S&P Dow Jones Indices

A Division of S&P Global

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> Holding a combination of factor strategies in a blended portfolio could potentially provide a powerful source of diversification and more stable excess return outcomes.

Blending Factors in Your Smart Beta Portfolio

In recent years, smart beta strategies have seen a significant increase in popularity. These strategies seek to measure systematic factors and aim to harvest the associated long-term risk premium. While many empirical studies show that smart beta strategies have historically outperformed their cap-weighted benchmarks, there is less evidence to suggest that any one factor will consistently outperform another. In fact, different factors tend to outperform in different market environments.¹ Therefore, holding a combination of these strategies in a blended portfolio could potentially provide a powerful source of diversification and more stable excess return outcomes.

This paper briefly reviews the definition and performance characteristics of the <u>S&P 500[®] Single-Factor Indices</u>, demonstrates their historical cyclicality and correlation, and presents a few examples of how market participants could potentially use investment vehicles tracking these single-factor indices as part of their own factor allocation, either as strategic or tactical plays. These examples expand the traditional asset allocation frameworks to factors, including optimal allocation frameworks, heuristic allocation frameworks, and a trend-based timing framework.

1. BRIEF REVIEW OF SINGLE FACTORS

The S&P Single-Factor Indices comprise four key factors: low volatility, momentum, value, and quality. A rule-based selection and non-market cap weighting approach is used to construct the indices, and diversification and investability are taken into consideration.

The indices are constructed from the universe of S&P DJI's headline global indices, including the <u>S&P 500</u>, <u>S&P Europe 350</u>, <u>S&P Global BMI</u>, and regional and country benchmarks. Generally speaking, one quintile of the universe is selected after applying liquidity criteria. The constituents are then weighted by the inverse of volatility in the case of low volatility indices, and by the product of factor score and market cap for momentum, value,

¹ Harvey (1989); Asness (1992); Cohen, Polk, and Vuolteenaho (2003).

Harvey, C. R., "Time-Varying Conditional Covariances in Tests of Asset Pricing Models," Journal of Financial Economics, vol. 24 (1989), pp. 289-317.

Asness, C., "Changing Equity Risk Premia and Changing Betas over the Business Cycle and January," University of Chicago Working Paper (1992).

Cohen, R.B., C. Polk and T. Vuolteenaho. "The Value Spread," Journal of Finance, vol. 58, No. 2 (2003), pp. 609-642.

and quality. The indices are rebalanced semiannually except for the low volatility indices, some of which are rebalanced quarterly.

Exhibit 1 provides an overview of the S&P Single Factor Indices. In this paper, we will forcus on the S&P 500 Single Factor Indices. Exhibit 1a provides the description of the four long-only, single-factor indices, together with a dividend index and an equal-weight index, built on the S&P 500 universe.



Exhibit 1: Overview of the S&PSingle-Factor Indices

Source: S&P Dow Jones Indices LLC. Table is provided for illustrative purposes.

Exhibit 2.a: Overview of the S&P 500 Single-Factor Indices						
FACTOR	INDEX	DESCRIPTION				
Low Volatility	S&P 500 Low Volatility Index	The 100 least volatile stocks in the S&P 500, weighted by inverse volatility				
Momentum	S&P 500 Momentum	The 100 companies in the S&P 500 that exhibit persistence in their relative performance, weighted by momentum score times market cap				
Value	S&P 500 Enhanced Value Index	The 100 companies in the S&P 500 with low price-multiple ratios (price-to-book, price-to- earnings, and price-to-sales), weighted by value score times market cap				
Quality	S&P 500 Quality Index	The 100 companies in the S&P 500 with high quality scores, weighted by quality score times market cap. Quality score is calculated based on return on equity, accruals ratio, and financial leverage ratio				
Dividend	S&P 500 High Dividend Index	The 80 highest-yielding companies in the S&P 500, equally weighted				
Size	S&P 500 Equal Weight Index	The 500 companies in the S&P 500, equally weighted				

Source: S&P Dow Jones Indices LLC. Table is provided for illustrative purposes.

The full sample period risk/return profile of the <u>S&P 500 Single-Factor</u> <u>Indices</u> is shown in Exhibits 2 and 3. Although a single period snapshot could introduce bias into analysis due to the cyclicality of the factors, this sample period of more than 20 years should be long enough to mitigate some endpoint effects.

Over the period from Dec. 31, 1994, to June 30, 2016, all six indices outperformed the <u>S&P 500</u>. Of the six indices, the <u>S&P 500 Low Volatility</u> <u>Index</u> and <u>S&P 500 Quality Index</u> had lower total risk than the benchmark over the period. Except for the <u>S&P 500 Enhanced Value Index</u>, all of the factor strategies offered better returns per unit of risk when compared with the benchmark. The S&P 500 Low Volatility Index had the highest risk-adjusted return; and the S&P 500 Quality Index had the highest information ratio. Historically, the low volatility, dividend, and quality factors have been procyclical, which is evident from the upside and downside capture ratios.

Exhibit 3: Full-Period Risk-Return Profile of the S&P 500 Single-Factor Indices



Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 1995, to June 30, 2016. Index performance based on total return in USD. 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.

Except for the S&P 500 Enhanced Value Index, all of the factor strategies offered better returns per unit of risk when compared with the benchmark.

Exhibit 4: Statistical Summary of the S&P 500 Single-Factor Indices									
	D	EFENSIVE		PR	O-CYCLICAL				
RETURN CHARACTER- ISTICS	S&P 500 LOW VOLATILITY INDEX	S&P 500 QUALITY INDEX	S&P 500 HIGH DIVIDEND INDEX	S&P 500 MOMENTUM	S&P 500 ENHANCED VALUE INDEX	S&P 500 EQUAL WEIGHT INDEX	S&P 500		
Monthly Alpha to S&P 500 (%)	0.46	0.39	0.35	0.17	0.13	0.14	-		
Beta to S&P 500	0.55	0.87	0.82	0.98	1.08	1.05	-		
Correlation With S&P 500	0.73	0.94	0.75	0.85	0.86	0.94	-		
Annual Return (%)	10.39	12.18	10.73	9.79	10.05	10.27	8.21		
Annual Volatility (%)	11.50	14.04	16.68	17.51	19.17	16.95	15.25		
Annual Risk- Adjusted Return	0.90	0.87	0.64	0.56	0.52	0.61	0.54		
Annual Excess Return (%)	2.18	3.96	2.52	1.58	1.84	2.06	-		
Annual Tracking Error (%)	10.37	5.21	11.38	9.22	9.79	5.63	-		
Information Ratio	0.21	0.76	0.22	0.17	0.19	0.37	-		
Maximum Drawdown (%)	-35.4	-44.4	-66.3	-59.9	-67.9	-54.9	-51.0		
MAR	0.29	0.27	0.16	0.16	0.15	0.19	0.16		
Upside Capture	0.66	0.97	0.88	1.07	1.12	1.10	-		
Downside Capture	0.50	0.80	0.76	1.00	1.04	1.01	-		

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 1995, to June 30, 2016. Index performance based on total return in USD. 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 annual risk-adjusted return is calculated as the annual return devided by the annual volatility. The information ration is calculated as the annual excess return devided by annual tracking error. The MAR ratio measures the annualized return over the maximum drawdown over the measurement period.

2. WHY BLEND FACTORS?

Factor indices can underperform their benchmark index for extended periods of time, but they seem to follow unique cycles and have low correlation among each other. As a result, diversifying factors exposure can help to address the problem of factor cycles, and increase the opportunity of outperformance for market participants with shorter horizons.

2.1 Factor Cycles Exist

To illustrate factor cycles, Exhibit 4 shows the cumulative return of the six <u>S&P 500 Single-Factor Indices</u> relative to the <u>S&P 500</u>. When the cumulative relative return line slopes upward, it suggests that the factor index is outperforming, and vice versa.

Take the <u>S&P 500 Low Volatility Index</u> as an example (see Exhibit 5). Over time, the index indeed outperformed the benchmark. However, it also underperformed the benchmark during protracted periods. The cumulative

One drawback of factor-based investing is that factor indices can underperform the benchmark index for extended periods of time. relative return peaked in September 2002 in the aftermath of the "internet bubble." It then began to drop before recovering over the next 72 months to reach that peak again in August 2008. We see a similar period from February 2009 to March 2016 during which the index did not outperform its benchmark. In the 69-month period from December 1995 to August 2001, the S&P 500 Low Volatility Index experienced long cyclical drawdowns. It should be noted that over those periods, the risk reduction relative to the benchmark was significant. Similar periods of over- and underperformance can be seen in other factor indices over the 20–year period (see Exhibits 12-16 in Appendix).

Similar periods of over- and underperformance can be seen in other factor indices over the 20–year period.











Notes: Shaded area represents time course for recovery of peak for the cumulative relative return. Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 1994, to June 30, 2016. Index performance based on total return in USD. 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.

Although the factor indices experienced long cyclical drawdowns, their cycles were generally unique, with different lengths and different peak and trough dates.

2.2 Correlation Matters

Although the factor indices experienced long cyclical drawdowns, their cycles were generally unique, with different lengths and different peak and trough dates (see Exhibit 4). This is because factors are driven by different market anomalies and tend to pay off at different times of the market cycle, economic cycle, and investment sentiment regime.²

We present the long-term correlations in excess returns of the <u>S&P 500</u> <u>Single-Factor Indices</u> in Exhibit 6. It shows that, with only a few exeptions, most of the factor indices have low correlations that are negative or close to zero over the period from Dec. 31, 1995, to June 30, 2016.

Exhibit 6 also illustrates the factor correlation during the financial crisis of 2008-2009. It is worth noting that the low correlations among factors are stable even in times of crisis, when asset class correlations often converge toward one.

Exhibit 6: Pa	irwise Correlat	ion of Single-	Factor Excess	Returns				
		DEFENSIVE		PRO-CYCLICAL				
STRATEGY	LOW VOLATILITY	QUALITY	DIVIDEND	MOMENTUM	VALUE	SIZE		
PERIOD FROM DEC. 31, 1995, TO JUNE 30, 2016								
Low Volatility	-	0.46	0.67	-0.25	0.2	0.23		
Quality	0.46	-	0.16	-0.15	-0.02	0		
Dividend	0.67	0.16	-	-0.49	0.6	0.59		
Momentum	-0.25	-0.15	-0.49	-	-0.46	-0.47		
Value	0.2	-0.02	0.6	-0.46	-	0.74		
Size	0.23	0	0.59	-0.47	0.74	-		
PERIOD FRO	OM DEC. 31, 20	07, TO DEC. 3	1, 2009					
Low Volatility	-	0.57	-0.54	0.42	-0.66	-0.65		
Quality	0.57	-	-0.72	0.53	-0.62	-0.38		

Quality	0.57	-	-0.72	0.53	-0.62	-0.38
Dividend	-0.54	-0.72	-	-0.83	0.82	0.67
Momentum	0.42	0.53	-0.83	-	-0.82	-0.61
Value	-0.66	-0.62	0.82	-0.82	-	0.76
Size	-0.65	-0.38	0.67	-0.61	0.76	-

Source: S&P Dow Jones Indices LLC. Index performance based on total return in USD. Data from Dec. 31, 1995, to June 30, 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.

² Ung, Daniel and Priscilla Luk, What Is in Your Smart Beta Portfolio? A Fundamental and Macroeconomic Analysis, 2016.

3. STRATEGIC FACTOR ALLOCATION

Market participants seeking strategic allocation to factors may need to consider a variety of variables, and the expected return is only one of these. Depending on the market participant's risk appetite, liquidity requirements, and investment horizon, the volatility, drawdowns, turnover, and factor cycle lengths can be equally important.

In this section, we will focus on three variables in the context of strategic factor allocation: return, volatility, and tracking error. We expand some of the traditional asset allocation frameworks to factors in order to study how allocations change with market participant objectives.

3.1Optimal Allocation Approaches

Markowitz introduced the concept of portfolio selection based on return and variance. Recognition that many market participants evaluate performance relative to a benchmark led to the idea of portfolio selection based on return and relative risk. Although many market participants acknowledge the importance of benchmarks, they are not indifferent to the variance of absolute return.

We examine the optimal multi-factor portfolio by applying full-period, insample mean-variance optimizations (MVOs) and two extensions to the mean-variance approaches. The objective functions are presented in Exhibit 7. The mean-tracking error (MTE) approach optimizes mean return against tracking error rather than variance. The mean-variance-tracking error (MVTE) approach adds a tracking risk penalty to the MVO objective function.

Exhibit 7: Overview of the Optimization Methods								
ABBREVIATION	MODEL	UTILITY FUNCTION	SOURCE					
MVO	Mean-Variance Optimization	Expected Return – Risk Tolerance * Variance	Markowitz (1952)					
MTE	Mean-Tracking Error Optimization	Expected Return – Tracking Error Tolerance * Expected Tracking Error ^2	Roll (1992)					
MVTE	Mean-Variance- Tracking Error Optimization	Expected Return – Tracking Error Tolerance * Expected Tracking Error ^2 – Risk Tolerance * Expected Variance	Chow (1995)					

Source: S&P Dow Jones Indices LLC. Table is provided for illustrative purposes.

The optimization results are presented in Exhibits 8 and 9. The maximized utility is achieved with 86% allocation to low volatility and 14% allocation to momentum when using the MVO method. On the other hand, the optimal allocation is 38% to size, 36% to quality, 24% to momentum, 2% to value, and 1% to dividend when the MTE approach is used.

This implies that the factor allocation should change as market participants' objectives change—whether they are seeking broad exposure across multiple rewarded factors to enhance risk-adjusted returns, blending factors

Recognition that many market participants evaluate performance relative to a benchmark led to the idea of portfolio selection based on return and relative risk. to improve diversification and reduce tracking error to the benchmark, or both.

Exhibit 8: Full-Period, In-Samp	le Optimization R	Results		
ALLOCATION	MVO	MTE	MVTE *	S&P 500
S&P 500 Low Volatility Index	0.86	-	0.49	-
S&P 500 Momentum	0.14	0.24	0.22	-
S&P 500 Enhanced Value Index	-	0.02	-	-
S&P 500 Quality Index	-	0.36	0.29	-
S&P 500 High Dividend Index	-	0.01	-	-
S&P 500 Equal Weight Index	-	0.38	-	-
RETURN CHARACTERISTICS				
Monthly Alpha to S&P 500 (%)	0.42	0.24	0.37	-
Beta to S&P 500	0.61	0.96	0.74	-
Correlation With S&P 500	0.83	0.98	0.94	-
Annual Return (%)	10.47	11.05	11.03	8.21
Annual Volatility (%)	11.30	14.95	11.99	15.25
Annual Risk-Adjusted Return	0.93	0.74	0.92	0.54
Annual Excess Return (%)	2.07	2.85	2.72	-
Annual Tracking Error (%)	8.69	2.74	5.74	-
Information Ratio	0.24	1.04	0.47	-
Maximum Drawdown (%)	-36.1	-48.5	-39.1	-50.95
MAR	0.28	0.23	0.28	0.16
Upside Capture	0.71	1.05	0.84	-
Downside Capture	0.57	0.93	0.70	-

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 1995, to June 30, 2016. Index performance based on total return in USD. 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. *Assume same level of risk tolerance and tracking error tolerance. We assume long-only portfolios, no leverage, and monthly rebalancing.

Exhibit 9 illustrates this point by varying the tolerance to risk relative to tracking error. As the penalty to tracking error increases, higher weight is allocated to quality. When the penalty to risk increases, a higher allocation to low volatility is desired.

There was always some allocation to momentum, ranging from 14% to 23%, as momentum tends to provide a diversification benefit given its negative correlation to both low volatility and quality. Note that the only constraints we applied here are long-only allocation and no leverage. This approach may not be preferred by many market participants.

In terms of performance, all the optimized portfolios outperformed the benchmark and earned annual excess returns ranging from 2.3% to 2.9% over the period studied. There is a tradeoff between tracking error and volatility. When MVO was used, the portfolio volatility was 11.3% and the

As the penalty to tracking error increases, higher weight is allocated to quality. When the penalty to risk increases, a higher allocation to low volatility is desired. tracking error was 8.3%. When MTE was used, the portfolio tracking error was as low as 2.9%, while volatility was 14.4%.



Exhibit 9: MVTE Optimal Allocation With Different Relative Risk Tolerance

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 1995, to June 30, 2016. Index performance based on total return in USD. 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. Assume same level of risk tolerance and tracking error tolerance. We assume long-only portfolios, no leverage, and monthly rebalancing.

3.2 Heuristic Allocation Approaches

Although MVO has been widely used to manage asset portfolios and to build strategic asset allocations, some argue that it faces serious stability issues. Another route of asset allocation has been explored by considering heuristic methods like equal-weighted, risk parity, and relative risk parity portfolios. These portfolios are special cases of a more general allocation approach based on risk budgeting methods.

This section illustrates three hypothetical portfolios built from the <u>S&P 500</u> <u>Single-Factor Indices</u> by using three heuristic approaches. The equalweight portfolio allocates 16.7% to each of the factor indices. In the risk parity portfolio, the weight of each factor index is proportional to the inverse of its full-period volatility. In the relative risk parity portfolio, the weight of each factor index is proportional to the inverse of its full-period tracking error against the <u>S&P 500</u>.

The results are presented in Exhibit 10. From Dec. 31, 1995, to June 30, 2016, the three hypothetical portfolios outperformed the S&P 500, with annual excess return ranging from 2.8% to 3.0% and tracking error from 4.4% to 5.3%. The annual risk-adjusted returns were improved by 26 bps-

Another route of asset allocation has been explored by considering heuristic methods like equalweighted, risk parity, and relative risk parity portfolios.

28 bps.	In terms of	drawdowns,	these	portfolios	have	levels th	hat are	similar
to those	of the S&P	500.						

Exhibit 10: Factor Allocation Results Using Heuristic Approaches								
ALLOCATION	EQUAL WEIGHT	RISK PARITY	RELATIVE RISK PARITY	S&P 500				
S&P 500 Low Volatility Index	0.17	0.23	0.13	-				
S&P 500 Momentum	0.17	0.15	0.14	-				
S&P 500 Enhanced Value Index	0.17	0.13	0.13	-				
S&P 500 Quality Index	0.17	0.18	0.25	-				
S&P 500 High Dividend Index	0.17	0.16	0.11	-				
S&P 500 Equal Weight Index	0.17	0.15	0.23	-				
RETURN CHARACTERISTICS								
Monthly Alpha to S&P 500 (%)	0.27	0.29	0.27	-				
Beta to S&P 500	0.89	0.86	0.91	-				
Correlation With S&P 500	0.95	0.95	0.96	-				
Annual Return (%)	10.89	10.93	11.00	8.21				
Annual Volatility (%)	14.26	13.85	14.37	15.25				
Annual Risk-Adjusted Return	0.76	0.79	0.77	0.54				
Annual Excess Return (%)	2.64	2.67	2.77	-				
Annual Tracking Error (%)	4.61	4.83	4.07	-				
Information Ratio	0.57	0.55	0.68	-				
Maximum Drawdown (%)	-52.4	-50.8	-51.1	-50.95				
MAR	0.20	0.21	0.21	0.16				
Upside Capture	0.97	0.94	0.99	-				
Downside Capture	0.85	0.82	0.87	-				

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 1995, to June 30, 2016. Index performance based on total return in USD. 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.

4. TACTICAL FACTOR ALLOCATION

The distinct cyclicality of factor returns provides great temptation for timing exposures. Indeed, factor strategies may provide a useful tool for tactically minded market participants to get the right exposure at the right time. Though it might be difficult to predict exactly when a specific strategy is likely to out- or underperform the market-cap-weighted index, that does not mean market participants should completely ignore timing questions.

4.1 Trend-Driven Factor Allocation

One approach is to apply a trend-following model to select factors. The goal is to utilize the past momentum signal as the basis for deciding which factors are in favor in the market.

We calculated the 12-month cumulative returns, excluding the most recent month, adjusted by the volatility during the same period of each of the <u>S&P</u>

Factor strategies may provide a useful tool for tactically minded market participants to get the right exposure at the right time. <u>500 Single-Factor Indices</u>. This strategy allocates 100% of the weight to the best-performing factor and rebalances every quarter. In the same manner, we also built four other portfolios by allocating 100% weight to the second-best-performing factor, the third, the fourth, and the worst-performing factor.

The results of the trend-following factor selection model are shown in Exhibit 11a-11b. We can make two observations. First, only the portfolio constructed using the worst-performing factor underperformed the <u>S&P 500</u> over the full period; all others outperformed. It might make sense to avoid the factor with poor recent performance. Second, the momentum factor did not seem to signal future performance in a linear way. The portfolio constructed using the second-best-performing factor had the highest return, risk-adjusted return, and information ratio over the period studied.

Exhibit 11a: Results of Trend-Following Factor Rotation Model with 12-Month Lookback Period and Quarterly Rebalancing



Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 1995, to June 30, 2016. Index performance based on total return in USD. 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.

Only the portfolio constructed using the worstperforming factor underperformed the S&P 500 over the full period; all others outperformed.

T enou and waartenry her	alancing						
RETURN	RANK	S&P 500					
CHARACTERISTICS	FIRST	SECOND	THIRD	FOURTH	FIFTH	SIXTH	
Monthly Alpha to S&P 500 (%)	0.32	0.52	0.42	0.19	0.23	-0.03	-
Beta to S&P 500	0.89	0.73	0.88	0.87	0.94	1.03	-
Correlation With S&P 500	0.84	0.83	0.86	0.86	0.83	0.85	-
Annual Return (%)	11.21	12.70	12.48	9.36	10.29	7.46	8.21
Annual Volatility (%)	16.14	13.42	15.54	15.45	17.40	18.53	15.25
Annual Risk-Adjusted Return	0.69	0.95	0.80	0.61	0.59	0.40	0.54
Annual Excess Return (%)	3.00	4.48	4.27	1.15	2.08	-0.76	-
Annual Tracking Error (%)	8.94	8.44	8.02	8.13	9.83	9.80	-
Information Ratio	0.33	0.53	0.53	0.14	0.21	-0.08	-
Maximum Drawdown (%)	-50.7	-40.5	-49.2	-44.5	-66.2	-63.8	-50.95
MAR	0.22	0.31	0.25	0.21	0.16	0.12	0.16
Upside Capture	0.99	0.90	1.00	0.90	0.98	1.00	-
Downside Capture	0.86	0.69	0.82	0.85	0.89	1.03	-

Exhibit 11b: Results of Trend-Following Factor Rotation Model with 12-Month Lookback Period and Quarterly Rebalancing

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 1995, to June 30, 2016. Index performance based on total return in USD. 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.

5. CONCLUSION

While single-factor smart beta strategies tend to outperform the market over the long term, there can be long periods where they underperform the standard market-cap-weighted benchmark. Evidence suggests that they perform on different cycles, and the pairwise correlations among factors were low, even during crises. This suggests potential for both strategic and tactical factor allocation. Market participants could seek broad exposure across multiple rewarded factors to enhance returns, and they could blend factors to improve diversification and reduce the tracking error to the benchmark. They could also change exposure to one or another factor throughout market cycles.

While single-factor smart beta strategies tend to outperform the market over the long term, there can be long periods where they underperform the standard market-capweighted benchmark.

6. APPENDIX





Notes: Shaded area represents time course for recovery of peak for the cumulative relative return. Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 1994, to June 30, 2016. Index performance based on total return in USD. 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 11: S&P 500 High Dividend Index/S&P 500

Notes: Shaded area represents time course for recovery of peak for the cumulative relative return. Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 1994, to June 30, 2016. Index performance based on total return in USD. 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 12: S&P 500 Momentum/S&P 500

Notes: Shaded area represents time course for recovery of peak for the cumulative relative return. Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 1994, to June 30, 2016. Index performance based on total return in USD. 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.





Notes: Shaded area represents time course for recovery of peak for the cumulative relative return. Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 1994, to June 30, 2016. Index performance based on total return in USD. 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 14: S&P 500 Equal Weight Index/S&P 500

Notes: Shaded area represents time course for recovery of peak for the cumulative relative return. Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 1994, to June 30, 2016. Index performance based on total return in USD. 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.

PERFORMANCE DISCLOSURE

The S&P 500 Low Volatility Index was launched April 4, 2011. The S&P 500 Momentum was launched November 18, 2014. The S&P 500 Enhanced Value Index was launched April 27, 2015. The S&P 500 Quality Index was launched July 8, 2014. S&P 500 High Dividend Index was launched September 21, 2015. The S&P 500 Equal Weight Index was launched January 8, 2003. 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 <u>www.spdji.com</u> 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.

Another limitation of using back-tested information is that the back-tested calculation is generally prepared with the benefit of hindsight. Backtested information reflects the application of the index methodology and selection of index constituents in hindsight. No hypothetical record can completely account for the impact of financial risk in actual trading. For example, there are numerous factors related to the equities, fixed income, or commodities markets in general which cannot be, and have not been accounted for in the preparation of the index information set forth, all of which can affect actual performance.

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