

Expand Your Mind and Your Commodity Universe

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For good reasons, many investors have a love-hate relationship with commodity investments. Operationally, the annoying K-1 form complicates tax filing, although thankfully the industry has started to launch “no K-1” funds.¹ However, for meaningful returns, most investors would be happy to deal with the inconvenience of the K-1.

Unfortunately, those returns haven’t materialized. From the start of the century through year-end 2024, the two most popular commodities-tracking indices, the Bloomberg Commodity Index (BCOM) and the S&P GSCI Index (GSCI), yielded minuscule 2.15% and 1.12% annualized returns, respectively, as **Figure 1** shows. Most of those returns came from cash collateral (total return) and not the commodity futures investments themselves (excess return). Neither index has kept up with CPI inflation, and since they both maintain volatilities in the mid-to-upper teens, their risk-adjusted returns have been paltry. The last decade has not been any better.

Figure 1. Commodity Index Performance, December 1999 to December 2024



	12/1999 – 12/2024		12/2014 – 12/2024	
	Total Return	Excess Return	Total Return	Excess Return
BCOM	2.15%	0.27%	1.28%	-0.55%
GSCI	1.12%	-0.74%	1.24%	-0.59%
CPI Inflation	2.55%		3.00%	

Source: Research Affiliates, based on data from Bloomberg. This time periods chosen were done so as to provide a consistent and comprehensive view over multiple years, allowing for more robust comparisons and trend identification.



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Key Points

- Expanding the commodity universe beyond the traditional index constituents can substantially improve risk-adjusted returns for both long-only and long-short factor portfolio constructions.
- These improvements can be attributed to the higher roll yields and liquidity premia offered by the additional commodities as well as diversification returns at the portfolio level.
- For practical implementation, investors should examine which commodities to include in their portfolio against capacity and tradability requirements based on expected portfolio size and apply trading constraints.

Not only has their performance underwhelmed, these particular indices have hardly evolved over the last 25 years.² Take the BCOM. Although the index has added a few instruments since 2000, Lead and Low Sulphur Gasoil, for example, **Figure 2** shows its overall sector weights, by construction, have barely budged from those a quarter-century ago.

Figure 2. BCOM Approximate Target Section Weights, 2000 and 2025

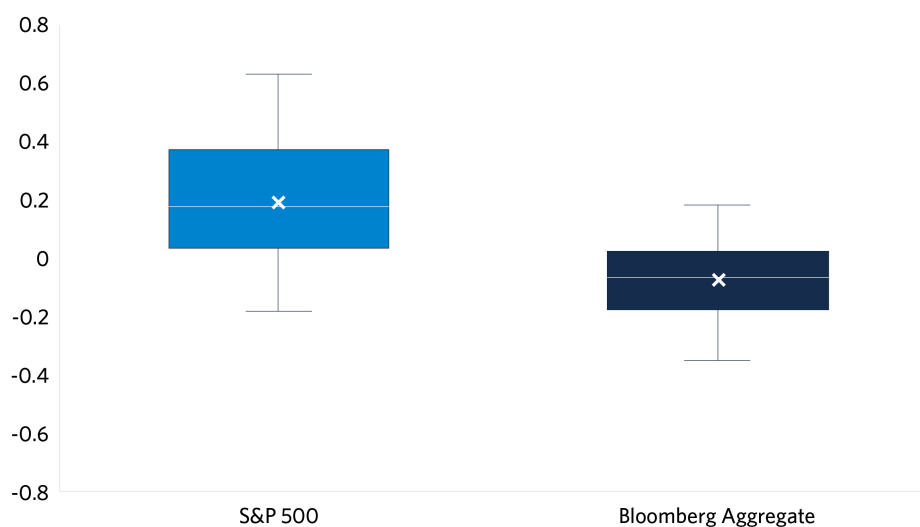
	2000 Weight	2025 Weight
Agriculture	21.0%	23.2%
Energy	30.0%	30.0%
Livestock	9.0%	5.3%
Industrial Metals	16.0%	15.1%
Precious Metals	14.0%	18.8%
Softs	10.0%	7.6%

Source: Research Affiliates, based on data from Bloomberg.



To be fair, although commodity indices haven't delivered the performance one would have liked over these 25 years, they have provided diversification to stocks and bonds. Look no further than 2022, when the S&P 500 and Bloomberg Aggregate fell 18% and 13%, respectively, while the BCOM rose 16% and the GSCI was up 26% due to its higher allocation to Oil. As **Figure 3** shows, relatively low rolling annual correlations between commodities and both stocks and bonds reflect the diversification coming from commodities.

Figure 3. Rolling 252-Day Correlation of BCOM to S&P 500 and Bloomberg Aggregate, 2000 to 2024



Notes: Each box's bottom edge represents the first quartile (25%), while its top edge represents the third quartile (75%), with the horizontal line inside each box marking the median. The whiskers extend to the smallest and largest correlation coefficients. The "X" inside each box indicates the average correlation.

Source: Research Affiliates, based on data from Bloomberg.



Given the mixed reviews for commodity investing, in this article, we address a simple question: Can we do better by expanding the universe of commodities available for investment, paying particular attention to the investability of the expanded universe? While many hedge funds and commodity trading advisors (CTAs) recognize the benefits such an expanded universe brings, most of the assets aren't currently known to the broader mass of investors.

The rest of this paper is laid out as follows: The first section describes the data, the second analyzes the tradability of the expanded universe, the third looks at adding these new commodities to a long-only portfolio, the fourth examines long-short factor portfolios, the fifth provides intuition into the sources of the benefits, and then we conclude.

1. Data Overview

As we look to grow the opportunity set of available commodities, we use the current universe of the BCOM and GSCI indices to evaluate the pros and cons of the expanded universe. For the purpose of this article, we evaluate all commodities based on the nearest-to-mature contract.³

Figure 4 displays the BCOM and GSCI universe (hereafter referred to as the liquid universe), as well as the expanded universe in gray (hereafter referred to the PLUS universe). The 10 additional commodities not currently part of the BCOM or GSCI universe include Canola, Milling Wheat, Rapeseed, UK Natural Gas,⁴ Tin, Palladium, Platinum, Robusta Coffee, Frozen Concentrated Orange Juice (FCOJ), and White Sugar.

**Figure 4. The Commodity Universe: An Overview,
December 1999 to December 2024**

Sector	Commodity	Annual Return	Standard Deviation	Sharpe Ratio	In BCOM	In GSCI
Ag	Canola	2.4%	21.5%	0.11		
Ag	Corn	-2.0%	26.6%	-0.08	Y	Y
Ag	Kansas Wheat	-2.5%	28.7%	-0.09	Y	Y
Ag	Milling Wheat (11/2014)	2.2%	20.6%	0.11		
Ag	Rapeseed (09/2001)	7.3%	19.0%	0.38		
Ag	Soybean Meal	12.8%	27.1%	0.47	Y	
Ag	Soybean Oil	3.9%	26.5%	0.15	Y	
Ag	Soybeans	7.7%	24.2%	0.32	Y	Y
Ag	Wheat	-5.6%	29.1%	-0.19	Y	Y
Energy	Blendstock Gasoline (RBOB)	16.7%	35.4%	0.47	Y	Y
Energy	Crude Oil, Brent	10.5%	31.3%	0.34	Y	Y
Energy	Heating Oil	10.7%	31.6%	0.34	Y	Y
Energy	Low Sulphur Gasoil	11.6%	31.8%	0.37	Y	Y

Sector	Commodity	Annual Return	Standard Deviation	Sharpe Ratio	In BCOM	In GSCI
Energy	Natural Gas	-13.6%	51.8%	-0.26	Y	Y
Energy	UK Natural Gas	-18.8%	55.2%	-0.34		
Energy	WTI Crude	7.2%	35.7%	0.20	Y	Y
Industrial Metals	Aluminum	0.3%	19.8%	0.02	Y	Y
Industrial Metals	Copper	8.6%	25.1%	0.34	Y	Y
Industrial Metals	Lead	9.3%	27.6%	0.34	Y	Y
Industrial Metals	Nickel	9.2%	34.8%	0.27	Y	Y
Industrial Metals	Tin (12/2011)	9.0%	26.3%	0.34		
Industrial Metals	Zinc	5.1%	26.6%	0.19	Y	Y
Livestock	Feeder Cattle	1.6%	15.4%	0.10		Y
Livestock	Lean Hogs	-5.8%	25.8%	-0.23	Y	Y
Livestock	Live Cattle	0.4%	14.2%	0.03	Y	Y
Precious Metals	Gold	7.7%	16.0%	0.48	Y	Y
Precious Metals	Palladium	7.6%	35.2%	0.22		
Precious Metals	Platinum	5.6%	22.4%	0.25		
Precious Metals	Silver	8.5%	30.0%	0.28	Y	Y
Softs	Cocoa	13.7%	32.9%	0.42		Y
Softs	Coffee	-2.8%	30.8%	-0.09	Y	Y
Softs	Coffee, Robusta (08/2008)	6.5%	26.2%	0.25		
Softs	Cotton	-0.4%	28.5%	-0.01	Y	Y
Softs	FCOJ	6.8%	29.6%	0.23		
Softs	Sugar	5.9%	30.9%	0.19	Y	Y
Softs	White Sugar	13.6%	23.8%	0.57		

Notes: All returns are annualized and excess of cash collateral. We use data starting from December 1999 unless otherwise specified.

Source: Research Affiliates, based on data from Barchart.

While our augmented list of commodities is by no means exhaustive, by adding 10 to the initial set of 26, we've already expanded the universe by close to 40%, which is more than sufficient for this study.

In choosing the commodities to add to our expanded universe, we focus on tradability and liquidity, which we discuss later, as well as the exchange on which the assets trade. We avoid exchanges that are hard for the average investor to access, including onshore Chinese commodities.

It is also important to recognize the volatility inherent in individual commodities. Therefore, we do not recommend investing in individual PLUS commodities or, for that matter, individual liquid commodities. For example, **Figure 5** shows Natural Gas and UK Natural Gas have annual returns of -13% and -18%, respectively, over the past quarter century, while Cocoa and White Sugar have returned more than 13% each. On a forward basis, we can't be sure which will be the next Cocoa or White Sugar, so with commodities, diversification is our friend.

**Figure 5. PLUS Commodity Set Overview,
December 1999 to December 2024**

Commodity	Exchange	Sector	Description	Avg Return (ITD)	Avg Return (10-Year)	Avg Return (5-Year)	Avg Return (3-Year)
Canola	ICE (US)	Ag	A type of oilseed selected from rapeseed developed by Canadian scientists. The contract represents the global Canola seed market.	2.4%	6.6%	15.0%	-11.4%
Milling Wheat	MATIF	Ag	Wheat of EU origin, producing more winter, soft, and white wheat than wheat of US origin.	2.2%	0.7%	8.9%	-4.1%
Rapeseed	MATIF	Ag	The second largest worldwide oilseed product producing oil for cooking and industrial processes. The contract is for European Rapeseed.	7.3%	8.5%	12.5%	-5.6%
UK Natural Gas	ICE (EU)	Energy	Natural Gas traded at the National Balancing Point (NBP) Virtual Trading Point, a virtual location for buying, selling, and exchanging natural gas in the UK.	-18.8%	-7.9%	9.9%	-51.6%
Tin	LME	Industrial Metals	Used as a solder to join electrical components to circuit boards, chemical heat stabilizers in PVCs, or tinplate for food storage.	9.0%	10.4%	20.1%	-2.1%
Palladium	NYMEX	Precious Metals	Used in jewelry and industrial usages such as electronic components, dentistry, or catalytic converters to reduce harmful emissions for automobiles.	7.6%	5.6%	-11.5%	-22.8%
Platinum	NYMEX	Precious Metals	Used mostly as automotive catalytic converters as well as in jewelry.	5.6%	-2.3%	-1.0%	-2.5%
Coffee, Robusta	ICE (EU)	Softs	The second largest coffee species grown on an industrial scale worldwide.	6.5%	12.8%	35.4%	43.2%
FCOJ	ICE (US)	Softs	Global frozen concentrated orange juice market.	6.8%	19.1%	42.6%	65.2%
White Sugar	ICE (EU)	Softs	Also known as Sugar No.5, representing the global refined sugar market.	13.6%	9.0%	17.9%	16.1%

Notes: All returns are annualized and excess of cash collateral. Headings 10-Year, 5-Year, 3-Year refer to windows of time that conclude at year-end 2024 (i.e., previous 10 years). ITD refers to initial-to-date of December 1999 to December 2024.

Source: Research Affiliates, based on data from Barchart.

2. PLUS Commodities: Capacity and Tradability

Two important considerations in expanding our commodity universe are the capacity and the tradability of those additional instruments. Capacity relates to investor needs and whether there is sufficient volume, on average, over *long periods* of time, relative to the investor's expected portfolio size. Tradability refers to if open contracts are actively changing hands in the market over relatively *short periods*.

“Two important considerations in expanding our commodity universe are the capacity and the tradability of those additional instruments.”

Defined as the average daily dollar volume over the past three years, capacity provides a direct measure of how much can be allocated to each instrument. To avoid setting capacity constraints that could absorb the entire capacity of the asset, we first apply an 80% haircut (20% cap) in estimating each asset's capacity requirement for our portfolio.

$$\text{Capacity Requirement}_t^i = 20\% \times \text{Avg Daily Dollar Volume}_{(t-3,t)}^i$$

Once we calculate the capacity requirement for each asset, we convert that dollar amount to the allowable exposure in our portfolio based on the target notional amount of our portfolio and a 50-basis-point minimum exposure amount. Any instrument that cannot handle at least 50 basis points (bps) of exposure we classify as too small to be meaningful.

$$\text{Max Allowable Portfolio Exposure}_t^i \% = \frac{\$ \text{Capacity Requirement}_t^i}{\$ \text{Total Portfolio Notional Amt}_t^i}$$

$$\text{Asset Allowable Portfolio Exposure}_t^i \% = \text{if} \left(\text{Max Allowable Portfolio Exposure}_t^i \% > 50 \text{ bps, Max Allowable Portfolio Exposure}_t^i \%, 0 \right)$$

For example, consider a commodity fund with \$500 million in allocated capital and a 200% average gross leverage target (i.e., \$1-billion total notional amount). An asset with allowable exposure of 50 bps would need a daily dollar capacity requirement of \$5 million, or an average dollar daily volume of \$25 million.

This capacity requirement constraint implies that the ability to expand the commodity universe depends on the fund's committed capital, gross leverage target, and minimum asset exposure threshold, or, in our example, \$500 million, 200%, and 50 bps, respectively. We apply these parameters throughout this paper. As **Figure 6** shows, under these starting values, we can expand the universe by 41%, from 22 to 31 assets.⁵ Further, our analysis suggests that at least one PLUS commodity can be included in the universe for up to a \$16-billion fund size, which exceeds the typical assets under management (AUM) of most active commodity funds in the current market.

Figure 6. Fund AUM and Number of Investable Commodities

AUM	Average Daily Dollar Volume	Investible Commodities	% of Universe Expanded
\$500 million	\$25 million	31	41%
\$1 billion	\$50 million	30	36%
\$5 billion	\$250 million	27	23%
\$10 billion	\$500 million	24	9%
\$20 billion	\$1 billion	17	-23%
\$50 billion	\$2.5 billion	11	-50%
\$150 billion	\$7.5 billion	3	-86%
\$600 billion	\$30 billion	0	-100%

Notes: LME commodities are excluded from the count. All rows assume 200% target gross leverage and 50 bps of minimum asset exposure.

Source: Research Affiliates, based on data from Barchart as of December 31, 2024.



We assess the tradability liquidity consideration as average daily volume relative to open interest over a relatively short 21-day period, indicating whether the market is sufficiently active, independent of any specific investor needs.

Our tradability criterion requires that instruments consistently maintain tradability above 5% over the past three years. Commodities that fail to meet this threshold would have experienced at least one month over the past three years when less than 5% of open contracts were actively traded. A stale market introduces liquidity risk in the form of difficulty in trading, increased transaction costs, poor execution pricing, or some combination thereof.

Figure 7. Capacity and Tradability Requirements Summary

Rules	Definition	Criterion for Inclusion
Capacity	Average daily dollar volume over past three years	Average daily dollar volume > \$25 million
Tradability	Average daily volume relative to open interest over past 21 days	Average 21-day volume to open interest over past three years maintains above 5%

Source: Research Affiliates.



Applying the rules and levels summarized in **Figure 7** to examine our commodity universe, with data as of year-end 2024, we unsurprisingly find that liquid universe commodities comfortably meet both the capacity and tradability criteria, reflecting their selection to BCOM and GSCI. While most PLUS commodities exhibit considerably lower capacity and tradability than their liquid

universe counterparts, all still satisfy both requirements.⁶ Our analysis of historical data shows the year when the various PLUS commodities began meeting both trading criteria: Canola, 2007; Milling Wheat, 2014; Rapeseed, 2009; UK Natural Gas, 2007; Palladium, 2007; Platinum, 2005; Robusta Coffee, 2011; FCOJ, 2006; and White Sugar, 2005.

Defining and measuring the best capacity and tradability levels is as much art as it is science. As a check, in **Figure 8**, we rank the full set of commodities by our capacity metric and compare them to the rank order of the BCOM's 2025 allocation weights. The Spearman rank-order correlation is statistically significant ($p\text{-value} < 0.001$) at nearly 0.7. That we see significant overlap between the two sets of ranks, with the exception of a few energy commodities, adds further credence to our measure. Quantica Capital (2025) also shows similar results, with fewer than 30 of 69 commodities accounting for 90% of the total portfolio risk for a \$5-billion trend fund.

Figure 8. Capacity and Tradability of Commodity Universe

Commodity	Capacity	Tradability	Capacity Rank	BCOM Weight Rank
Gold	\$26,016	20%	1	1
Crude Oil, Brent	\$21,523	43%	2	2
WTI Crude	\$19,135	60%	3	4
Soybeans	\$6,782	23%	4	5
Low Sulphur Gasoil	\$5,754	42%	5	14
RBOB	\$5,628	44%	6	17
Copper (CME)	\$5,463	30%	7	7
Silver	\$5,457	20%	8	8
Heating Oil	\$5,338	43%	9	16
Corn	\$3,824	16%	10	6
Natural Gas	\$3,381	28%	11	3
Soybean Meal	\$2,175	21%	12	10
Soybean Oil	\$1,912	24%	13	11
Wheat	\$1,892	19%	14	15
Coffee	\$1,605	12%	15	12
Live Cattle	\$1,540	15%	16	9
Sugar	\$1,461	10%	17	12
Cocoa	\$878	14%	18	N/A
Cotton	\$855	9%	19	20
Kansas Wheat	\$854	12%	20	18
Platinum	\$810	17%	21	N/A
ICE UK Natural Gas	\$675	6%	22	N/A

Commodity	Capacity	Tradability	Capacity Rank	BCOM Weight Rank
Lean Hogs	\$659	16%	23	19
Feeder Cattle	\$626	20%	24	N/A
Milling Wheat	\$481	10%	25	N/A
Palladium	\$322	14%	26	N/A
Rapeseed	\$250	10%	27	N/A
Robusta Coffee	\$249	11%	28	N/A
Canola	\$211	11%	29	N/A
White Sugar	\$191	9%	30	N/A
FCOJ	\$32	6%	31	N/A

Notes: Capacity values are shown in millions. LME commodities are excluded from the count due to data limitations. We admit that determining exact capacity and tradability values is as much art as it is science. Although the exact magnitudes can be disputed, for comparison, we include the rank order of the target weights for the 2025 BCOM index. Here we can see that our capacity ranks line up well with BCOM with the exception of Low Sulphur Gasoil, RBOB Gasoline, and Heating Oil, in which our numbers show strong capacity versus what BCOM chooses at weight. All of the other values are similar or show BCOM with a larger rank weight than our capacity ranks.

Source: Research Affiliates, based on data from Barchart as of December 31, 2024.



“Defining and measuring the best capacity and tradability levels is as much art as it is science.”

Having established that the expanded universe offers adequate capacity and tradability, let’s move on to determine if adding these assets is accretive to portfolio performance.

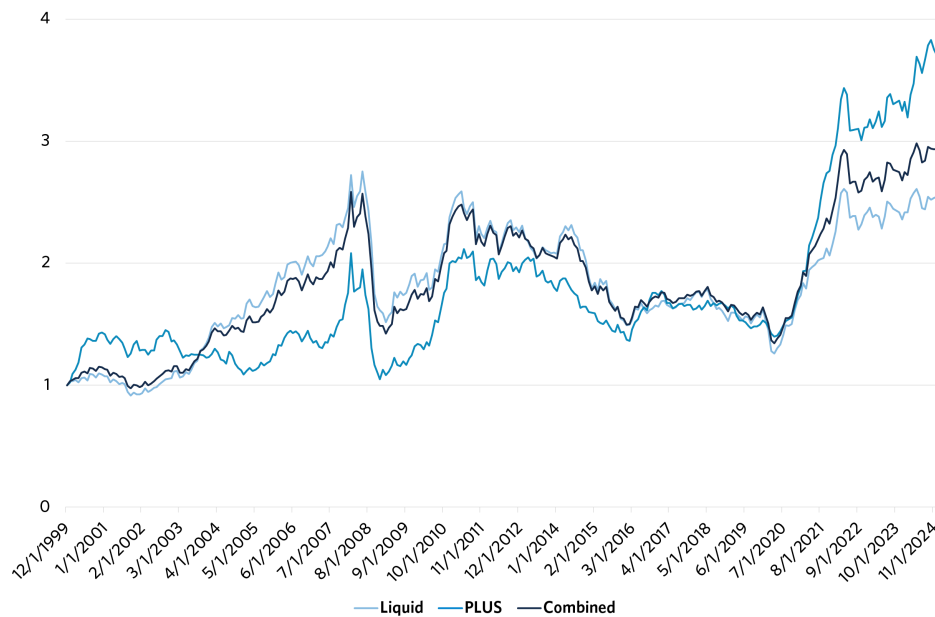
3. PLUS Commodities in Long-Only Portfolios

We first compare the performance of long-only portfolios constructed from three universes: liquid, PLUS, and combined liquid + PLUS. To ensure comparability, all three portfolios have the same portfolio construction methodology—equal volatility weighted² rebalancing monthly—as opposed to directly using BCOM or GSCI methodology. This eliminates the differences attributable to specific index creation rules and isolates the performance impact of the PLUS commodities.

Figure 9 shows the results over the past 25 years. The PLUS portfolio exhibits better performance relative to the liquid portfolio, with higher average returns,⁸ improved Sharpe ratio, reduced maximum drawdown, and less negative skew. The combined portfolio also demonstrates the same improvements compared to the liquid portfolio, though to a lesser extent, since the liquid commodities represent around 75% of the portfolio allocation over time (PLUS commodities are 25% of the total allocation).

Figure 9. Long-Only Equal-Volatility Portfolios, 2000 to 2024⁹

	Long Only Equal-Vol Portfolio		
	Liquid	PLUS	Combined
Avg. Return	4.62%	6.28%	5.12%
Volatility	12.85%	13.80%	12.22%
Sharpe Ratio	0.36	0.45	0.42
MaxDrawDown	(54.22%)	(49.59%)	(47.90%)
Skew	(0.68)	(0.27)	(0.62)
Turnover	32.60%	33.90%	33.43%
Gross Leverage	100.00%	100.00%	100.00%



Notes: Portfolios rebalance monthly and target 100% gross leverage. All portfolio analytics shown hereafter are in excess terms and annualized using the arithmetic average of monthly returns. The portfolios constructed herein are simulated. Please see our disclosures for important information regarding simulated data terms and annualized using the arithmetic average of monthly returns.

Source: Research Affiliates, based on data from Barchart as of December 31, 2024.

As markets have evolved and deepened over time, we know less trading was conducted in the PLUS commodities in the early years relative to the end of our sample period. To ensure our results aren't biased by early performance, we next look at only the last 10 years, from 2015 to 2024.

Figure 10 shows the results over the most recent decade have even more outperformance in the PLUS portfolio compared to the liquid portfolio, with a significantly higher average return and Sharpe ratio as well as meaningfully reduced maximum drawdown and positive skew. The performance of the combined portfolio, even at 25% allocation to PLUS commodities, demonstrates improvement over the liquid universe alone.

Figure 10. Long-Only Equal-Volatility Portfolios, 2015 to 2024

	Long Only Equal-Vol Portfolio		
	Liquid	PLUS	Combined
Avg. Return	3.67%	8.96%	5.19%
Volatility	11.65%	10.63%	10.64%
Sharpe Ratio	0.31	0.84	0.49
MaxDrawDown	(32.73%)	(20.89%)	(25.69%)
Skew	(0.32)	0.29	(0.10)
Turnover	32.45%	33.09%	33.03%
Gross Leverage	100.00%	100.00%	100.00%

Notes: Portfolios rebalance monthly and target 100% gross leverage. The portfolios constructed herein are simulated. Please see our disclosures for important information regarding simulated data.

Source: Research Affiliates, based on data from Barchart as of December 31, 2024.

In the next section, we investigate whether the performance improvement from the PLUS universe could also be captured through a cross-sectional, long-short portfolio construction.

4. Long-Short Portfolio Performance

As previously discussed, the risk-adjusted returns of the long-only commodity indices, BCOM and GSCI, have been modest over time. Fortunately, since commodity investing is implemented via derivatives—specifically commodity futures—we have a couple of dials that we can adjust. First is the ability to obtain leverage without having to explicitly borrow capital at a fee. This allows us to magnify the returns, albeit with higher volatility. Second is the ability to obtain short exposure to a commodity without the high borrowing costs that affect equities, providing us with a cost-effective means of capturing profits when asset prices fall. Finally, an extensive and growing literature documents various factor-based investing approaches in the commodity space, illustrating the mechanism to systematically capture various sources of return. See, for example, Erb and Harvey (2006), Koijen et al. (2018), Asness et al. (2013), and Fernandez-Perez et al. (2018).

To assess the effects of including the PLUS commodities, we select four well-documented factors, as **Figure 11** shows. For consistency, we create the factor portfolios in the same way, which may differ from the original literature; however, since we focus on the relative benefits of introducing the PLUS commodities to the liquid universe of assets, any changes in construction will not impact our findings. To avoid imposing ex-ante views on the relative performance of these factors, we aggregate them into a long-short portfolio such that they contribute the same expected portfolio volatility. To account for the lower liquidity of PLUS commodities and to mitigate portfolio concentration risk, we apply exposure and exposure change trading constraints to each commodity at each

monthly rebalance.¹⁰ These constraints are critical for evaluating the PLUS commodity effects in a more realistic, implementable framework.

Figure 11. Long-Short Factor Construction

Portfolio Name	Signal Definition	Portfolio Construction
Carry	Roll yield from current contract to a reference contract based on roll schedule	1. Rank signals and long (short) top (bottom) 1/3 2. Equal-vol weighted targeting 100% gross leverage
Value	Negative of the seasonally adjusted change in real price between last month and that from five years ago	1. Rank signals and long (short) top (bottom) 1/3 2. Equal-vol weighted targeting 100% gross leverage
Momentum	Rolling 12-month average returns	1. Rank signals and long (short) top (bottom) 1/3 2. Equal-vol weighted targeting 100% gross leverage
Skew	Cubic measure of skewness using rolling one-year returns	1. Rank signals and long (short) top (bottom) 1/3 2. Equal-vol weighted targeting 100% gross leverage

Source: Research Affiliates.



Over the past 25 years, as **Figure 12** shows, PLUS commodities have significantly enhanced the performance of the multi-factor long-short portfolio. We observe a 0.4 increase in Sharpe ratio and a nearly 50% reduction in max drawdown. More importantly, the performance improvement persists even after applying trading constraints, though at a lower magnitude given the overall exposure limits to the PLUS commodities. Furthermore, the trading costs do not materially detract from the benefits observed.¹¹

Figure 12. Long-Short Portfolios, 2000 to 2024

	L/S Portfolio		L/S Portfolio + Constraints		L/S Portfolio + Constraints + Costs	
	Liquid	Combined	Liquid	Combined	Liquid	Combined
Avg. Return	10.35%	14.32%	10.06%	11.79%	9.05%	10.75%
Volatility	15.41%	13.44%	14.95%	12.43%	14.96%	12.42%
Sharpe Ratio	0.67	1.07	0.67	0.95	0.60	0.87
MaxDrawDown	(33.83%)	(18.50%)	(31.58%)	(18.51%)	(32.77%)	(22.25%)
Skew	(0.12)	0.07	(0.19)	(0.02)	(0.19)	(0.01)
Turnover	377.48%	365.00%	355.37%	345.55%	355.37%	345.55%
Avg. Gross Leverage	200.00%	200.00%	190.75%	184.56%	190.75%	184.56%

Notes: Portfolios rebalance monthly and target 200% gross leverage and apply maximum exposure and trading exposure change limits (per 200% gross leverage) as well as transaction and roll costs. The portfolios constructed herein are simulated. Please see our disclosures for important information regarding simulated data.

Source: Research Affiliates, based on data from Barchart as of December 31, 2024.



Notably, the return contribution from the PLUS commodities is about 40% of the overall performance while also accounting for about 40% of the total gross leverage (200%). All PLUS commodities positively contribute to the overall performance with the exception of Platinum.¹² Given the inclusion of the PLUS commodities is determined solely by liquidity and fundamental criteria, these findings provide empirical support for the value of expanding the commodity universe.

However, to be fair, we didn't have the data to know these 10 PLUS commodities would have the necessary capacity and tradability to include in our long-short portfolios in 2000, but we would have had that information by 2015. **Figure 13** shows similar improvements in performance over the last 10 years across all portfolio analytics, while trading constraints and costs still do not eliminate the benefits of incorporating the PLUS commodities.

Figure 13. Long-Short Portfolios, 2015 to 2024

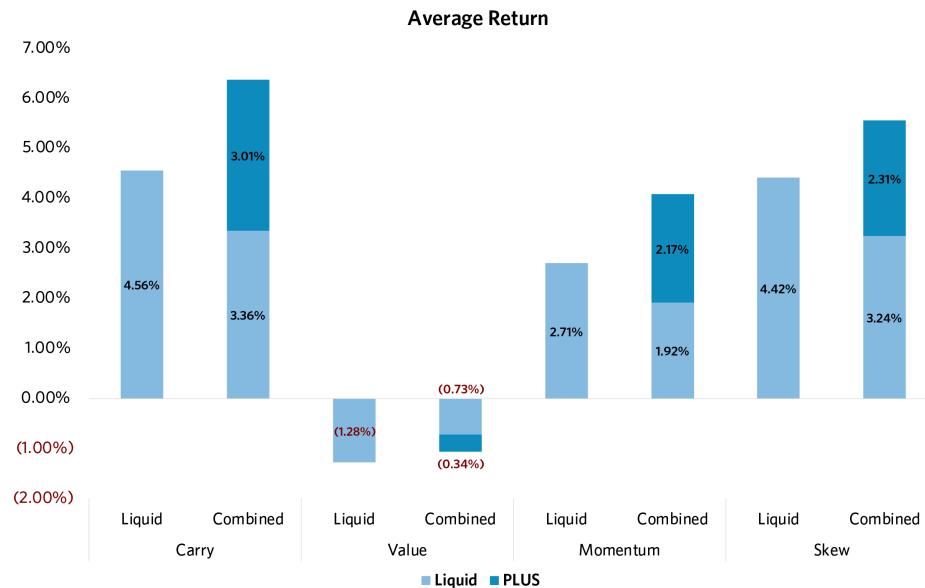
	L/S Portfolio		L/S Portfolio + Constraints		L/S Portfolio + Constraints + Costs	
	Liquid	Combined	Liquid	Combined	Liquid	Combined
Avg. Return	5.20%	11.38%	6.16%	7.84%	5.30%	6.95%
Volatility	17.67%	14.15%	17.58%	13.49%	17.59%	13.50%
Sharpe Ratio	0.29	0.80	0.35	0.58	0.30	0.51
MaxDrawDown	(33.83%)	(18.50%)	(31.58%)	(18.51%)	(32.77%)	(22.25%)
Skew	(0.21)	0.07	(0.22)	(0.01)	(0.22)	(0.01)
Turnover	395.13%	380.44%	367.44%	358.87%	367.44%	358.87%
Avg. Gross Leverage	200.00%	200.00%	192.95%	184.16%	192.95%	184.16%

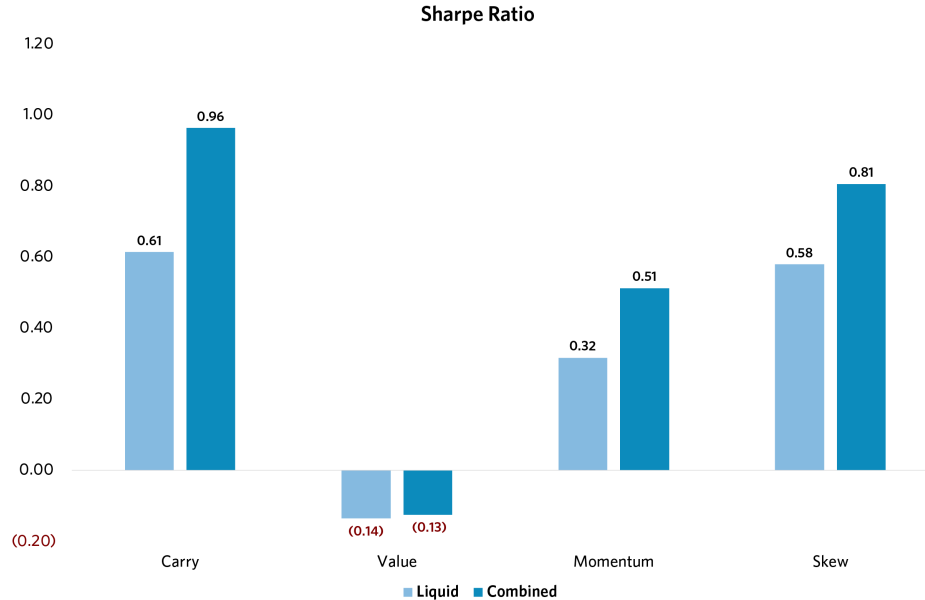
Notes: Portfolios rebalance monthly and target 200% gross leverage and apply maximum exposure and trading exposure change limits (per 200% gross leverage) as well as transaction and roll costs. The portfolios constructed herein are simulated. Please see our disclosures for important information regarding simulated data.

Source: Research Affiliates, based on data from Barchart as of December 31, 2024.

Finally, to further validate the robustness of these results, in **Figure 14**, we compare the average return of each individual factor portfolio constructed on the liquid universe to one created with the combined universe and also decompose the performance of the portfolios constructed on the combined universe into liquid and PLUS commodities. Across all four factor portfolios, including the PLUS commodities consistently results in higher average returns and improved Sharpe ratios. In portfolios with positive overall performance, the return contribution from PLUS commodities is comparable to that from liquid commodities despite accounting for only ~25% of the total gross leverage (100%).

Figure 14. Long-Short Factor Portfolios, 2000 to 2024





Notes: Portfolios rebalance monthly and target 100% gross leverage without considering trading constraints or costs since they do not impact our findings.

Source: Research Affiliates, based on data from Barchart as of December 31, 2024.

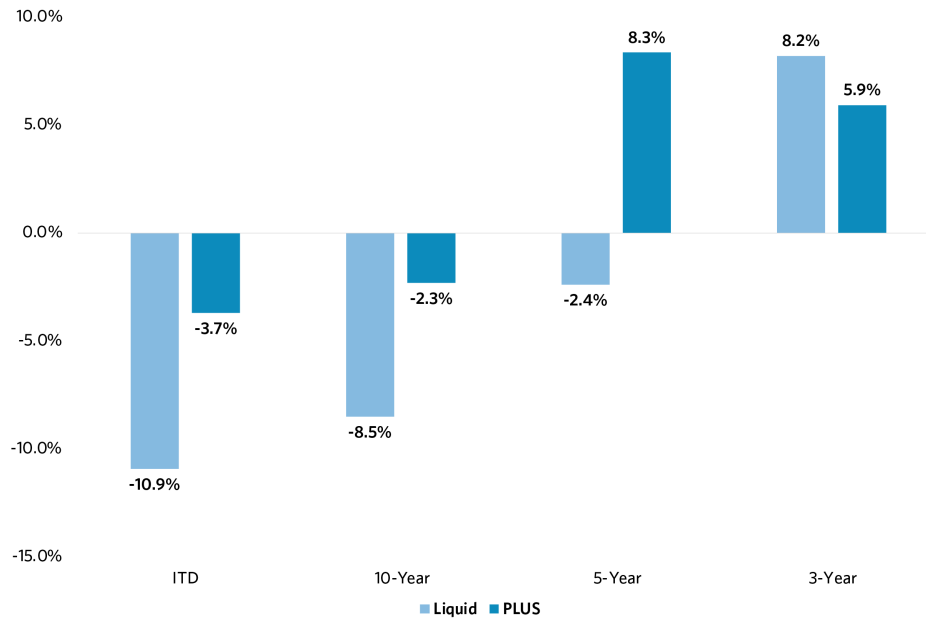
Although these results are encouraging, we need to dive deeper to better understand the drivers of these findings to ascertain whether they have the potential for continuation in the future.

5. Drivers of Performance Improvement

Both the long-only and the long-short factor strategies provide evidence of the value of adding the PLUS commodities to a portfolio. Before concluding, we conduct a cursory peeling back of the onion to examine different characteristics and assess whether they are potential sources of the excess performance. Specifically, we look at three such drivers—the roll yield and liquidity premium at the asset level and the diversification return at the portfolio level.

First, the return of a commodity future can be decomposed into the roll yield, also known as carry, which accounts for the change in the price of the derivative as it approaches maturity, and the return due to changes in the spot price of the underlying commodity. **Figure 15** shows that across multiple horizons—other than the most recent three-year period, which is significantly distorted by UK Natural Gas¹³—PLUS commodities consistently demonstrate higher average volatility-adjusted roll yields, suggesting higher average returns.

Figure 15. Average Volatility-Adjusted Roll Yield

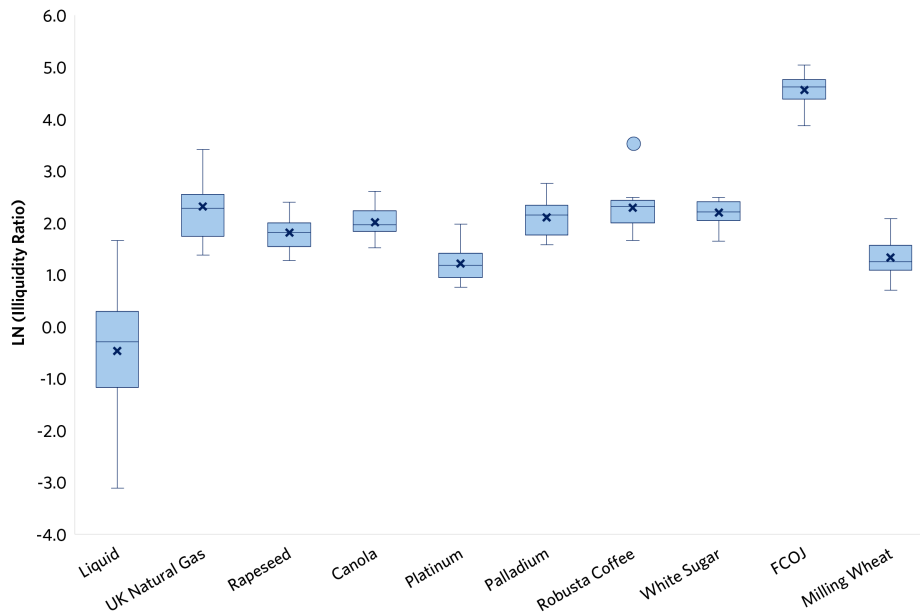


Notes: Roll yields are annualized and adjusted by asset volatility for an apples-to-apples comparison. Labels 10-Year, 5-Year, and 3-Year refer to windows of time that conclude at year-end 2024. ITD refers to initial-to-date, which is 2000 to 2024.

Source: Research Affiliates, based on data from Barchart as of December 31, 2024.

Second, although the PLUS commodities meet our capacity and tradability thresholds, they do have lower liquidity than their liquid universe counterparts and therefore may command a higher return premium to compensate for liquidity risk. To measure this, we use the Amihud (2002) illiquidity ratio, which compares an asset's absolute daily return to its daily dollar volume, averaged over one year, indicating an asset's price reaction to a dollar of trading volume over time. Larger values imply more price impact per dollar traded, or a more illiquid asset. **Figure 16** shows that all PLUS commodities have higher illiquidity measurements than liquid commodities.

Figure 16. Illiquidity Ratio, 2015 to 2024



Notes: We leverage the past 10 years of data to ensure comprehensive return and dollar volume data availability. LME commodities are excluded due to data limitations. The ratios are log-scaled for better visualization. The bottom edge of each box represents the first quartile (25%) while the top edge represents the third quartile (75%), with the horizontal line inside each box marking the median. The whiskers extend to the smallest and largest ratios. The "X" inside each box indicates the average ratio.

Source: Research Affiliates, based on data from Barchart as of December 31, 2024.

Comparing the average returns of the PLUS commodities over the last 10 years and the average return of the liquid universe grouped by sector, we find that seven of the 10 PLUS commodities outperform their sector's average return, as **Figure 17** shows. Tying this back to measures of illiquidity, there seems to be a positive relationship between the magnitude of the outperformance and the instrument's illiquidity ratio. In general, the higher the illiquidity ratio rank, the higher the outperformance rank. This suggests that the excess performance of PLUS over liquid is at least partially attributable to a liquidity premium.

Figure 17. Average Return: PLUS vs. Sector Average, 2015 to 2024

Commodity	Avg Return	Avg Return (Liquid in Same Sector)	Capacity Rank	Illiquidity Ratio Rank	Sector Outperformance Rank
Platinum	-2.3%	6.5%	1	9	8
UK Natural Gas	-7.9%	6.2%	2	2	9
Milling Wheat	0.7%	-0.8%	3	8	5
Palladium	5.6%	6.5%	4	5	7
Rapeseed	8.5%	-0.8%	5	7	2
Robusta Coffee	12.8%	8.2%	6	3	4
Canola	6.6%	-0.8%	7	6	3
White Sugar	9.0%	8.2%	8	4	6
FCOJ	19.1%	8.2%	9	1	1
Tin	10.4%	3.4%	N/A	N/A	N/A

Notes: Tin is excluded from the rankings due to data limitations. Higher capacity ranks are generally associated with lower illiquidity ranks as well as lower sector outperformance ranks.

Source: Research Affiliates, based on data from Barchart as of December 31, 2024.



Third, incorporating PLUS commodities into all portfolios discussed in the previous sections reduces overall portfolio volatility,¹⁴ as **Figure 18** shows, despite these commodities not exhibiting materially lower volatility on average compared to the liquid universe (28.0% vs. 28.4%). This implies diversification benefits through lower pairwise correlation between PLUS and liquid commodities.

Figure 18. Portfolio Volatility

Portfolio	Combined	Liquid	Difference
Long-Only	12.2%	12.8%	-0.6%
Long-Short	12.4%	15.0%	-2.5%
Carry	6.6%	7.4%	-0.8%
Value	8.5%	9.5%	-1.0%
Momentum	8.0%	8.6%	-0.6%
Skew	6.9%	7.6%	-0.7%

Source: Research Affiliates, based on data from Barchart as of December 31, 2024.



Indeed, **Figure 19** shows the overall average asset correlations are lower for PLUS commodities than for liquid commodities both within sector and across the entire universe, with the exception of Softs, driven by higher correlations between Robusta Coffee vs. Coffee and White Sugar vs. Sugar. Consistent with our results, Declerck and Vy (2024) find that a trend strategy constructed on 16 off-BCOM constituents delivers much higher risk-adjusted returns than one based on BCOM constituents alone, attributing this outperformance to the broader diversification offered by the off-BCOM universe.

Figure 19. Average Asset Correlations

	Within Sector		Across Universe	
	Liquid	PLUS	Liquid	PLUS
Agriculture	0.55	0.45	0.26	0.19
Energy	0.60	0.12	0.28	0.05
Industrial Metals	0.54	0.37	0.26	0.17
Precious Metals	0.78	0.51	0.22	0.21
Softs	0.16	0.20	0.15	0.16
Overall	0.52	0.34	0.24	0.17

Notes: The values in an asset correlation matrix are divided into three parts: Liquid vs. Liquid, PLUS vs. Liquid, and PLUS vs. PLUS. The header "Liquid" includes Liquid vs. Liquid, while the header "PLUS" includes PLUS vs. Liquid and PLUS vs. PLUS (i.e., does not include Liquid vs. Liquid). All values exclude diagonal of correlation matrix (i.e., 1.0).

Source: Research Affiliates, based on data from Barchart as of December 31, 2024.



Finally, **Figure 20** examines the diversification return proposed by Willenbrock (2011), measured by half the difference between the assets' variance and the assets' covariance with the portfolio, of our monthly rebalanced long-only portfolios. It shows that the diversification return is uniformly higher when including the PLUS commodities over various horizons. This is attributable to both the rebalancing premium¹⁵ and a reduction in portfolio variance as observed by Erb and Harvey (2006). We noted that diversification is our friend when it comes to commodity investing, and adding PLUS commodities to the liquid universe provides diversification effectively, leading to improved portfolio risk-adjusted returns.

Figure 20. Diversification Return

Horizon	Combined	Liquid	Difference
3-Year	4.0%	3.5%	0.5%
5-Year	3.6%	3.4%	0.2%
10-Year	2.9%	2.8%	0.1%
20-Year	3.0%	2.9%	0.1%

Notes: Horizons 3-Year, 5-Year, 10-Year, and 20-Year refer to windows of time that conclude at year-end 2024.

Source: Research Affiliates, based on data from Barchart as of December 31, 2024.



“Diversification is our friend when it comes to commodity investing, and adding PLUS commodities to the liquid universe provides diversification effectively, leading to improved portfolio risk-adjusted returns.”

Conclusion

This study demonstrates that expanding the commodity universe to include PLUS commodities offers substantial benefits in both long-only and long-short portfolio contexts. Our analysis shows that these benefits are not merely theoretical but are implementable, as our proposed capacity and tradability criteria illustrate.

Long-only equal-volatility portfolios constructed on the combined universe exhibit better risk-adjusted performance than those composed of conventional benchmark constituents, with improvements in Sharpe ratio, maximum drawdown, and skewness. Moreover, long-short factor-based portfolios that incorporate the PLUS commodities deliver superior enhancements in performance, particularly in terms of significantly increased Sharpe ratios and reduced drawdowns, even after accounting for trading constraints and costs. These performance gains are largely attributable to several potential drivers: higher asset roll yields, exposure to the liquidity risk premium, and improved portfolio diversification.

“Long-only equal-volatility portfolios constructed on the combined universe exhibit better risk-adjusted performance than those composed of conventional benchmark constituents, with improvements in Sharpe ratio, maximum drawdown, and skewness.”

Our findings support the practical and strategic merit of expanding the investable commodity universe, especially for investors managing diversified multi-asset portfolios. The results also suggest that traditional benchmark indices such as BCOM and GSCI may no longer sufficiently capture the full opportunity set available in global commodity markets. As such, equipped with our proposed liquidity rules, investors should re-evaluate the composition of their commodity exposures and consider broader, liquidity-aware universes to capture the return benefits these markets offer.

End Notes

1. Many commodity funds are set up as “limited partnerships” with pass-through taxation, and the K-1 is the associated tax form.
2. BCOM determines the weightings of constituents based on liquidity and US dollar-weighted production data subject to single and group commodity-exposure constraints.
3. See the appendix for each commodity’s specific roll schedule.
4. In this article, we include UK Natural Gas. In recent years, the liquidity of Dutch Natural Gas has eclipsed that of UK Natural Gas. However, we focus on UK Natural Gas due to data availability and higher liquidity in past years.
5. In this section, we remove the four industrial metal commodities (Aluminum, Copper, Nickel, and Lead) and our PLUS commodity (Tin) from these numbers. Due to data limitations, we measure capacity and tradability with data from other sources. While we are confident in the liquidity of all five assets, the data is not apples-to-apples with the other assets and was removed for interpretability.
6. JPX Rubber, Oats, and Rough Rice are not included in PLUS as they do not meet our capacity criterion. (Investors with smaller portfolios can also consider including these commodities in their universe.) Milk, Cheese, and Butter, on the other hand, failed to meet both our capacity and tradability criteria.
7. Asset volatilities are estimated with historical daily returns using a one-year window and six-month half-life, taking the max volatility of trailing 1.5 years.
8. Attentive readers will notice the full period difference in average returns is not quite statistically significant, though it is over the last 10 years.
9. The outperformance of our Liquid equal-volatility portfolio relative to BCOM is around 3% per annum over the past 25 years, which is consistent with the performance difference between the “inverse volatility” portfolio and BCOM from 2006 to 2019 shown in Ghia, Kartik, Zarvan Khambatta, and Michael K. Donat, “Commodity Investment Insight: Sector Characteristics.” Bloomberg, November 6, 2019.
10. The exposure constraints follow Asset Allowable Portfolio Exposure discussed previously, with a 30% cap to address portfolio concentration concerns for liquid commodities. Consistent with BCOM’s methodology, this limits the exposure of one single instrument to 15% of the entire portfolio. The exposure change constraints are half of the exposure constraints, representing at most 10% (i.e., > 90% haircut) of each instrument’s capacity to control market impact. For the purpose of this article, we assume the constraints are static and apply them across the entire backtesting period.
11. Trading costs include transaction cost (occurs on exposure change) and roll cost (occurs on contract rolling). Both costs are estimated with bid-ask spread, approximately 2x tick size of a futures contract.
12. The cumulative return contribution over the past 25 years is -0.58%, which is close to 0.
13. In fact, if we remove UK Natural Gas, the average volatility-adjusted roll yields for the remaining PLUS commodities are 3.5%, 3.3%, 15.7%, and 16.9% for ITD, 10-year, five-year, and three-year windows, respectively, all of which are positive and far exceed the average volatility-adjusted roll yields of the liquid commodities.
14. Gross leverage across portfolios remains constant.

15. Buying assets that have declined in relative value and selling assets that have appreciated in relative value.

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Appendix: Roll Schedules

Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Canola	H	K	K	N	N	X	X	X	X	F	F	H
Corn	H	K	K	N	N	U	U	Z	Z	Z	H	H
Kansas Wheat	H	K	K	N	N	U	U	Z	Z	Z	H	H
Milling Wheat	H	K	K	U	U	U	U	Z	Z	Z	H	H
Rapeseed	K	K	K	Q	Q	Q	X	X	X	G	G	G
Soybean Meal	H	K	K	N	N	Z	Z	Z	Z	Z	F	H
Soybean Oil	H	K	K	N	N	Z	Z	Z	Z	Z	F	H
Soybeans	H	K	K	N	N	X	X	X	X	F	F	H
Wheat	H	K	K	N	N	U	U	Z	Z	Z	H	H
Blendstock Gasoline (RBOB)	H	J	K	M	N	Q	U	V	X	Z	F	G
Crude Oil, Brent	J	K	M	N	Q	U	V	X	Z	F	G	H
Heating Oil	H	J	K	M	N	Q	U	V	X	Z	F	G
Low Sulphur Gasoil	H	J	K	M	N	Q	U	V	X	Z	F	G
Natural Gas	H	J	K	M	N	Q	U	V	X	Z	F	G
UK Natural Gas	H	J	K	M	N	Q	U	V	X	Z	F	G
WTI Crude	H	J	K	M	N	Q	U	V	X	Z	F	G
Aluminum	H	K	K	N	N	U	U	X	X	F	F	H
Copper	H	K	K	N	N	U	U	Z	Z	Z	H	H
Lead	H	K	K	N	N	U	U	X	X	F	F	H
Nickel	H	K	K	N	N	U	U	X	X	F	F	H
Tin	H	K	K	N	N	U	U	X	X	F	F	H
Zinc	H	K	K	N	N	U	U	X	X	F	F	H
Feeder Cattle	H	J	K	Q	Q	Q	U	V	X	F	F	H
Lean Hogs	J	J	M	M	N	Q	V	V	Z	Z	G	G
Live Cattle	J	J	M	M	Q	Q	V	V	Z	Z	G	G
Gold	J	J	M	M	Q	Q	Z	Z	Z	Z	G	G
Palladium	H	M	M	M	U	U	U	Z	Z	Z	H	H
Platinum	J	J	N	N	N	V	V	V	F	F	F	J
Silver	H	K	K	N	N	U	U	Z	Z	Z	H	H
Cocoa	H	K	K	N	N	U	U	Z	Z	Z	H	H
Coffee	H	K	K	N	N	U	U	Z	Z	Z	H	H
Coffee, Robusta	H	K	K	N	N	U	U	X	X	H	H	H
Cotton	H	K	K	N	N	Z	Z	Z	Z	Z	H	H
FCOJ	H	K	K	N	N	U	U	X	X	F	F	H
Sugar	H	K	K	N	N	V	V	V	H	H	H	H
White Sugar	H	K	K	Q	Q	Q	V	V	Z	Z	H	H

Source: Research Affiliates, January (F), February (G), March (H), April (J), May (K), June (M), July (N), August (Q), September (U), October (V), November (X), and December (Z)

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