ARC Commodity Factor Risk Model
Monthly Report December 2020

The Asset Risk Company (ARC) Commodity model is a cross-sectional commodity factor model. Factors including commodity sectors, sub-sectors, and styles are estimated daily. It provides a framework for managing risk and investment decisions. The model is presented in a nesting format allowing the decision maker to view the market from a macro lens of broad classes (metals, energy, agricultural) to finer product classifications, while preserving the attribution of risk between the style and non-style factors.

YTD, MTD & Historical Styles Performance Report:

Factor	Dec Perf	2020 Perf	Historical Returns*	Volatility*
Basis	-1.9%	5.0%	-5.1%	5.7%
Open Interest	-0.2%	-4.5%	-1.2%	3.3%
Momentum	0.8%	-4.0%	0.4%	4.8%
ST Momentum	1.5%	-5.9%	-5.5%	5.0%
Trading Activity	0.4%	1.1%	-0.1%	1.8%
Volatility	1.0%	14.3%	3.6%	5.6%
ST Volatility	4.8%	0.6%	-2.0%	5.8%

* Annualized 2017-2020

Obviously 2020 was an eventful year by all standards. The Covid-19 pandemic "stressed" all markets including commodities markets with a once in a century event. Our Style factors include volatility factors (full year historical and a 60 day, short term). Commodity markets tend to be volatile and these two factors capture long term and short term trends. For sure 2020 saw a

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huge change in the long term Volatility Factor, with a 2020 performance of 14.3%, up almost 20% since the end of March.

As mentioned previously, futures with high loadings to this factor (the most volatile this year) will get a performance boost compared to less volatile ones. We find that after the crisis some managers stayed away from the front month contracts, probably because of their volatility. With the Volatility factor on a tear, underweighting it will hurt performance versus the commodity indices as the indices tend to be more weighted towards front months.

Noticeably Short Term Momentum stayed on par with its recent historical returns, with a -5.5% for 2020 and an average yearly return of -5.1% over the last 4 years. With an annualized volatility at 5%, a short or reverse strategy mimicking this factor will deliver a Sharpe above 1.
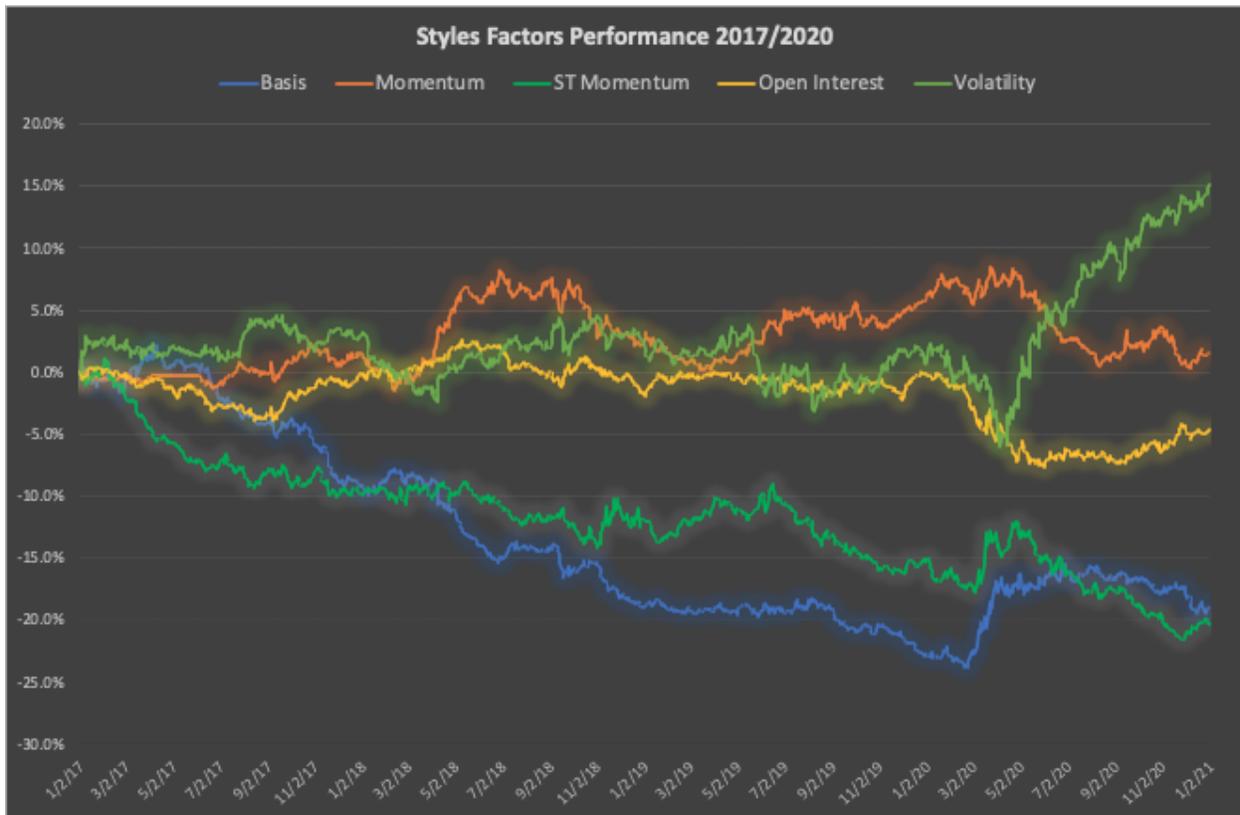
Factor Tilted Portfolios Performance Report:

All three tilted portfolios outperformed the index in 2020. In particular, the Low Vol portfolio returned 7.5%. Over the last 4 years all tilted portfolios outperformed the index. Noticeably the Value tilted portfolio annualized return is 7.7%. These portfolios are composed of some of the most liquid commodity futures and rebalanced once a month.

Returns	ARC Value	ARC Momentum	ARC Low Vol	IPath BB Index
2020	4.7%	2.5%	7.5%	-3.1%
December	6.6%	9.7%	4.6%	5.0%
Annualized*	7.7%	-0.3%	1.8%	-1.5%
Volatility*	15.9%	13.8%	8.9%	12.6%

*2017/2020

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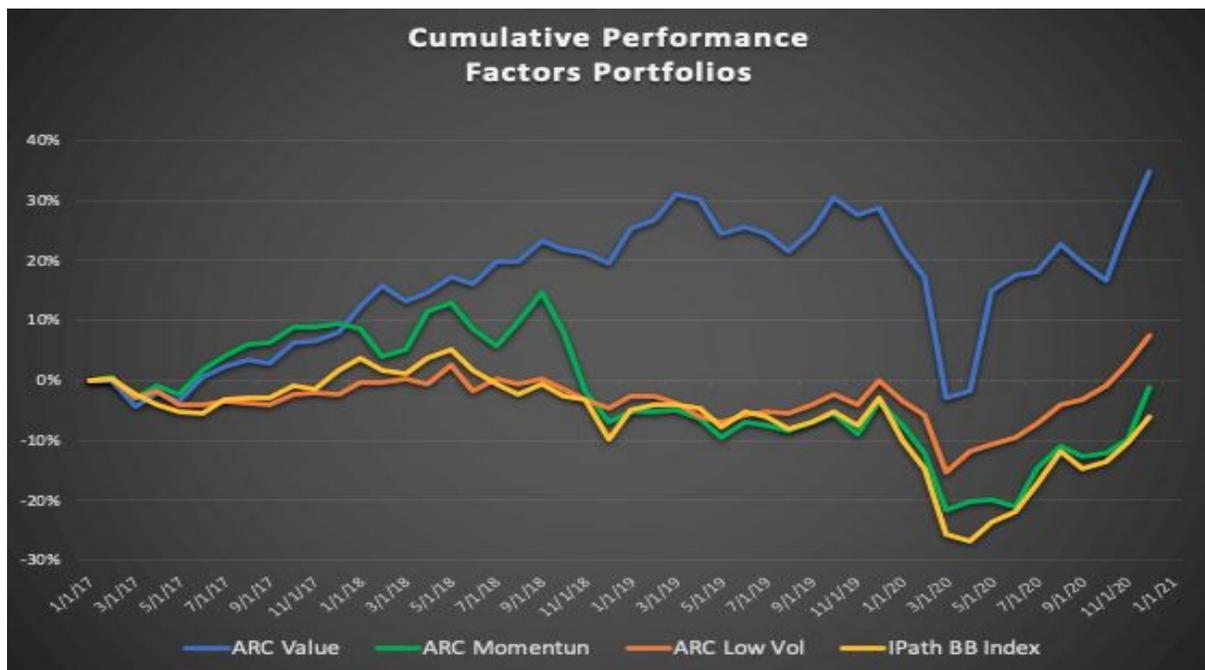
Sectors, Subsectors MTD, YTD & Historical Report

ARC sectors and subsectors returns are estimated from the statistical model and not from preset weightings of commodities. Our model covers around 50 Commodities contracts , around 1,200 futures when we count all their maturities.

Factor	Dec Perf	2020 Perf	Historical Returns*	Volatility*
Agriculture	6.5%	26.0%	5.8%	9.6%
Grain And Oilseed	8.8%	35.0%	7.8%	11.8%
Lumber And Pulp	1.0%	92.8%	25.7%	38.4%
Proteins	5.3%	7.5%	4.2%	9.8%
Softs	1.7%	19.2%	1.0%	10.5%
Energy	2.8%	-16.9%	-8.1%	13.2%
Biofuels	7.7%	-2.6%	-1.3%	17.9%
Coal	11.0%	3.5%	4.3%	15.0%
Crude Oil	0.8%	-26.7%	-8.9%	16.2%
Natural Gas	0.4%	-13.7%	-9.8%	10.0%
Petrochemicals	5.7%	0.5%	-8.8%	17.4%
Refined Products	1.9%	-28.6%	-8.3%	19.5%
Metals	3.8%	26.7%	13.9%	14.7%
Base	2.7%	22.9%	12.0%	16.0%
Precious	5.5%	38.7%	17.4%	17.5%

* 2017-2020

Agriculture and Metals posted a significant win this year with +26% and +26.7%. The energy sector, unsurprisingly, with the Covid-19 crisis, posted a negative year at -16.9%. At the

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sub-sector level, Lumber recorded an exceptional + 92.3%. Grain & Oilseed and Softs posted remarkable numbers as well with 35% and 19% respectively. Precious Metals, and in particular Gold, were seen as a "safe haven" with +38.7% this year. Base Metals, that will benefit from a recovery, posted a very good year as well with +22.9%. Energy was dragged down by Crude Oil (-26.5%), Refined Products (-28.6%) and Natural Gas (-13.7%). Noticeably Natural gas has been on a negative trend for the last 4 years with an annualized return of -10% and a volatility of 10%. A short portfolio replicating this sector could provide a Sharpe of 1.

Factor Correlations:

As market volatility decreases, short term correlations have come down. Long term correlations between Styles Factors are low.

Correlations	Agriculture	Energy	Metals	Basis	Open Interest	Momentum	ST Momentum	Trading Activity	Volatility	ST Volatility
Agriculture	1.00	0.55	0.48	0.20	0.17	(0.28)	(0.37)	(0.12)	0.32	0.28
Energy	0.30	1.00	0.42	(0.31)	0.35	(0.33)	(0.43)	(0.10)	0.19	0.26
Metals	(0.21)	0.01	1.00	0.07	0.12	(0.19)	(0.33)	(0.09)	0.10	0.28
Basis	(0.19)	0.13	(0.41)	1.00	0.09	0.01	0.04	(0.12)	0.14	(0.13)
Open Interest	(0.05)	0.34	(0.06)	0.41	1.00	(0.21)	(0.22)	(0.32)	0.02	(0.02)
Momentum	(0.05)	0.15	(0.15)	0.10	(0.23)	1.00	0.35	0.04	(0.13)	(0.11)
ST Momentum	0.04	(0.19)	0.08	(0.27)	(0.35)	0.47	1.00	0.02	(0.21)	(0.00)
Trading Activity	(0.08)	(0.27)	0.29	(0.40)	(0.42)	0.07	0.46	1.00	0.01	(0.02)
Volatility	0.31	0.63	0.13	(0.05)	0.34	(0.10)	(0.16)	(0.08)	1.00	(0.58)
ST Volatility	0.17	(0.45)	(0.07)	(0.39)	(0.65)	0.19	0.46	0.40	(0.62)	1.00

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

Commodity Indices Risk Decomposition

We look at the risk factor decomposition of the main indices through the prism of the ARC short term model as of 01/04/2021. The Bloomberg Commodity Index is currently overweight in metals and S&P GSCI in energy, which the model captures. Both have significant exposure to Open Interest, reflecting a bias towards the front of the curve (short maturity contracts are more volatile). The Volatility factor contribution is significant for GSCI due to an overweight in volatile futures, mostly from the energy sector. The GSCI and BB COM energy exposures are respectively 1.4 and 0.4. Styles factors contribute to 44% and 56% of the total volatility for BB COM and S&P GSCI.

As a reminder, the exposures to sectors and sub-sectors are simply 1 or 0. ARC sector returns come from a regression model and not from a manual weighing of commodities in each sector. For the style factors, exposures are standardized (z-scores) and winsorized (between -3 and 3). As one might imagine, an exposure of 0 corresponds to the mean. A negative exposure means

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the asset is less exposed to that factor than the average of the assets in the model. Conversely, a positive exposure reflects the fact that the asset has more exposure than the average. The model's exposures are computed daily for more than 1,200 commodity futures. ARC's model comes in a nested format. This means two models are jointly estimated in such a way that the explanatory power of the **style factors** is unchanged whether looking from a higher level aggregation of the data or lower level (sub-sector) aggregation.

Index	BB COM	GSCI	BB COM Contribution	GSCI Contribution
Total Risk	19.4%	25.1%	100.0%	100.0%
Agriculture	3.2%	2.2%	16.7%	8.9%
Energy	2.9%	7.0%	14.8%	27.9%
Metals	4.3%	1.5%	22.1%	5.8%
Basis	0.1%	0.1%	0.6%	0.3%
Open Interest	8.3%	7.0%	42.6%	27.8%
Momentum	-0.6%	0.7%	-3.1%	2.9%
ST Momentum	-0.1%	-1.2%	-0.5%	-4.7%
Trading Activity	-0.2%	0.3%	-1.1%	1.1%
Volatility	0.9%	7.2%	4.4%	28.7%
ST Volatility	0.2%	-0.1%	1.2%	-0.2%
Specific Risk	4.3%	4.3%	21.9%	17.1%

Performance Attribution of Commodity Indices for 2020

Using the time series of our factors we decompose the performance of the BB COM index for 2020. The R-Square is in the 90% range.

As expected Agriculture and Metal contributed positively to the index return while the energy sector dragged down the index. However if it had been for sectors only the index would have been positive. Several Styles factors had significant negative impact, Open Interest ,Basis and Momentum. In particular, Open Interest's contribution was -7% in 2020 for the index. Open

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Interest captures the risk associated with the most liquid futures, which tend to be front month contracts. The exposure/loading of the index to Open Interest was 1.3 in the regression period and the factor return was -5% for the year (so larger exposure than the average futures in the model since the exposures are standardized).

BB COM	2020 Returns Contribution
Agriculture	10.1%
Energy	-7.1%
Metals	7.3%
Basis	-2.3%
Open Interest	-6.0%
Momentum	-2.2%
ST Momentum	0.1%
Trading Activity	0.7%
Volatility	0.3%
ST Volatility	0.0%