NORTHFIELD | modeling financial markets worldwide

The Performance of Long-Term Momentum

Jason MacQueen, Director of Research
& Tiangu Zhang, Research Assistant

Research Webinar

23rd October 2019

XRD Risk Model Style Factors

- The Northfield XRD risk models include a number of Style factors
- These are defined in fairly standard ways, as follows:-
  - **Dividend Yield** Trailing 12-month Dividend Yield
  - **Growth** A composite of 5-year Growth Trend and 5-year Growth Momentum
    - **Growth Trend** A composite of Earnings per share (EPS), Book Value per share (BPS) and Sales per share (SPS) growth over the last 5 years
    - **Growth Momentum** A composite of EPS, BPS and SPS acceleration over last 5 years
  - **Value** A composite of Book/Price, Earnings/Price and CashFlow/Price
  - **Momentum** 12 month return to 1 month ago
  - **Quality** Return on Assets, Return on Equity and Cash Flow/Sales

Standard Long-Term Momentum

- These are all standard definitions, except for Long-Term Momentum
- The standard definition of Long-Term Momentum is the past return of a stock over a one-year period up to one month ago:-

$$\mathbf{STDMOM(i) = (P_{t-13} / P_t) - 1}$$

where P is the stock price and t is the number of calendar months.

- However, the evolution of the stock price over that year can vary a lot
- One stock may stay flat for a long time, then suddenly have a large price jump, another may first have a large price jump, and then go flat, while a third may have a fairly steady increase over the year
- If these three cases all have the same Long-term Momentum, do we really think they all carry the same information?

NIS XRD Risk Model Construction

- Most medium-to-long horizon risk models are built on a single set of calendar month returns, typically over a five year look-back
- However, it can be argued that a set of calendar month returns is not a true random sample, since there are well-documented end-of-year, end-of-quarter and end-of-month effects
- Moreover, building a risk model using only a single set of returns exposes the result to sample-specific idiosyncratic estimation errors
- To minimise both these concerns, the XRD risk models are based on four sets of eighty 4-weekly returns, staggered one week apart
- We first calculate 4 SRD (Single Reference Day) risk models, and then average the four sets of factor covariances, stock betas and stock specific risks to get the final, robust XRD (Cross Reference Day) model

NIS XRD Long-Term Momentum Beta - examples

- To calculate Long-Term Momentum betas, we take fourteen 4-weekly prices from 56 weeks ago (13 months) up to 4 weeks ago (1 month)
- We divide through by the first price, so the first value is always 1.00
- Then we calculate an OLS slope through these 14 normalised prices
- This slope represents the average change in price over 4 weeks, so we multiply the slope by 13 to get an annualised Momentum value

- As an example consider the behaviour of two stocks, AMAZON and EXELON, from 11-Jun-2008 to 10-Jun-2009, during which period the S&P 500 (TR) index fell by -27.8%
- AMAZON went up from $77.28 to $86.59, a gain of 12.05%
- EXELON went down from $87.57 to $50.33, a loss of -42.53%

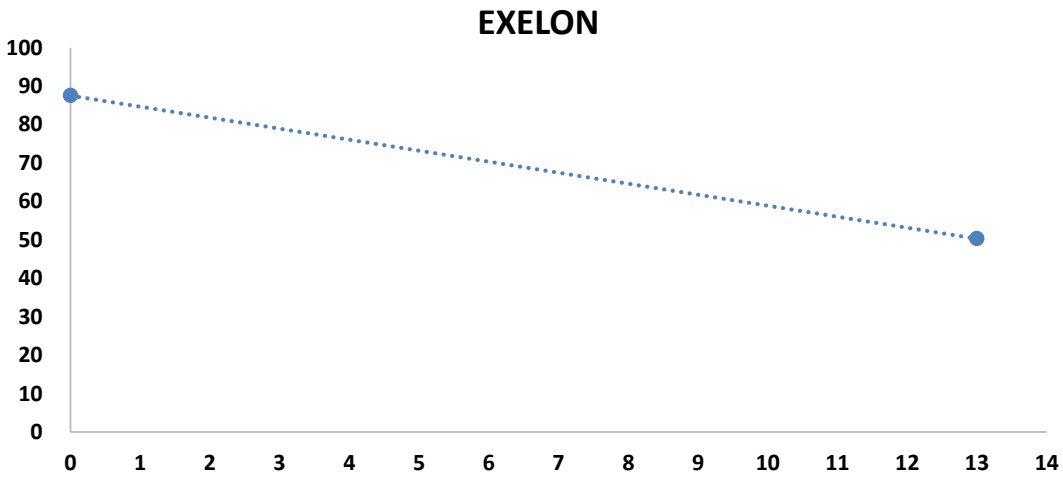
Long-Term Momentum for EXELON

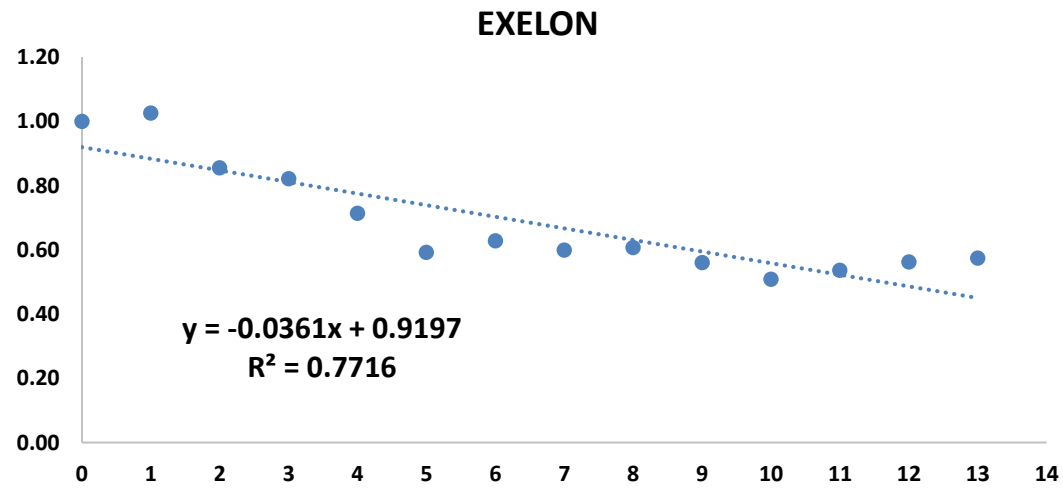
- Using the Standard method
  STDMOM = -0.425

- In this case, the price decline over the year was fairly steady, so the two Momentum betas are quite similar

- Using the Northfield method
  NISMOM = -0.036 * 13

  NISMOM = -0.470

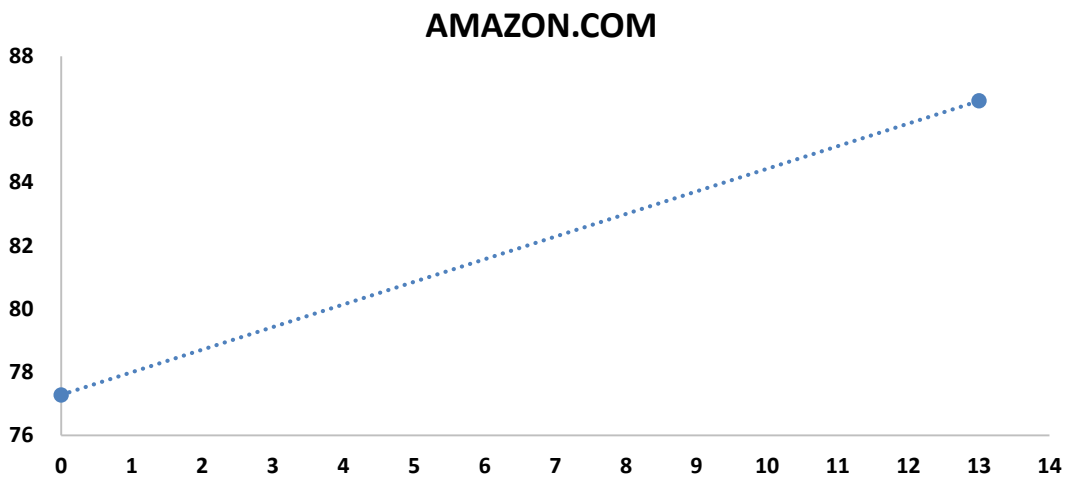


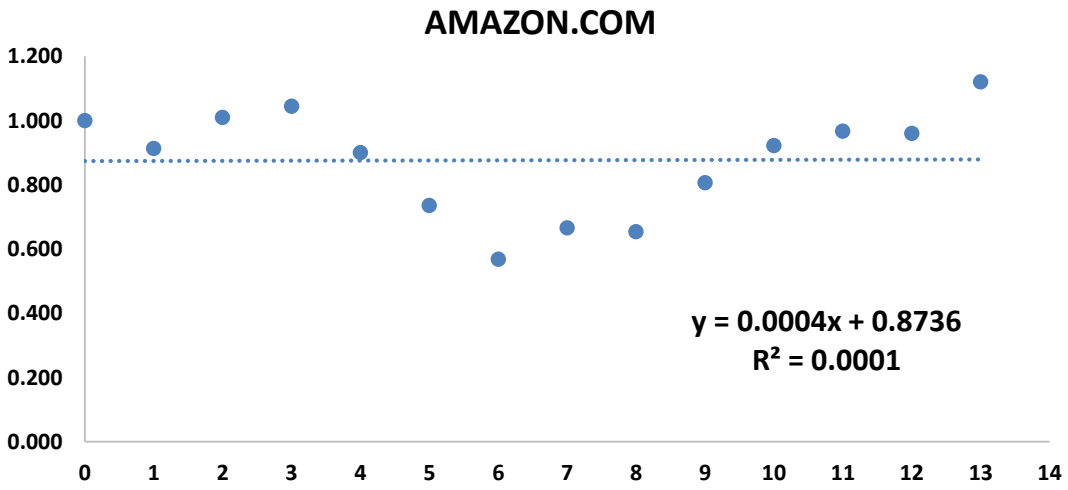


Long-Term Momentum for AMAZON

- Using the Standard method
  STDMOM = 0.120
- In this case, the price moved down, then up for 2 months, then down for 3 months, and then mostly up, so the betas are rather different
- Using the Northfield method
  NISMOM = 0.00044 * 13

  NISMOM = 0.006

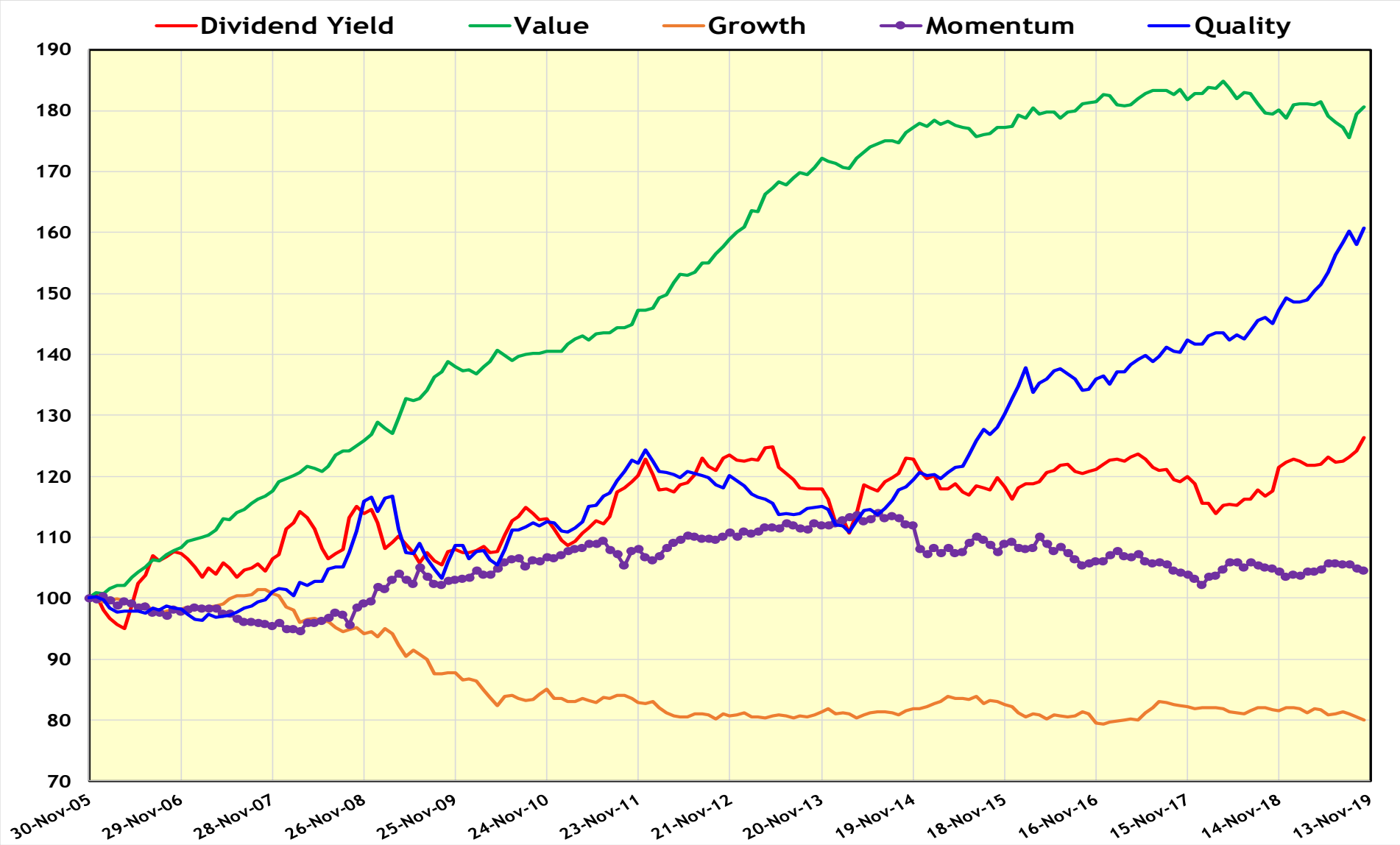




Long-Term Momentum Performance

- Conventional wisdom says that stocks with higher Momentum betas tend to have higher subsequent returns
- I am not aware of any sound economic rationale for this effect, although I have been hearing “the trend is your friend” for 40 years
- The Style factors in the NIS XRD risk models are fairly standard, and most of them behave as we would expect
- However, Long-Term Momentum is – if you will pardon the term! – something of an anomaly, as it has not behaved as it ‘should’
- The chart on the next slide shows the performance of these five Style factors from the December 2005 up to October 2019
- While the other four behave pretty much as expected, Long-Term Momentum does not have a positive risk premium most of the time

XRD Risk Model Style Factor Returns



Long-Term Momentum Return from 2006 to 2019

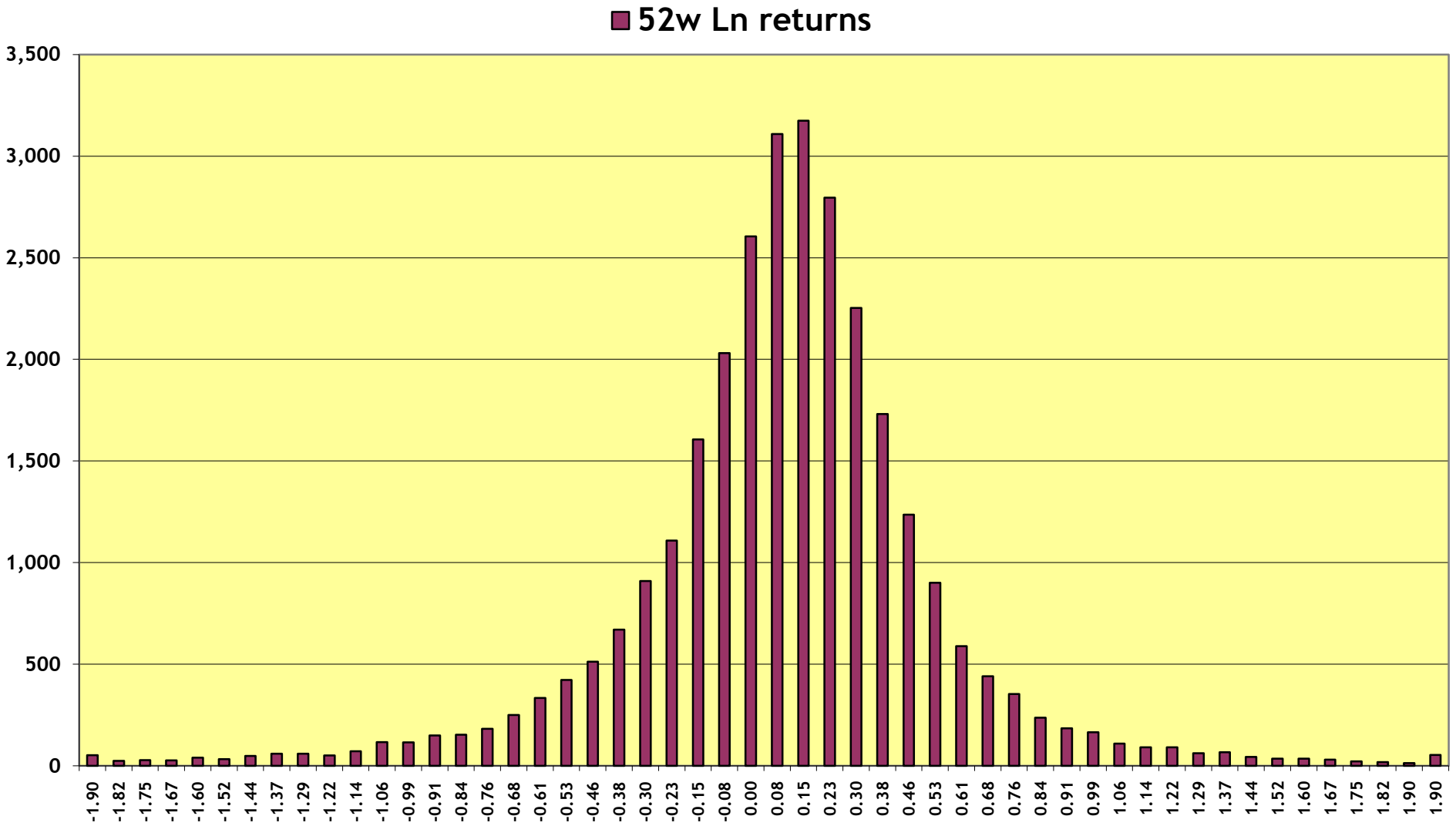
- From Jan-2006 to Oct-2008, the return to Momentum is negative
- From Nov-2008 to May-2014, the return to Momentum is positive
- From Jun-2014 to Oct-2019, the return to Momentum is negative
- Over the whole period, it had an annualised return of 0.32% p.a.
- So we decided to do some investigation

- We calculated STD and NIS Momentum betas for US common stocks with look-back periods of 6, 9 and 12 months, and then looked at the subsequent performance over a number of investment horizons, ranging from 3 months up to 18 months out
- We computed Decile Returns and Information Coefficients (ICs)

Momentum Betas & Stock Returns

- Standard Momentum betas were calculated on the change from first price to last price over 26, 39 and 52 weeks (6, 9 and 12 months)
- We ran regressions on normalised prices at 4-week intervals to get NIS Momentum betas over 28, 40 and 52 weeks (about the same)
- We also calculated stock total returns over 4, 13, 26, 39, 52, 65 and 78 week periods (1, 3, 6, 9, 12, 15 and 18 months)
- Inevitably, we have some rogue data, and hence first need to remove unbelievable data (outside 4 standard deviations from the mean), and then Winsorise the extreme outliers remaining (down to 4 s.d.s)
- For the returns, we eliminated about 0.66% of the data, and Winsorised about 0.44% of the data
- An example of the 52 week returns is shown on the next slide

Distribution of 52-week Ln Returns



Average IC Results - Not as Expected!

- The table below summarises the average ICs from June 2008 to July 2018 for each Momentum beta and each Return horizon

I.C.s	4 week	13 week	26 week	39 week	52 week	65 week	78 week	Averages
NIS MOM 52	-0.003	-0.022	-0.033	-0.038	-0.042	-0.042	-0.053	**-0.033**
NIS MOM 40	-0.003	-0.020	-0.028	-0.034	-0.038	-0.038	-0.042	**-0.029**
NIS MOM 28	-0.005	-0.019	-0.027	-0.028	-0.032	-0.033	-0.035	**-0.026**
STD MOM 52	-0.009	-0.035	-0.051	-0.059	-0.065	-0.068	-0.081	**-0.053**
STD MOM 39	-0.011	-0.031	-0.047	-0.053	-0.061	-0.060	-0.069	**-0.047**
STD MOM 26	-0.011	-0.029	-0.043	-0.043	-0.049	-0.051	-0.056	**-0.040**
AVERAGES	**-0.007**	**-0.026**	**-0.038**	**-0.043**	**-0.048**	**-0.048**	**-0.056**	

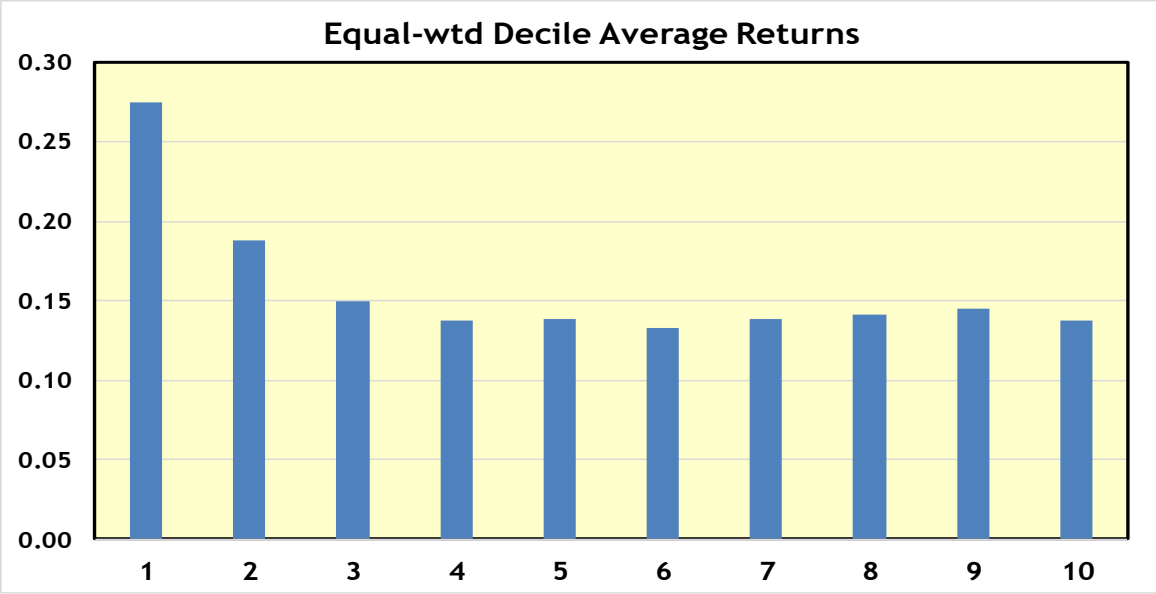
- Unfortunately, they are all very small and negative, rather different from the significant positive numbers we were hoping for!
- If any trend is discernible, it is that the average ICs get larger (but are still negative) at longer return horizons

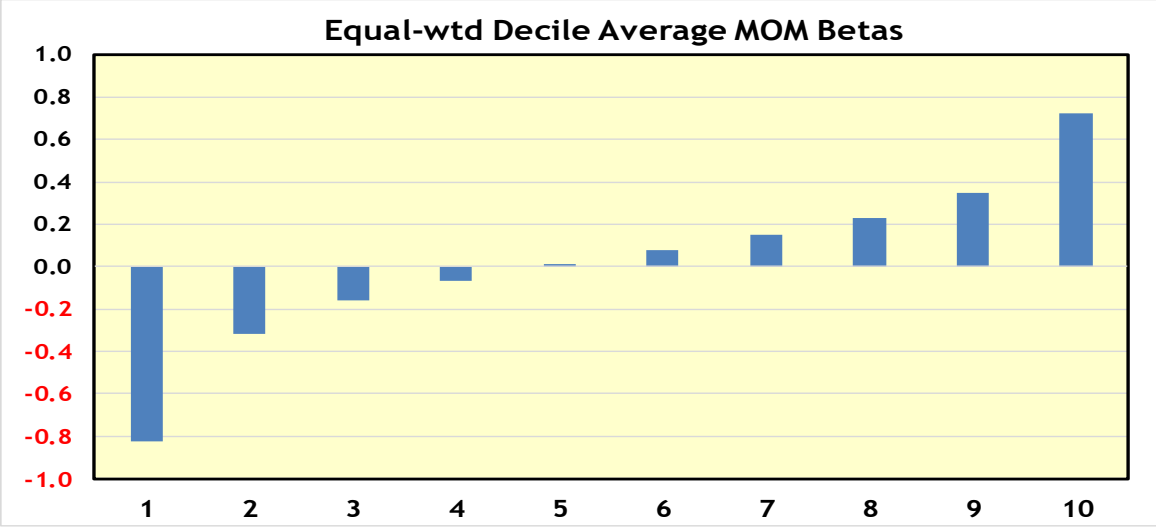
Decile Returns

- Our next thought was to sort the stocks into deciles by each of the Momentum betas, and look at the average returns in each decile
- Our convention is that decile 1 is defined by the lowest Momentum betas, and decile 10 is the highest Momentum betas, so we are hoping that decile 10 will outperform decile 1
- We tried both equal-weighted deciles (nearly the same number of stocks in each decile) and also interval-weighted deciles (divide the range from lowest beta to highest beta into 10 intervals, and collect all stocks with betas in each of those sub-ranges)
- We looked at the average returns to each decile, the average Momentum beta and the number of stocks in each decile
- Example results are given in the next few slides

EW Deciles : STDMOM 52 betas over 52 weeks

Decile	Average Returns	STDMOM 52 beta	Count
1	0.275	-0.827	282
2	0.188	-0.315	282
3	0.150	-0.161	282
4	0.137	-0.065	283
5	0.139	0.010	283
6	0.133	0.079	283
7	0.139	0.148	283
8	0.141	0.230	282
9	0.146	0.348	282
10	0.138	0.722	282
Averages	0.159	0.017	282

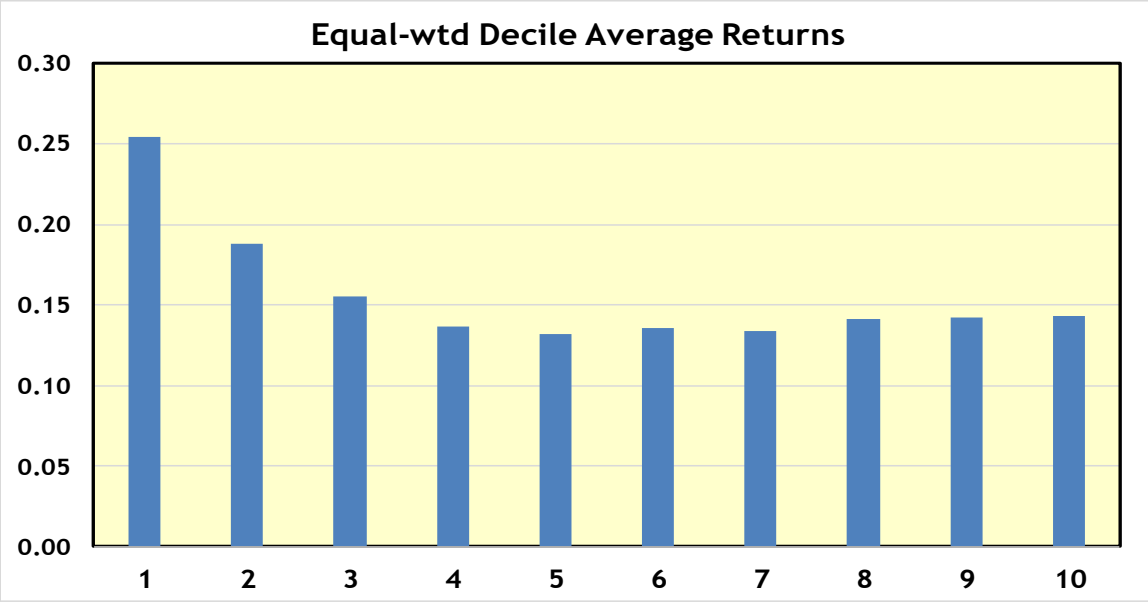


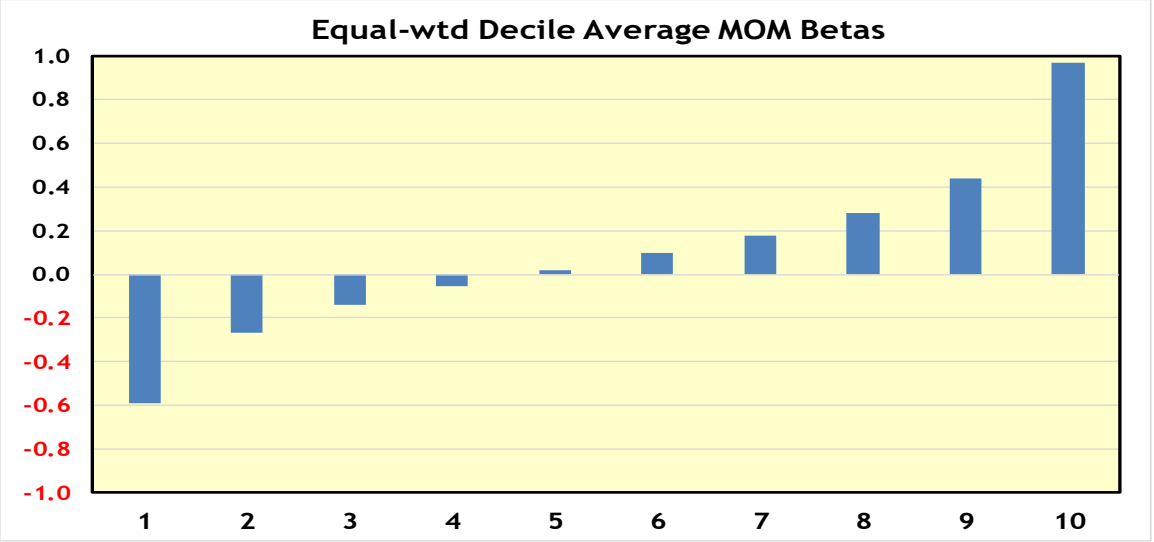


Note that the decile returns are highest (0.275) for the Lowest Momentum beta Decile (average -0.827)

EW Deciles : NISMOM 52 betas over 52 weeks

Decile	Decile Returns	NIS MOM 52 beta	Count
1	0.255	-0.591	285
2	0.188	-0.268	285
3	0.155	-0.143	285
4	0.137	-0.055	286
5	0.132	0.021	286
6	0.136	0.096	286
7	0.134	0.177	286
8	0.142	0.279	285
9	0.142	0.441	285
10	0.143	0.971	285
Averages	0.156	0.093	285

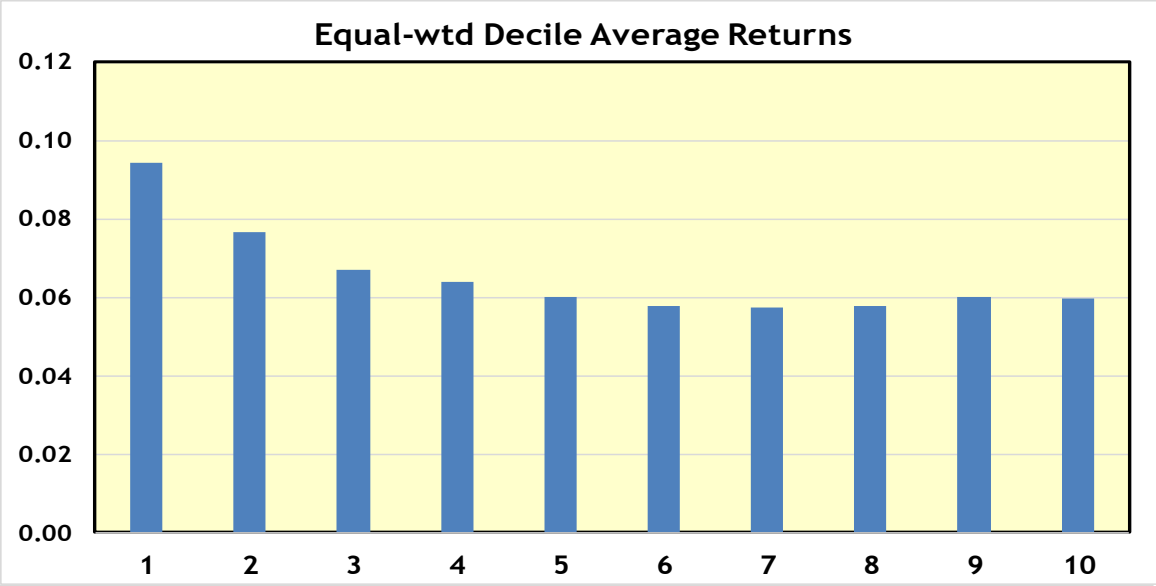


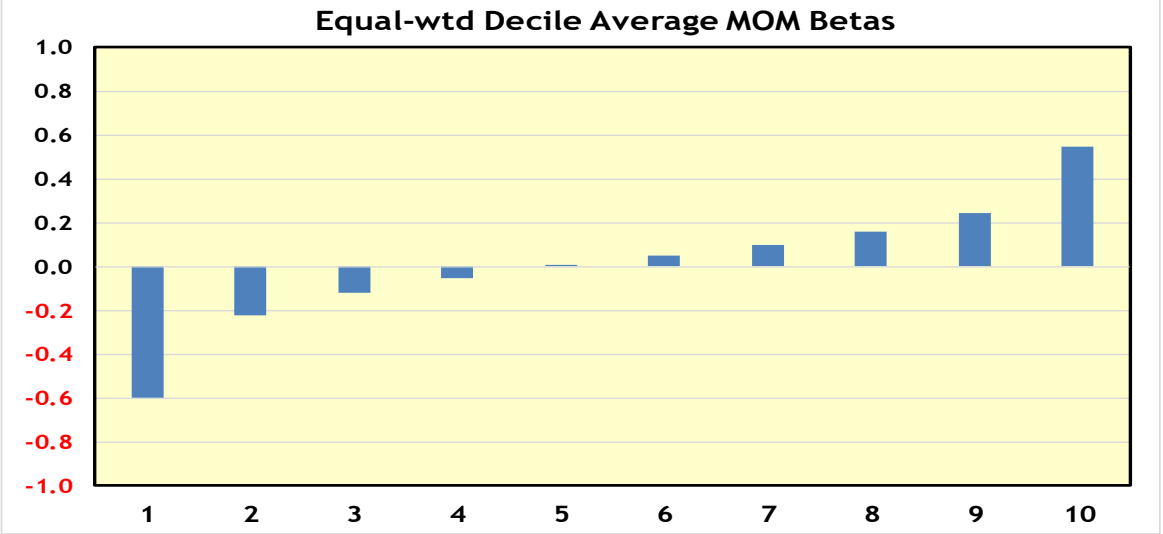


Note that the decile returns are highest (0.255) for the Lowest Momentum beta Decile (average -0.591)

EW Deciles : STDMOM 26 betas over 26 weeks

Decile	Decile Returns	STDMOM 26 beta	Count
1	0.094	-0.597	292
2	0.077	-0.223	293
3	0.067	-0.120	293
4	0.064	-0.053	293
5	0.060	0.000	293
6	0.058	0.049	293
7	0.057	0.100	293
8	0.058	0.159	293
9	0.060	0.247	292
10	0.060	0.548	292
Averages	0.065	0.011	293

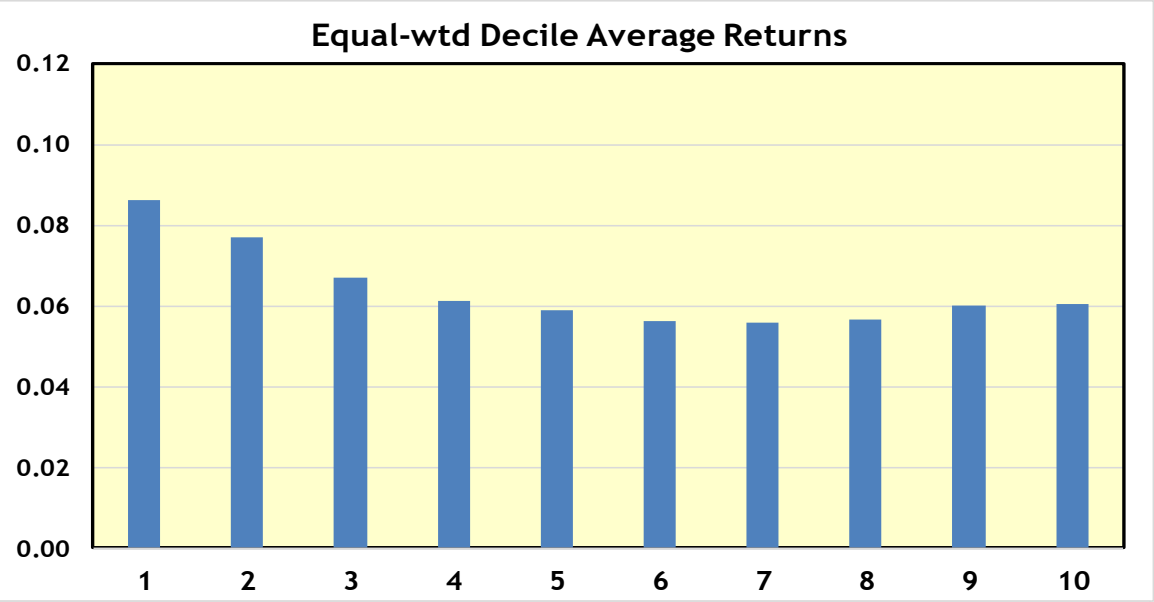


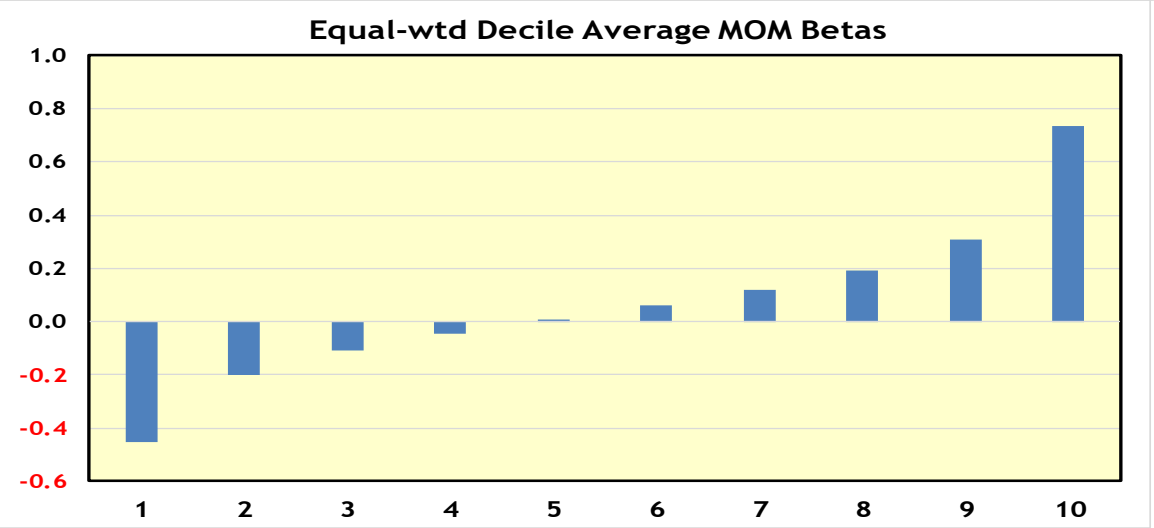


Note that the decile returns are highest (0.094) for the Lowest Momentum beta Decile (average -0.597)

EW Deciles : NISMOM 28 betas over 26 weeks

Decile	Decile Returns	NISMOM 28 beta	Count
1	0.086	-0.454	294
2	0.077	-0.201	294
3	0.067	-0.110	295
4	0.061	-0.047	295
5	0.059	0.008	295
6	0.056	0.061	295
7	0.056	0.120	295
8	0.057	0.192	294
9	0.060	0.307	294
10	0.061	0.736	294
Averages	0.064	0.061	295

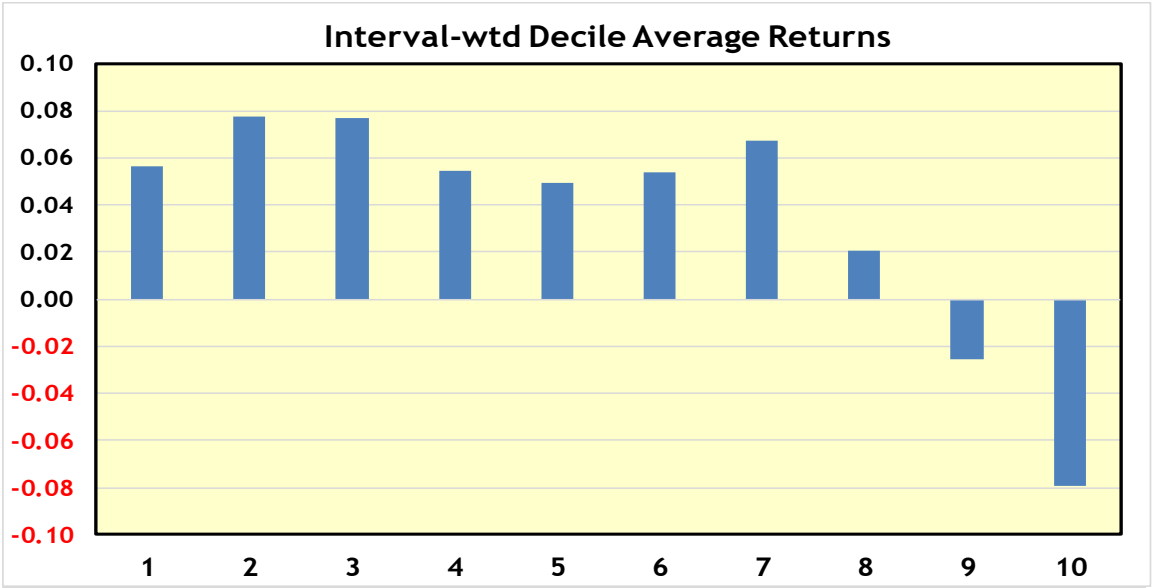


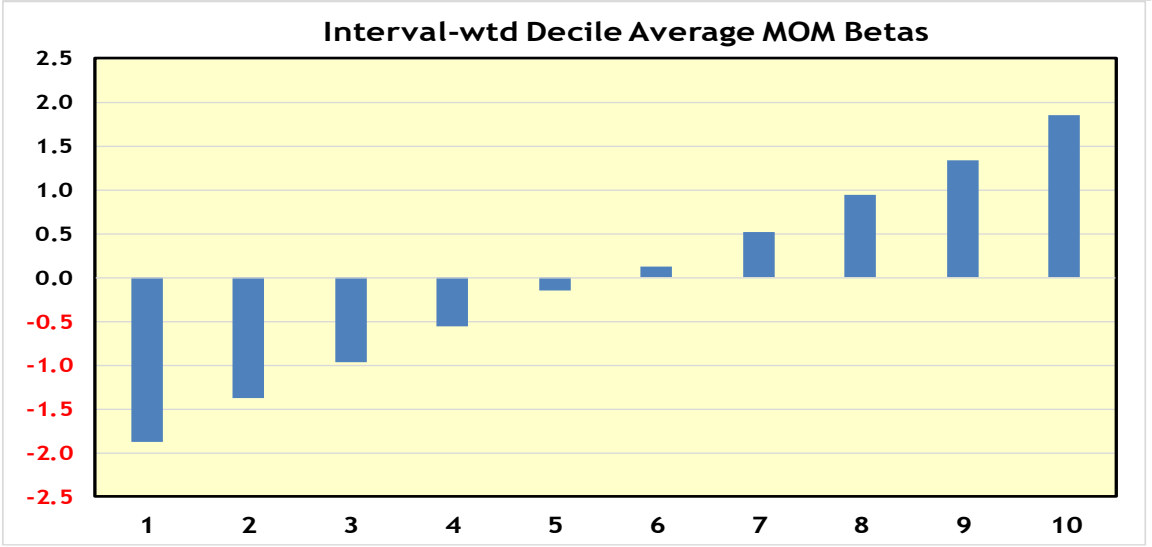


Note that the decile returns are highest (0.086) for the Lowest Momentum beta Decile (average -0.454)

IW Deciles : STDMOM 26 betas over 26 weeks

Decile	Decile Returns	STDMOM 26 beta	Count
1	0.057	-1.875	13
2	0.078	-1.369	16
3	0.077	-0.967	45
4	0.055	-0.555	160
5	0.050	-0.142	966
6	0.054	0.132	1,492
7	0.067	0.520	185
8	0.021	0.940	32
9	-0.026	1.342	10
10	-0.080	1.858	8
Averages	0.035	-0.012	293

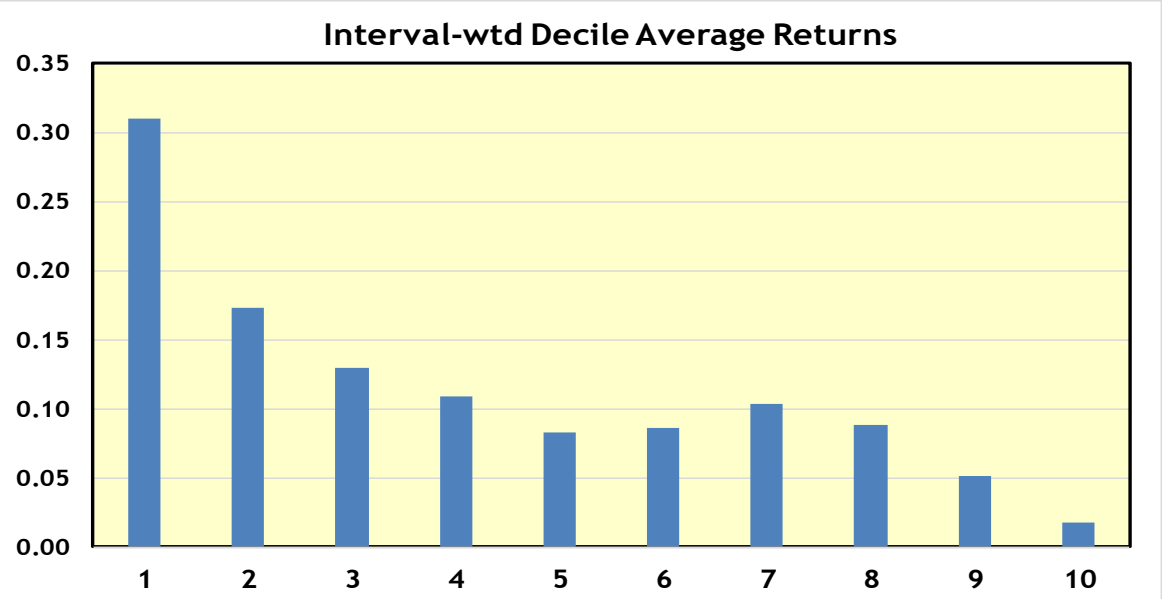


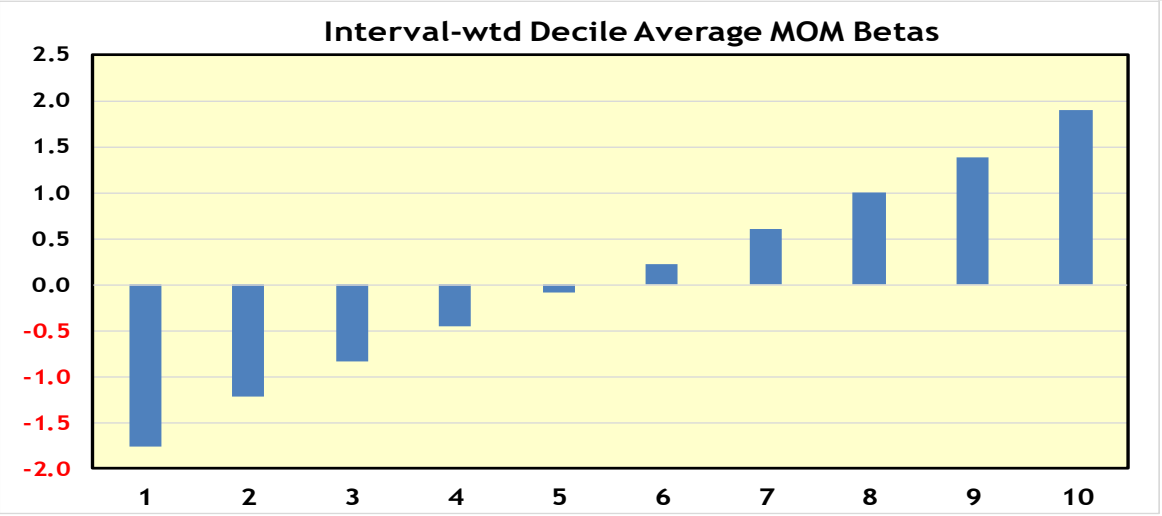


Note that the decile returns are highest (0.057) for the Lowest Momentum beta Decile (average -1.875)

IW Deciles : NISMOM 40 betas over 39 weeks

Decile	Decile Returns	NISMOM 40 beta	Count
1	0.310	-1.760	3
2	0.173	-1.219	10
3	0.130	-0.833	67
4	0.109	-0.456	332
5	0.083	-0.087	1,108
6	0.086	0.219	1,012
7	0.103	0.601	235
8	0.088	0.999	69
9	0.051	1.392	30
10	0.018	1.896	33
Averages	0.115	0.075	290





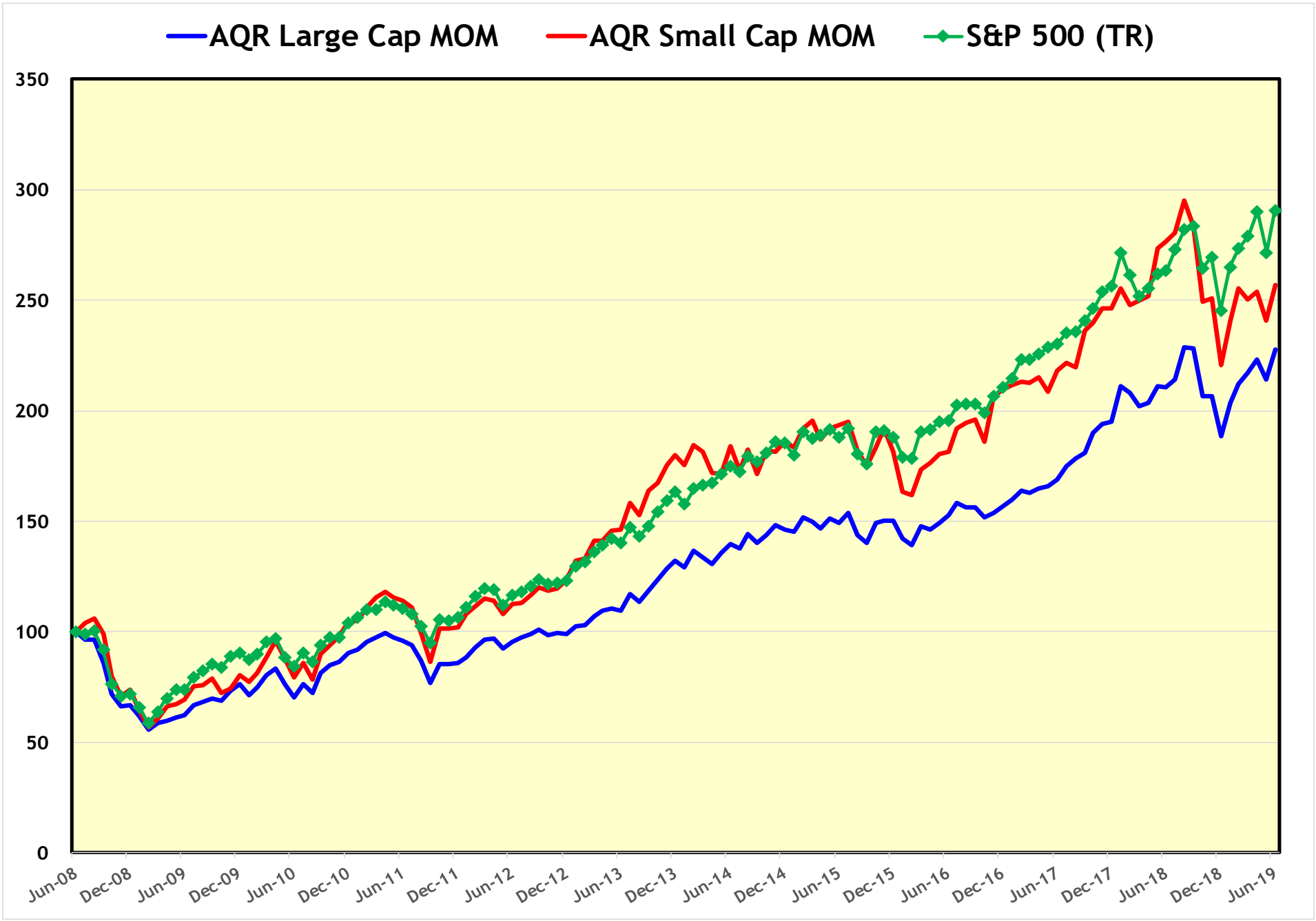
Note that the decile returns are highest (0.310) for the Lowest Momentum beta Decile (average -1.760)

Summary So Far

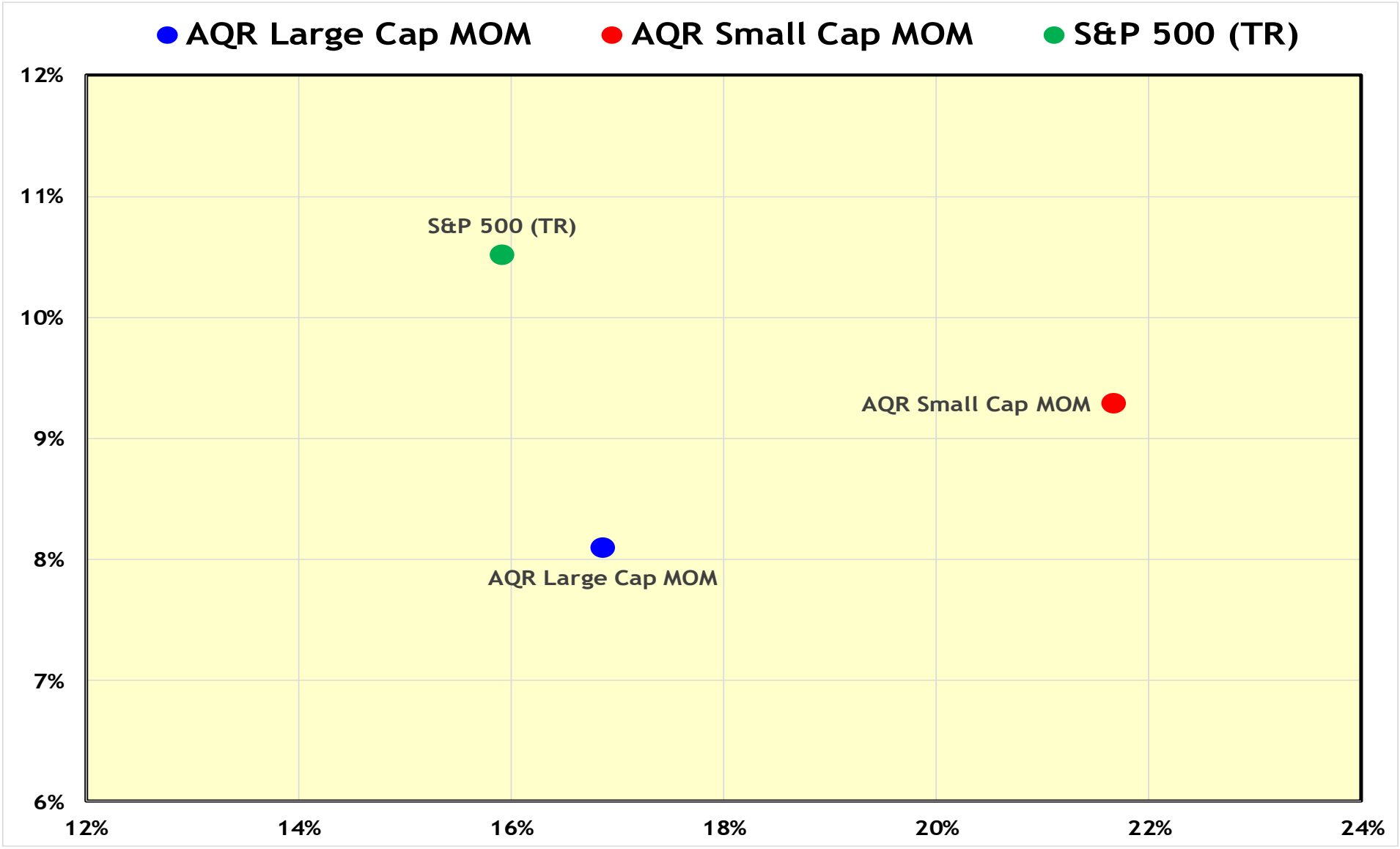
- We have results for the 6, 9 and 12 month look-back versions of both STDMOM and NISMOM Momentum beta deciles, giving the average decile returns over the subsequent 1, 3, 6, 9, 12, 15 and 18 months
- The results over 1 month (4 weeks) are rather erratic, but virtually all the other results show that the Low Momentum stocks tend to have higher returns than High Momentum stocks
- Using Equal-weighting, deciles 1 and 2 tend to have higher average returns, while the other deciles all have similar average returns
- Interval-weighting gives bigger differences in the decile averages, due to the lower numbers of stocks in the outer deciles, but the basic result is still that Low Momentum is good, High Momentum is bad
- We are getting the opposite of the expected result, although these results are consistent with our Momentum factor returns over time

Evidence from the AQR US Momentum Indices

- AQR Capital Management LLC (AQR) publishes both a US Large Cap Momentum index and a US Small Cap Momentum index
- These indices are rebalanced at the end of each calendar quarter, and are market capitalisation-weighted
- The constituents of the US Large Cap index are the 333 stocks with the highest Momentum betas (STDMOM) in the top 1,000 stocks by market capitalisation
- The constituents of the US Small Cap index are the 666 stocks with the highest Momentum betas (STDMOM) taken from the next largest 2,000 stocks by market capitalisation
- The next two slides compare the performance of these indices to the S&P 500 (TR) index over the same period, June 2008 to July 2019


AQR Large Cap MOM
AQR Small Cap MOM
S&P 500 (TR)
350
300
250
200
150
100
50
0
Jun-08
Dec-08
Jun-09
Dec-09
Jun-10
Dec-10
Jun-11
Dec-11
Jun-12
Dec-12
Jun-13
Dec-13
Jun-14
Dec-14
Jun-15
Dec-15
Jun-16
Dec-16
Jun-17
Dec-17
Jun-18
Dec-18
Jun-19

Annualised Return & Risk : Jun-2008 to Jul-2019



Performance of the AQR US Momentum Indices

- Annualised performance characteristics are given in this table:-

	AQR Large Cap MOM	AQR Small Cap MOM	S&P 500 (TR) index
Return p.a.	8.10%	9.29%	10.51%
Risk p.a.	16.86%	21.67%	15.91%
Alpha p.a.	-2.14%	-3.02%	0.00%
Beta	0.991	1.195	1.000

- Both are more risky than the S&P 500, as might be expected
- Both have lower return than the S&P 500, and the Large Cap index return is lower than the Small Cap index return

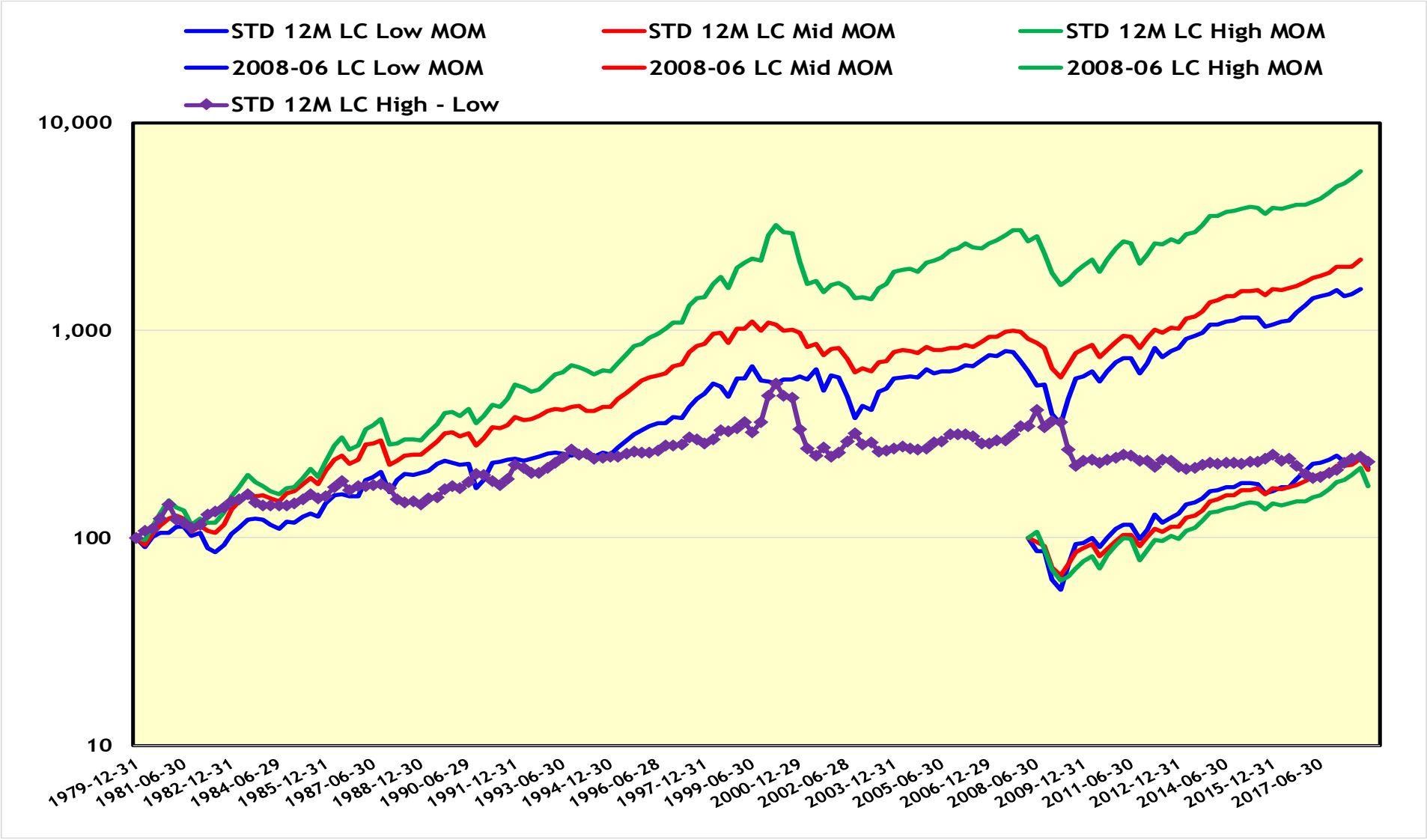
Comments on Performance of AQR Indices

- The performance of these two indices, will, by construction, and to some extent, reflect the performance of the Momentum factor
- However, their performance will also reflect the fact that they are capitalisation-weighted, and that they may have significant Market or Industry bets, since these have not been controlled in any way
- Nonetheless, they do seem to suggest that the Momentum factor risk premium has been mainly negative over this period
- The fact that the Small Cap index outperforms the Large Cap index is also interesting.
- To some extent, this may be just the Small Cap risk premium itself
- However, we also have other evidence that suggest the Momentum effect is stronger for Small Cap stocks than for Large Cap stocks

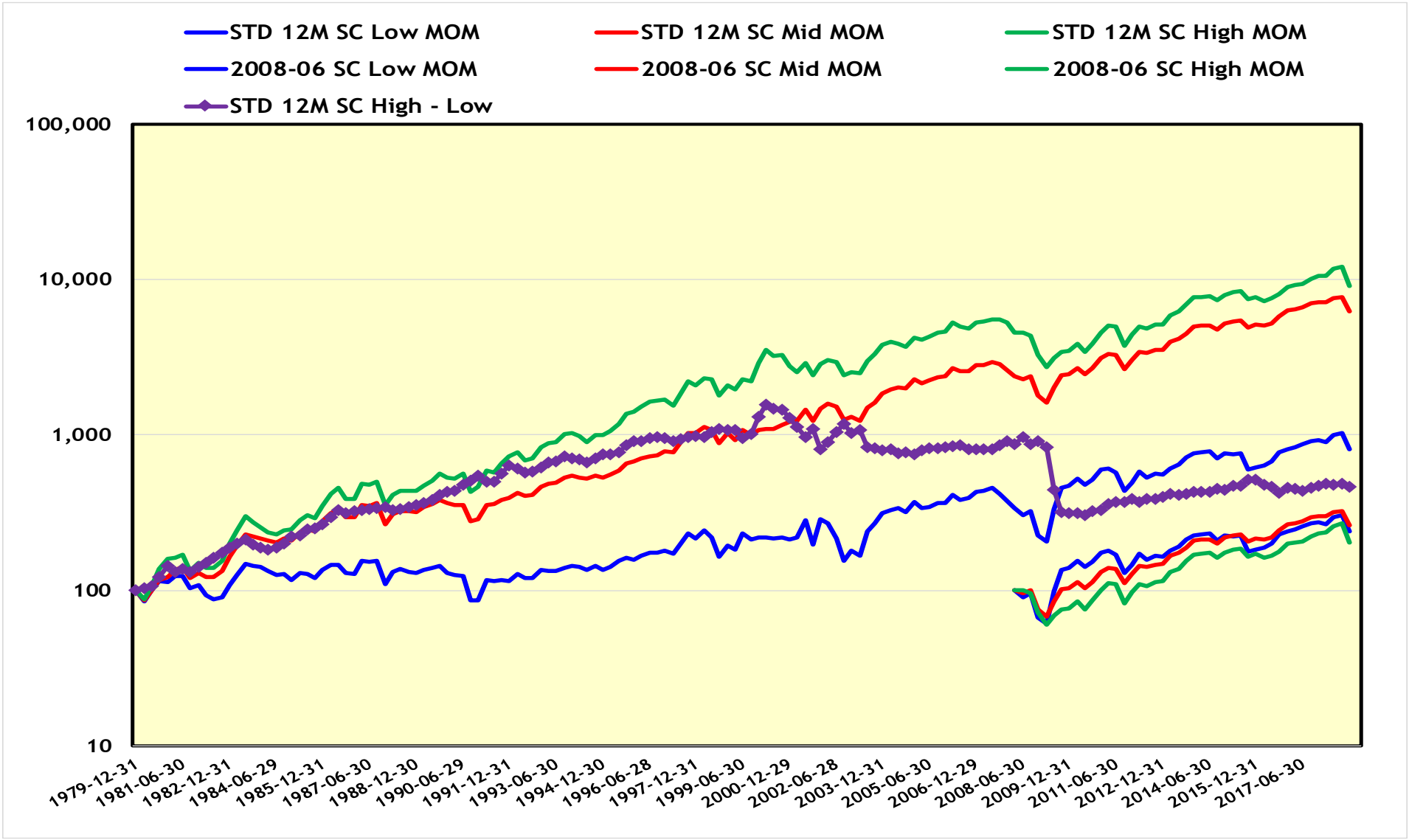
Interaction between Size and Momentum

- Following AQR's methodology, we took the top 1,000 stocks by capitalisation at the end of each quarter, sorted them high to low by their Momentum beta, and created three sets: 333 High Momentum stocks, 334 Mid Momentum stocks and 333 Low Momentum stocks
- We also looked at Small Cap stocks, taking the next 2,000 stocks, and again dividing them into thirds by the Momentum beta
- We tracked the performance over the next quarter, and repeated this exercise over 39 years, from 31-Dec 1979 to 28-Sep-2019
- We calculated the quarterly returns both on an Equal-weighted and a Capitalisation-weighted basis
- We ran the exercise using both the STDMOM and NISMOM betas
- The results finally reveal what is going on!

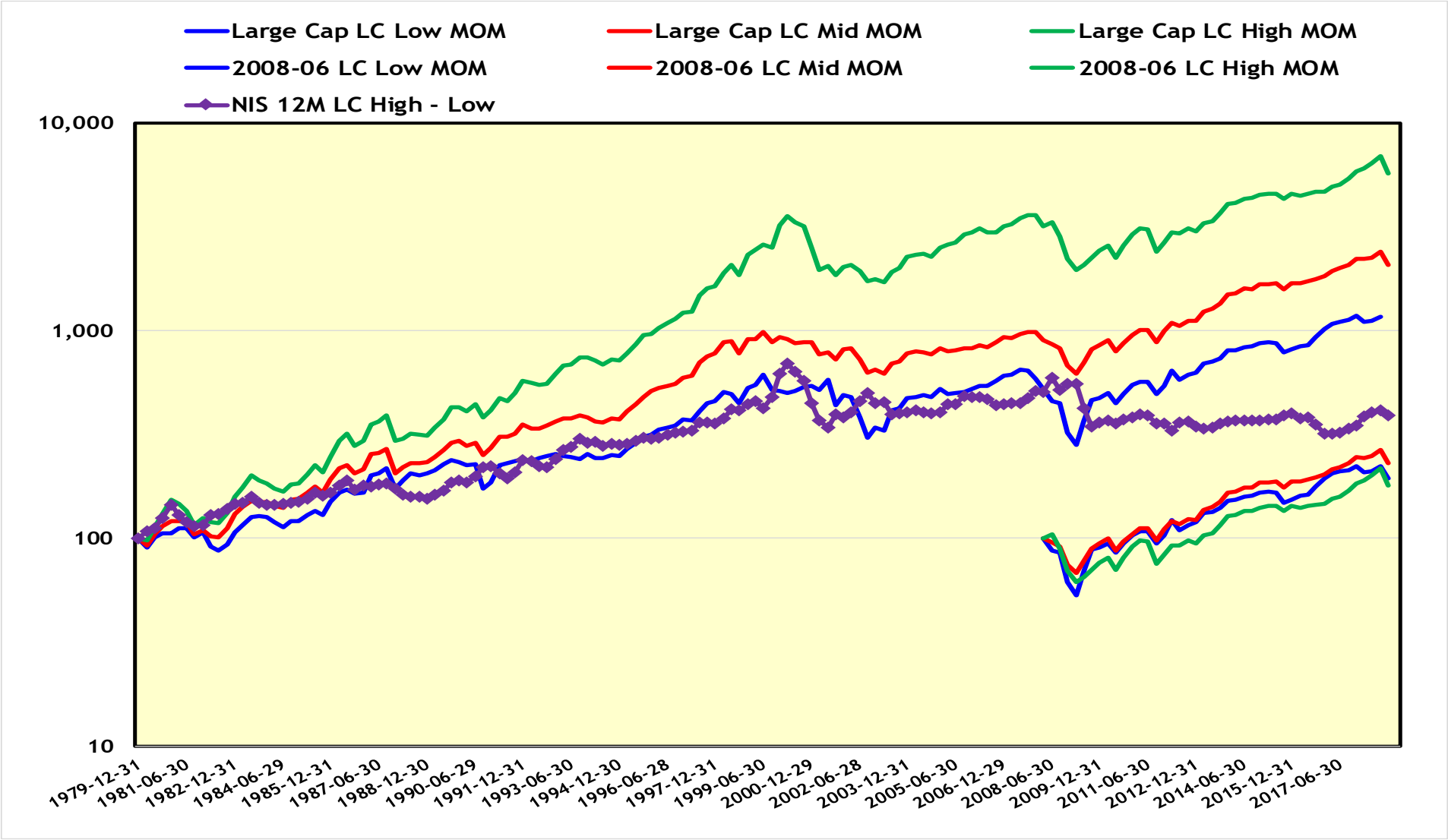
STD Large Cap CW Returns 1979-12 to 2018-09



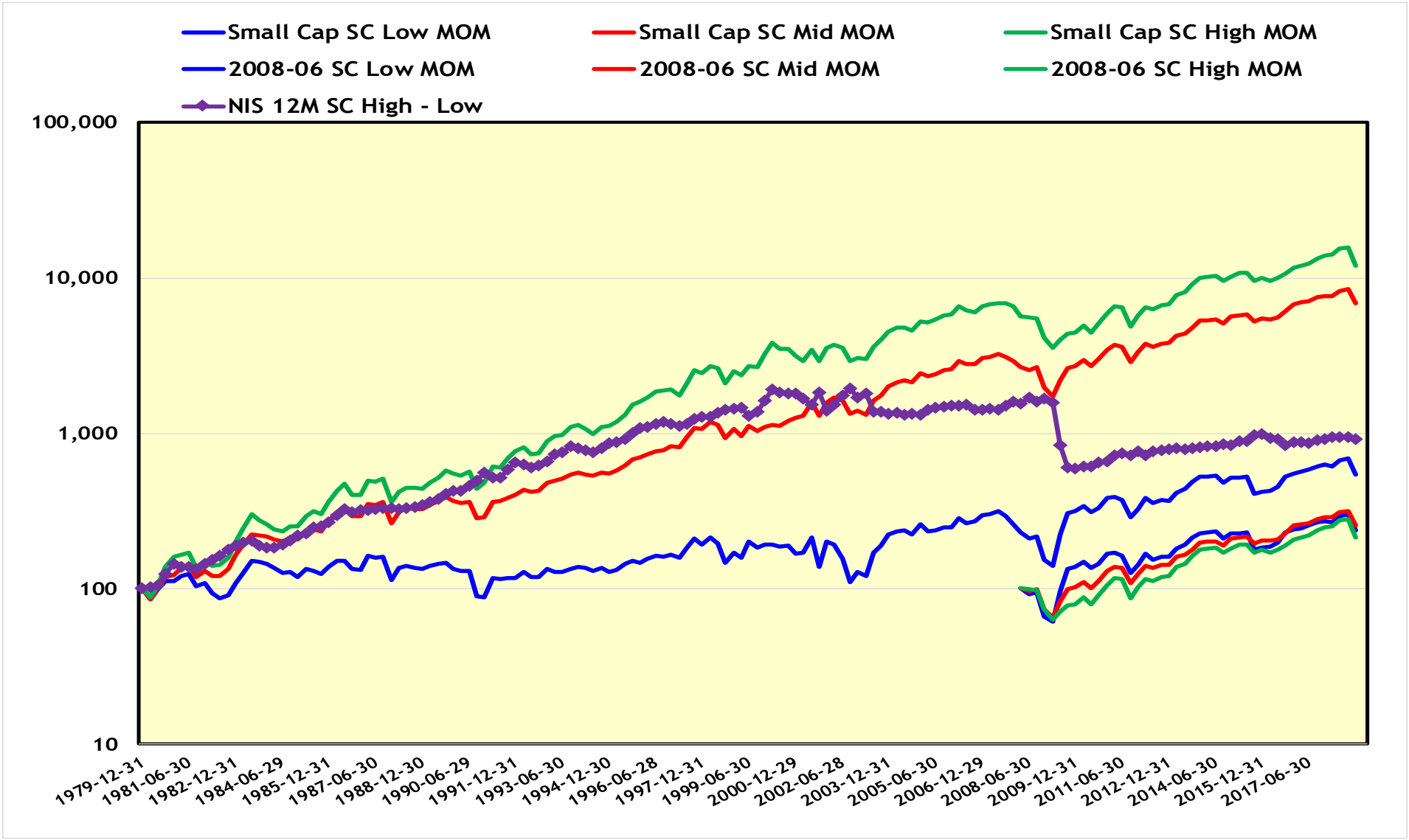
STD Small Cap CW Returns 1979-12 to 2018-09



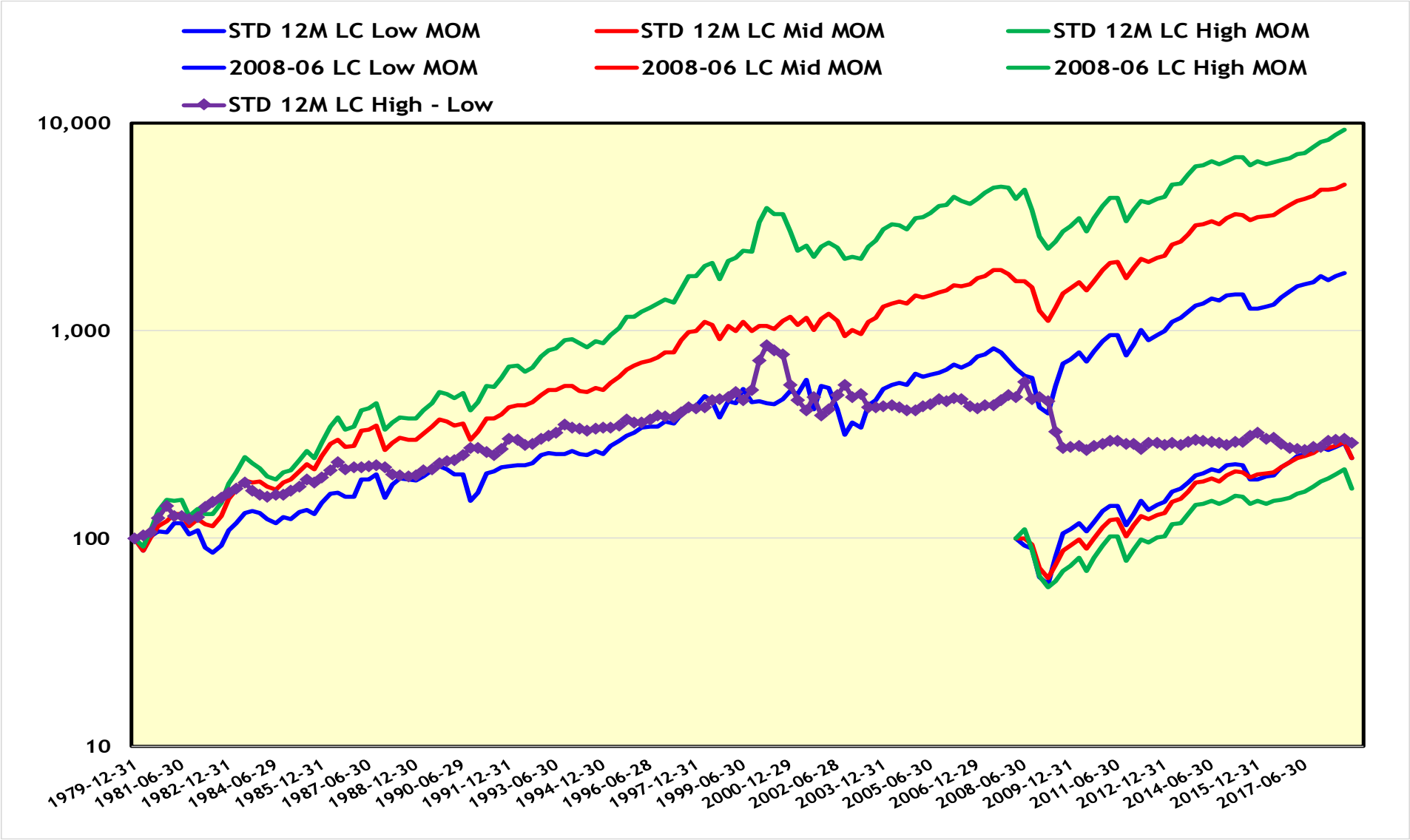
NIS Large Cap CW Returns 1979-12 to 2018-09



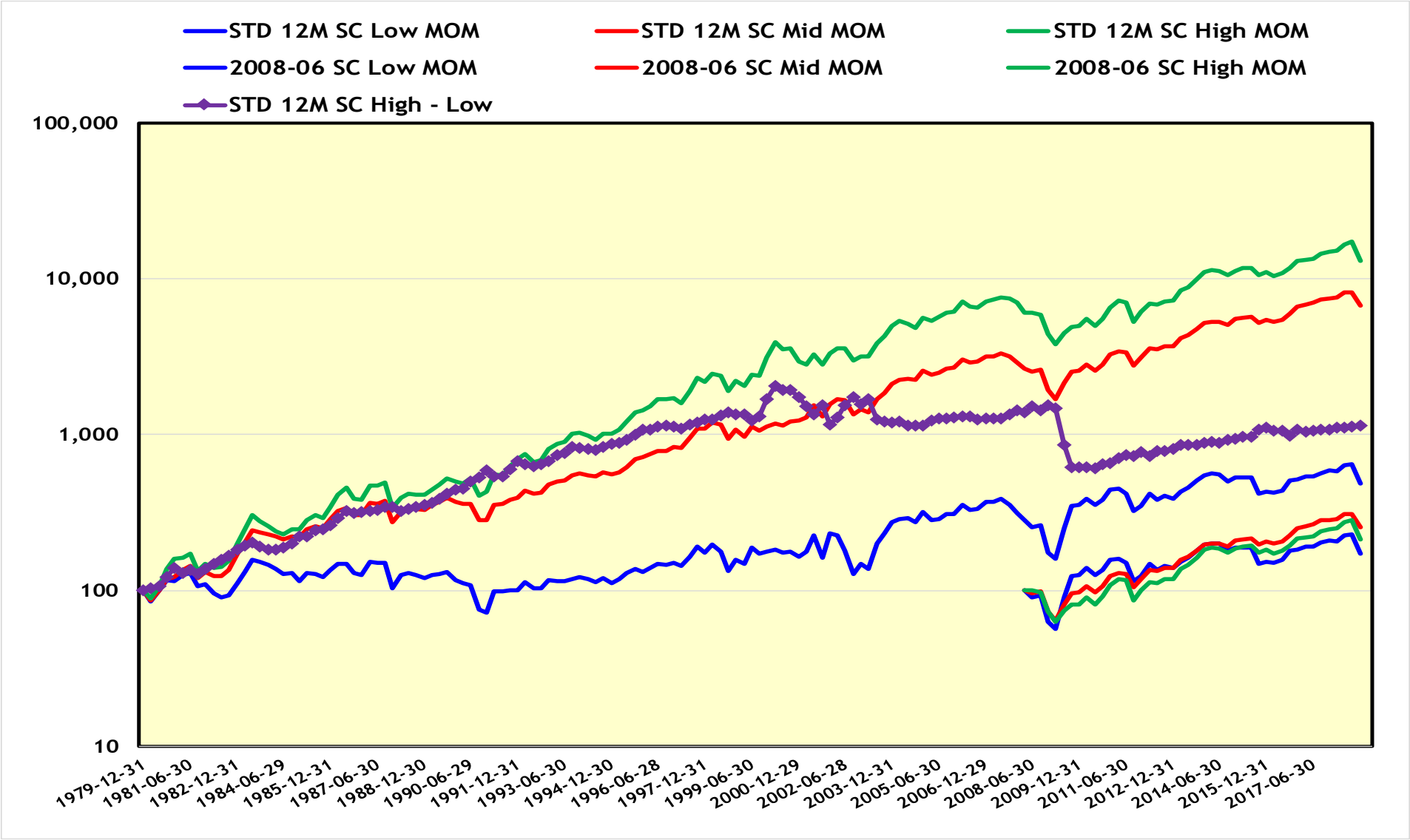
NIS Small Cap CW Returns 1979-12 to 2018-09



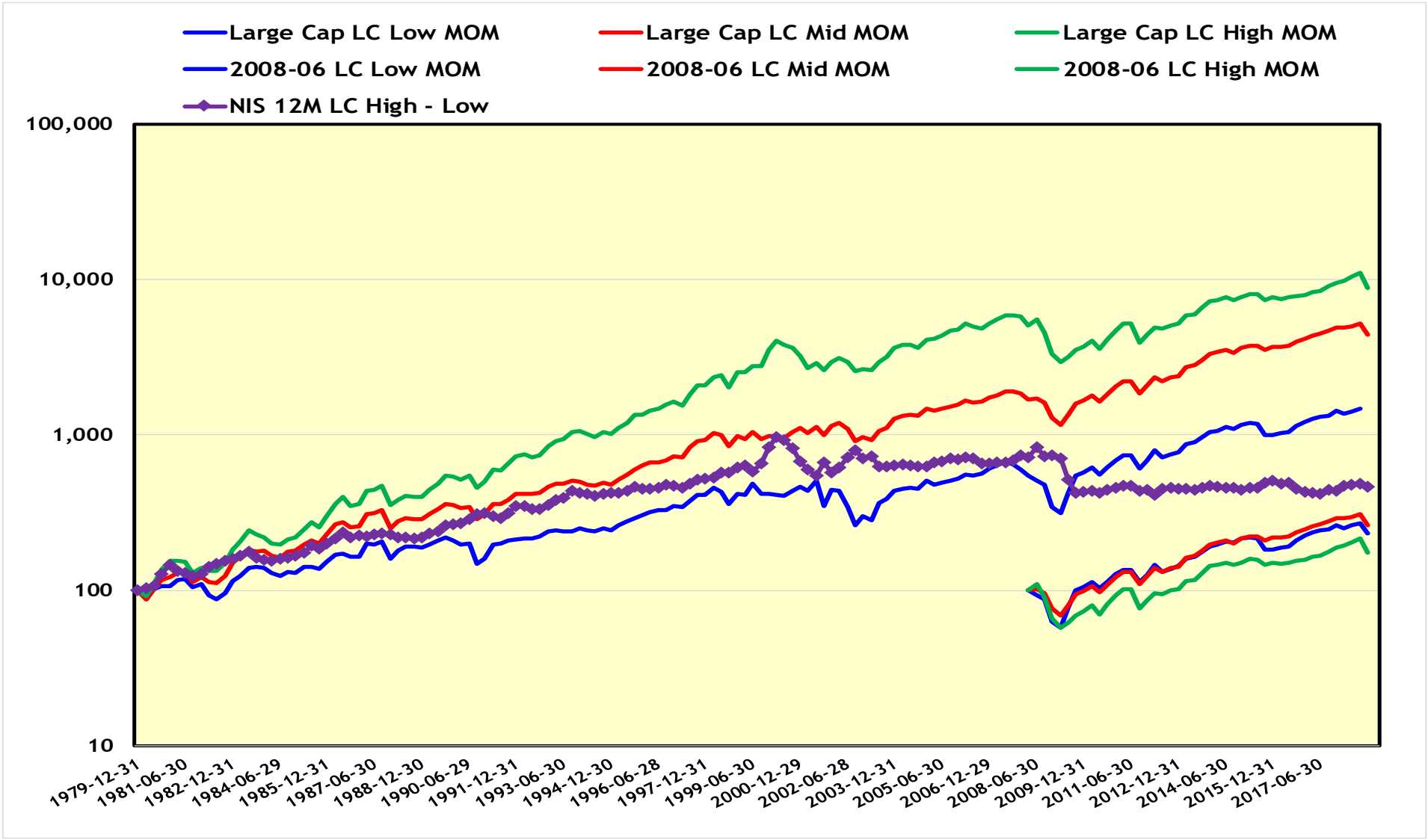
STD Large Cap EW Returns 1979-12 to 2018-09



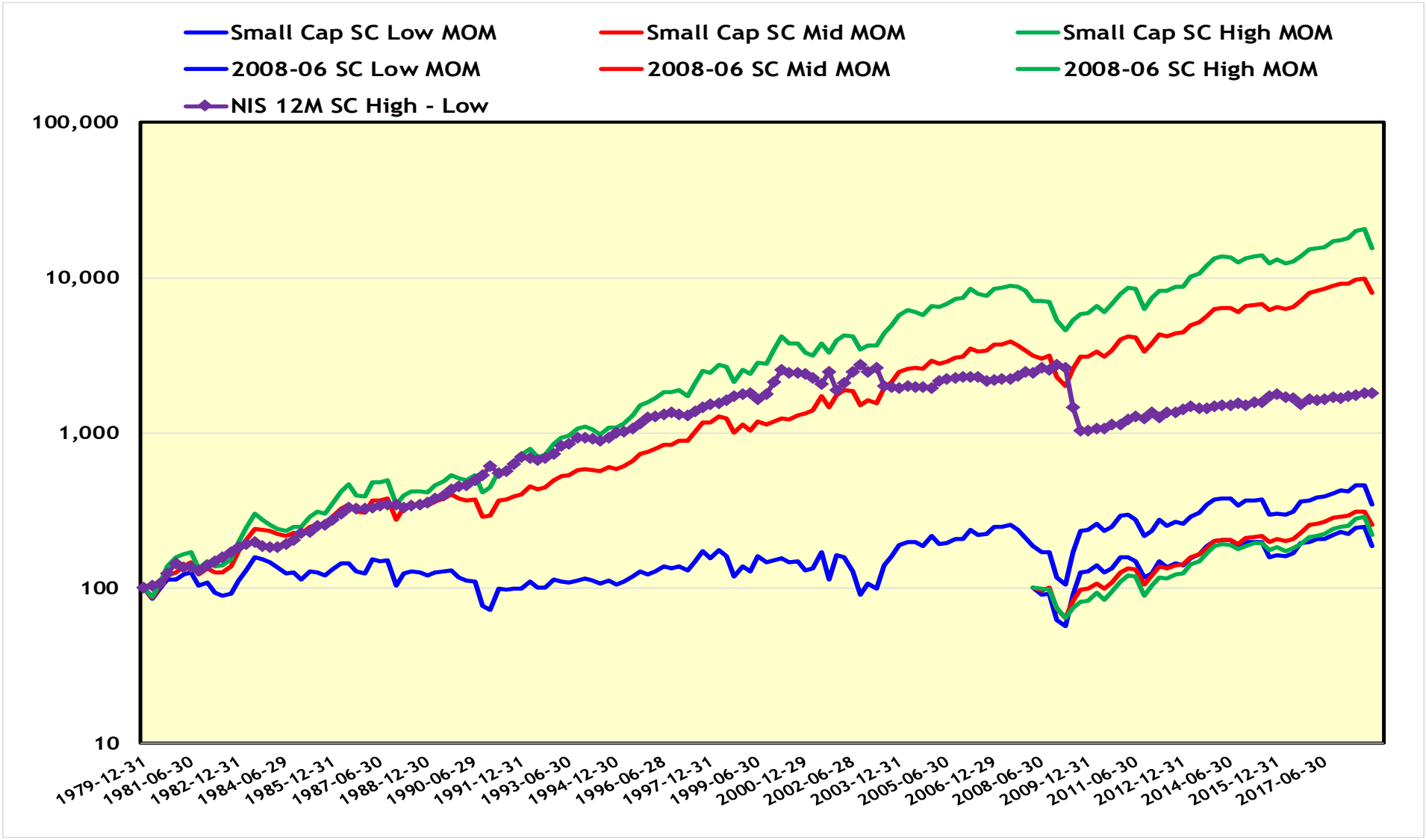
STD Small Cap EW Returns 1979-12 to 2018-09



NIS Large Cap EW Returns 1979-12 to 2018-09



NIS Small Cap EW Returns 1979-12 to 2018-09



Summary and Conclusion

- It turns out that Momentum behaved in the way it is supposed to for many years, from 1980 up to the Crash of 2008
- Since then, however, it has mostly reversed itself, so that Low Momentum stocks have generally outperformed High Momentum stocks
- One take away from this presentation should be that it is sometimes difficult to see from long term charts what exactly is going on; we needed to re-plot the charts from June 2008 to see clearly that the Momentum effect had reversed itself
- One other conclusion we can draw from this analysis is that taking more information into account when calculating a NIS Momentum beta does seem to make a better predictor of future returns than simply using the STD methodology