ARC Commodity Factor Risk Model
Monthly Report August 2022

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 20 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
- Inflation prediction
- Examples of Style Tilted Portfolios (Low Vol, Value, Momentum, Backwardation)
- Risk Factor Decompositions of Popular Commodity Indexes (BCOM, GSCI)

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* Annualized 5 years

Sectors/Subsectors	Aug. 22	YTD Perf	5-year Return	5-year Volatility*
Agriculture	**5.4%**	**17.6%**	**14.9%**	**11.8%**
Grain And Oilseed	5.7%	13.8%	16.3%	13.9%
Lumber And Pulp	-6.2%	-36.0%	18.8%	50.6%
Proteins	5.9%	33.1%	12.6%	10.4%
Energy	**-3.0%**	**24.6%**	**5.6%**	**14.9%**
Biofuels	6.2%	23.2%	15.2%	21.8%
Coal	1.7%	123.2%	28.7%	22.2%
Crude Oil	-10.0%	9.2%	1.6%	17.8%
Natural Gas	3.6%	41.9%	5.6%	14.0%
Petrochemicals	-2.5%	12.8%	2.9%	18.9%
Refined Products	-6.1%	25.3%	6.7%	20.6%
Metals	**2.6%**	**4.3%**	**11.1%**	**14.8%**
Base	3.6%	-4.0%	13.1%	18.1%
Precious	1.0%	16.8%	9.4%	17.0%

Energy as a sector is down in August due to Crude Oil (-10%) and Refined Products (-6.1%). But Natural Gas is up +3.6% this month and 41.9% YTD. This bifurcation could last in the winter as Europe can diversify its oil suppliers but is in a tough spot when it comes to Natural Gas. Agriculture is up this month (5.4%) while both Precious and Base were up +3.6% and 1%. As a reminder, ARC sectors and sub-sectors returns are not estimated using a static configuration of commodity 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 and Crude Oil have

more than 120 maturities each in the model. The model uses all of that information to derive sector and subsector returns. Year to date, commodities are the only asset class performing well for investors. If inflation is not transitory, it stands to reason that the appetite for commodity exposures should increase.

Table 2. Styles Performance *Annualized 5 years

Factor	Aug-22	YTD Perf	5-year Return	5-year Volatility
Basis	-3.9%	-12.0%	-7.0%	5.7%
Open Interest	1.2%	10.7%	1.8%	4.1%
Momentum	2.2%	9.0%	2.2%	5.2%
ST Momentum	1.2%	-5.6%	-5.9%	5.9%
Trading Activity	-0.9%	-4.6%	-0.4%	2.4%
Volatility	4.0%	8.8%	5.8%	7.2%
ST Volatility	-2.3%	1.0%	-1.0%	7.7%

Most factors YTD have outperformed their 5 year historical return. As we highlighted before, Momentum was a key driver for the first part of the year and is back this month. The Basis factor is way above its 5 year historical returns. Also Open Interest is behaving in a very unusual way with a YTD performance of 10.7% vs 1.8% historically. High Open interest Futures tend to be the front month contracts. So indices like BCOM, composed of mostly front month futures, will have a boost from this factor while funds that tend to be loaded down the curve will underperform. Similarly long/short portfolios should check their exposure to this factor. Remember that the factor returns are estimated through cross-sectional regression. The factor returns here come from large portfolios of what are known as "factor replicating" portfolios. 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) portfolios later in this analysis.

Inflation:

Another application of a commodity factor model is inflation, forecasting, or attribution. We find that the ARC Commodity Model is a good predictor for breakout moves in the headline number, both in bouts of inflation and deflation. For the upcoming August inflation number we forecast a flattish to negative CPI and year on year inflation decreasing significantly from to 8.5% to 8.1%.

Style Tilted Portfolios Performance Report:

BCOM is flat this month (+0.1%) while GSCI is down -2.7%. Year to date BCOM is still up 23.6% and GSCI is up 32.1%. All styles tilted portfolios were down this month except Momentum. The factor tilted Momentum portfolio was unchanged, but cast against the backdrop of the other factor tilted portfolios the performance was quite good. What is also interesting is the divergence between the smaller Style Tilted portfolio and the full factor replicating portfolios.

Table 3. Factor Tilted Portfolios and BCOM Performance

Perf	Value	Momentum	Low Vol	Backwardation	BCOM
August	-3.3%	0.0%	-0.5%	-1.0%	0.1%
YTD	-0.9%	36.4%	10.1%	21.3%	23.6%
Annualized	12.6%	10.4%	9.7%	12.6%	8.7%
Volatility	15.3%	17.2%	9.4%	16.1%	15.8%

Factor Correlations:

There is much to note in the factor correlations matrix. First, along the top level sectors note that correlations stay roughly consistent between Agriculture, Energy and Metals. Long term correlations between sectors and style factors are also relatively 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.

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Table 4. Factor Correlations

Correlations	Agriculture	Energy	Metals	Basis	Open Interest	Momentum	ST Momentum	Trading Activity	Volatility	ST Volatility
Agriculture	1.00	0.46	0.46	(0.18)	0.12	0.17	0.09	0.00	(0.00)	0.23
Energy	0.37	1.00	0.41	0.08	0.44	(0.08)	0.09	(0.14)	(0.24)	0.47
Metals	0.29	0.10	1.00	(0.27)	0.22	0.18	0.28	(0.04)	(0.05)	0.29
Basis	(0.02)	0.31	(0.10)	1.00	(0.15)	(0.17)	(0.23)	0.11	(0.08)	0.05
Open Interest	(0.09)	0.18	(0.21)	(0.25)	1.00	(0.07)	(0.06)	(0.70)	(0.33)	0.10
Momentum	0.29	0.08	(0.03)	(0.06)	(0.36)	1.00	0.34	0.02	0.17	(0.10)
ST Momentum	(0.20)	(0.38)	(0.15)	0.08	(0.15)	0.38	1.00	0.09	0.06	0.18
Trading Activity	0.28	(0.00)	0.26	0.27	(0.81)	0.20	(0.17)	1.00	0.20	0.01
Volatility	0.29	0.13	0.03	(0.20)	(0.15)	0.62	0.01	0.21	1.00	(0.65)
ST Volatility	(0.08)	(0.03)	0.24	0.34	0.02	(0.39)	0.24	(0.13)	(0.81)	1.00

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

Commodity Indices Risk Decomposition

In terms of sector exposures, GSCI is overweight in Energy and while BCOM was equal weighted at the beginning of the year it is now 30/40/30 for Agriculture, Energy and Metals. 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 6. Factor Exposures

Factors Exposures	BCOM	GSCI
Agriculture	0.32	0.23
Energy	0.40	0.65
Metals	0.28	0.13
Basis	0.88	0.86
Open Interest	2.35	2.07
Momentum	0.09	0.49
ST Momentum	0.27	-0.19
Trading Activity	1.16	0.31
Volatility	0.49	0.57
ST Volatility	0.70	0.69

Exposures, z-scores for BCOM and GSCI as of 8/31/2022

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Table 7. Risk Attribution of BCOM and GSCI

Index	BCOM	GSCI
Total Risk	26.8%	27.3%
Agriculture	2.6%	1.8%
Energy	6.8%	11.6%
Metals	3.1%	1.1%
Basis	0.5%	0.8%
Open Interest	8.5%	7.8%
Momentum	0.0%	-0.1%
ST Momentum	0.4%	0.0%
Trading Activity	-0.8%	-0.3%
Volatility	-1.8%	-1.9%
ST Volatility	6.5%	5.6%
Specific Risk	7.8%	7.0%

Ex-Ante Annual Volatility Decomposition for BCOM and GSCI as of 8/31/2022

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. 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.

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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.