A Better Way to Invest in Commodities

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INTRODUCTION

Commodities can be a powerful asset class to incorporate into the classic stock/bond portfolio mix, but they are prone to extended periods of flat returns and sharp crashes that correlate with broader risk-off events. In this paper we present a systematic framework for minimizing these unwanted effects, creating a commodity strategy that offers both superior returns and diversification when compared to holding a simple long-only basket of diversified commodities.

We begin this case study by outlining the opportunities and challenges of holding commodities. Over the long term, there is clear historical evidence that commodities can diversify stock exposure while delivering comparable returns. One challenge, however, is this can come with significant stretches of underperformance, such as the recent period since the Global Financial Crisis (GFC). Another challenge is that while the correlation to stocks is low, the very worst months for commodities coincide with the worst periods for stocks, exemplified by sell-offs during the GFC and the COVID crisis.

We then present a way to invest in commodities that seeks to avoid these two key challenges. First, we find that a risk-based allocation system can reduce the correlation of a commodity basket to stocks during volatile periods such as the GFC and COVID crisis, a very useful feature for portfolio diversification. Second, we find that modulating a long exposure using a trend signal can help alleviate extended drought periods, and do so significantly better than carry-based methods, whereby one attempts to reduce the effect of contango (negative roll yield) by optimizing where to invest along the curve.

THE OPPORTUNITY AND CHALLENGE OF A COMMODITY ALLOCATION

An extensive analysis of the benefits of adding commodity exposure to a stock/bond portfolio was performed by Gorton and Rouwenhorst ([1], [2]). They found significant additional upside from holding long positions in commodity futures, rather than spot commodities. This result suggested commodity futures were typically in 'backwardation', implying a discount for buying the commodity for future delivery. This was fortuitous since in many cases holding spot commodities is not practical, due to complex storage requirements (for example Natural Gas) or perishability (for example Soybeans). From 1959 to 2004, they found that a basket of commodity futures delivered comparable returns to stocks, with lower risk, as shown in Figure 1.

Figure 1: Risk-Adjusted Return Benefits of Commodities (1959-2004)

	Commodity Futures	Stocks	Bonds
Average Risk Premium	5.23%	5.65%	2.22%
Standard Deviation of Annual Return	12.10%	14.85%	8.47%
Sharpe Ratio	0.43	0.38	0.26

Source: Gorton and Rouwenhorst [1].

Figure 2 shows the correlations between commodities, stocks, and bonds from 1989 to 2022 (bond data starts in 1989), demonstrating the historical diversification benefits of commodities to the typical stock/bond portfolio. We see that the correlation between commodities and stocks is about 0.1 while the correlation to bonds is around -0.2.

Figure 2: Correlations Between Commodities, Equities, and Bonds (1989-2022)

	S&P GCSI Commodity Total Return Index	S&P 500 Total Return Index	Aggregate Bond Total Return Index
S&P GCSI Commodity Total Return Index	1.00	0.13	-0.16
S&P 500 Total Return Index	0.13	1.00	0.23
Aggregate Bond Total Return Index	-0.16	0.23	1.00

Source: Bloomberg. Calculations by Altis Partners.

With these long-term benefits, however, come two key short-term challenges: extended droughts and correlated crashes. Let's now discuss each of these in more depth before we review how to tackle them.

Extended Droughts – Commodity returns can be lackluster for prolonged periods, as evidenced by the performance of the GSCI Index from 2000 to 2022 in Figure 3. The S&P GSCI Total Return Index wasn't even able to register a positive average return, while the S&P 500 delivered 5% annually, and bonds have printed almost 3% annually. These droughts can first and foremost be due to extended periods of poor spot performance, so any solution to this problem should address this. But there is also the effect of curve shape on returns, so let's now review this return driver as well.

Figure 3: The Challenge of Droughts (2000-2022)

	S&P GCSI Commodity Total Return Index	S&P 500 Total Return Index	Aggregate Bond Total Return Index
Average Risk Premium	-0.2%	5.0%	2.7%
Standard Deviation of Annual Return	24.8%	18.2%	4.8%
Sharpe Ratio	-0.01	0.27	0.57

Source: Bloomberg. Calculations by Altis Partners.

The data set analyzed by Gorton and Rouwenhorst shows a strong tailwind from backwardation, implying a positive carry. Figure 4 shows that since the turn of the century, this pattern has reversed (curve has mostly been in contango). The total return GSCI Index (black) has severely underperformed the spot GSCI Index (gold); spot commodities are up 200% yet the returns to a commodity futures investor have been negligible. By carefully choosing where on the curve to invest, the contango problem can be mitigated, as evidenced by the performance of the DBIQ Optimal Yield Diversified Commodity Index (gray) in Figure 4. Unfortunately, the optimal yield approach ignores information on spot price movement, hence it is optimal to address droughts with a more generalized approach that can address both spot price concerns as well as curve shape challenges. Additionally, there are scenarios where the contango is so bad that no optimal curve point selection can help, and only spot-price-based systems can help with extended droughts.

Figure 4: Effects of Contango
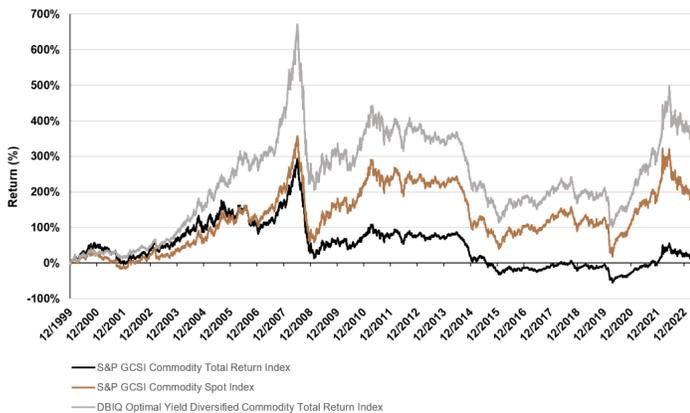
Source: Bloomberg. Calculations by Altis Partners.

Correlated Crashes – By looking at return and volatility on a 20-trading day horizon, Figure 5 shows commodity indices are negatively skewed. The most extreme returns of the DBIQ Optimal Yield Diversified Commodity Index are all to the downside and during equity market selloffs, limiting the value of commodities as a diversifier to equities. We will present a risk-based allocation methodology, also known as risk budgeting, to manage this skew risk.

Our approach reduces commodity exposure when risk is elevated, exploiting the persistence of volatility [4] to dramatically reduce exposure to crashes in the commodity market.

Figure 5: 20-Trading-Day Return: DBIQ Optimal Yield Total Return Index vs S&P 500 Index (2000 to 2022)
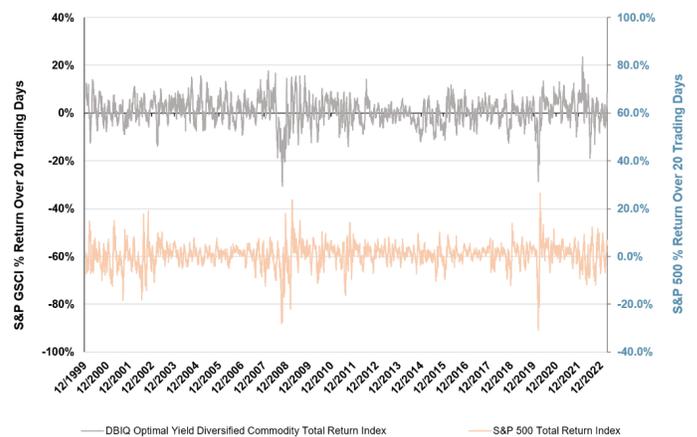
Source: Bloomberg. Calculations by Altis Partners.

THE SOLUTION – MANAGED COMMODITY EXPOSURE

Our proposed solution to the challenges inherent in a simple long-only commodity strategy is to overlay both trend-following and a risk-based allocation system on a long futures portfolio. A trend-following overlay can potentially reduce exposure to both contango and long periods of underperformance in the commodity space. A risk-based allocation to commodity futures may also reduce exposure to crashes by exploiting the phenomenon of 'volatility clustering', whereby elevated levels of volatility tend to persist, so exposure to the latter stages of a crash can be contained. A short summary of research on volatility clustering can be found on Wikipedia [4]. It provides a reference to Benoit Mandelbrot's original observations from the 1960s and its subsequent incorporation into the famous GARCH models of the 1980s. Let's now quickly review in general how we will address the challenges previously described, and then we will dig into the detailed methodology and results of our approach.

Droughts: In a long-only strategy, low to negative spot performance will never go away completely, but by using a trend signal to reduce exposure to commodities with a downtrend in their returns, the negative impact can potentially be reduced. To address the additional issue of contango in this context we compute a trend signal on a continuation of commodity futures for each market. This creates a continuous series, in which the profit/loss from backwardation/contango is embedded into the price. Hence, the return from carry appears in the trend computed from this series. Consequently, an extremely contangoed market will have an extremely negative trend signal.

Volatility & Crashes: We may also greatly improve risk management by employing a risk-based allocation system. This approach reduces exposure when volatility increases, decoupling commodity exposure from stock market crashes, breaking the link demonstrated in Figure 5.

For the simulations in this section, we use the portfolio shown in Figure 6, a universe of the most liquid energy, metal, and grain futures in the United States. The simulations receive the upper bound of the fed funds target rate on capital not deployed as futures margin, ensuring a fair test against the total return indexes we are using as benchmarks.

Figure 6: Managed Commodity Portfolio Constituents

| Description	Exchange Code	Sector
Blendstock Gasoline (RBOB)	NYMEX	Energy
Crude Oil	NYMEX	Energy
Heating Oil	NYMEX	Energy
Natural Gas	NYMEX	Energy
Corn	CBOT	Grain
Soybean Oil	CBOT	Grain
Soybeans	CBOT	Grain
Wheat	CBOT	Grain
Copper (High Grade)	COMEX	Metal
Gold	COMEX	Metal
Silver	COMEX	Metal

Source: Bloomberg.

We perform three simulations (color-coded to match the figures in this section) to illustrate our approach to overcoming the challenges of commodity investing:

Equal Notional Exposure to Each Market: This is the simplest way to get exposure to a basket of commodities and will serve as our benchmark for this study. The markets in Figure 6 are chosen for their high liquidity, so an equal allocation can be traded in considerable size.

5% Bias with Risk-Based Allocation: In this simulation we employ a risk-based allocation system and input a constant 5% annualized return expectation. It uses a Fractional Kelly [5] approach to risk management, with a fraction of 25%. This solution will take less exposure if risk expectations are higher. The 5% bias was selected to match historical return expectations calculated in [1], [2] & [6].

5% Bias with Risk-Based Allocation and Trend: This simulation augments the 5% return expectation by adding a trend signal. The trend model is a 5-day versus 65-day double moving average crossover which should be easy for the interested reader to replicate. The signal is regressed to scale it to reflect the fraction of historical variance predicted by trend. It is then added to the 5% bias. Consequently, the strategy can sell short markets where the annualized return expectation from trend is less than -5%. The trend signal captures contango effects because it is calculated on a 'continuation' of futures contracts, where the price of past contracts is adjusted by a multiplier equal to the percent of carry, to create a continuous price series. As a result, the effect of roll yield is incorporated into the price series on which we compute the trend.

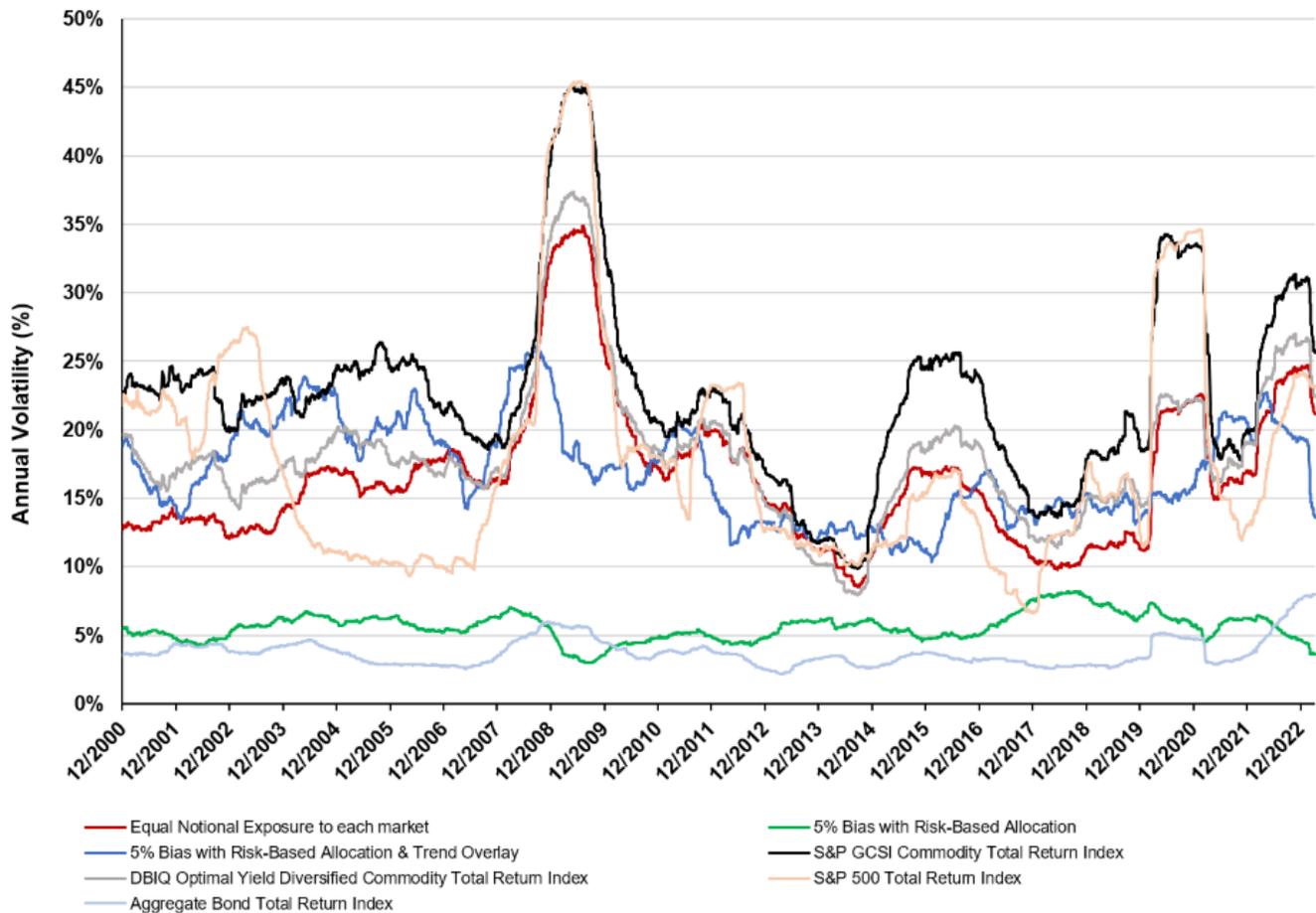**Figure 7: Managed Commodity Simulations (2000-2022)**
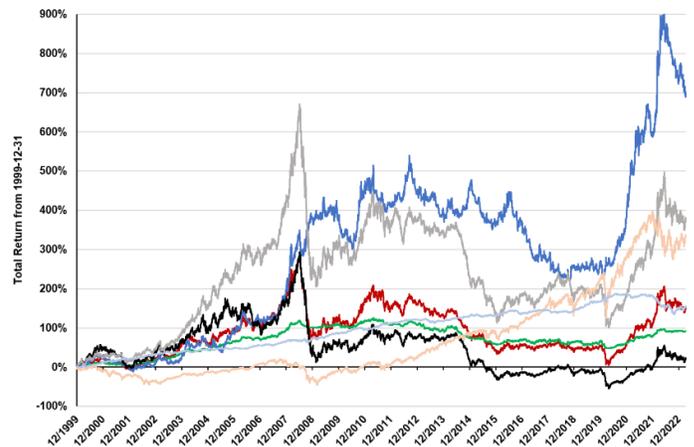
Source: Bloomberg. Calculations by Altis Partners.

Figure 7 also shows that the risk-based allocation system with a 5% return expectation in each market (green) outperforms the GSCI index (black) but underperforms the equal notional simulation (dark red). This is because it has greatly reduced volatility. However, Figure 8 shows that it has much more consistent volatility, at a level consistent with the bond index. Figure 7 shows that this would have been particularly beneficial in 2008 because exposure to the GFC is greatly reduced. This is a key advantage over the pure optimal roll yield approach. It allows an investor to hold commodities without worrying as much about amplifying losses in a stock market crash.

Risk-based allocation (green) delivers a more consistent risk profile and provides some crash protection in comparison to an equal notional allocation (dark red). Furthermore, Figure 9 shows that it increases the Sharpe ratio (a measure of the consistency of performance above the risk-free rate) from 0.17 to 0.24, but absolute returns of just 2.8% are too low. Our final simulation (blue) in Figure 7 adds a trend-following layer to address this issue. Figure 9 shows that it increases the Sharpe ratio to 0.41, exceeding the 0.27 achieved by the S&P 500. Even better, the average annual return increases from 2.9% to 9.6%. This efficacy of trend comes from two sources, the persistence of trends in the spot price and the persistence of backwardation or contango.

Figure 8: Rolling Volatility of Managed Commodity Simulation (2000-2022)

Source: Bloomberg. Calculations by Altis Partners.

Figure 9: Statistics of Managed Commodity Simulation (2000-2022)

	Equal Notional Exposure to Each Market	5% Bias with Risk-Based Allocation	5% Bias with Risk-Based Allocation & Trend Overlay	S&P GCSI Commodity Total Return Index	DBIQ Optimal Yield Diversified Commodity Total Return Index	S&P 500 Total Return Index	Aggregate Bond Total Return Index
Geometric Average Annual Return	4.3%	2.9%	9.6%	1.0%	7.1%	6.3%	4.0%
Geometric Average Annual Return ex. Risk Free Rate	3.2%	1.7%	8.4%	-0.2%	5.8%	5.0%	2.7%
Standard Deviation of Annual Return	19.2%	7.6%	21.0%	25.4%	20.7%	18.0%	5.0%
Standard Deviation of Annual Return ex. Risk Free Rate	18.76%	7.12%	20.49%	24.75%	20.13%	18.25%	4.76%
Information Ratio = Geometric Return / Standard Deviation	0.23	0.38	0.46	0.04	0.35	0.35	0.79
Sharpe Ratio	0.17	0.24	0.41	-0.01	0.29	0.27	0.57
Skewness	-0.36	-0.11	0.30	-0.29	-0.38	-0.70	-1.58
Kurtosis	-0.90	-1.07	0.12	-0.72	-0.73	0.13	4.70

Source: Bloomberg. Calculations by Altis Partners.

Figure 10 shows the correlation of our simulations to benchmarks. It reveals that adding risk management and trend overlays to a commodity basket improves the diversification of stocks. Risk-based allocation with a trend overlay (blue) has a correlation of -0.25 to the S&P 500, far lower than equal notional exposure (dark red), which has a correlation to the S&P 500 of 0.25.

The downside is reduced correlation to the commodity indices to around 0.2 because the trend component is quite strong compared to the positive return expectation of 5% annualized. Consequently, the strategy is net short commodities in the crash of 2008 for example, greatly reducing correlation to the commodity indexes.

Figure 10: Correlation Matrix of Managed Commodity Simulation (2000-2022)

	Equal Notional Exposure to Each Market	5% Bias with Risk-Based Allocation	5% Bias with Risk-Based Allocation & Trend Overlay	S&P GCSI Commodity Total Return Index	DBIQ Optimal Yield Diversified Commodity Total Return Index	S&P 500 Total Return Index	Aggregate Bond Total Return Index
Equal Notional Exposure to Each Market	1.00	0.82	0.28	0.90	0.89	0.27	-0.05
5% Bias with Risk-Based Allocation	0.82	1.00	0.54	0.77	0.83	-0.09	0.02
5% Bias with Risk-Based Allocation & Trend Overlay	0.28	0.54	1.00	0.17	0.25	-0.25	0.03
S&P GCSI Commodity Total Return	0.90	0.77	0.17	1.00	0.90	0.20	-0.03
DBIQ Optimal Yield Diversified Commodity Total Return Index	0.89	0.83	0.25	0.90	1.00	0.25	-0.04
S&P 500 Total Return Index	0.27	-0.09	-0.25	0.20	0.25	1.00	-0.01
Aggregate Bond Total Return Index	-0.05	0.02	0.03	-0.03	-0.04	-0.01	1.00

Source: Bloomberg. Calculations by Altis Partners.

Figure 11: 20-Trading-Day Return Risk-Based Allocation & Trend Strategy vs S&P 500 Index (2000 to 2022)
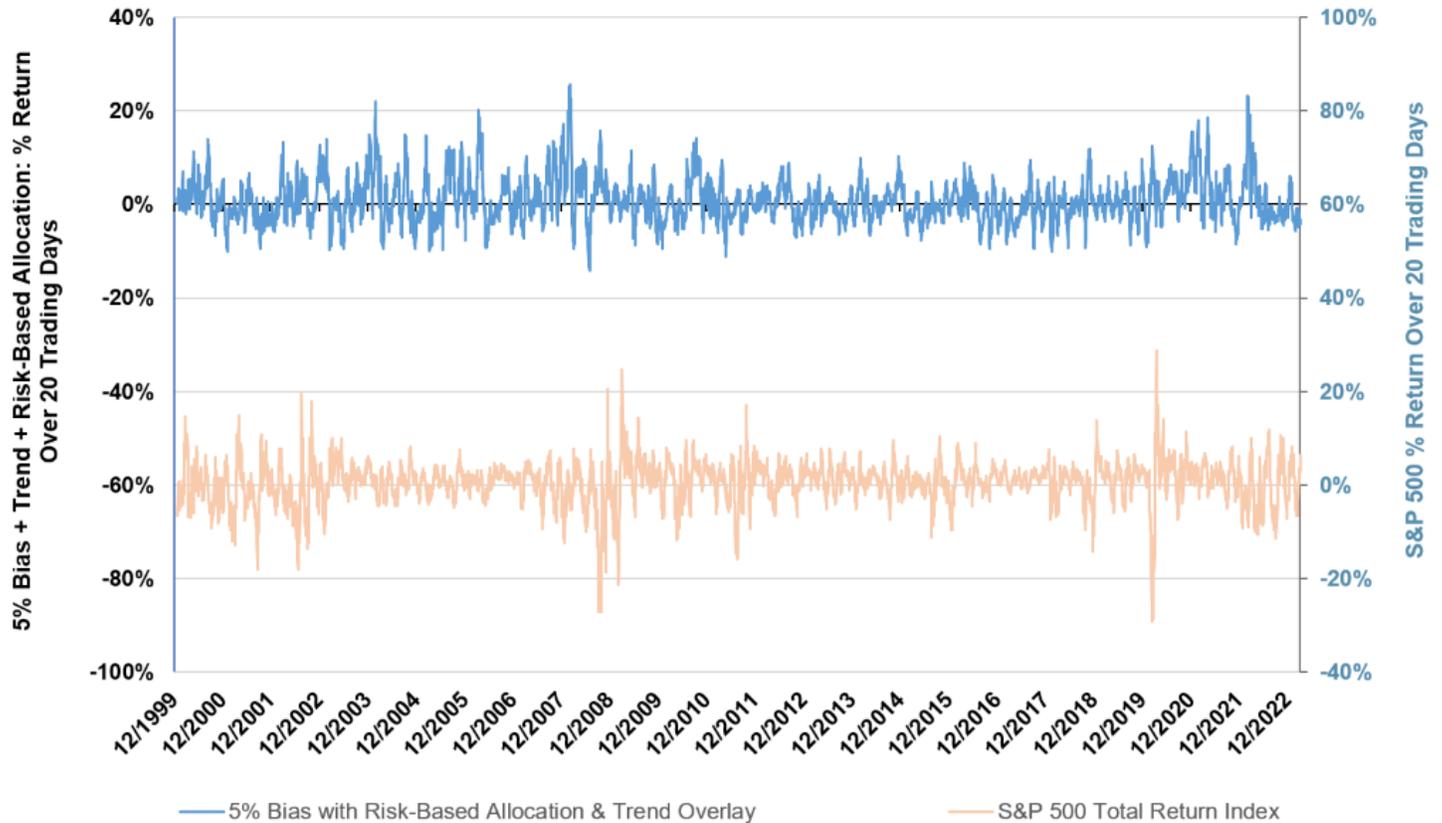
Source: Bloomberg. Calculations by Altis Partners.

Finally, Figure 11 shows how our system reduces untimely correlation to the S&P 500. It compares the rolling 20-trading-day return of the S&P 500 to our simulation with trend and risk management overlays. We see that the commodity losses that were concurrent with the market turmoil of 2008 and 2020 (discussed earlier in Figure 5) are now largely eliminated. By reducing exposure during equity crashes, we can potentially make commodities a superior diversifier for a core holding of stocks.

CONCLUSION

In this report, we investigated two improvements to a long-only basket of commodity futures. First, we added a risk management layer, to reduce overall exposure when risk is high and prevent excessive exposure to individual markets when they are undergoing volatility. Secondly, to protect the basket from losses when markets are in contango or during extended declines in spot, we added a trend signal that seamlessly incorporates carry. By adding these elements to our basket, we created a strategy with comparable performance to the S&P 500 index but with lower volatility, that is also a great diversifier to both equities and bonds.

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