchased over the counter or in the futures markets. The latter are by far the more convenient, involving virtually no counterparty credit risk, and because resale of the contracts (at the time of roll) in standardized units is enabled by the exchanges. For these reasons, all the five major commodity indexes discussed here are based on futures contracts.

Pricing Of Futures Contracts

The change in the price of a futures contract from the purchase date to the sale date is not exactly the same as the change in the price of the underlying physical commodity between the two dates. This is because the futures contract is priced to take into account the carrying costs, including storage cost and the cost of money (which is not expended by the futures contract holder) during the holding period. As these costs are generally time sensitive, the futures contract requiring delivery in, say, five months should cost more than that deliverable in two months to reflect the additional costs during the three-month holding period. This is the normal situation, referred to as "contango." In some cases, there may occur "backwardization," when the "nearby" futures contract costs more than the "farther" delivery. This happens generally when availability has a premium, also referred to as "convenience yield." In either event, the price of the futures contract approaches the price of the physical commodity with the passage of time, and equals it on the date of delivery.

Total Returns

When an investor purchases a futures contract, there is

no requirement to pay the full value of the contract. Instead, the investor can invest the value in, for example, a Treasury bill, and post the bill as collateral. Interest earned on the collateral accrues to the investor. Earlier, we said that the futures contract is priced to take into account not only the price of the underlying commodity, but also storage costs and the time value of money. Assuming that the interest earned on the collateral offsets the time value of money, the return from holding a rolling series of futures contracts equals the return from holding the underlying commodity and incurring storage costs. Since commodity indexes are calculated based on futures prices, the index provider adds the interest on the collateral to obtain "total returns." In this article, "returns" imply total returns.

Delivery Months And Roll Dates

The two factors, storage and interest, may not be the

Table 2: COMPARISON OF SECTOR WEIGHTS

	CRB	GSCI	DJ-AIG	SPCI	RICI
Energy	18	67	33	50	44
Metals	24	10	25	7	21
Grains & Seeds	18	13	21	21	21
Softs	29	4	11	14	9
Livestock	12	6	10	8	3
Other					2
Total	100	100	100	100	100

Source: Price Asset Management Inc.

**Table 3: SECTOR COMPONENTS
(NOT ALL INDEXES HAVE ALL COMPONENTS)**

Energy:	Metals:	Grains & Seeds:
Crude Oil	Gold	Red Wheat
Heating Oil	Silver	Wheat
Unleaded Gas	Platinum	Corn
Natural Gas	Palladium	Soybeans
Brent Crude	Aluminum	Soybean Oil
Gas Oil	Copper	Soybean Meal
	Zinc	Rice
Softs:	Lead	Azuki Beans
Cotton	Nickel	Barley
Coffee	Tin	Canola
Sugar		Oats
Cocoa	Livestock:	
Wool	Live Cattle	Other:
Orange Juice	Feeder Cattle	Rubber
Silk	Live Hogs	Lumber

Source: Price Asset Management Inc.

same for all traders over a given period. The difference in price between two delivery months for the same commodity therefore cannot be calculated precisely, and trade at prices slightly different from those dictated by the cost-of-carry model. This raises the question of which delivery

month should be used as a proxy for holding a commodity. Since the largest trading volume (and therefore liquidity) is found in the nearby month, investable indexes should perhaps be using these contracts, and rolling into the next delivery month sufficiently ahead of the delivery date of the physical commodity. Some indexes use two or more delivery months as the basis of their calculations. Further, some indexes, concerned that rolling the entire position on one day might cause pricing distortions, assume that the roll is accomplished over a predetermined number of days.

COMMODITY INDEXES CURRENTLY AVAILABLE

At present, there are five commodity indexes with varying components and features. These are:

- Reuters – CRB Futures Index (“CRB”)
- Goldman Sachs Commodity Index (“GSCI”)
- Dow Jones – AIG Commodity Index (“DJ-AIG”)
- S&P Commodity Index (“SPCI”)
- Rogers International Commodity Index (“RICI”)

FEATURES

Inception: CRB is the oldest commodity index: it was first calculated by Commodity Research Bureau in 1957, and first published in the 1958 CRB Commodity Year Book. The calculation was changed in 1987. GSCI came next, in 1992. DJ-AIG and RICI were developed at about the same time, 1998-1999. SPCI was developed in 2001.

Exchange Traded: Only CRB and GSCI are currently traded on exchanges.

Components: See Table 2 for a summary of components by index and sector.

- CRB now has 17 commodities, chosen to represent “a broad measure of overall commodity prices.” The components are equally weighted. By sectors, Softs have the largest weight (29%), followed by Metals (24%). Grains and Energy carry a weight of 18% each, with Livestock at 12%.
- GSCI has 24 commodities, chosen to represent a “broad range of constituents.” The components are production weighted. By sectors, Energy has the largest weight (67%), followed by Grains (13%) and Metals (10%).
- DJ-AIG has 20 commodities, chosen to represent a “diversified benchmark for commodities as an asset class.” For relative weights, DJ-AIG relies primarily upon liquidity, and to a smaller extent upon production. By sectors, Energy carries the most weight at 33%, followed by Metals at 25% and Grains (21%).
- SPCI has 17 commodities, chosen “to facilitate the increased use of commodities as an alternative asset class.” Relative weights are based on open interest dollar value, a measure of liquidity of the related futures contracts. By sectors, Energy has the largest weight at 50% with Grains at 21%.
- RICI has 35 commodities, chosen to create a “balanced, representative international raw materials index.” Weights are based on an assessment of each commodity’s relative importance to international commerce. By sectors, Energy has 44% and Grains and Metals have 21% each.

INDEX CALCULATION

Changes To Component List And Weights

The commodities included in an index may not always be fixed. Each index follows a different procedure to change the list of commodities it follows. When commodities are removed from or added to the component list, the weight assigned to each of the commodities may change. The weight change can occur even if the component list remains the same, because of the way in which each index determines the relative importance of the component commodities.

- CRB changes the component commodities pursuant to its objective of ensuring an “accurate representation” of broad commodity prices. There have been nine revisions to the component list, the most recent in December 1995. CRB is an equal-weight index and does not therefore change weights, beyond those that accompany the occasional changes to the component list.
- GSCI reviews changes to the component list and weights generally once a year, with 2003 experiencing two changes. Since the weights are recalculated based on world production (which in turn is a function of quantities produced and prices), changes can be quite drastic at times. For example, weights for the Energy sector have varied between 44% and 73% of the index.
- DJ-AIG’s Oversight Committee meets annually to consider changes to the component list and weights. Five-year average liquidity data and five-year average production data are taken into account. Certain minimum and maximum limits are applied to the weights assigned to individual commodities and to sectors. Changes become effective in January of each year, and are less drastic than in the case of GSCI.
- SPCI’s Commodity Index Committee considers changes to the component list and weights using the open interest calculation mentioned above. Changes are announced each November 1, and the effective date is the following business day.
- RICI reviews the component list and weights continually. There has only been one change since inception, involving 0.15% of the index.

Averaging Method

- CRB calculates the average price of two or more delivery months to get a price for each commodity; a geometric average of the prices obtained represents the index.
- GSCI assumes the price of the nearby futures contract as the commodity price for each component, until the fourth business day of the delivery month. On the fifth business day, 80% of the price of the nearby contract and 20% of the price of the next contract are added to determine the price. On the sixth day, the ratio is 60/40, on the seventh day it is 40/60, and on the eighth, 20/80. From the ninth business day on, the next contract is considered the “nearby contract” until its own delivery month. After determining the price for each commodity as above, GSCI calculates their weighted average as the basis for the index.
- DJ-AIG uses the price of the nearby futures contract (until

the last business day preceding the delivery month) as the commodity price. The weighted average of the component prices forms the basis for the index.

- SPCI uses the average price of the nearby contract and the immediately following contract as the price of the commodity. The index is based upon the geometric weighted average of the prices of the component commodities.
- RIC uses the price of the nearby futures contract (until the last business day preceding the delivery month) as the commodity price. The weighted average of the component prices forms the basis for the index.

Notes:

- the arithmetic average of (for example) ten equally weighted prices is the average of the prices
- the average of ten unequally weighted prices is the sum total of each price multiplied by its weight
- the geometric average of ten equally weighted prices is the tenth root of the product of the prices
- the geometric average of ten unequally weighted prices is the product of each price raised to the power of its weight

Geometric averaging has certain advantages including, generally, a lower volatility than arithmetic averaging. However, a fund based on an index computed as a geometric average will have to rebalance the portfolio continuously to minimize tracking error; but such rebalancing would involve additional transaction costs, which in turn will increase the after-cost tracking error. The manager will therefore have to find a balance between the two. Additionally, if the geometrically averaged index or a fund based upon it is listed on an exchange, market makers will find it more difficult to quickly assess the impact of a change in one or more constituents than they could with instruments based on arithmetical averaging.

INDEX PERFORMANCE

Given the many differences among the five indexes in terms of methodology, one can also expect differences in their performance. We look at performance below from three points of view: returns, volatility of returns and

**Table 4: COMPARATIVE PERFORMANCE STATISTICS
1999 - 2003**

	CRB	GSCI	DJ-AIG	SPCI	RICI	S&P500	Lehman	EAFE
Return	6.71%	19.95%	13.31%	12.30%	21.92%	1.48%	7.30%	0.31%
Standard Deviation	9.52%	21.92%	14.41%	16.74%	16.86%	16.90%	9.25%	16.19%
Information Ratio	0.71	0.91	0.92	0.73	1.30	0.09	0.79	0.02
Average Correlation	0.15	0.13	0.19	0.17	0.17	-----	-----	-----

Table 5: Individual Correlations

	CRB	GSCI	DJ-AIG	SPCI	RICI
S&P500	0.19	0.05	0.16	0.10	0.17
Lehman Treasury Bond	-0.01	0.15	0.10	0.17	0.06
EAFE	0.26	0.20	0.32	0.24	0.30
Average	0.15	0.13	0.19	0.17	0.17

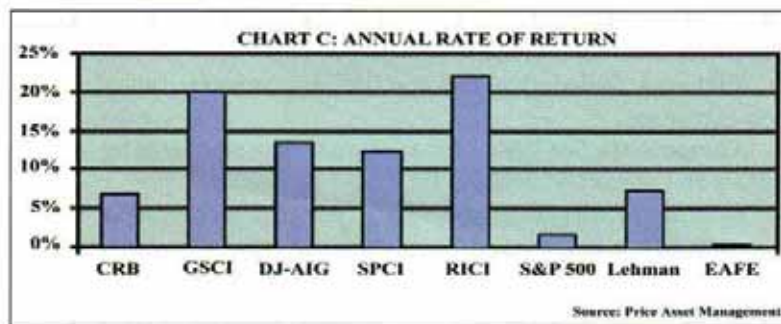
correlation with traditional asset classes. These comparisons are made for the five-year period of 1999 through 2003. Four indexes have actual computations for the period; SPCI has actual figures since 2001 and hypothetical ones for the previous two years.

Tables 4 and 5 summarize these and derived statistics. Also included for comparison are the performance statistics of

three benchmark indexes: S&P500 Index, Lehman Treasury Bond Index and the EAFE Index.

Returns

See Chart C for a bar chart comparison. For the period of the study, RIC produced the highest average annual rate of return at 21.92%, followed by GSCI at 19.95%

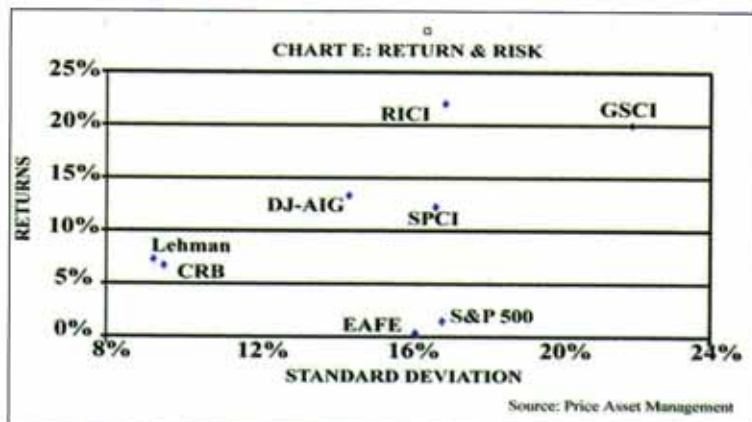


Volatility Of Returns

For this measure, we annualize the monthly standard deviation of each index. Other things remaining the same, a

lower standard deviation represents a lower risk than a higher standard deviation. CRB has the lowest volatility figure at 9.52%, followed by DJ-AIG at 14.41%. See Chart D for a comparison.

In general, the more components in the index, the lower the



standard deviation; and the more diverse the weights, the lower the standard deviation.

Return Versus Risk: Relative Positioning

The performances of the five indexes are plotted in Chart E, with returns on the y-axis and risk (as measured by standard deviation) on the x-axis. It can be seen that RICI and GSCI have similar returns, helped to a large extent by appreciating energy prices; but because RICI is more diversified than GSCI, its standard deviation is lower. From the risk

standard deviation), if an additional return commensurate with this additional risk is available. This would be the case if the information ratio increased.

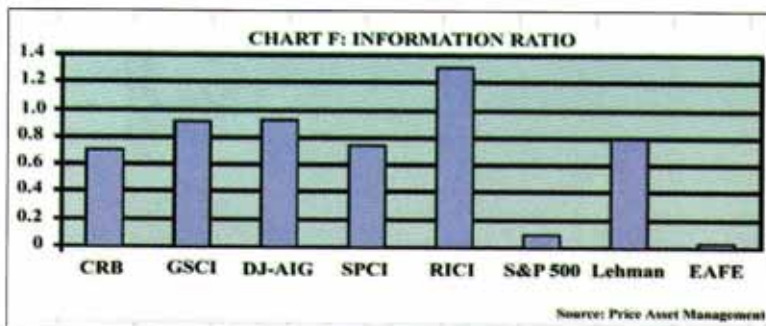
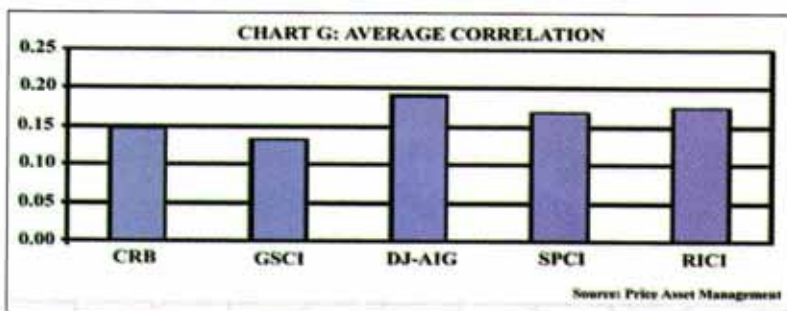
RICI has the highest information ratio at 1.30, followed by DG-AIG (0.92) and GSCI (0.91). See Chart F for a comparison.

Correlation

While considering a new asset class as a source of diversification, an investor would prefer not only acceptable levels of returns and risk, but also a lower correlation with the other assets in the portfolio.

Table 5 shows the correlation of each index against the traditional asset classes. The net effect on the risk/return characteristics of the portfolio will be a function of the allocations to these asset classes and to the chosen commodity index. Since each investor has a different allocation, we show an indicative statistic, the average correlation.

Chart G is a bar chart that compares the average correlations. From this point of view, the indexes are not



perspective, RICI and SPCI (as well as EAFE and S&P500) have similar standard deviations, but RICI has a much higher return.

Return Versus Risk: Information Ratio

To assess return and risk together, we calculate the information ratio by dividing the annual return by the annualized standard deviation. Other things remaining the same, an investor might be willing to take additional risk (higher stan-

very different from one another.

SUMMARY

It appears likely that commodity prices will appreciate over the next several years. The returns from commodities may exceed the returns from equities and may deserve an investment. Even if this were not the case, investors might want to consider an exposure to commodities as a valuable source of diversification. An exposure to commodity futures is a reasonable proxy to an exposure to physical commodities, and rather less cumbersome. Commodity indexes, based on commodity futures, provide a basis for considering an investment in this asset class. Different indexes have different components, weights and other rules, which render them vastly different from one another in terms of historical and projected performance. Investors interested in this asset class need to carefully examine these differences before acquiring the appropriate exposure.

Endnotes

Legg Mason Wood Walker Inc. Equity Research, April 19, 2002.

Charts A and B. While the data is available from public sources, the analysis and interpretation belong to Legg Mason.

Reilly & Brown, Investment Analysis and Portfolio Management, The Dryden Press.