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Momentum: A Practitioner's Guide

WHAT IS MOMENTUM?

As an investable concept, momentum is straightforward—purchase (avoid) stocks that have performed relatively well (poorly) recently. The period over which returns are evaluated is important for momentum; for example, there is evidence of a one-month reversal effect in stock prices.

Momentum has performed better than the S&P 500 over an extended period.

The most influential paper on momentum is arguably Mark Carhart's 1997 study; adding momentum to the Fama-French Three Factor Model increased the model's explanatory power and showed momentum was a key factor in describing cross-sectional returns.[1] After momentum had first been formalized into a systematic investment strategy as part of Dow Theory and following a period in the latter half of the 20th century where there was much debate over its existence and potential origins.[2] Carhart's study meant momentum was incorporated into risk management and active management processes.

The S&P Momentum Indices are rebalanced semiannually after the close of the third Friday of March and September; the reference dates are the last business day of February and August, respectively. As of the rebalance reference dates, momentum is calculated using 12 months of data beginning 13 months prior, ensuring the one-month reversal effect is avoided. The momentum scores for each security are adjusted for risk to account for the standard deviation of daily price returns over the period that is used to calculate the unadjusted momentum values. For more information regarding the calculation of the S&P Momentum Indices, please see the S&P Momentum Indices Methodology.

HOW HAS MOMENTUM PERFORMED?

One of the first questions to ask about momentum is: how has it performed? To analyze this, we turn to the S&P 500® Momentum, which was launched on Nov. 18, 2014.[3] Exhibit 1 shows the total return performance of the S&P 500 Momentum compared to the S&P 500. As the

[1] Carhart, Mark, "On Persistence in Mutual Fund Performance", *Journal of Finance*, 52:1, 57-82 (March 1997) https://faculty.chicagobooth.edu/john.cochrane/teaching/35150_advanced_investments/Carhart_funds_jf.pdf

[2] For an overview, see Swinkels, Laurens. "Momentum investing: A survey." *Journal of Asset Management* 5.2 (2004): 120-143.

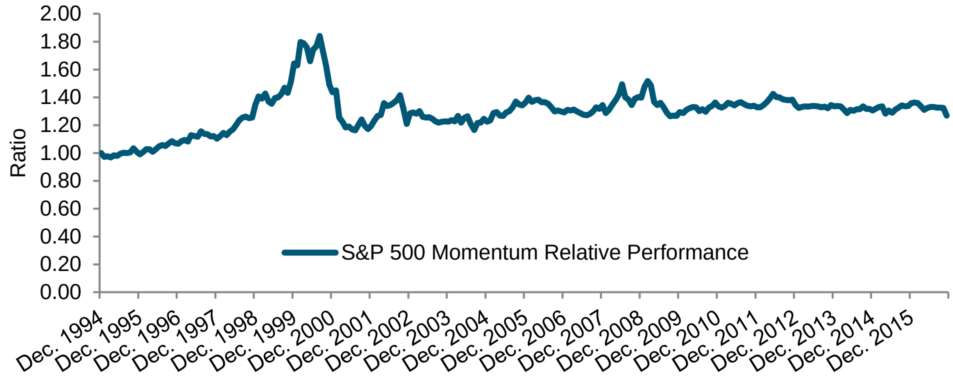
[3] All S&P 500 Momentum data used in this document prior to this date is based on back-tested data.

ratio was routinely above one, we can see that momentum performed better than the S&P 500 over the period studied. Additionally, the biggest upward movements in the ratio appear to have preceded the most sizeable falls—namely in the late 1990s, early 2000, and the period around 2008. This should not be too surprising; momentum did relatively better when strong trends emerged and many market participants bought into these trends. However, if such a trend becomes a bubble that subsequently bursts—as was the case for the technology bubble—it is not difficult to imagine momentum being relatively more affected than the broader market, which has exposure to other factors in addition to momentum.

Interestingly, although the relative performance of momentum was fairly constant since early 2010, the annualized risk and return statistics paint quite a different picture. Indeed, the risk-adjusted return of the S&P 500 Momentum lagged the S&P 500 over the five-year period ending November 2016. Only over longer horizons did momentum do as well—if not slightly better—than the benchmark. The similarity in risk profiles means that the smaller returns for momentum in the short-run explain the sizeable differences in the risk-adjusted returns.

The risk-adjusted return of the S&P 500 Momentum lagged the S&P 500 over the five-year period ending November 2016.

Exhibit 1: Relative Performance of the S&P 500 Momentum to the S&P 500



Source: S&P Dow Jones Indices LLC. Data from December 1994 to November 2016. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

Exhibit 2: Risk/Return Comparison		
PERIOD	**S&P 500**	**S&P 500 MOMENTUM**
ANNUALIZED RETURN (%)		
1-Year	8.06	2.50
3-Year	9.07	6.94
5-Year	14.45	13.19
10-Year	6.89	6.64
15-Year	6.62	7.18
20-Year	7.47	8.38
ANNUALIZED RISK (%)		
3-Year	10.77	10.62
5-Year	10.36	10.23
10-Year	15.28	15.05
15-Year	14.35	14.11
20-Year	15.30	17.55
RISK-ADJUSTED RETURN		
3-Year	0.84	0.65
5-Year	1.39	1.29
10-Year	0.45	0.44
15-Year	0.46	0.51
20-Year	0.49	0.48
MAXIMUM 12-MONTH DRAWDOWNS (%)		
3-Year	8.36	6.86
5-Year	8.36	8.28
10-Year	46.41	42.73
15-Year	46.41	42.73
20-Year	46.41	49.10

Source: S&P Dow Jones Indices LLC. Data from December 1994 to November 2016. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

The S&P 500 Momentum likely lagged the S&P 500 over shorter horizons because of a relatively low capture in upward market movements.

Exhibit 3 shows that the S&P 500 Momentum likely lagged the S&P 500 over shorter horizons because of a relatively low capture in upward market movements. This may indicate a recent lack of persistently strong trends in the S&P 500; therefore, even though momentum may recognize new trends, the market environment was not conducive to momentum outperforming over the five-year period. This is exactly what we see in Exhibit 4, which shows the relative over- or under-weighting of each sector in the S&P 500 Momentum compared with the S&P 500. The relative weights changed much more quickly in the five-year period than they did 15 years prior—thus, any recent trends, even if strong, have been fleeting.

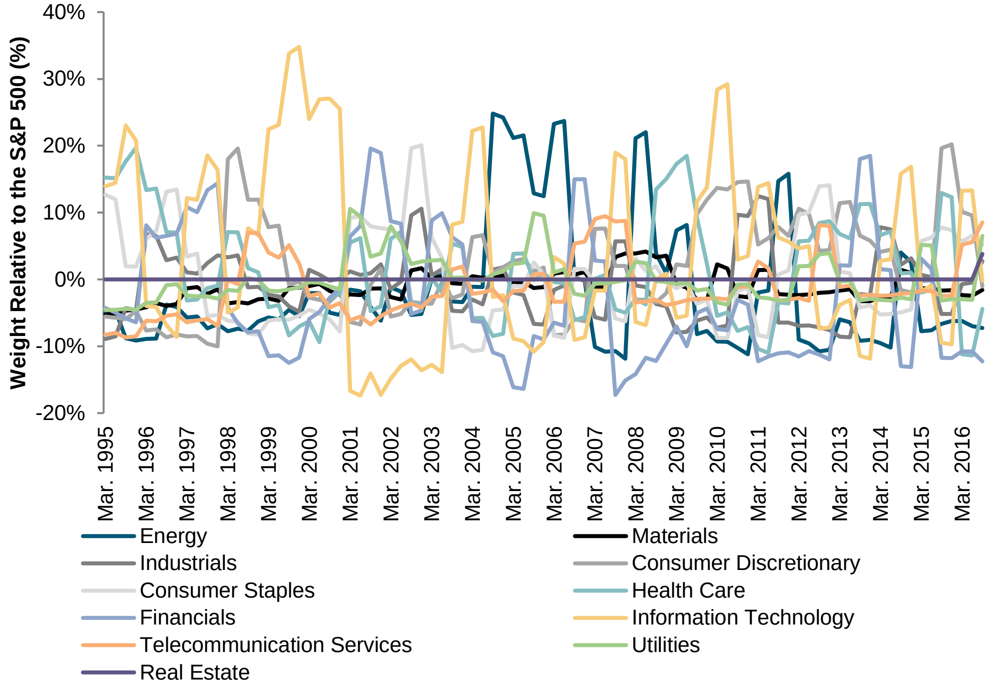
Exhibit 3: Percentage of Up and Down Movements in the S&P 500 Captured by the S&P 500 Momentum

PERIOD	3-YEAR	5-YEAR	10-YEAR	15-YEAR	20-YEAR
DOWN CAPTURE (%)					
S&P 500 Momentum	77	85	93	94	104
UP CAPTURE (%)					
S&P 500 Momentum	84	81	94	91%	100

Source: S&P Dow Jones Indices LLC. Data from December 1994 to November 2016. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

Any recent trends, even if strong, have been fleeting.

Exhibit 4: Relative Sector Weights Compared to the S&P 500



Source: S&P Dow Jones Indices LLC. Data from December 1994 to November 2016. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

As a result, the S&P 500 Momentum tended to perform relatively well compared to the S&P 500 when strong, persistent trends have emerged in the market. The smaller maximum drawdowns show that momentum has been successful at identifying new trends, although when these trends have not been strong or persistent, momentum is much more likely to be have been a laggard.

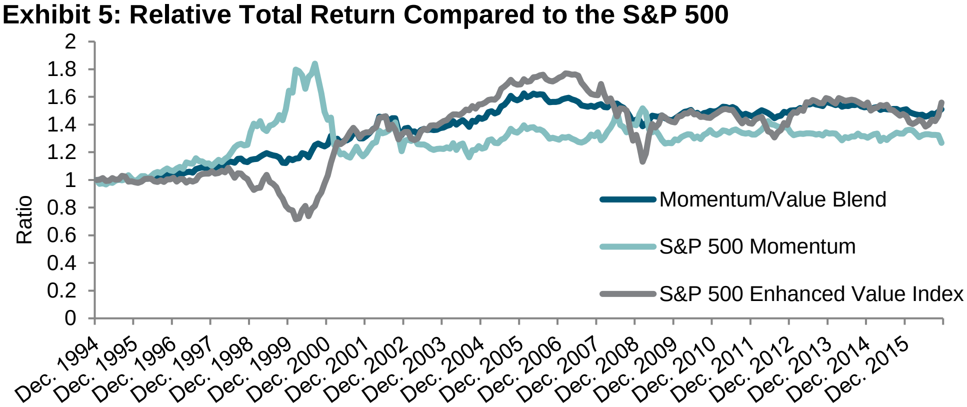
The blend's information ratio almost always exceeded at least one of the corresponding ratios for the individual factors during the period studied.

POSSIBLE USES OF MOMENTUM

Another key question for any factor—momentum included—is: how might market participants use it? One possibility would be to combine value and momentum. Exhibit 5 shows the total return ratio between the S&P 500 and a hypothetical 50%-50% blend of the S&P 500 Enhanced Value Index[4] and S&P 500 Momentum. From this, we can see the benefit of combining the factors; not only did the blend improve on the relative performance of either enhanced value or momentum (and at times both), but its relative performance compared to the S&P 500 was less volatile than for either individual factor. The benefits of diversification can be seen in the higher risk-adjusted returns; despite the annualized risk sometimes being greater for the blend than for momentum, the increase in annualized returns more than compensates for this (see Exhibit 6).

This is not too surprising, because momentum should perform well when persistently strong trends emerge. In these environments, value may suffer if bubbles emerge and valuations become removed from fundamentals. Conversely, in the absence of strong, persistent trends—when momentum is likely to underperform the market—value may be able to negate any such underperformance. This is exactly what we see from the information ratios; the blend's information ratio almost always exceeded at least one of the corresponding ratios for the individual factors during the period studied. In short, the benefit to combining value and momentum is that these factors have tended to work well in different market environments, and so there have been advantages to diversification.

Exhibit 5: Relative Total Return Compared to the S&P 500



Source: S&P Dow Jones Indices LLC. Data from December 1994 to November 2016. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

[4] The S&P 500 Enhanced Value Index was launched on April 27, 2015. All data for this index prior to this date is back-tested. The hypothetical 50%-50% blend of Momentum and Enhanced Value is rebalanced on a monthly basis.

The benefit to combining value and momentum is that these factors have tended to work well in different market environments, and so there have been advantages to diversification.

Exhibit 6: Risk/Return Characteristics – Comparison of Benchmark, Momentum, and Value Indices With Hypothetical Blended Portfolio

PERIOD	MOMENTUM/ VALUE BLEND	S&P 500	S&P 500 MOMENTUM	S&P 500 ENHANCED VALUE INDEX
ANNUALIZED RETURN (%)				
1	8.46	8.06	2.50	14.23
3	7.77	9.07	6.94	8.34
5	15.10	14.45	13.19	16.75
10	6.52	6.89	6.64	5.83
15	7.69	6.62	7.18	7.73
20	9.50	7.47	8.38	9.85
ANNUALIZED RISK (%)				
3	11.12	10.77	10.62	13.74
5	11.23	10.36	10.23	14.15
10	17.21	15.28	15.05	21.72
15	15.80	14.35	14.11	19.65
20	16.53	15.30	17.55	19.39
RISK-ADJUSTED RETURN				
3-Year	0.70	0.84	0.65	0.61
5-Year	1.34	1.39	1.29	1.18
10-Year	0.38	0.45	0.44	0.27
15-Year	0.49	0.46	0.51	0.39
20-Year	0.57	0.49	0.48	0.51
MAXIMUM 12-MONTH DRAWDOWNS (%)				
3-Year	9.00	8.36	6.86	14.65
5-Year	10.93	8.36	8.28	14.65
10-Year	51.98	46.41	42.73	61.29
15-Year	51.98	46.41	42.73	61.29
20-Year	51.98	46.41	49.10	61.29

Source: S&P Dow Jones Indices LLC. Data from December 1994 to November 2016. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

Exhibit 7: Tracking Error and Information Ratio Comparisons

PERIOD	MOMENTUM/ VALUE BLEND	S&P 500 MOMENTUM	S&P 500 ENHANCED VALUE INDEX
TRACKING ERROR			
3-Year	2.52%	5.01%	6.46%
5-Year	2.99%	4.65%	6.98%
10-Year	3.49%	6.59%	9.31%
15-Year	4.66%	7.57%	8.46%
20-Year	4.96%	9.32%	10.02%
INFORMATION RATIO			
3-Year	-0.5142	-0.4253	-0.1133
5-Year	0.2194	-0.2701	0.3296
10-Year	-0.1061	-0.0375	-0.1135
15-Year	0.2301	0.0748	0.1316
20-Year	0.4093	0.0980	0.2382

Source: S&P Dow Jones Indices LLC. Data from December 1994 to November 2016. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

MOMENTUM: A GLOBAL REACH

Momentum has a global reach—it has been shown to work in many different markets.

For those concerned that this analysis focuses solely on the U.S., it is worth noting that momentum has a global reach—it has been shown to work in many different markets. For example, Fama and French (2012) showed the presence of momentum in North America, Europe, and Asia Pacific (the notable exception where momentum did not work was Japan).[5] To further illustrate momentum working in many markets, we consider the S&P Momentum Developed LargeMidCap, which is designed to measure the performance of securities in the developed markets that exhibit persistence in their relative performance (see Exhibit 8). Since the pattern of risk, returns, and drawdowns for this index seem to have been similar to the S&P 500 Momentum over the period in question, it appears that converting various currencies into U.S. dollars when calculating the index on a daily basis does not change the results substantially. This is not too surprising, because the momentum scores are calculated using returns denominated in each stock's local currency, and many exchange rates have a tendency to behave as though they are following a random walk.[6] Such behavior may help to ensure that the returns to momentum (denominated in U.S. dollars) have not been driven, or subsumed, by currency movements in general.

[5] Fama, Eugene and Kenneth French, "Size, value, and momentum in international stock markets," *Journal of Financial Economics, 105:3, 457-472* (2012) https://ideas.repec.org/a/eee/jfinec/v105y2012i3p457-472.html#biblio. For earlier evidence of momentum please see, among others, Rouwenhorst (1998); Chan, Jegadeesh, and Lakonishok (1996); and Jegadeesh and Titman (1993).

[6] For evidence on this random walk phenomenon, see Meese and Rogoff (1983); Taylor (1995); and Kilian and Taylor (2001).

Exhibit 8: Risk/Return Characteristics of S&P Momentum Developed LargeMidCap

PERIOD	ANNUALIZED RETURN (%)	ANNUALIZED RISK (%)	RISK-ADJUSTED RETURN	MAXIMUM 12-MONTH DRAWDOWNS (%)
3-Year	2.18	10.54	0.21	9.12
5-Year	10.17	10.45	0.97	11.61
10-Year	5.19	16.27	0.32	48.01
15-Year	7.86	14.86	0.53	48.01
20-Year	7.55	17.47	0.43	48.01

Source: S&P Dow Jones Indices LLC. Data from December 1994 to November 2016. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

CONCLUSION

In general, momentum is straightforward as an investable concept: purchase (avoid) stocks that have performed relatively well (poorly) recently. Over the 20-year period ending in November 2016, the S&P 500 Momentum performed well relative to the S&P 500. Its risk-adjusted return was similar to—if not slightly higher than—that of the S&P 500 over longer horizons when strong, persistent trends emerged in the market. Over shorter horizons, when market trends were more fleeting and the relative sector weights changed more quickly, the S&P 500 Momentum lagged the S&P 500. The momentum strategy provided lower participation in market gains, despite having a similar risk profile to the benchmark.

The momentum factor has been present in many different markets, and the factor returns have not been driven, or subsumed, by currency movements in general.

The hypothetical 50%-50% blend of momentum and value demonstrated the potential benefits of diversification. Over the period studied, the blend's risk-adjusted return was always higher than the risk-adjusted returns of at least one of the individual factors and the information ratio almost always exceeded at least one of the corresponding ratios for the individual factors. The similarity in risk, returns, and 12-month drawdowns between the S&P 500 Momentum and the S&P Momentum Developed LargeMidCap illustrates that the momentum factor has been present in many different markets, and the factor returns have not been driven, or subsumed, by currency movements in general.

PERFORMANCE DISCLOSURE

The S&P 500 Momentum was launched on November 18, 2014. The S&P 500 Enhanced Value Index was launched on April 27, 2015. All information presented prior to an index's Launch Date is hypothetical (back-tested), not actual performance. The back-test calculations are based on the same methodology that was in effect on the index Launch Date. Complete index methodology details are available at www.spdji.com.

S&P Dow Jones Indices defines various dates to assist our clients in providing transparency. The First Value Date is the first day for which there is a calculated value (either live or back-tested) for a given index. The Base Date is the date at which the Index is set at a fixed value for calculation purposes. The Launch Date designates the date upon which the values of an index are first considered live: index values provided for any date or time period prior to the index's Launch Date are considered back-tested. S&P Dow Jones Indices defines the Launch Date as the date by which the values of an index are known to have been released to the public, for example via the company's public website or its datafeed to external parties. For Dow Jones-branded indices introduced prior to May 31, 2013, the Launch Date (which prior to May 31, 2013, was termed "Date of introduction") is set at a date upon which no further changes were permitted to be made to the index methodology, but that may have been prior to the Index's public release date.

Past performance of the Index is not an indication of future results. Prospective application of the methodology used to construct the Index may not result in performance commensurate with the back-test returns shown. The back-test period does not necessarily correspond to the entire available history of the Index. Please refer to the methodology paper for the Index, available at www.spdji.com for more details about the index, including the manner in which it is rebalanced, the timing of such rebalancing, criteria for additions and deletions, as well as all index calculations.

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