ARC Commodity Factor Risk Model
Monthly Report March 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, and over 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. 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)
- Popular Commodity Index (BCOM, GSCI) Risk Factor Decomposition

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 & Factors Performance Report:

Factors	March 21	YTD	Historical Returns*	Volatility*
Agriculture	**2.7%**	**12.1%**	**8.3%**	**10.0%**
Grain And Oilseed	3.3%	16.4%	11.3%	12.4%
Lumber And Pulp	5.2%	14.8%	28.1%	37.9%
Proteins	4.6%	10.0%	6.3%	9.8%
Softs	-1.4%	2.1%	1.4%	10.6%
Energy	**0.2%**	**10.1%**	**-5.5%**	**13.5%**
Biofuels	3.0%	21.0%	3.3%	19.4%
Coal	5.7%	7.9%	5.9%	14.8%
Crude Oil	-1.2%	9.8%	-6.3%	16.4%
Natural Gas	0.5%	4.5%	-8.3%	10.0%
Petrochemicals	-0.4%	11.6%	-5.9%	17.6%
Refined Products	0.4%	13.0%	-5.1%	19.7%
Metals	**2.9%**	**7.4%**	**14.9%**	**15.4%**
Base	7.2%	20.4%	16.2%	18.1%
Precious	-2.9%	-8.7%	13.8%	17.5%

* Annualized 2017-2021

Factors	March 21	YTD	Historical Returns*	Volatility*
Basis	-0.8%	-3.1%	-5.5%	5.7%
Open Interest	-2.1%	-0.7%	-1.3%	3.3%
Momentum	-1.1%	0.1%	0.4%	4.8%
ST Momentum	-0.6%	-3.6%	-6.0%	5.0%
Trading Activity	1.3%	0.5%	0.0%	1.8%
Volatility	3.5%	11.7%	6.1%	6.0%
ST Volatility	0.2%	-4.0%	-2.8%	5.9%

* Annualized 2017-2021

There was a slow down this month for most sectors after a blistering start this year. We will note however that Grain & Oilseed, Lumber and Pulp and Proteins had a very good month and are up double digits YTD. Precious Metals are still in retreat but Base Metals are up 7.2% this month and 20% YTD. The end of the pandemic is driving up a lot of these commodities.

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.

On the Styles side, Volatility and Short Term Momentum Factors continue their historical and recent trend. Volatility is defined as the 252 day (one business year) historical volatility for each future in the model. Starting in April 2020, the factor return has been on an upward trajectory and finished 2020 at 14.3%. So far this year the factor return is 11.7%.

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Cumulative Returns ARC Styles
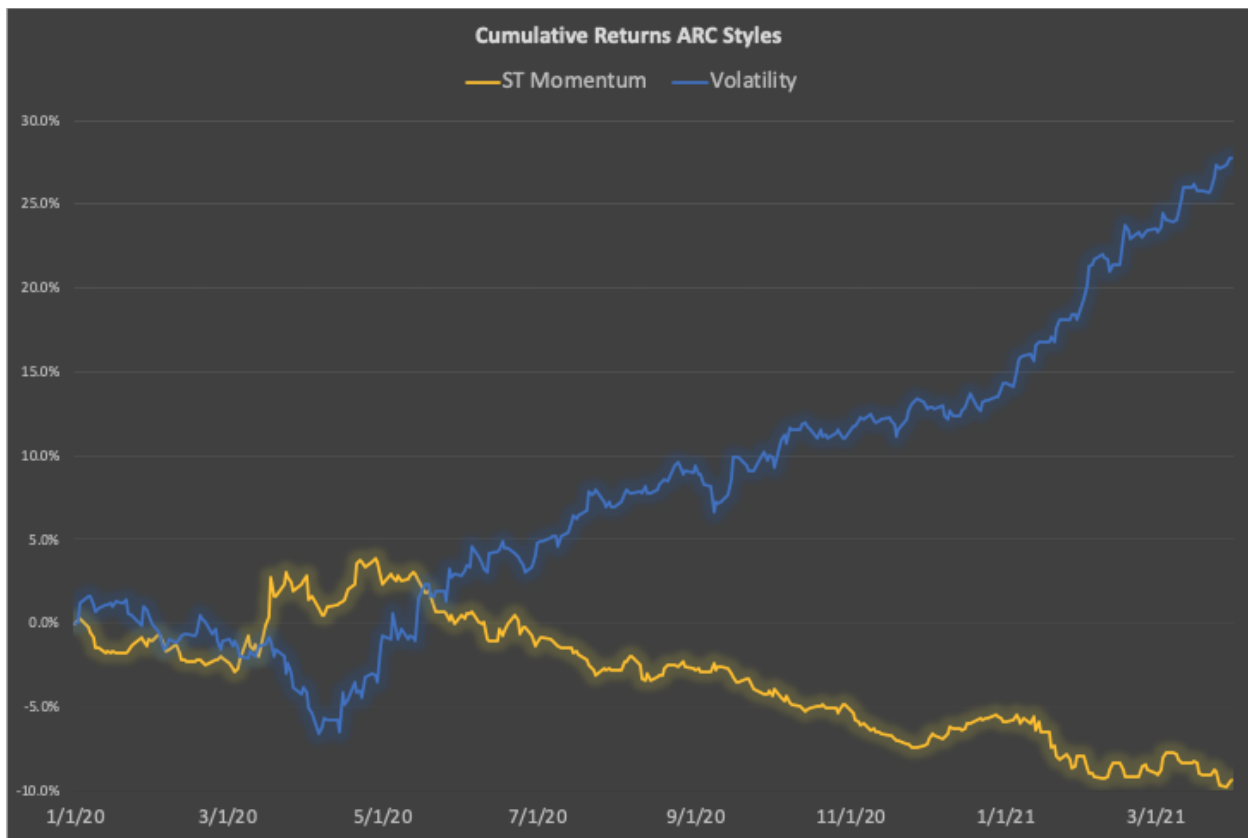
## Factor Tilted Portfolios Performance Report:

In order to illustrate the power 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. Similar to stocks, there is clearly a premium for low volatility commodities. So far this year the Low Vol tilted portfolio has outperformed BCOM on a realized volatility half that of the index. It is in line with historical returns. Value continues its historical trend with a strong month and year to date (+13.4%). We define Value as the commodities which exhibit very low exposures to the momentum factor.

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Returns	Value	Momentum	Low Vol	IPath BB Index
2021	13.8%	6.7%	7.9%	6.9%
March 2021	1.2%	-0.5%	1.2%	-2.1%
Annualized*	10.4%	1.2%	3.5%	0.1%
Volatility*	15.8%	13.8%	8.8%	12.6%

*2017/2021

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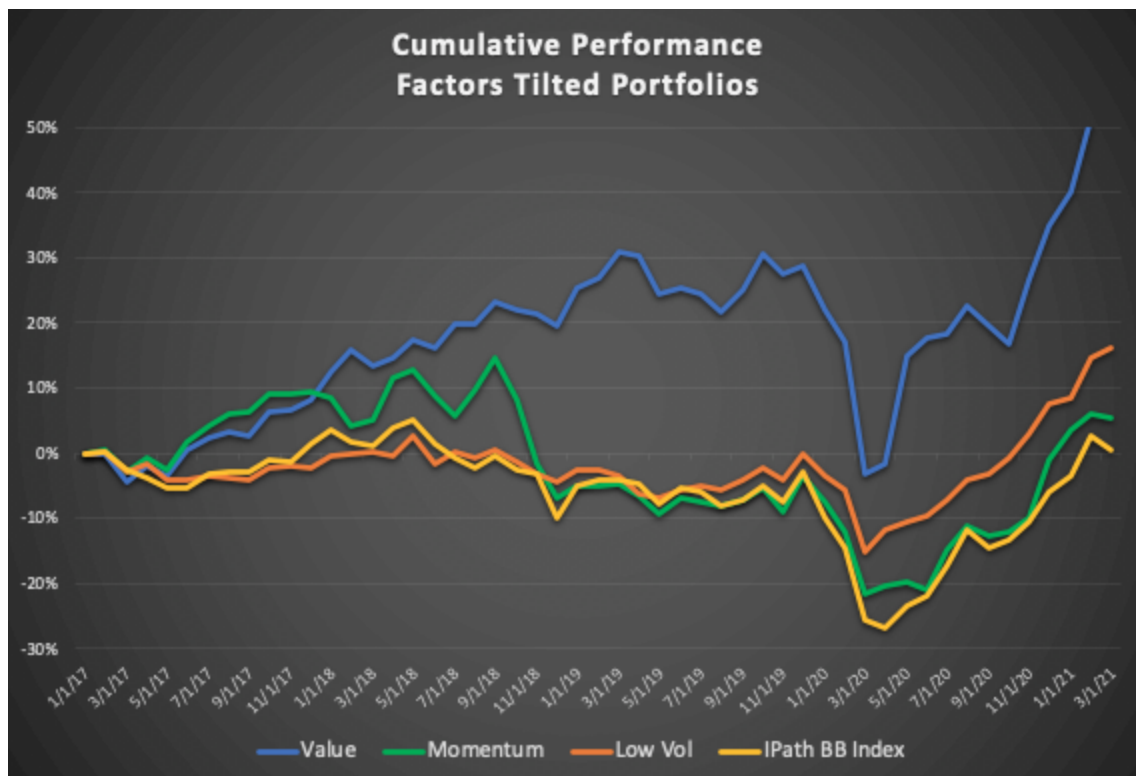
Factor Correlations:

Correlations	Agriculture	Energy	Metals	Basis	Open Interest	Momentum	ST Momentum	Trading Activity	Volatility	ST Volatility
Agriculture	1.00	0.50	0.35	0.12	0.23	(0.25)	(0.11)	(0.03)	0.37	0.16
Energy	0.41	1.00	0.33	(0.12)	0.47	(0.18)	(0.07)	(0.18)	0.23	0.11
Metals	0.39	0.56	1.00	0.01	0.15	(0.11)	(0.09)	0.02	0.08	0.12
Basis	(0.41)	(0.55)	(0.14)	1.00	(0.00)	(0.13)	(0.22)	0.06	0.11	(0.17)
Open Interest	0.38	0.86	0.43	(0.53)	1.00	(0.17)	(0.09)	(0.39)	0.06	(0.13)
Momentum	0.39	0.57	0.62	(0.13)	0.43	1.00	0.22	0.13	(0.13)	(0.20)
ST Momentum	0.49	0.19	(0.06)	(0.30)	0.31	0.02	1.00	(0.07)	(0.31)	0.05
Trading Activity	0.23	0.18	0.17	(0.29)	(0.01)	0.31	(0.27)	1.00	(0.05)	0.08
Volatility	0.01	(0.11)	(0.34)	(0.26)	0.03	(0.56)	0.19	(0.16)	1.00	(0.54)
ST Volatility	(0.22)	(0.31)	(0.35)	(0.10)	(0.39)	(0.43)	(0.37)	0.26	0.02	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, with only the Metals/Energy correlation changing dramatically. In the Style camp, the Momentum factor's correlation to the other style factors has changed drastically. This might be something to monitor.

Commodity Indices Risk Decomposition

Next, we turn to the exposure and ex-ante annual volatility of the two indices BCOM and GSCI as of 3/31/2021. In terms of sector exposures, BCOM is currently fairly equi-weighted while, as expected, GSCI is overweight in Energy. For the style factors both indices have similar exposures except with respect to the volatility factors. The higher exposures come from the more volatile energy commodities. 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, in most cases, is the most traded contract.

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Factors	BB COM	GSCI
Agriculture	36%	28%
Energy	32%	54%
Metals	32%	18%
Basis	49%	49%
Open Interest	264%	271%
Momentum	85%	116%
ST Momentum	-65%	-37%
Trading Activity	-91%	-142%
Volatility	66%	120%
ST Volatility	36%	75%

Exposures, z-scores for BCOM and GSCI as of 3/31/2021

We compute and present the factor attribution of the total volatility of each index, respectively. Styles factors contribute to 55% and 57% of the total volatility for BCOM and GSCI.

All risk is not equal. Systematic risk can display non normal behavior when compared to specific or idiosyncratic risk. We can make an analogy to bad cholesterol and good cholesterol, where both are cholesterol but one is believed to increase cardiac risk and the other ameliorates it. Both types of risks are driven by fluctuation, but systematic risk is driven by the "crowd". Because these are common factors, the systematic risk is market risk. A factor model is key as it divines not only the risk numbers but their nature. As expected most of the risk for long only indices is systematic. The make of the risk systematic/specific is as important as the raw risk number.

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Index	BCOM	GSCI
Total Risk	18.9%	21.0%
Agriculture	2.3%	1.8%
Energy	3.1%	5.7%
Metals	2.6%	1.1%
Basis	0.0%	-0.1%
Open Interest	7.7%	7.6%
Momentum	-0.1%	0.0%
ST Momentum	0.8%	0.4%
Trading Activity	0.5%	0.9%
Volatility	1.8%	3.8%
ST Volatility	-0.4%	-0.5%
Specific Risk	3.9%	3.9%

Ex-Ante Annual Volatility Decomposition for BCOM and GSCI as of 3/31/2021

Conclusion:

In this report, we have shown the factor performance driving the commodity markets. The sluggish performance of the commodity markets this month was not uniform and we highlighted Agriculture and Base Metals are strong performers. 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.

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