



# Do Commodities Belong in Your Allocation?

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For much of the last several years, poor performance from commodities has hurt investors' portfolios, a result of depressed interest rates, low inflation and slow economic growth. Any diversification value they provided was masked by strong equity-market performance. My analysis shows that only a small allocation to commodities is justified, and advisors can obtain most of the same benefits with real-estate investment trusts (REITs) or individual Treasury inflation-protected bonds (TIPS).

I'll begin with a review of the key research on commodities as an asset class, followed by a discussion of a number of representative funds that provide diversified exposure to commodities. In the final section, I'll present Monte Carlo simulations of the portfolio impact of adding commodities funds to a traditional stock-bond allocation.

## Research on commodities as an asset class

The market price of a basket of commodities should increase roughly in line with inflation, but why would there be returns beyond this? While the spot prices of commodities tend to track inflation, futures contracts of commodities have historically delivered positive returns.

John Maynard Keynes laid the foundation of modern thinking on commodity futures markets. He proposed that investors in commodity futures are providing risk capacity to the producers of commodities by allowing them to lock in a fixed price for commodities to be delivered at a future date. In other words, investors in future contracts are essentially insuring commodity producers against a decline in prices in the future.

Investors can benefit from purchasing a futures contract at a discount to the expected future spot price. As the delivery date approaches, the futures price should rise to meet the spot price. This, in turn, means that the forward curve (the prices of futures contracts as a function of delivery date) should fall as the time to delivery increases. This situation is referred to as backwardation.

But what if futures contracts are more expensive than the spot price for a commodity? A second theoretical argument posits that commodities futures prices are expected to increase through time to create an incentive for investors to build and maintain storage facilities. If later-dated contracts are more expensive than near-term contracts, the shape of the futures curve is called contango. Storage adds value for consumers of commodities. For agricultural commodities, production tends to follow a seasonal cycle but demand may be constant year-round. Storage allows producers to sell their crops when they are harvested and maintain a constant supply for consumers. For energy commodities,

production may be constant year-round, but demand may be seasonal. Prices will adjust to make it worthwhile for investors to provide stability of supply.

In both cases, there is an expected positive return to investors by being long commodity futures contracts. These two broad concepts as to why long-only commodity investors, or investors who only bet that commodity futures prices will tend to rise as they approach the expiration date, should expect positive returns are referred to as the theory of backwardation and the theory of storage.

The empirical research demonstrating the value of investing in commodity futures focuses on fully collateralized futures strategies. Buying a futures contract means that an investor agrees to purchase a certain amount of a commodity at a specific price at the settlement date. A fully collateralized futures purchase means that the investor concurrently buys Treasury-bills in an amount equal to the purchase price of the futures contract. This means that there is no risk the buyer of the contract will be caught short of cash needed at the settlement date.

Historical analysis of commodity futures suggests that investors have, indeed, reaped attractive risk-adjusted returns. In a now-classic paper from 2005, *Facts and Fantasies about Commodity Futures*, Gary Gorton and K. Geert Rouwenhorst, both of the Yale School of Management, found that a diversified fully collateralized (e.g. zero-leverage) basket of commodities futures has historically provided returns comparable to equities. In addition, such a strategy has delivered returns that are negatively correlated to equities, which means that a combination of equities and commodities in a portfolio provided substantial diversification benefits.

This analysis used data from 1959 to 2004. An equal-weighted annually rebalanced portfolio of commodity futures provided return of 11.2% per year (arithmetic average return of 11.97% per year) in this 45-year period, with average inflation of 4.1% per year. The spot price of a buy-and-hold portfolio of these same commodities provided a return that was effectively equal to inflation. The authors concluded that commodities futures provided an effective hedge against inflation along with equity-like returns and that the benefits of a fully collateralized commodity futures strategy cannot be achieved via investing in the equity of commodity producers.

Another important piece of research on commodity futures strategies is *The Tactical and Strategic Value of Commodity Futures*, by Claude Erb and Campbell Harvey of Duke University. The paper confirmed that a diversified rebalanced portfolio of commodity futures has historically generated returns comparable to equities, but with some important caveats that investors need to understand. Perhaps the most striking finding in this paper was that the compounded return for futures on individual commodities was near zero.

This sounds paradoxical. How can a portfolio of zero-return investments have average returns of more than 10% per year? The answer is in the diversification return. Diversification reduces the volatility of a portfolio's returns without reducing the arithmetic average return. This, in turn, increases the geometric return of the portfolio. The magnitude of the increase in portfolio geometric return is greater if the correlations between the portfolio components are low. The correlations between commodities were so low between 1945 and 2004 that the diversification premium was enormous.

A 2006 paper by Ibbotson Associates remains one of the best overviews of the portfolio impacts of adding commodities to the asset-allocation mix. The focus of this analysis was on creating estimates of expected returns from a diversified commodity-futures portfolio, along with correlations to other major asset classes. The analysis included estimates of expected return and risk for other major asset classes. Using these inputs, the authors then calculated optimized asset-allocation portfolios with and without commodities. The asset classes included were T-Bills, TIPS, U.S. bonds, international bonds, U.S. stocks, international stocks and commodities. The optimal moderate-risk portfolio in their results had a 10% expected volatility and a 25% allocation to commodities. This portfolio was projected to provide 0.65% per year in additional return as compared to an optimal portfolio at this same risk level without commodities.

The research suggests that diversified commodity futures have historically provided attractive risk-adjusted returns, although the Ibbotson study suggests that a substantial allocation may be necessary to exploit these benefits as part of an overall asset allocation plan.

The largest problem with any commodity strategy is that the expected returns are difficult to estimate. In recent years, returns from commodity funds have been poor. Rouwenhorst recently argued that the longer-term expected returns from a well-designed collateralized futures strategy remain substantial, while GMO's James Montier argued that an increase in the speculative long interest in these markets (as opposed to actual buyers and sellers of commodities) have substantially reduced the expected return when futures curves are in backwardation. A number of commodities have been in contango in recent years, so investors who were long futures contracts found themselves selling expiring contracts and buying more expensive longer-dated contracts. This resulted in losses rather than the positive returns that Keynes hypothesized for properly functioning (i.e., in backwardation) futures markets.

Montier is concerned that this situation may persist due to an abundance of speculators. Advisors will need to assess of whether speculators will continue to drive markets into contango and erode investor returns.

## Commodity funds

A commodity exchange-traded fund (ETF), exchange-traded note (ETN) or mutual fund provides the best access to a diversified portfolio of commodity futures. I am going to discuss what distinguishes four of the better-known funds.

### *Sample of available commodity funds*

Name	Ticker	Assets	Expense Ratio	Fund Type	Description
iPath Dow Jones-UBS Commodity Index	DJP	\$1.7 Billion	0.75%	ETN	Fully collateralized futures index
PowerShares DB Commodity Index	DBC	\$5.8 Billion	0.85%	ETF	Fully collateralized futures index with roll strategy
Pimco Commodity Real Return	PCRD	\$14 Billion	1.19%	Mutual Fund	Actively managed
Credit Suisse Commodity Return	CRSAX	\$5.6 Billion	1.09%	Mutual Fund	Actively managed

The iPath Dow Jones UBS Commodity ETN (DJP) provides the simplest and cheapest access to commodity markets. This ETN is a simple index-tracker that purchases futures contracts of 19 major

commodities, sells the contracts as they near expiration and purchases contracts in the next month. This type of so-called front-month roll strategy is straightforward and should, over time, deliver a positive return when the futures are backwardation – the price of the futures contract being sold is higher than the contract purchased.

Sometimes, however, the futures contracts with later delivery dates are more expensive, or in contango). This situation can result in a substantial loss for a front-month-roll strategy over time.

The Powershares DB Commodity ETF (DBC) provides a partial solution to the problem of contango roll losses by rolling into later-dated contracts rather than the front month, to avoid contango situations. Over the past five years, DBC has outperformed DJP by 2% per year. This has been a period when some energy commodities have been in contango. The assets in DBC are much greater than in DJP, reflecting widespread acceptance of the approach.

Beyond the two index trackers, there are a number of actively managed commodity futures funds. The PIMCO Commodity Real Return Fund (PCRD) and the Credit Suisse Commodity Return Fund (CRSAX) are the two largest.

**Performance of commodity funds (Source: Morningstar)**

Name	Ticker	Annualized Return (%)			5-Year Annualized Volatility (%)
		1 Year	3 Year	5 Year	
iPath Dow Jones-UBS Commodity Index	DJP	-3.3	-7.1	4.4	17.0
PowerShares DB Commodity Index	DBC	-4.8	-4.2	6.4	17.9
Pimco Commodity Real Return	PCRD	-7.6	-4.8	10.8	18.2
Credit Suisse Commodity Return	CRSAX	-3.4	-6.8	4.7	15.8

While there is considerable variability in the performance of these funds, returns have been negative for the most recent one- and three-year periods. While developed-market equities have rebounded sharply over this period, reduced expectations for growth in the developing economies (particularly China) and falling inflation expectations have resulted in broadly declining commodities prices. Commodities have also had a low correlation to equities and to bonds. For this reason, commodities are not expected to perform well when equities are rallying.

**Correlations of commodity fund returns to each other and to major asset classes (5 years)**

	DJP	DBC	PCRD	CRSAX	TIP
DJP	100%				
DBC	94%	100%			
PCRD	97%	92%	100%		
CRSAX	99%	95%	97%	100%	
TIP (iShares TIPS ETF)	16%	15%	36%	17%	100%
S&P500	-5%	-13%	12%	-5%	73%
Aggregate Bond Index	63%	65%	65%	64%	1%
30-Year Treasury Yield	29%	35%	16%	29%	-66%
10-Year Treasury Yield	42%	48%	33%	42%	-47%

Those low correlations are evident in the table above. All of the funds have positive correlations to changes in 30- and 10-year Treasury bond yields. The correlation is far from 100%, however, so there are clearly other factors that explain commodity returns.

The correlations also demonstrate why commodities are superior to TIPS as an inflation hedge. While income from TIPS rises with inflation, their prices have a negative correlation to Treasury bond yields, as shown by the negative correlation between Treasury bond yield and the return from TIPS (iShares TIPS ETF). TIPS perform better than traditional Treasury bonds when yields increase, but they still lose value. Because Treasury bond yields rise in response to inflation, commodities are more effective as an inflation hedge than TIPS.

This result applies to TIPS funds. A single TIPS bond provides a perfect hedge for inflation over its lifetime, but the market value of that bond may vary considerably. To the extent that the primary goal is to have a constant value of purchasing power at a specific future date (the maturity of the bonds), a TIPS bond is the perfect hedge. Commodities futures provide no such guarantee, but have historically provided a substantially higher return than inflation as well.

### Asset allocation and commodity exposure

The final question is how much benefit commodities provide and how to choose from the available funds. To address these questions, I have used Quantext Portfolio Planner (QPP), a portfolio planning tool that I designed, to calculate the expected future risk and return associated with a basic stock-bond asset allocation with and without commodity funds. QPP generates forward-looking estimates of risk and return for the commodity funds and other asset classes using Monte Carlo simulation.

I started by calculating the expected risk and return for a portfolio allocated 60% to an S&P 500 fund (SPY) and 40% to an aggregate bond fund (AGG). I then ran an optimizer to determine the asset allocation between SPY, AGG and one or more commodity funds that provided the highest expected return for the same risk level as the 60/40 portfolio. I used the baseline settings in QPP, in which the S&P 500 has expected arithmetic nominal return of 8.3% per year with a volatility of 15.1%. Aside from this setting, all other asset class returns and risk levels are generated by QPP, based on five years of historical data, through February 2014.

The expected return of AGG from QPP is 2.4% (close to its trailing 12-month yield of 2.3%), and the four commodity funds have expected total returns ranging from 9% to 10.3% per year. These returns are somewhat lower than the 11.97% arithmetic annual average return reported by Gorton and Rouwenhorst.

### ***Projected return and volatility for commodity funds***

Ticker	Beta With Respect to S&P500	Expected Volatility	Expected Return
DJP	0.74	17.9%	9.7%
DBC	0.81	18.8%	10.2%
PCRD	0.82	19.2%	10.3%
CRSAX	0.71	16.6%	9.0%
SPY	1.00	15.1%	8.3%
AGG	-0.04	3.2%	2.4%

A 60/40 portfolio has expected return of 5.93% per year and expected volatility of 9.0% per year. I used an optimizer to determine the optimal allocation of each commodity fund that would increase expected return without increasing risk. I have also simulated cases that included two commodity funds. The results are shown in the table below.

### ***Optimized portfolios including one or two commodity funds***

	Allocation							
DJP	18.4%				11.8%			
DBC			17.5%		11.3%		11.4%	
PCRD			16.7%				11.5%	
CRSAX					18.6%		11.7%	
SPY	60.0%	42.6%	42.3%	42.9%	43.8%	38.1%	38.5%	37.7%
AGG	40.0%	39.0%	40.2%	40.4%	37.6%	38.8%	38.4%	39.9%
Expected Return	5.93%	6.24%	6.24%	6.24%	6.20%	6.37%	6.34%	6.36%
Expected Volatility	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%
Correl to 10 Yr Treasury Yield	38%	35%	37%	29%	36%	35%	31%	31%
Beta with respect to S&P500	0.59	0.55	0.55	0.55	0.56	0.55	0.55	0.55
Gain Relative to 60/40	0.00%	0.31%	0.31%	0.30%	0.27%	0.43%	0.40%	0.43%

Including a single commodity fund added 30 basis points per year to the expected return of a 60/40 portfolio. While this is not an appreciable amount, it must be considered in light of the current low-yield environment. The addition of commodities represents a 5% increase in expected return over the 60/40 portfolio (0.3% / 5.93%). But obtaining this expected benefit requires 17-18% allocations to a commodity fund.

Allowing the optimizer to choose two commodity funds has a greater diversification benefit, providing 40 to 43 basis points in expected return using commodity allocations of 20% or more of the total portfolio. The Ibbotson study suggested comparable benefits at those allocation levels. But these levels of allocation to commodities are likely to be too high for most advisors and clients.

REITs also provide exposure to hard assets. The Ibbotson study did not include REITs in its analysis. When I include REITs, the results look much more reasonable.

### **Optimized portfolios including REITs and commodity funds**

	Allocation									
DJP			10.0%					7.7%		
DBC				9.7%				7.5%		7.5%
PCRD					8.9%				6.9%	6.8%
CRSAX						9.9%		7.4%		
SPY	60.0%	37.1%	32.9%	32.7%	33.9%	33.4%	31.3%	32.3%	31.7%	
AGG	40.0%	45.9%	43.7%	44.4%	44.3%	43.1%	42.6%	42.3%	43.2%	
ICF		8.7%	6.9%	6.9%	6.7%	7.0%	5.7%	5.7%	5.6%	
RWR		8.3%	6.5%	6.4%	6.3%	6.5%	5.2%	5.4%	5.2%	
Expected Return	5.93%	6.34%	6.44%	6.44%	6.43%	6.42%	6.51%	6.48%	6.50%	
Expected Volatility	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	
Correl to 10 Yr Treasury Yield	38%	27%	29%	30%	26%	29%	30%	27%	28%	
Beta with respect to S&P500	0.59	0.55	0.54	0.54	0.54	0.54	0.54	0.54	0.54	
Gain Relative to 60/40	0.00%	0.40%	0.51%	0.51%	0.50%	0.48%	0.57%	0.55%	0.56%	

Adding allocations to two REIT ETFs (ICF and RWR) resulted in higher returns and lower allocations to commodities. The resulting portfolios have 50-57 basis points in greater expected return per year with a maximum allocation to commodities of 15.2%. The portfolios that included a single commodity fund and the two REIT funds had as much as a 51-basis-point increase in return for a 9-10% allocation to commodities and 13-14% allocation to REITs.

The optimal portfolio including REITs but not commodities added 40 basis points in expected return. The optimal portfolios including commodities but not REITs added 43 basis points per year in expected return. When both were included, the maximum total benefit is 57 basis points per year.

These are modest levels of incremental gain, given all of the uncertainties in this type of analysis. On the other hand, with the low level of expected return from stock/bond portfolios, a 10% increase from the baseline (0.57% vs. 5.93%) is worth considering. The majority of this increase can be achieved using REITs alone, however.

### **Conclusions**

A body of research has shown that a diversified portfolio of commodity futures historically delivered attractive risk-adjusted returns. Commodities have also exhibited low correlation to equities and bonds, providing valuable diversification benefits. While commodity indices and funds have delivered unattractive returns in recent years, the cause is understood. Muted economic growth around the globe has resulted in low price inflation and reduced demand for commodities. When growth and inflation return, history suggests an allocation to commodities will provide an effective hedge. In the current global economic environment, an allocation to commodities is best viewed as a diversifier and as protection from an inflation shock.

While a collateralized-futures strategy has historically delivered attractive returns comparable to that

from equities, there is no guarantee that this risk premium will persist. My simulations treated collateralized commodity funds as having a risk-return relationship consistent with other asset classes, but their expected returns are lower than historical values.

In the current environment, the best course of action is a modest allocation to a commodities fund – even though my simulation results, consistent with Ibbotson’s from 2006, suggest an allocation as high as 23%. A considerable portion of the available gains from commodities can be accessed by REITs. My analysis suggests that a 10% allocation to a diversified collateralized futures strategy can add value to a portfolio of stocks, bonds and REITs. But the long-term incremental return from a 10% allocation to commodities and REITs is small – approximately 10 basis points. The greater value of such an allocation is insurance against inflation, along with the potential for equity-like returns.

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