ARC Commodity Factor Risk Model
Monthly Report June 2021

The Asset Risk Company (ARC) Commodity model is a cross-sectional commodity factor model. The model contains 50 of the most 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, open interest. The model is estimated daily with 20 years of history. It provides a framework for managing risk and investment decisions.

In this report, you will find:

- Performance of Sectors, Sub-Sectors and Style Factors
- Examples of Factor Tilted Portfolios (Low Vol, Value, Momentum)
- Risk Factor Decomposition of some 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, 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.

Sectors and Factors Performance Report:

Table 1. Sector and Subsector Performance

Factor	June 2021	YTD Perf	Historical Returns*	Volatility*
Agriculture	**1.0%**	**21.0%**	**9.7%**	**10.0%**
Grain And Oilseed	0.8%	26.9%	12.7%	12.4%
Lumber And Pulp	-22.5%	12.1%	25.7%	44.5%
Proteins	2.8%	13.6%	6.7%	9.7%
Softs	3.4%	13.0%	3.7%	10.6%
Energy	**5.7%**	**27.1%**	**-2.1%**	**13.6%**
Biofuels	4.0%	65.6%	10.6%	22.0%
Coal	3.0%	25.6%	9.2%	15.0%
Crude Oil	4.0%	25.7%	-3.1%	16.4%
Natural Gas	7.1%	11.8%	-6.5%	10.3%
Petrochemicals	10.8%	33.3%	-1.8%	18.0%
Refined Products	3.1%	29.7%	-1.9%	19.4%
Metals	**-2.8%**	**16.9%**	**16.2%**	**15.2%**
Base	-1.2%	36.0%	18.4%	18.1%
Precious	-4.9%	-5.4%	13.9%	17.3%

* Annualized 2017-2021

Energy posted a solid month, favored by the renewed economic activity. Natural Gas rallied this month with a +7.1.% return. Both Precious & Base Metals are down this month. Lumber and Pulp’s correction continues for a second month in a row.

As a reminder, ARC sectors and sub-sectors returns are not estimated using a static configuration of commodity weightings. The returns come naturally from the cross-sectional regression of the 1,200 assets in the model and therefore cover the entire term structure.

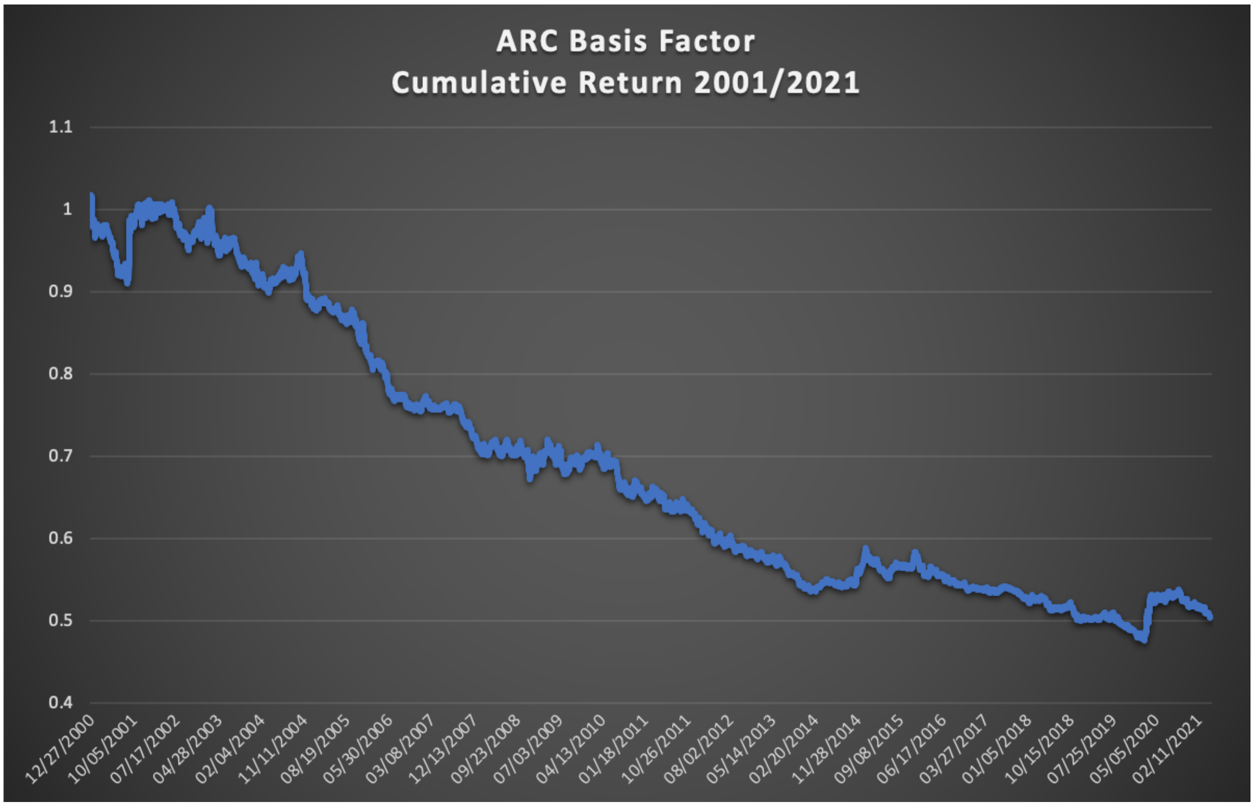
Table 2. Styles Performance

Factor	June-21	YTD	Historical Returns*	Volatility*
Basis	**-1.2%**	**-4.5%**	**-5.5%**	**5.5%**
Open Interest	**0.9%**	**1.6%**	**-0.7%**	**3.4%**
Momentum	**0.2%**	**2.3%**	**0.9%**	**4.7%**
ST Momentum	**3.7%**	**-3.0%**	**-5.6%**	**5.3%**
Trading Activity	**0.2%**	**1.7%**	**0.3%**	**1.9%**
Volatility	**-0.5%**	**10.2%**	**5.4%**	**6.0%**
ST Volatility	**1.0%**	**-3.8%**	**-2.6%**	**5.7%**

* Annualized 2017-2021

Basis performance is in line with its historical trend. This has been one of the most interesting factors. Over the 4 year period 2017-2021, a short position in the factor would have delivered a Sharpe ratio of 1. This is consistent with a recent research ARC completed on 20 years of daily commodity and factor returns. Figure 1 illustrates the performance of Basis factor. A short position in the factor delivers a Sharpe of 0.7 over 20 years.

Figure 1. Basis Factor Performance



Factor Tilted Portfolios Performance Report:

In order to illustrate a real world application of the model, ARC calculates three factor tilted portfolios. They are the Low Vol, Momentum and Value portfolios. The Low Vol is composed of commodities whose exposures favor low volatility. All commodity futures selected have large open interest. The other two portfolios are similarly constructed each favoring its respective factor.

Table 3. Factor Tilted Portfolios and BCOM Performance

Returns	Value	Momentum	Low Vol	IPath BB Index
2021	22.6%	19.9%	19.0%	21.1%
June 2021	1.2%	1.6%	1.7%	1.9%
Annualized*	11.6%	3.8%	5.5%	2.9%
Volatility*	15.6%	13.7%	9.4%	13.1%

*2017/2021

The factors tilted portfolios underperformed the index this month with a sluggish Value performance. On a risk adjusted basis, all of the ARC Factor Replicating portfolios dominate the industry benchmark this year.

Factor Correlations:

Table 4. Factor Correlations

Correlations	Agriculture	Energy	Metals	Basis	Open Interest	Momentum	ST Momentum	Trading Activity	Volatility	ST Volatility
Agriculture	1.00	0.37	0.29	(0.15)	0.16	(0.01)	0.09	0.01	0.22	0.13
Energy	0.43	1.00	0.27	(0.14)	0.47	0.07	(0.03)	(0.14)	0.25	(0.07)
Metals	0.45	0.48	1.00	(0.13)	0.16	0.06	0.03	(0.01)	0.01	(0.03)
Basis	(0.46)	(0.09)	(0.05)	1.00	(0.09)	(0.13)	(0.19)	(0.04)	(0.07)	(0.19)
Open Interest	0.30	0.41	0.47	(0.36)	1.00	0.13	0.05	(0.48)	(0.15)	(0.32)
Momentum	0.72	0.44	0.41	(0.45)	0.60	1.00	0.16	(0.06)	(0.22)	(0.19)
ST Momentum	0.24	0.17	0.10	(0.44)	0.35	0.29	1.00	(0.13)	(0.30)	0.13
Trading Activity	(0.20)	(0.28)	(0.31)	0.42	(0.83)	(0.48)	(0.42)	1.00	0.04	0.24
Volatility	(0.29)	(0.25)	(0.40)	0.09	(0.74)	(0.65)	(0.15)	0.59	1.00	(0.32)
ST Volatility	0.30	0.13	0.21	0.34	(0.21)	0.12	(0.29)	0.43	(0.22)	1.00

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

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.

Commodity Indices Risk Decomposition

Next, we turn to the exposure and ex-ante annual volatility of the two indices BCOM and GSCI as of 6/30/2021. In terms of sector exposures, BCOM is approximately equal weighted, though the contribution to risk from Agriculture is now lower than Energy and Metals. As expected, GSCI is overweight in Energy. 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 and, which in most cases is the most traded contract. It is worth noting that despite very different sector allocations the current risk estimates for both indices is similar, around 15/16% annualized. Also the proportion of risk coming from sectors vs styles is around 50% for both. 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.

Table 5. Factor Exposures

Factors	BCOM	GSCI
Agriculture	0.34	0.26
Energy	0.36	0.57
Metals	0.30	0.17
Basis	0.71	0.69
Open Interest	2.52	2.51
Momentum	0.56	0.57
ST Momentum	-0.22	0.03
Trading Activity	0.26	0.19
Volatility	0.49	0.58
ST Volatility	0.51	0.41

Exposures, z-scores for BCOM and GSCI as of 6/30/2021

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. A factor model is key as it divines not only the risk numbers but their nature. There are managers whose finger is on the pulse of the market. These people should have systematic components (and hopefully be successful). Most managers, however, avoid the market risk and base their strategies around relative risk/performance. The risk should then be driven primarily by idiosyncratic risk, with no discernable pattern to the factor exposure.

Table 6. Risk Attribution of BCOM and GSCI

Index	BCOM	GSCI
Total Risk	**15.9%**	**16.1%**
Agriculture	2.2%	1.5%
Energy	3.0%	5.3%
Metals	3.0%	1.3%
Basis	-0.3%	-0.4%
Open Interest	7.4%	7.8%
Momentum	0.5%	0.5%
ST Momentum	0.0%	0.0%
Trading Activity	-0.1%	-0.1%
Volatility	-0.1%	0.0%
ST Volatility	-0.1%	-0.3%
Specific Risk	3.6%	3.5%

Ex-Ante Annual Volatility Decomposition for BCOM and GSCI as of 6/30/2021

Conclusion:

In this report, we have shown the factor performance driving the commodity markets. The strong performance of the commodity markets this month was mostly uniform. Using the ARC model, we have built factor tilted portfolios that 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.