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Why Invest in Momentum as a Factor?


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As part of our series of examinations into Smart Beta factors, we look at momentum in equities. This paper highlights what we think about the factor and why we view managing turnover as the biggest challenge in capturing momentum, while its diversification potential with other factors is one of its key advantages.

While momentum has only attracted interest from Smart Beta strategies over the past few years, the factor has a longer history of academic research. Dating back to the early 1990s, empirical studies have shown that stocks which have generated strong returns in the near term continue to outperform their lower-return counterparts. Historically, in a long-only index or portfolio, overweighting stocks that have outperformed recently and underweighting stocks that have underperformed recently will outperform a market cap weighted benchmark over sufficiently long horizons.

To investigate the notion of momentum as a single factor, we start with the academic literature to understand the various ways in which it can be defined and to assess the possible theoretical explanations behind its performance. We also evaluate different portfolio construction methodologies proposed for capturing momentum. In our view, the greatest hurdle for capturing momentum lies in its inherently high turnover and subsequent transaction costs. We show that optimization and similar portfolio construction methods which address the turnover issue can successfully capture the benefit of momentum.

From a multi-factor perspective, we address the often-asked question whether momentum can improve the performance characteristics of an existing set of other factors — particularly value — where there could be diversification potential. We illustrate the point that momentum works until it stops working, and present a simple market timing method that can improve the efficiency of a momentum strategy by adjusting exposure to the factor in accordance with the risk of the market.

Understanding Why Momentum Works

The central tenet of momentum as a factor is the empirical observation that past performance is a predictor of future performance. In an early seminal paper, Jegadeesh and Titman (1993) found positive returns for past winners over 3 – to 12-month holding periods, using US stock returns over the 1965–1989 period. They found that the profitability of these strategies did not appear to be the result of either their systematic risk or delayed stock price reactions to common factors.

High momentum stocks — defined here as the past 12-month returns minus the last month's return — have continued to exhibit higher returns than low momentum stocks (see Figure 1).

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Figure 1: Returns to Global Stocks Sorted into Quintiles based on Momentum*

March 1993 to November 2016, Blended Returns

	Quintile 1 (%)	Quintile 2 (%)	Quintile 3 (%)	Quintile 4 (%)	Quintile 5 (%)	Quintile 1 minus Quintile 5 (%)
Full Period	10.7	10.1	8.9	7.4	3.8	6.9
Mar 31, 1993 to Jan 31, 2009	11.2	8.6	6.5	4.0	-0.9	12.1
Jan 31, 2009 to Nov 30, 2016	9.7	13.1	13.8	14.8	14.2	-4.5

Source: SSGA, FactSet. Subperiods are chosen because Q1–Q5 spread peaked on January 31, 2009.

*Past performance is not a guarantee of future results. The sorted index returns reflect all items of income, gain and loss and the reinvestment of dividends and other income.

The results shown represent current results generated by our — [enter official name of model] — model. The results do not reflect actual trading and do not reflect the impact that material economic and market factors may have had on SSGA's decision-making. The results shown were achieved by means of a mathematical formula, and are not indicative of actual performance which could differ substantially. The performance reflects management fees, transaction costs, and other fees expenses a client would have to pay.

Carhart (1997) later popularized an extension of the Fama-French model to include momentum; this is known as the Carhart Four-Factor model. In that paper, the persistence of positive performance in equity mutual funds can be largely explained by common factors like size, value and momentum. Fama and French (2012) subsequently found strong momentum returns in North America, Europe and Asia Pacific, but not in Japan over the 1989–2011 sample period. They also confirmed the robustness of the Four-Factor model — that is, momentum is a persistent factor not captured by either value or size.

The theory underlying momentum's premium is still a matter of extensive discussion. Unlike value and size, there are few efficient market-based theories that can explain the momentum factor. The most widely cited theories tend to be behavioral in nature. Investors either overreact — see Barberis, Sheleifer and Vishny (1998) and Daniel, Hirshleifer and Subrahmanyam (1998) — or underreact to news — see Hong, Lim and Stein (2000). Either reaction may lead to the momentum effect under varying assumptions. These "irrational" reactions may be driven by overconfidence, self-attribution, conservatism bias, aversion to realize losses or representative heuristics — for example, the tendency to identify an uncertain event by the degree to which it is similar to the parent population.[1]

Critics of momentum cite high turnover, the potential for crowding, and the risk of a sudden reversal – which is difficult to predict and manage. History shows the probability of a short-term reversal is positively correlated with volatility, and forecasting volatility is anything but easy. Momentum, by construction, exhibits negative correlations with value, suggesting its potential for diversification. Asness, Moskowitz and Pedersen (2010) offer support for this, finding significant diversification benefits from combining the two factors.

Defining Momentum as a Factor

In the original research of Jegadeesh and Titman (1993), momentum is defined as stock returns over the previous first, second, third and fourth quarters. Carhart (1997) defines momentum as the prior 11-month average of returns lagged by one month — that is, returns from months *t–12* to *t–1*. Fama and French[2] define momentum as prior 12–month returns lagged by one month — that is, returns from months *t–13* to *t–1*. Though these measures are anecdotally the most widely used, there is no single industry-wide consensus definition of momentum. Novy-Marx (2012) most recently argues that 12– to 7–month past returns drive the momentum effect.

Any of the following measures of price momentum[3] can be reasonably employed:

MONTH				YEAR			
1	3	6	12	2	3	4	5

If the universe is global, these measures of momentum can be expressed in local currency or US dollars (USD). Both forms exhibit the expected momentum premium over long horizons, though the effect in USD embeds currency momentum by definition. Monthly or weekly data can be used. Index providers have proposed risk adjusting the momentum measure by scaling the price return by price volatility, as in the MSCI momentum indices, for example. Some researchers have suggested removing the market momentum component of momentum. Still others have recommended residualizing momentum to value, size and other factors — see Martin and Grundy (2001) and Blitz, Huij and Martens (2011).

Capturing Momentum in Indices

In traditional active strategies, momentum is typically incorporated as a signal within a broader proprietary methodology for portfolio construction. Smart Beta forms of momentum focus on isolating pure momentum and providing exposure to the factor in a direct, transparent way. Today, there are a variety of ways to capture momentum, using different methodologies (see Figure 2) that result in varying key performance characteristics for these indices (see Figure 3).

Figure 2: Overview of Different Methodologies for Capturing Momentum

Dimension	MSCI Momentum	MSCI Momentum Tilt	AQR Momentum	FTSE Russell Momentum
Level of Differentiation	Security	Security	Security	Security
Measure of Momentum	Average of 12m and 6m returns above risk-free excluding last month divided by annual volatility (weekly local returns over 3 years)	Average of 12m and 6m returns above risk-free excluding last month divided by annual volatility (weekly local returns over 3 years)	Total return over prior 12m excluding last month	Total return over prior 12m excluding last month
Rebalancing Frequency	Semi-annually w/conditional monthly	Semi-annual w/conditional monthly	Quarterly	Semi-annually
Weighting Method	Tilt from cap weight	Tilt from cap weight	Cap weight	Tilt from cap weight
Constituent Selection Process	Top N by Fundamental (~300 for MSCI World)	Full Universe	Approximately 300–350 highest ranked securities	Selection by Country/Industry/ Max Stock weight constraints
Third-Party Index	Yes	Yes	Yes	Yes

Source: SSGA, MSCI, AQR, FTSE.

Figure 3: Key Performance Characteristics of Momentum Indices*
October 2001 to June 2016

	MSCI World Index	MSCI World Momentum ndex	MSCI World Momentum Tilt Index	AQR Momentum (US & International)	FTSE Developed Momentum Index
Annualized Return since 2001 (%)	6.1	8.6	7.0	8.3	7.6
Annualized Return (5 years) (%)	6.6	10.5	8.6	5.9	7.9
Annualized Return (10 years) (%)	3.3	5.0	4.3	3.4	4.3
Annualized Risk (%)	15.4	14.6	14.5	16.8	15.0
Sharpe Ratio	0.28	0.46	0.36	0.39	0.38
Annualized Active Return (%)	—	2.5	0.9	2.3	1.5
Average Annualized Active Risk (%)	—	7.5	2.8	6.6	1.4
Information Ratio (%)	—	33	33	34	110
Drawdown (%)	-54	-53	-52	-52	-52

Source: SSGA, MSCI, AQR, FTSE. AQR combines 50% AQR US and 50% AQR International, rebased monthly.

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Index characteristics are as of the date indicated, are subject to change, and should not be relied upon as current thereafter.

The returns to the different momentum indices are significant over the period for all the options shown. But the turnover is high, on average. Momentum necessitates frequent rebalancing — at least monthly or quarterly — to maintain exposure to high momentum stocks, given the natural turnover in these names. For instance, one-way annual turnover for the MSCI World Momentum Index averages well above 100%. This raises the question of whether anything can be done about the high turnover in momentum.

Controlling Momentum's Turnover

If incurring high turnover seems to be inherent in capturing momentum, then it makes sense to find ways to mitigate the turnover. In rules-based strategies, buffer rules can be used to control turnover. Imagine, for example, a momentum portfolio defined as the top 100 stocks ranked by momentum in a particular universe. A buffer rule could be added so that at each rebalancing, a newly qualified security would need to rank higher than 90 to be added to the portfolio. An alternative buffer rule might require that a security must qualify over at least two rebalancing intervals before it is added to the portfolio.

The problem with buffer rules is that they come at the expense of exposure to the targeted factor. The exposure to the intended factor will always be less than it would be without the buffer rule, and that eats into the factor premium. In the case of momentum, the amount of exposure given up to bring turnover down to a reasonable amount — say, at most 100% one-way — would be significant.

In our view, using an algorithm to balance competing objectives is a better way to control turnover. Standard commercial optimizers currently offer the means to solve for turnover constraints. Thus the desired exposure to the factor can be balanced with the effort to mitigate turnover. In this way, it can be possible to curtail turnover without any deterioration of the factor exposure.

As evidence of this, consider the key performance metrics of optimized momentum portfolios against a benchmark of the MSCI World Index (see Figure 4). Varying levels of tracking error can be specified by calibrating the risk aversion setting used in the optimizer.

Figure 4: Key Performance Characteristics and Turnover of SSGA Optimized Momentum Factor Strategies

	SSGA Optimized Momentum* (Low TE)	SSGA Optimized Momentum* (Medium TE)	SSGA Optimized Momentum* (High TE)	MSCI World**
Annualized Return (%)	8.85	9.95	9.79	6.32
Annualized Risk (%)	16.21	17.78	18.81	17.87
Sharpe Ratio	0.55	0.56	0.52	0.35
Annualized Active Return (%)	2.41	3.52	3.36	—
Average Annualized Active Risk (%)	3.86	6.58	8.14	—
Information Ratio	0.63	0.53	0.41	—
Average Turnover (%)	98.49	98.69	98.69	

Source: SSGA, MSCI. TE=Tracking Error.

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Evaluating Momentum in Multi-Factor Portfolios

Investors may wonder whether momentum should be viewed as a standalone strategy or as part of a multi-factor approach. Our view is that this factor can be used either way, but the beauty of momentum is its diversification potential with other factors in the portfolio, particularly value. The majority of investors have exposure to value in their portfolios, even if they do not recognize it as such, given the prevalence of value-driven active strategies in the equity arena.

Figure 5: Correlation of Momentum with Other Factors
April 1993 to June 2016, Monthly USD Excess Returns Relative to MSCI World Index

	Value	Low Volatility	Size	Quality	Momentum
Value	1.00				
Low Volatility	0.09	1.00			
Low Size	0.60	-0.03	1.00		
Quality	-0.39	0.54	-0.36	1.00	
Momentum	-0.50	0.14	-0.28	0.32	1.00

Source: SSGA, MSCI. Excess correlations are shown for backtested SSGA Tilted strategies. Please refer to the Backtesting Methodology for a description of the methodology used as well as an important discussion of the inherent limitations of backtested results.

Figure 6: Impact of Adding Momentum to a Multi-Factor Mix
December 1996 to September 2016, Backtested* USD Gross Returns

	Three-Factor Optimized Portfolio* (Value, Low Volatility,Quality)	Four-Factor Optimized Portfolio* (Value, Low Volatility, Quality, Momentum)	MSCI World**
Annualized Return (%)	9.31	10.86	6.47
Annualized Risk (%)	14.40	14.76	15.61
Sharpe Ratio	0.65	0.74	0.41
Annualized Active Return (%)	2.84	4.39	—
Average Annualized Active Risk (%)	4.72	4.14	—
Information Ratio	0.60	1.06	—
Average Turnover (%)	21.16	56.44	—

Source: SSGA, MSCI.

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Based on the historical correlations in excess returns between the factors, momentum has clearly been a good diversifier to value and size, defined here as small cap (see Figure 5).

Therefore, adding momentum to existing factor allocations — whether embedded factor bets in active portfolios or explicit factor-based Smart Beta portfolios — has been shown to

improve diversification historically. In a backtest over a nearly 20-year period from December 1996 to September 2016, combining momentum with a mix of value, low volatility and quality could have improved the information ratio dramatically through much higher active returns (see Figure 6).

When combining these factors, it is important that the negative value bias in momentum does not wash out the existing value exposure. Ideally, the final mix would preserve the strong positive exposure to all the targeted factors. We have found that this could be done in a bottom-up portfolio such as the optimized mix shown above, where the portfolios all have a minimum exposure of 0.5 to the targeted factors.

Timing Momentum

We are often asked if factors can be timed. Momentum is a unique factor in that it tends to perform well over relatively long periods of time, but it can experience episodic corrections when the market environment changes. Much research has been done around timing these corrections using a range of possible signals.

Here we present an example that uses market risk as a timing signal. Consider a strategy that invests in momentum when risk has been low, and switches back to the MSCI World Index when risk has been high. Risk is measured as the historical volatility over the whole period from December 1997 to March 2016. We define market risk as the past one-year volatility, which we compare with the average volatility over the historical period. If the past one-year volatility is below the average historical volatility, then market risk is considered low, and the timed portfolio is invested in the SSGA Optimized Momentum (Medium Tracking Error) strategy. If the past one-year volatility is above the average historical volatility, then risk is considered as high, and the portfolio is invested in the MSCI World Index.

We can evaluate this timed approach against a naïve benchmark of 50% MSCI World Index and 50% SSGA Optimized Momentum strategy. Based on annualized returns and Sharpe Ratios, the timed portfolio could have outperformed the equal-weighted benchmark (see Figure 7). This exercise illustrates one way that momentum could be timed. However, buying and holding the Optimized Momentum strategy could have produced even higher returns over the historical period.

In summary, momentum as a factor has a long history of academic research and has shown strong empirical results. For investors considering a factor-based approach to capturing the momentum effect, we believe it is also important to understand the factor's downsides, which are the higher turnover needed to implement it and the likelihood of episodic drawdowns. These reasons, among others, help to explain why momentum-based investing has not been more prevalent. We have shown here, however, that a momentum strategy could be captured effectively using optimization-based portfolio construction techniques. And we have also demonstrated that momentum could provide diversification to more widely employed factors, such as value and size.

Figure 7: Impact of Using Market Risk to Time Momentum
December 1997 to March 2016, Backtested* USD Gross Returns

	MSCI World ** (Net Dividends)	SSGA Optimized Momentum* (Medium TE)	50% MSCI World/50% SSGA Optimized Momentum*	Timed Portfolio*
Annualized Return (%)	5.5	10.0	7.8	9.1
Annualized Risk (%)	16	18	16	16
Sharpe Ratio	0.35	0.56	0.47	0.55
Worst Monthly Return (%)	-19	-18	-19	-19

Source: SSGA, MSCI.

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[1] Other theories in a different vein are as follows: Dasgupta, Prat and Verardo (2011) argue that reputation concerns cause managers to herd, and this generates momentum under certain assumptions. Vayanos and Woolley (2011) propose a framework based on the dynamics of institutional investing rather than individual biases. In their framework, momentum and value effects jointly arise because of flows between investment funds. Negative shocks to the fundamental values of assets trigger outflows from funds holding those assets, while outflows cause asset sales, which amplify the negative effects of the shocks. If the outflows are gradual because of institutional constraints or inertia, then momentum effects arise. Moreover, because flows push prices away from fundamental value, value effects also arise.

[2] See Kenneth French's website: **here**

[3] Momentum in earnings has also been proposed; however, alternative momentum measures are beyond the scope of this paper.

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