

Getting Smarter About Commodities

An index to counter the possible pitfalls

By Robert Arnott, Denis Chaves, Jodie Gunzberg, Jason Hsu and Peter Tsui



Commodities entice investors for two main reasons: inflation protection, and portfolio diversification (low correlations with other asset classes). Given these important benefits, and rising interest from institutional investors in recent years, it is puzzling that commodity allocations are still modest at best. In fact, many investors have no exposure to commodities at all. Barclays estimates the total global commodity assets under management (AUM), as of June 2014, at \$325 billion.¹ This is dwarfed by the estimated U.S. \$70 trillion invested in global equities and U.S. \$50 trillion invested in global bonds. This apparent lack of interest in commodities by investors can be explained by many things. In this article, we focus on one of the most important elements: performance.

Most investors gain exposure to commodities by trading commodity *futures* rather than investing directly in physical commodities, which would also incur costs for storing and transporting them. Physical commodities are mostly traded by producers of commodities and those consumers—frequently manufacturers—who require them as factor inputs. The objectives and incentives faced by different participants in futures markets differ. For example:

- Commercial producers sell physical commodities and therefore suffer losses when commodity prices go down. To hedge this downside risk, they may sell their commodities ahead of time at a set price by taking on short positions in futures contracts.

- Commercial consumers buy physical commodities from producers and therefore experience lower profits when commodity prices go up. To hedge their risk of a price rise, they may choose to buy the commodities ahead of time at a set price by buying long positions in futures contracts.

Depending on the supply and demand dynamics in the physical market, resulting in an excess or shortage of inventories, there may be upward or downward pricing pressure on futures prices that are further from expiration relative to the futures contracts with earlier expirations. This means commodity futures with later expirations can trade at a premium or a discount relative to near-dated futures contracts; these conditions are known as “contango” or “backwardation,” respectively, in the jargon of the industry. These conditions determine the roll yield or returns from selling expiring contracts and buying later-dated contracts. Backwardation is profitable and contango is losing to long-only index investors in the front months. The roll yields through time vary based on the inventory levels, costs of storage and the premium a processor will pay to hold a commodity. For example, gold is relatively abundant and cheap to store, so has historically been in a slight contango where the roll is negative but not by much; conversely, energy or agriculture can be difficult and costly to store, with swings between excess and shortage that drive the curves to be steeper and more volatile.

Hicks (1946) argued that consumers have more flexibility than producers, since consumers can pass-through price hikes or use substitutes. They also buy a more diversified basket of goods for their manufacturing needs than the producers have as a production basket, and therefore

can be more risk tolerant. Thus, under normal market and economic conditions, producers have stronger hedging needs than consumers, resulting in a net short position from commercial participants. As an incentive to hold long positions and take the downside risk out of producers’ hands, investors require a positive return premium, or insurance risk premium.

A theory formulated by Keynes (1930), called the “theory of normal backwardation,” says there is downward pressure on current prices of commodities from selling in advance. This lower current price should rise through time as the futures contract nears expiration so that the spot and futures converge at the expiration date.

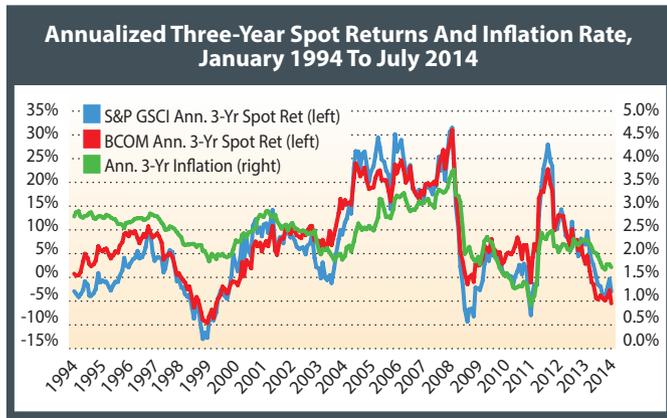
Though both of these theories indicate a money-making opportunity, sometimes market conditions indicate otherwise. Commodity term structures can experience long periods of contango when there is an excess of inventory and weak demand, like after the global financial crisis. Oppositely, backwardation may persist when there is a shortage, since producers take time to grow, drill and mine, causing processors to put a premium on having commodities immediately, called a “convenience yield.”

A recent and vivid example of strong contango in commodity markets happened as a consequence of the global financial crisis and the Great Recession. Poor economic activity and weak global demand created a worldwide glut in physical commodities, sending near contracts down materially more than the corresponding later-dated futures contracts. At the same time, investors’ risk aversion spiked periodically in the risk-on/risk-off scenario, where the unprecedented quantitative easing either worked or didn’t work. At times where investors did not feel they were getting paid for the risk of providing insurance to the producers, they withdrew their money, causing open interest to collapse by the lack of incentive for producers to produce and store.

Meanwhile, a substantial fear of inflation arose, as indicated by the real yield on Treasury inflation-protected securities becoming negative. Despite fears of inflation, investors may have hesitated to allocate to commodities due to the increased volatility caused by withdrawals in the risk-off environment. Not only has the volatility for some commodities been elevated, but the shifts in the term structure have been volatile. Starting in 2012, commodities have been more frequently in backwardation than in the period from 2005-2011 when contango was nearly constant. For this reason, a strategy that is smarter about frequently weighting, rebalancing and rolling is necessary to perform in this environment, but is adaptable to stable environments, as will be shown below.

There are significant benefits to holding contracts further out the curve since front-month contracts need to be rolled often, creating higher turnover, and tend to experience higher volatility and more negative roll yields when there is contango. Second, a strategy can change its allocations to different commodities over time, favoring those in backwardation and reducing exposure to those in contango. Given that roll yields are dynamic and vary significantly

Figure 1



Source: Research Affiliates, using data from Bloomberg

across commodities, this approach has the potential to significantly improve the strategy’s overall roll yield.

In this article, we explore ways to meaningfully increase the performance for a commodity index without sacrificing the main sources of return from the asset class. Special attention is devoted to maintaining high capacity, liquidity, diversification and economic representation. This is the first commodity index offered by a major provider that uses a combination of dynamic weights and contract selection to improve returns with less risk over the long run.

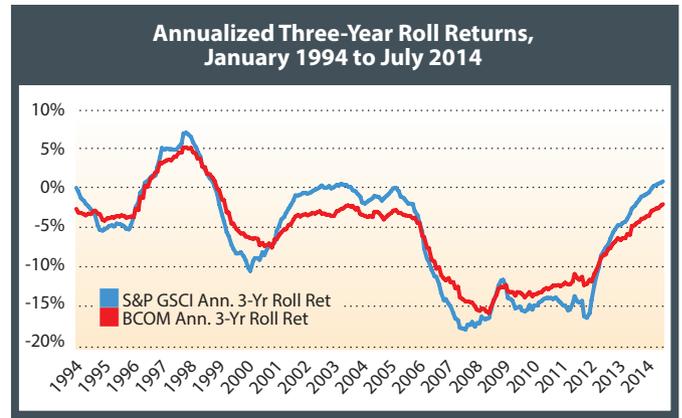
TRADITIONAL INDEXES

Despite their underwhelming allocations, traditional commodity indices have experienced significant growth in AUM over the past 10 years. The S&P GSCI and Bloomberg Commodity Index (BCOM) are the two most widely tracked commodity indexes. Those who do not invest in traditional indexes typically benchmark their active managers against them. Unlike other asset classes, there is no obvious construction for a “market-capitalization-weighted” portfolio. Although it is unclear what would constitute the market capitalization for many commodities such as live cattle and crude oil, the S&P GSCI uses a weight based on world production to reflect the general economic significance of commodities. The BCOM uses a 2-1 ratio of liquidity to world production weighting, then further limits weights by commodity, commodities derived from each other, and group.

In spite of their very different weighting schemes, both the S&P GSCI and the BCOM indexes are considered reasonable for measuring and representing the commodity futures market, because of their shared characteristics: both are long-only, invest generally in front-futures contracts, and contain most of the key commodity futures that are liquid and representative of global production. For these reasons, in this article, we use the S&P GSCI and the BCOM as representative benchmarks, for comparison purposes.

Because commodity index products track investments in commodity futures that need to be rolled before their delivery dates, it is useful to separate their excess returns (i.e., net of the cash collateral return) into two components: spot return, and roll return. The spot return represents the price change in the near-futures contract driven by the price change in the

Figure 2



Source: Research Affiliates, using data from Bloomberg

underlying physical commodity. The roll return—the difference between the excess return and the spot return—isolates the return generated by exiting the near-expiration contract and entering the next expiration. Decomposing commodity futures returns this way offers important insights into the characteristics and performance of commodity indexes.

Figure 1 shows annualized spot returns for the S&P GSCI and the BCOM over rolling three-year windows. The red and blue lines follow each other almost perfectly, and both track annualized three-year inflation rates, represented by the green line, very closely.² The high correlation between the two commodity indexes might be surprising at first, given the differences in their weighting schemes, but it makes sense when we consider that the same food and energy that comprise the CPI are in the indexes. We emphasize, however, that commodities provide a “magnified” exposure to inflation. Using the axes in Figure 1 as reference points, we see that an inflation rate of 3 percent is associated with a commodity spot return of roughly 15 percent. This is a useful characteristic; it means that a modest allocation to commodities provides meaningful protection against inflation.

Since the spot indexes are not investable because they do not include roll returns, let’s examine in Figure 2 that, over the past 20 years, roll returns have been negative on average, and sometimes have been as large as -15 percent. Revisiting our earlier example, roll yields reached their most negative level at the peak of the global financial crisis, when weak global demand for physical commodities created an excess inventory level. These conditions maintained commodity futures in contango even after the economy and commodity prices began recovering; roll returns remained below negative 10 percent until 2012.

In the past two years, roll yields have slowly recovered as the economy gained some strength, suppliers stopped supplying, and inventories went back to more normal levels and even into historical shortages in some cases. Additionally, the seemingly benign rates of reported inflation,³ paired with occasional bouts of deflation worries, have eased inflation fears. However, market and economic conditions are hard to forecast; it is entirely possible for roll yields to become negative again. If this is the case, the inflation hedging and diversification benefits from investing in long-only commod-

ity indexes must be balanced against the costs incurred. At a -15 percent negative roll yield, it is very understandable why rational investors may have forgone their commodities allocation in favor of other asset classes offering less inflation protection but more attractive expected returns.

In the remainder of this article, we describe a new way of constructing a long-only commodity index. Specifically, we seek to move away from the front contracts for the commodities in contango, where the roll yields are often the most negative, and we dynamically allocate more to commodities that are experiencing higher roll yields and greater price momentum.

DESIGNING A SMARTER INDEX

Similar to the “smart beta” movement in equities and bonds, where new methodologies strive to outperform traditional market-capitalization-weighted indexes by addressing potential return drags in their construction, we seek to find a smarter way of allocating and rolling, to not only reduce the impact of contango but improve the returns from the weight. However, there are differences in commodities from the smart-beta movement in other asset classes. With smart beta, the defining attribute is that these indexes break the link between the price of an asset and its weight in the index; in so doing, smart-beta strategies move away from capitalization weighting.

In commodities, there is no such thing as cap weighting, though production weighting has a price component, as would volume or open-interest weighting. In this way, most indexes loosely tether to price, but do not link the current weight directly to the current price. Most indexes are already partway to smart beta in this core attribute. In this index, we use the five-year average of the dollar volume traded as a key driver for our weighting metric, also largely severing the link with the current price.

To achieve this goal of superior index performance, we tap into known sources of added return in the commodity space. In commodities, there is a vast literature on roll yields (both across different commodities and along the term structure of contracts for one commodity) and momentum.⁴ Note that roll yields and momentum in commodities are already widely adopted in practice by commodity trading advisors (CTAs). In fact, Bhardwaj, Gorton and Rouwenhorst (2014) show that most of the CTAs’ performance comes from taking advantage of these two characteristics. In many ways, our new commodity index could be viewed as a low-cost, high-transparency, large-capacity strategy providing an alternative to active CTA offerings that trade commodities.

Unlike CTAs, we devote special attention to preserving the most desirable features of traditional commodity indexes, diversification and inflation protection. With CTAs, the strategies are long/short, so it is not at all clear whether rising inflation will help or hurt. As with CTAs and existing commodity indexes, we preserve the profoundly low correlation with other asset classes. To achieve these goals, an index needs to be well diversified and have broad economic representation by including multiple individual commodities from each of the key commodity sectors. We also carefully address capac-

ity and liquidity issues in an effort to ensure that the index can be tracked by substantial assets without experiencing return erosion due to flow-driven market price impact.

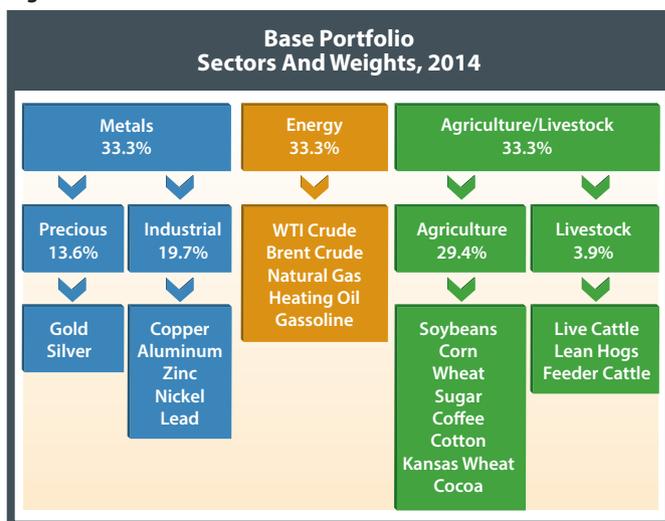
Economic Representation, Liquidity And Diversification

It is well known that weighting commodities based on world production alone can have a large impact on diversification. For instance, the S&P GSCI has arguably the best economic representation among all indexes, but developed economies are heavily dependent on energy, and this dependency is reflected by the index with a current allocation of roughly 70 percent to energy. Gold, which is heavily traded but sparsely produced, ends up receiving a small allocation. Using traded volume alleviates such concerns, but only to a certain extent. The BCOM, for instance, uses a combination of world production and traded volume, but achieves real diversification only after introducing layers of explicit constraints on individual commodities, derived commodities and commodity groups.

Given these considerations, our starting point is a portfolio based on the Dow Jones Commodity Index (DJCI). The DJCI is a modern version of BCOM that simply gets to the point of diversification by dropping world production from its weighting scheme; instead, it liquidity-weights commodities and equally weights sectors. This enables us to achieve similar levels of liquidity and diversification as other traditional indexes by means of a simple layering methodology. The universe contains exactly the same number of commodities as the DJCI: 23 for the year 2014.⁵ Diversification is explicitly achieved by dividing commodities into three groups—energy, metals and agriculture plus livestock—that are then equally weighted. Within each group, the commodities are weighted by a five-year average of dollar volume traded, ensuring high liquidity and capacity.⁶

Figure 3 shows the starting universe and sector weights for calendar year 2014. We note that livestock, which has three single commodities with appreciably lower production value and liquidity, takes on a small weight in the base portfolio.

Figure 3



Sources: Research Affiliates and S&P Dow Jones using data from S&P Dow Jones

Having fixed (equal) weights in the three groups not only diversifies the base portfolio, but reduces risk by reining in undue concentrations of investments, while improving the long-term performance through what is known in the literature as the “rebalance premium” or “diversification return.”⁷ The rebalance premium can be found in other asset classes as well, but it is particularly strong in commodities because of their characteristics. First, commodities in different sectors tend to have very low, or even negative, correlations. Gold, soybeans and copper, for instance, respond to very different shocks in the economy. Second, commodity prices mean-revert over long horizons. Temporary shocks in supply or demand cause price momentum in the short term, but prices usually revert to marginal costs of production.⁸

Weighting

Stable weights reduce turnover and avoid unnecessary trading. In fact, besides lower fees, one of the main advantages of passive indexes over actively managed strategies is the reduction in transaction costs. Given this observation, an index should be carefully designed to reduce potential market price impact, and turnover should be minimized as much as reasonably possible. Any feature that tends to increase turnover in the pursuit of enhanced returns must be carefully evaluated in light of its potential impact on implementation cost.

As shown earlier, traditional indexes have earned negative roll returns over long periods of time in some cases, such as in 2005–2011. This occurs because they don’t have a mechanism that allows them to reduce exposure to commodities that are in contango and increase exposure to commodities in backwardation. However, to overcome this, one must go beyond simply overweighting the backwarddated commodities to capture positive roll return. It is possible that a temporarily backwarddated commodity is unattractive because it exhibits very negative price momentum. This can arise when a commodity has suffered negative fundamental shocks to future demand, which would depress futures prices meaningfully more than the near price. Despite the implied positive roll yield, the documented momentum effect in commodity returns could continue to push prices down, generating substantial negative returns. The index methodology described in this paper considers roll yield in conjunction with price momentum, thereby improving roll return without unintentionally injecting negative momentum.

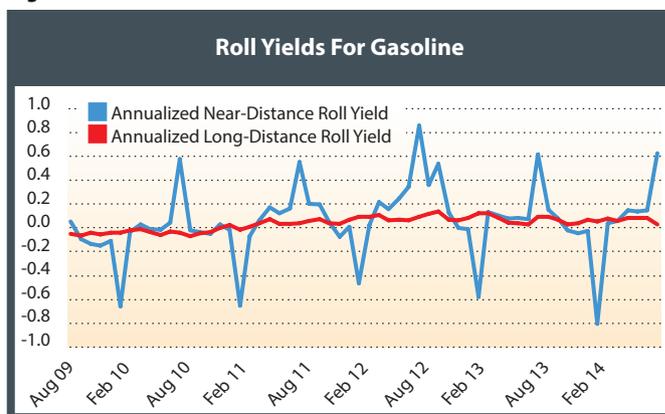
Successful CTAs similarly employ the roll yield and momentum information, often in concentrated active long/short portfolios. Our strategy makes these two commodity return drivers available through a liquid, transparent, long-only index.

Roll Yield

Most papers studying contango and backwardation use the slope between the nearest two contracts in the curve to calculate roll yields.⁹ We prefer to use the slope between the first nearby contract (C_0) and its next-year counterpart (C_1):¹⁰

$$\text{roll yield} = \ln \left[\frac{C_0}{C_1} \right] \frac{12}{T_1 - T_0}$$

Figure 4



Source: Authors, using data from CRB

Several benefits come with this choice. First, using contracts with a fixed one-year distance between them gives us a measure that is more homogeneous across different commodities. As an example, using the first two nearby contracts to calculate the roll yield of crude oil always results in a distance of one month between contracts, whereas gold roll yields are calculated using a distance that is either two or four months, depending on the current nearby contract.¹¹

Second, calculating roll yields over longer distances significantly reduces the volatility of roll yields and the occurrence of extreme values, consequently reducing the total amount of turnover in the portfolio. Third, seasonality in prices often provides misleading signals. For instance, Figure 4 shows that the term structure of gasoline has been in backwardation according to our definition (positive long-distance roll yields) over the past few years, but the nearby slope switches between contango and backwardation every six months.

Momentum

The literature on momentum shows that most measurement horizons tend to result in similar performance.¹² We measure momentum as the return over the previous 12 months in order to eliminate the influence of seasonal changes in prices as well as to reduce total portfolio turnover. Further, we calculate momentum using spot returns, i.e., the return from nearby contracts but excluding the return due to the roll of these contracts. In practice, we only have to look at the price of the nearby contract at two points in time—12 months ago and today—in order to calculate momentum:

$$\text{momentum} = \frac{C_{0,t}}{C_{0,t-12}}$$

Excluding the roll return provides a measure that has a lower correlation with roll yields already captured by the first strategy.

Before using roll yields and momentum in an index, it is important to show that these two components are powerful predictors of ex post relative performance. To provide a case study, we split all commodities on a monthly frequency into

Figure 5

Annualized Excess Return Portfolios By Momentum And Roll Yield Range, January 1999 To July 2014			
Regime	High	Low	Difference
Roll Yield	10.1%	-1.2%	11.3%
Momentum	7.9%	0.7%	7.3%

Source: Authors, using data from CRB and Bloomberg. Differences may not agree with high- and low-group figures due to rounding.

two groups—high and low—according to momentum and roll yields, and then track their average performance over the following month. Figure 5 shows that commodities with high roll yields outperform those with low roll yields by 11.3 percent, while high-momentum commodities outperform low-momentum ones by 7.3 percent.

Calculating Weights

The methodology starts with the base weights, presented in the previous Weighting section, to ensure the index has high capacity and economic representation. Next, it incorporates roll yields and momentum to help eliminate—and often reverse—the drag from negative roll returns. Because these two return components provide information about time-varying market conditions of each individual commodity, it is important to measure and update them more frequently. Thus, while the base weights are recalculated only once a year, the index is rebalanced once a month.

Using the raw measures—which can occasionally assume extreme values—often generates concentrated weights. Instead, we rank each commodity from 1 (worst) to 23 (best) according to each measure. This choice provides homogeneity both across time and between the two measures. These rankings are then combined with the base weights to form momentum and roll-yield portfolios:

$$\text{momentum weight} = \frac{\text{base weight} * \text{momentum rank}}{\sum \text{base weight} * \text{momentum rank}}$$

$$\text{roll yield weight} = \frac{\text{base weight} * \text{roll yield rank}}{\sum \text{base weight} * \text{roll yield rank}}$$

Notice that both portfolios are constructed identically and that their weights are always positive, i.e., no short-selling is allowed. Commodities with a high rank receive a larger allocation (*overweight* relative to the base portfolio), whereas commodities with a low rank receive a smaller allocation (*underweight* relative to the base portfolio). The final index weights are calculated as a simple arithmetic average between these two portfolios:

$$\text{final weight} = \frac{1}{2} \text{momentum weight} + \frac{1}{2} \text{roll yield weight}$$

We stress the fact that there is no attempt to optimize or time the contribution of each portfolio, because there's no reliable way to predict which one is going to outperform. The correlation between the signals is also relatively high, confirming that both signals tend to capture the same underlying conditions of each individual commodity.

Before analyzing the final index performance, there is one important step missing: contract selection. However, at this point, it is possible to look at the relative bets taken by the index over time. Figure 6 shows that the index has taken active positions relative to the base portfolio, but with a moderate level of turnover. Energy, for example, had an average allocation of roughly 30 percent, but varied from as low as 15 percent to as high as 50 percent during the sample period in the chart. Livestock, on the other hand, always had a small allocation, highlighting the economic representation and capacity provided by the base portfolio.

Contract Selection

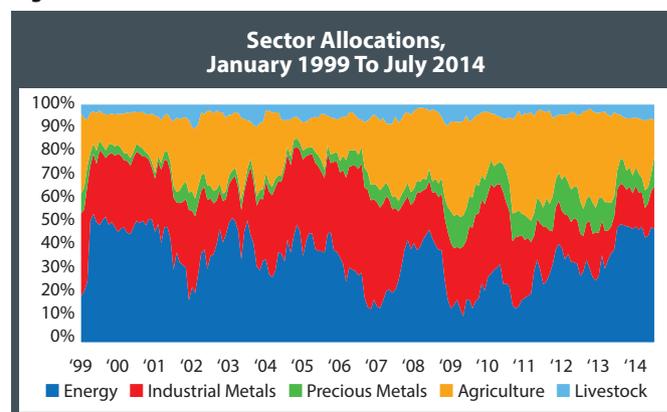
One of the most important characteristics of commodity indexes is the choice of which contracts to hold at each point in time. Contract selection has the potential to significantly help or hurt the performance of an index. Since traditional indexes are commonly used as benchmarks for other products, we use their choice of front contracts as a reference point here. Some indexes choose to hold more than one contract for each commodity. We prefer to hold only one contract for each commodity, thereby reducing implementation complexity. The most important aspect of the methodology, however, is its flexibility to hold contracts anywhere on the curve, depending on how attractive each contract is.

We use the same commodities as the rules-based DJCI, but use a three-step procedure to select which contract to hold for each commodity. First, to ensure that the index has high capacity, a set of liquid-candidate contracts is selected using simple criteria:¹³

1. Contract tenure is less than, or equal to, 24 months
2. Contract average open interest is at least \$100 million
3. Contract average open interest is at least 5 percent of the average open interest of the front contract

The front contract generally satisfies all three criteria, so the set of liquid candidate contracts includes it. Using the average open interest of the front contract as a reference point in item 3 is particularly important, because this makes sure that liquidity is scalable over time and that the number of candidate contracts varies according to the specific liquidity profile of each commodity.

Figure 6



Source: Authors, using data from CRB, Bloomberg and S&P Dow Jones Indices

Figure 7

Contract Selection Improvements On Performance, Volatility And Turnover, January 1999 To July 2014						
	Annualized Excess Return		Annualized Std. Dev.		Monthly Turnover	
	DJ RAFI Contract	Front Contract	DJ RAFI Contract	Front Contract	DJ RAFI Contract	Front Contract
Energy	12.8%	7.2%	27.4%	36.5%	33%	100%
Precious Metals	7.4%	6.8%	24.5%	24.7%	22%	42%
Industrial Metals	9.9%	6.5%	26.3%	28.6%	54%	100%
Agriculture	-0.5%	-4.7%	26.6%	30.5%	24%	40%
Livestock	3.5%	-1.7%	15.5%	17.3%	38%	58%

Source: Authors, using data from CRB, Bloomberg and S&P Dow Jones Indices

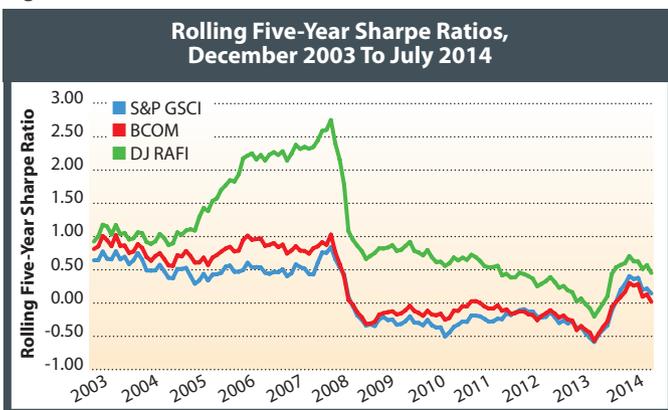
Figure 8

Index Performance, January 1999 To July 2014			
	Annualized Excess Return	Annualized Std. Dev.	Sharpe Ratio
S&P GSCI	3.7%	23.0%	0.16
BCOM	3.2%	16.7%	0.19
DJ RAFI*	12.5%	16.3%	0.77

* Simulated

Source: Authors, using data from Bloomberg and S&P Dow Jones Indices

Figure 9



Source: Authors, using data from S&P Dow Jones Indices

In the second step of the contract selection procedure, we can calculate the implied roll yield of each liquid candidate contract as

$$\text{implied roll yield } (j) = \left[\frac{C(j-1) - C(j)}{C(j)} \right] \frac{1}{d(j)}$$

where $C(j)$ is the price of candidate contract j , and $d(j)$ is the distance (in months) between candidate contracts j and $j-1$. We then rank all contracts from worst to best in terms of implied roll yield.

In the third step, we select the final-roll contract based on the results of the first two steps. If the number of liquid candidate contracts from the first step is less than or equal to six, then the contract with the best implied roll yield is always selected. If the number of liquid-candidate contracts is

between seven and 12, then the contract with the best implied roll yield is selected, unless the current contract is among the top two candidates (in which case, it is retained). Finally, if the number of liquid-candidate contracts is between 13 and 24, then the contract with the best implied roll yield is selected, unless the current contract is among the top three candidates.

This final step reduces contract turnover by allowing the index to keep the current contract in cases where it is still a top choice among a large number of liquid candidates.

To highlight the benefits of this contract selection procedure, Figure 7 shows annualized returns, standard deviations and monthly turnover figures averaged across the commodities comprising each of the five sectors.¹⁴ It bears mention that, because these are futures indexes, the return is an excess return over whatever is earned on the collateral that the investor owns. In other words, if an investor owns a portfolio of Treasury bills, these returns would be in excess of the Treasury bill yield. It is the price return plus the roll return.

Energy commodities enjoy the largest benefits, with added returns in excess of 5 percent and reduced volatility of roughly 9 percent. The smallest improvements come from precious metals, since silver and gold are relatively easy to store and hence have stable term structures.

The reduction in turnover from the contract roll is also significant. Using energy as an example, front contracts require 100 percent turnover, because they have to be rolled *every* month.¹⁵ Our methodology, on the other hand, rolls energy contracts only one-third of the time, on average. As explained above, the methodology has the choice—but not the obligation—to roll the contract each month. If the current contract still has the best implied roll yield, it continues to be used and the roll is not required. For other sectors, the improvements are not as high, but turnover is still reduced by about 50 percent in comparison with always using front contracts.

It's important to highlight the difference between the roll yield used during the weighting part of the methodology and the *implied* roll yield used in contract selection. The goal of the first is to get a macro view of the term structure, i.e., to capture the broad fundamentals of each market that are then used to over- and underweight the commodities in the index. The second focuses on the details of each term structure, selecting contracts based on a micro view.

There are pros and cons to each approach, but using both of them at different stages provides a powerful combination that tends to enhance the performance of the index by exploring all available information.

INDEX PERFORMANCE

Finally, putting the weighting and contract selection methodologies together results in the simulated performance presented in Figure 8. The index has a higher return combined with a lower standard deviation, resulting in a significantly higher Sharpe ratio overall.

To investigate the performance over shorter periods of time, Figure 9 plots rolling Sharpe ratios over five-year windows. The significant drop in the middle of 2008 was caused by a massive decline in global demand and commodity price during the global financial crisis (Figure 1). Commodity markets remained in strong contango until 2012, creating negative roll returns for traditional indexes (Figure 2). The hypothetical outperformance of our index during those years can be summarized by its ability to reduce—and often reverse—negative roll returns by selecting contracts with better implied roll yields and reducing exposure to commodities in contango. Over the past few years, the amount of contango in commodity markets has been slowly coming down, with crude oil in the United States even becoming backwardated. This trend has helped traditional indexes earn less negative—and even mildly positive—roll returns (Figure 2). As a consequence, their underperformance has been less pronounced.

To emphasize the similarities and differences between the index described here and traditional commodity indexes, Figure 10 presents a decomposition of excess returns over the simulation period from January 1999 to July 2014. All three indexes had strikingly similar spot returns, confirming the evidence in Figure 1 that long-only commodity indexes offered great inflation protection. Our index, however, not only provided inflation protection but also insured against strong head winds caused by negative roll returns. In fact, it has turned average *negative* roll returns of roughly 7 percent into average *positive* roll returns of about 2 percent.

Finally, to test the hypothesis that eliminating negative roll returns improves performance without reducing inflation protection, we investigated the performance of the three indexes in two regimes: low and high inflation. Figure 11 shows that between December 1999 and July 2014, the United States experienced annual inflation rates above 3 percent roughly one-third of the time (61 periods of 12 months), and below 3 percent in the remaining two-thirds (115 12-month periods). It is not surprising that all three indexes performed significantly better in times of high inflation. The S&P GSCI, for instance, lost 2.6 percent in low-inflation 12-month periods, but gained 24.7 percent in high-inflation 12-month periods. The striking fact about Figure 11 is the benefit of eliminating negative roll returns: Our index was able to gain an impressive 6 percent in times of low inflation. We should emphasize that past results are not indicative of future performance, and that every index experiences periods of poor returns. Nonetheless, it is reassuring to have a mechanism that is able to alleviate the pain during bad times.

Figure 10

	Spot Return	+ Roll Return	= Excess Return
S&P GSCI	10.4%	-6.7%	3.7%
BCOM	10.4%	-7.1%	3.2%
DJ RAFI	10.3%	2.2%	12.5%

Source: Authors, using data from Bloomberg and S&P Dow Jones Indices

Figure 11

Regime	# Obs	S&P GSCI	BCOM	DJ RAFI
High Inflation (> 3%)	61	24.7%	14.4%	27.9%
Low Inflation (< 3%)	115	-2.6%	-0.1%	6.0%

Source: Authors, using data from Bloomberg and S&P Dow Jones Indices

A brief digression on data mining is warranted. We have all seen historical simulations. Most of us have never seen a published simulation showing adverse results or underperformance. Why? Because these wind up in the dustbin. In this work, we did not data-mine our weighting scheme. We borrowed heavily from DJCI, because of its reliance on rebalancing as a source of risk management and (mild) return enhancement. The literature on long-horizon mean reversion and the “rebalancing premium” is well established. We did not data-mine our contract selection: We defined our methodology—based on common sense—and then tested it, rather than using the testing to design the methodology. We did not data-mine our integration of momentum into the process: We designed our methodology—again based on common sense—and then tested it, rather than using past data to design the process.

This is not to say that there was no data mining. We lived through these decades and were aware that momentum matters—more in some commodities than others. And, to be sure, if these ideas did not “work,” we would not be publishing this article or launching this index. However, we are very comfortable that we have used common sense to design a better index, ratified by historical data, rather than using data to design a better historical backtest.

CONCLUSION

Although commodities offer two important benefits—*inflation protection and portfolio diversification*—many investors give them scant allocations. A huge reason for this neglect is disappointing performance. While Keynes may have predicted positive roll yields for the last quarter-century, they’ve been more the exception than the rule. Perhaps this is because there’s a new buyer on the block, the long-only investor seeking inflation protection. However, whatever the reason, this is a problem we can fix.

[continued on page 132](#)

The fix does not have infinite capacity, but it does have very large capacity. And even if its advantage can be reduced through large adoption, there should never be a disadvantage in choosing the right contracts to optimize roll yield, as compared with the more common naive approach.

We have shown in simulation that it is possible to improve performance without impairing inflation protection, all the while retaining other desirable characteristics such as large capacity, high liquidity, effective diversification and broad economic representation. Dynamically selecting futures contracts

on the forward curve, rather than simply using the most liquid nearby contracts, makes it possible to reduce exposure to contracts in contango and increase exposure to contracts in backwardation. In addition, the successful CTAs' practice of taking momentum as well as roll yield into account can be built into a transparent, rules-based process for selecting and weighting futures contracts. By incorporating these strategies into an index, and adhering to other portfolio construction methods described in this paper, the new index may help investors insure their portfolios against inflation shocks and lower overall portfolio volatility without impairing expected returns.

Disclosures

This article is for informational purposes only, and nothing herein is to be construed as investment advice or commodity trading advice. The views and opinions stated in the article are those of the authors and not necessarily those of S&P Dow Jones Indices LLC or Research Affiliates, LLC.

S&P Dow Jones Indices LLC, a part of McGraw Hill Financial, is the world's largest, global resource for index-based concepts, data and research. Research Affiliates, LLC is a global leader in innovative indexing, asset allocation and smart beta strategies.

Standard & Poor's® and S&P® are registered trademarks of Standard & Poor's Financial Services LLC, and Dow Jones is a registered trademark of Dow Jones Trademark Holdings LLC. The trade names Fundamental Index®, RAFF®, and the Research Affiliates® corporate name are the exclusive intellectual property of Research Affiliates, LLC and are registered trademarks in the U.S. and other countries.

References

- Asness, Clifford, Toby J. Moskowitz, and Lasse H. Pedersen. 2013. "Value and Momentum Everywhere." *Journal of Finance*, vol. 68, No. 3:929-985.
- Bhardwaj, Geetesh, Gary B. Gorton, and K. Geert Rouwenhorst. 2014. "Fooling Some of the People All of the Time: The Inefficient Performance and Persistence of Commodity Trading Advisors." *Review of Financial Studies*, forthcoming.
- Booth, David G. and Eugene F. Fama. 1992. "Diversification Returns and Asset Contributions." *Financial Analysts Journal*, vol. 48, No. 3:26-32.
- Erb, Claude B. and Campbell R. Harvey. 2006. "The Strategic and Tactical Value of Commodity Futures." *Financial Analysts Journal*, vol. 62, No. 2:69-97.
- Fernholz, Robert and Brian Shay. 1982. "Stochastic Portfolio Theory and Stock Market Equilibrium." *Journal of Finance*, vol. 37, No.2:615-624.
- Fuertes, Ana-Maria, Joëlle Miffre, and Georgios Rallis. 2010. "Tactical Allocation in Commodity Futures Markets: Combining Momentum and Term Structure Signals." *Journal of Banking and Finance*, vol. 34, No. 10:2530-2548.
- Greer, Robert. 2005. "The Handbook of Inflation Hedging Investments." McGraw Hill Professional.
- Hicks, John R. 1946. "Value and Capital." vol. 2. Oxford: Clarendon Press.
- Keynes, John M. 1930. "A Treatise on Money." vol. 2. London: Macmillan.
- Koijen, Ralph S.J., Toby J. Moskowitz, Lasse H. Pedersen, and Evert B. Vrugt. 2013. "Carry." Fama-Miller Working Paper. Available at SSRN: <http://ssrn.com/abstract=2298565>
- Miffre, Joëlle and Georgios Rallis. 2007. "Momentum Strategies in Commodity Futures Markets." *Journal of Banking and Finance*, vol. 31, No. 6:1863-1886.
- Mouakhar, Tammam and Mathieu Roberge. 2010. "The Optimal Approach to Futures Contract Roll in Commodity Portfolios." *The Journal of Alternative Investments*, vol. 12, No. 3:51-60.
- Reuters. 2014. "Commodities Assets Under Management Rise \$8 bln in June - Barclays." (July 30) <http://uk.reuters.com/article/2014/07/30/commodities-assets-barclays/idUKL4N0Q527S20140730>

Endnotes

- ¹Reuters (2014).
- ²We use the U.S. Consumer Price Index (CPI) for all consumers including all items as our measure of inflation throughout this article. It is common to exclude energy and food items from the CPI and look at core inflation, but this would understate the power of commodities to track inflation, for obvious reasons.
- ³Many inflation observers wonder about the quality and the politicization of the data. The "big four" in the consumption basket for the average American are rent (or owner's equivalent rent), food, energy (including fuel) and health care, approximately in that order. In the last five years, according to the Bureau of Labor Statistics, the inflation rate in *all of these* has been higher than the CPI-U, by an average of 1.1 percent per annum. Is it possible that deflation in the cost of flat-screen TVs and iPads offsets inflation in the big four for the average American? The GDP deflator is worse. Five-year real GDP growth is, officially, less than 2 percent, and the GDP deflator is, officially, fully 1.5 percent per annum lower than the average inflation for the big four items in the consumption basket for the average American. Using inflation instead of the deflator on the big four, our five-year real GDP growth would be 0.3 percent per annum. No wonder people are angry and skeptical.
- ⁴See Erb and Harvey (2006), Fuertes, Miffre, and Rallis (2010), and Mouakhar and Roberge (2010), among others.
- ⁵The number of commodities in the index will increase to 24 in 2015 with the inclusion of gas oil.
- ⁶The DJCI includes an extra step intended to meet diversification requirements by capping component weights in accordance with stated index construction rules. This extra set of constraints has only marginal effects on the final DJCI weights. http://us.spindices.com/documents/methodologies/methodology-dj-commodity-index.pdf?force_download=true
- ⁷See Fernholz and Shay (1982), Booth and Fama (1992), and Erb and Harvey (2006) for more details.
- ⁸See chapter 5 of Greer (2006) for a formal treatment of the relationship between commodities and inflation.
- ⁹For a few references studying roll yields in commodities, see Erb and Harvey (2006), Fuertes, Miffre, and Rallis (2010), and Koijen, Moskowitz, Pedersen and Vrugt (2013), among others.
- ¹⁰For example, if the current nearby contract is December 2014, we calculate the slope between this contract and the December 2015 contract. In cases where this 12-month-distant contract does not exist, we use the longest contract available with a tenor of less than 12 months.
- ¹¹Annualizing roll yields provides a more accurate comparison across commodities, but only partially solves the problem of comparability. Assuming the nearby slope is constant across the next 12 months in the curve is often imprecise.
- ¹²The average open interest used in items 2 and 3 is measured over the same month of the previous year, because liquidity tends to be seasonal. For instance, the group of candidate contracts for October is selected at the end of September using average open interest observed during October of the previous year.
- ¹³The average open interest used in items 2 and 3 is measured over the same month of the previous year, because liquidity tends to be seasonal. For instance, the group of candidate contracts for October is selected at the end of September using average open interest observed during October of the previous year.
- ¹⁴Keep in mind that the index rolls its contracts over a five-day period starting on the *second* business day of the month, thus the simulations in Figure 7 follow the same rules for the benchmark (i.e., the roll starts on the second business day instead of the traditional approach of starting on the fifth business day).
- ¹⁵Other sectors besides energy and industrial metals usually have a front-contract turnover of less than 100 percent, because their individual components (commodities) do not have a full schedule of monthly contracts. Sugar, for instance, has a schedule that includes only four contracts every 12 months, resulting in a monthly turnover of approximately 33 percent (4/12). In other words, 100 percent of the contracts are rolled, but only every third month, on average.