



ARC Commodity Factor Risk Model Annual Report 2023

The Asset Risk Company (ARC) Commodity Model is a cross-sectional commodity factor model. The model contains 50 of the most widely traded commodity products with approximately 1,200 futures in total over all maturities. All futures in the model have exposures to sectors, sub-sectors, and style factors such as basis, momentum, and open interest. The model is estimated daily with 23 years of history. It provides a framework for managing risk and investment decision making.

In this report, you will find:

- Performance of Sectors, Sub-Sectors and Style Factors
- Examples of Style Tilted Portfolios (Low Vol, Value, Momentum, Backwardation)
- Low Vol Performance over 23 years.
- Risk Factor Decompositions of Popular Commodity Indexes (BCOM, GSCI)
- Inflation prediction

The ARC Commodity Model is a powerful tool to help many constituencies in the financial industry, trading, and real economy. Some of the applications of the model are very straightforward, but some uses of the model are more nuanced. We recommend this short piece that provides details on both common and novel use cases for a commodity factor model: <https://www.assetriskcompany.com/whyfactor.html>. You can access our latest research at <https://www.assetriskcompany.com/library.html>.



Sectors and Factors Performance Report:

Table 1. Sectors and Subsectors Performance

Sectors	Dec. 23	2023	5-year Return	5-year Volatility
Agriculture	-2.2%	-9.0%	14.3%	12.8%
Grain And Oilseed	-2.5%	-15.3%	15.1%	15.2%
Lumber And Pulp	6.9%	-16.8%	11.2%	51.8%
Proteins	0.0%	-9.1%	10.0%	11.2%
Softs	-3.4%	23.7%	9.5%	14.0%
Energy	-3.8%	-9.3%	1.6%	16.0%
Biofuels	-3.8%	-4.9%	14.6%	22.4%
Coal	-3.8%	-10.9%	22.1%	25.6%
Crude Oil	-1.3%	-5.4%	-1.7%	18.7%
Natural Gas	-5.1%	-10.1%	2.2%	16.4%
Petrochemicals	-3.8%	-10.4%	-2.3%	18.7%
Refined Products	-5.3%	-14.8%	2.9%	20.7%
Metals	1.3%	-9.2%	9.9%	15.8%
Base	0.5%	-9.7%	9.7%	19.4%
Precious	2.1%	-7.0%	13.1%	18.5%

After two excellent years in a row, 2023 was a disaster for long commodity investors. All 3 major sectors were negative and in the double digit region. Energy was hit pretty hard in December with Natural Gas down 5.1% and Refined Products down 5.3%. Both Base and Precious Metals jumped back in December but finished the year negative. In the Agriculture sector, Grains & Oilseeds were down 15.3% in 2023 while Softs were the only positive subsector this year with a return of 23.7%. As a reminder, ARC sectors and sub-sectors returns are not estimated using a static configuration of commodity

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weightings. The returns come naturally from a cross-sectional regression of the 1,200 assets in the model and therefore cover the entire term structure. For instance, Natural Gas has more than 120 maturities in the model. The model uses all of that information to derive sector and subsector returns and one can think of our sectors as risk weighted on the entire curve.

Table 2. Styles Performance

Factor	Dec. 2023	2023	5 Year Return	5 Year Volatility
Basis	-1.2%	-9.1%	-6.2%	5.3%
Open Interest	-1.5%	-3.5%	1.2%	4.2%
Momentum	-2.1%	-0.6%	0.4%	5.8%
ST Momentum	-0.8%	-6.7%	-7.7%	5.7%
Trading Activity	0.6%	2.2%	-0.1%	2.4%
Volatility	-2.6%	-7.6%	1.7%	9.0%
ST Volatility	1.6%	2.7%	1.8%	8.2%

The most noticeable trait for style factors in 2023, was the performance of the Volatility factor with a -7.6% return in a down market. When looking at the cumulative performance of the factors over the last 5 years (Figure 1 below), we have noticed major changes in the Volatility factor, clear trends in Basis and Short Term Momentum, while the other factors including Momentum seem to mean revert to zero.

The factor replicating portfolios are not a practical way to trade and consist of positions (both long and short) in most of the instruments in the model's universe. We provide a much more parsimonious factor-tilted (long only) portfolio later in this analysis.

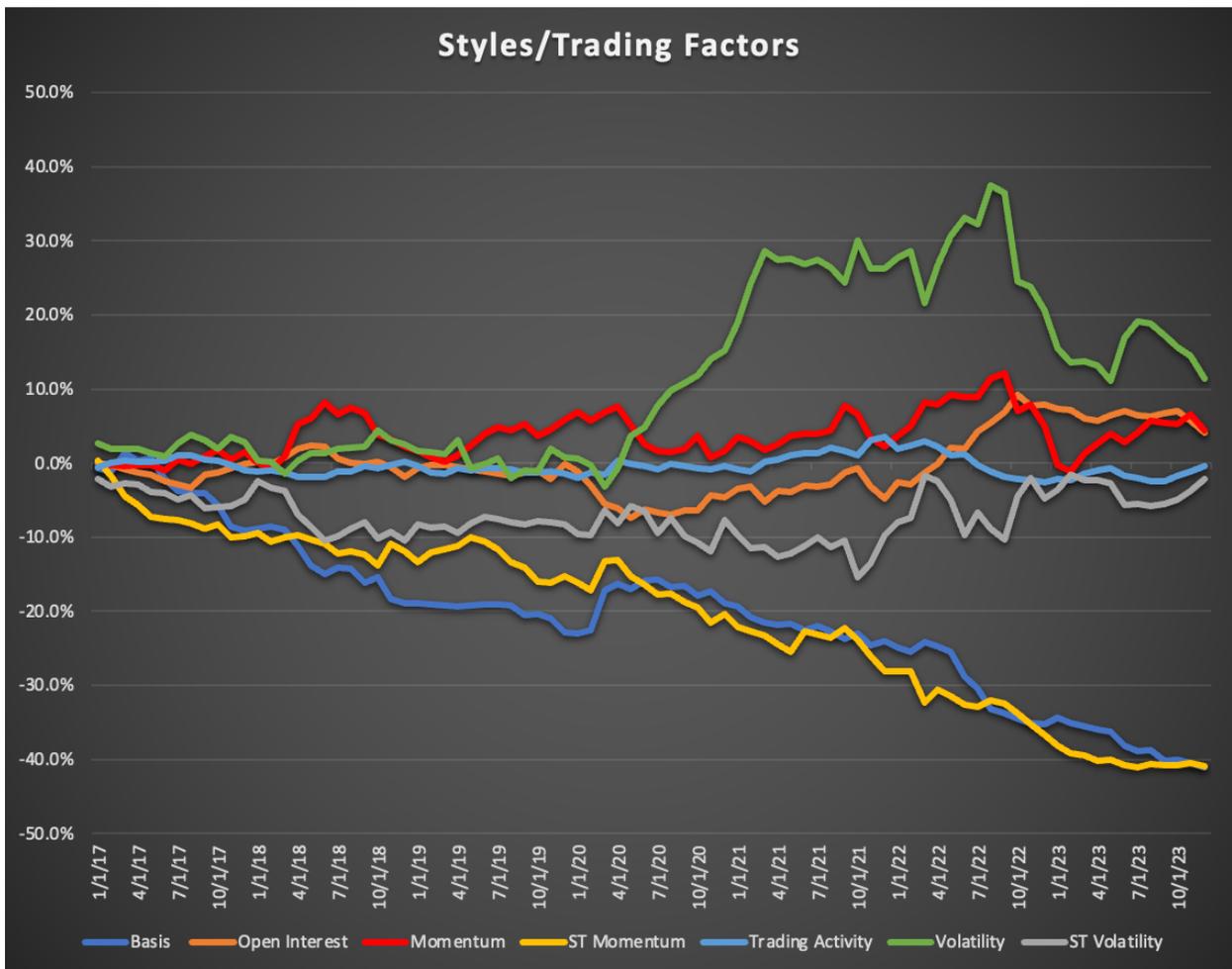


Figure 1: 5-year Cumulative Performance of ARC Styles/Trading Factors

Style Tilted Portfolios Performance Report:

As shown above there are some clear patterns emerging for the ARC Commodity Styles and Trading Factors. Unfortunately, as with all cross sectional factor models, these factors are not tradable because the replicating portfolios are made up of hundreds of futures, some of them not liquid. However in order to take advantage of these trends, ARC created long only tilted versions. Our findings based on 23 years of data are:



- Low Volatility and Low Momentum (Value) are reliable and produce much better performance and risk than traditional indices
- High Momentum is not a reliable factor premia unless you can time it
- High Basis is reliable in underperforming the indices

Table 3. Top 10 Futures Tilted Portfolios and BCOM Performance

	Value	Momentum	Low Vol	Backwardation	BCOM
Dec. 2023	-2.5%	-3.8%	-2.3%	-5.0%	-2.7%
2023	3.3%	-10.1%	0.8%	-13.6%	-7.9%
Annualized*	10.9%	9.8%	10.7%	9.4%	6.3%
Volatility*	17.8%	16.5%	9.7%	16.9%	15.9%

*Annualized 5 years

Table 3 shows the performance of tilted equi-weighted portfolios made of 10 liquid futures, rebalanced once a month. BCOM Total Return index and GSCI Total Return Index finish the year down (-7.9% and -4.3% respectively). Both Low Vol and Low Momentum portfolios ended the year positively. Momentum and Low Basis (backwardation) were negative for the year. Our research shows that over 20+ years, Backwardation reliably outperforms BCOM.

Low Volatility:

We look in detail at the Low Vol implementations. The Low Vol factor replicating portfolio is constructed by selecting the 5 or 10 futures with the lowest volatility exposures in the ARC model. We apply liquidity constraints and avoid selecting only one contract type (so we don't end up with, let's say, 5 soybean meal futures). It is worth noting that creating more concentrated portfolios of low volatility commodity futures generates a better risk/return profile. On a gross basis, these portfolios of long positions in 5 futures generate a Sharpe of 1 over 23 years! A picture is worth more than a 1000 words so we illustrate (in Figure 2) the cumulative performance of both tilted portfolios (and add BCOM for good measure). In 2023, the top 10 Futures portfolio outperformed BCOM by 8.7%, while the top 5 Futures Portfolio outperformed by 16%.

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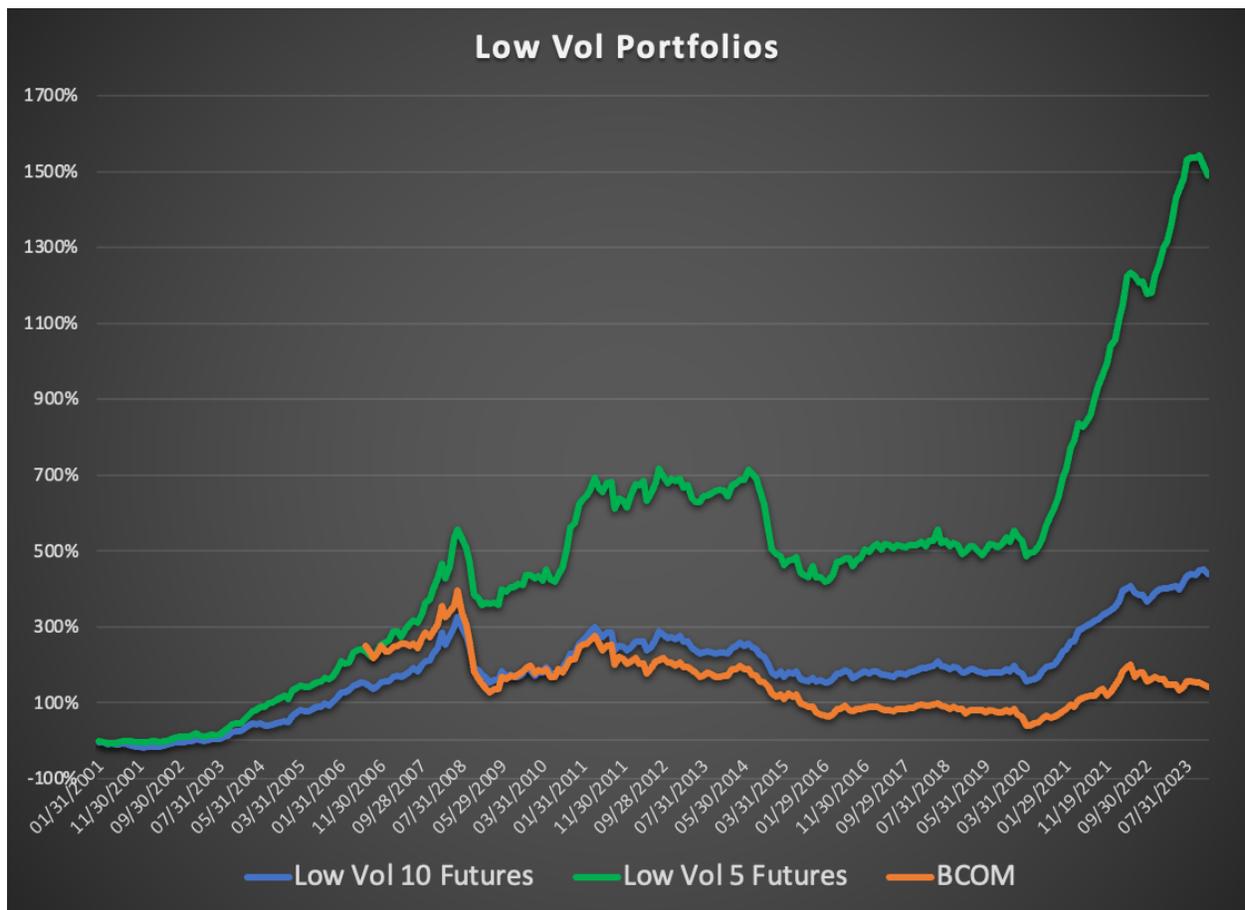


Figure 2: Long only Low Vol Tilted Portfolios vs BCOM

Hopefully this will draw our readership’s attention. Forget Momentum, look at low volatility futures. There is no doubt that our readers could take advantage of this and do better than this simple implementation.

Factor Correlations:

Long term correlations between sectors and style factors are very low. The model is able to separate sector allocation risk from style risk providing key insights in the real key drivers of risk and performance of a portfolio.



Table 6. Factor Correlations

Correlations	Agriculture	Energy	Metals	Basis	Open Interest	Momentum	ST Momentum	Trading Activity	Volatility	ST Volatility
Agriculture	1.00	0.24	0.24	0.03	0.01	(0.10)	(0.13)	(0.03)	0.20	0.09
Energy	0.11	1.00	0.27	(0.07)	0.29	(0.18)	(0.14)	(0.22)	(0.01)	0.24
Metals	0.24	0.13	1.00	(0.22)	0.06	(0.06)	(0.09)	(0.05)	0.04	0.11
Basis	(0.02)	0.06	(0.25)	1.00	(0.25)	(0.03)	(0.04)	0.23	0.04	(0.06)
Open Interest	0.13	0.08	(0.01)	(0.36)	1.00	(0.35)	(0.03)	(0.66)	(0.26)	(0.02)
Momentum	(0.14)	0.10	(0.21)	(0.05)	(0.14)	1.00	0.14	0.25	0.40	(0.20)
ST Momentum	(0.06)	(0.34)	(0.07)	(0.06)	(0.08)	0.22	1.00	0.12	0.01	0.05
Trading Activity	(0.04)	(0.24)	0.04	0.26	(0.60)	0.14	0.10	1.00	0.16	0.02
Volatility	0.08	(0.06)	0.22	(0.31)	0.06	0.46	(0.03)	0.11	1.00	(0.63)
ST Volatility	0.17	0.20	0.06	0.40	(0.51)	(0.24)	0.24	0.17	(0.62)	1.00

1 yr correlations on the right (above the diagonal), 30 days on left (below the diagonal).

Commodity Indices Risk Decomposition

Energy is the largest sector in GSCI but the smallest in BCOM. Both indices have high z-scores with respect to Open Interest reflecting the fact that the indices' constituents are weighted more heavily on the front month contract.

Table 7. Factor Exposures

Factors Exposures	BCOM	GSCI
Agriculture	0.33	0.26
Energy	0.28	0.57
Metals	0.38	0.17
Basis	-0.28	-0.28
Open Interest	2.38	2.27
Momentum	-0.06	0.00
ST Momentum	-0.11	-0.14
Trading Activity	-1.54	-2.07
Volatility	0.27	0.52
ST Volatility	0.13	0.32

Exposures, z-scores for BCOM and GSCI as of 12/29/2023



We use a 6 month half life for this risk decomposition so the model is fairly reactive to market conditions. Despite different sector allocations, both indices have similar risk and exposures to styles. A portfolio which is long/short would be evaluated on the breakout between systematic exposures and whether idiosyncratic risk. Long only managers will want to find their exposures relative to their benchmark. As shown above in the correlation tables, sector correlations with style factors are relatively small. The model is able to separate risk due to sector allocation and styles risk. All risk is not equal. Systematic risk can display non normal behavior when compared to specific or idiosyncratic risk. Both types of risks are driven by fluctuation, but systematic risk is driven by the “crowd” expressing some thematic bet. The systematic risk is related to market risk.

Table 8. Risk Attribution of BCOM and GSCI

Index	BCOM	GSCI
Total Risk	17.9%	19.0%
Agriculture	1.2%	0.8%
Energy	2.0%	5.2%
Metals	3.2%	1.0%
Basis	0.8%	0.7%
Open Interest	8.0%	7.5%
Momentum	0.1%	0.0%
ST Momentum	0.1%	0.1%
Trading Activity	1.9%	2.7%
Volatility	0.3%	0.6%
ST Volatility	-0.1%	-0.3%
Specific Risk	4.0%	4.7%

Ex-Ante Annual Volatility Decomposition for BCOM and GSCI as of 12/29/2023



Inflation:

Empirical testing finds that the ARC Commodity Model is an excellent predictor of breakout moves in the headline number, both in bouts of inflation and deflation. For December, we predict a higher CPI level, and an increase for year on year change (Inflation). Reach out to info@assetriskcompany.com for our estimate.

Conclusion:

In this report, we have shown the factor performance driving the commodity markets. Using the ARC Commodity model, style tilted portfolios have shown great performance and seem to be suitable benchmarks for active managers to track. We then conducted an analysis into the risk dynamics of two major commodity indices. The view of commodities as diversifiers is quite accurate. All of this was possible with the ARC model. The model enables the user to look at their book or portfolio and how it fits into their thesis as well as how it fits in the broader economic landscape.