



## Invesco White Paper Series on the Active/Passive Debate

This white paper was generated in conjunction with Invesco's global Investors Forum, based on research conducted by PowerShares by Invesco. The Investors Forum brings together each of Invesco's 650-plus investment professionals from around the world to discuss issues that are critical to global investors.

# Getting smart about beta

## Examining smart beta equity methodologies and their impact over full market cycles

### Contributors:

**Jason Stoneberg, CFA**  
Director, Research and Product Development, PowerShares by Invesco

**Bradley Smith**  
ETF Research Analyst, PowerShares by Invesco

### Invesco's perspective on the active/passive debate

At Invesco, we believe the greatest opportunity for investors to achieve their unique objectives is through a well-constructed portfolio that spans asset classes and considers both actively managed and index-based strategies. However, we believe in taking a high-conviction approach that goes beyond the limitations of traditional passive investing and benchmark-centric active management.

In this white paper series, we explore various topics that are key to building outcome-oriented portfolios and moving past the active/passive debate.

Due to its simplicity, market-cap weighting has long been a popular means of calculating the value of market indexes. But as an investment strategy, market-cap weighting has limitations – frequently resulting in outsized proportions of overvalued stocks and less-than-optimal exposure to undervalued stocks. This one-size-fits-all approach is simple, but it limits investors' ability to target stocks with specific characteristics or investment factors. Smart beta solutions offer a high-conviction approach by providing exposure to objective, rules-based methodologies that harvest returns from specific investment factors. Smart beta solutions may also deliver broad market exposure through alternative weighting strategies.

Not all smart beta approaches are alike. There are a wide variety of methodologies available – each with certain potential benefits and risks. In this study, we examined two categories of smart beta strategies – factors and alternative weighting methodologies – and analyzed how they performed over full market cycles and in different economic environments. We selected simple and transparent versions of well-established factor and weighting methodologies that are both widely recognized and commonly implemented. The results were compared with two market-cap-weighted indexes: the S&P 500 Index, which we use as a proxy for US stocks, and the MSCI EAFE Index, which we use as a proxy for international stocks, and which serves as a barometer of mid- and large-cap equity performance in developed markets outside of North America.

Our research shows that smart beta factors and methodologies outperformed the S&P 500 and MSCI EAFE indexes over multiple market cycles and in different economic climates. Our results also show that smart beta strategies generally outperformed market-cap-weighted indexes when adjusted for risk, while exhibiting lower downside capture ratios than market-cap-weighted indexes during most market cycles.

### Results vs. the S&P 500 Index:

- All of the five factors and five alternative weighting methodologies we tested resulted in higher absolute returns relative to the S&P 500 Index during the testing period.
- The majority of smart beta strategies delivered higher risk-adjusted returns than the S&P 500 Index.
- Favorable results were also seen when measuring downside capture in periods of weakness for the S&P 500 Index.

### Results vs. the MSCI EAFE Index:

- All of the factors and most of the alternative weighting methodologies we tested resulted in higher absolute returns relative to the MSCI EAFE Index during the testing period.
- All of the factors and the majority of the alternative weighting methodologies delivered the same or higher risk-adjusted returns as the MSCI EAFE Index.
- Favorable results were also seen when measuring downside capture in periods of weakness for the MSCI EAFE Index.

It is important to note that each of the factors and alternative weighting strategies we examined generated different levels of outperformance, and at different times. This has important implications for portfolio diversification, particularly given smart beta strategies' relatively low correlation to each other. In our view, staggered performance across different periods can help lower the risk profile of a diversified portfolio.

In addition, we analyzed performance across five full market cycles. We believe this a more appropriate prism through which to gauge performance than arbitrary snapshots in time. There were periods when market-cap-weighted exposure generated higher returns than a smart beta approach. Considered over the entire testing period, however, smart beta strategies generated a clear pattern of outperformance relative to the S&P 500 and MSCI EAFE indexes.

---

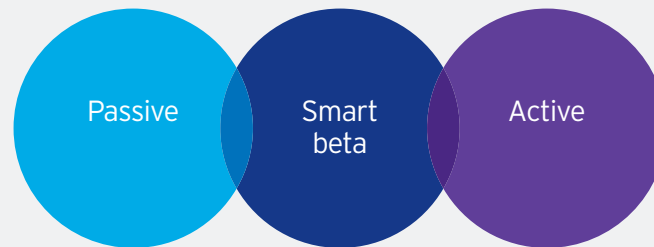
## Defining smart beta

Smart beta has become somewhat of a buzzword in recent years, as have related terms such as strategic beta and alternative beta. No matter the moniker, the concept has been around for decades, as institutional investors have used alternative weighting and factor-driven tools to manage portfolio risk and return. These strategies can be implemented using both passive and active approaches, with exchange-traded funds (ETFs) serving as the primary delivery vehicle.

For the purposes of our study, we use the term smart beta to describe a rules-based methodology that uses factor selection and/or alternative weighting in an effort to outperform a benchmark, reduce portfolio risk, or both. Smart beta strategies are based on the premise that market prices are not perfectly efficient and that alternative weighting and factor exposure can exploit these inefficiencies.

---

### Approaches such as smart beta have altered the traditional definitions of 'active' and 'passive'



---

## About the study

We tested five factors and five alternative weighting strategies based on the earliest date for which we could obtain reliable factor data. Our testing period for US smart beta strategies spanned December 1991 through December 2016. Our testing period for international smart beta strategies spanned June 1995 through December 2016. We also examined smart beta strategies across five full market cycles – the first of which began in July 1998. Our goal was to understand what effect these factors and weighting strategies had on performance. We examined economic variables in the form of US dollar values, interest rates and volatility. Assuming quarterly portfolio rebalancing, we analyzed how smart beta factors performed during these different environments.

### Factors

A factor refers to an objective determinant of investment style. While broad market indexes do not filter by factors, many smart beta portfolios do. In our study, we selected five factors that are commonly used to construct smart beta portfolios. We then segmented the constituents of the market-cap-weighted S&P 500 Index and MSCI EAFE Index using these definitions:

- 1 **Quality** – Top 20% of stocks with the highest quality score, as measured by return on equity, debt to equity and earnings variability
- 2 **Value** – 20% of stocks with the lowest price-to-book ratio
- 3 **Small tilt** – 20% of stocks with the smallest market capitalization within each index's universe
- 4 **Momentum** – Top 20% of stocks with the highest risk-adjusted 12-month price return
- 5 **Low volatility** – 20% of stocks with the lowest realized volatility, as measured by standard deviation, on a trailing 12-month basis

Stocks within each of the factors above were equally weighted.

### Alternative weighting methodologies

Most traditional indexes are weighted by market capitalization (the number of shares outstanding multiplied by share price), which may result in a bias toward overvalued stocks. By contrast, alternative weighting methodologies allocate stocks based on measures apart from market capitalization. In our study, we examined five commonly used weighting methodologies:

- 1 **Book value weighted** – Weights constituent companies within an index according to their book value
- 2 **Total dividend weighted** – Weights dividend-paying constituent companies within an index according to the total value of dividends paid by each company
- 3 **Equal weighted** – Allocates the same weight to each constituent company within an index
- 4 **Low volatility weighted** – Considers all stocks in an index and weights them inversely to their realized volatility
- 5 **Sales weighted** – Weights constituent companies within an index according to their total revenue

In this paper, we refer to factors and alternative weighting methodologies collectively as “smart beta strategies.”

Within the study period, we examined five distinct, full market cycles, which are depicted in **Figure 1**. These market cycles cover peak-to-peak and trough-to-trough environments. We used the S&P 500 Index as a market-cap-weighted US equity benchmark and the MSCI EAFE Index as a market-cap-weighted international equity benchmark for developed countries outside the United States and Canada.

**Figure 1: Market cycles measured**

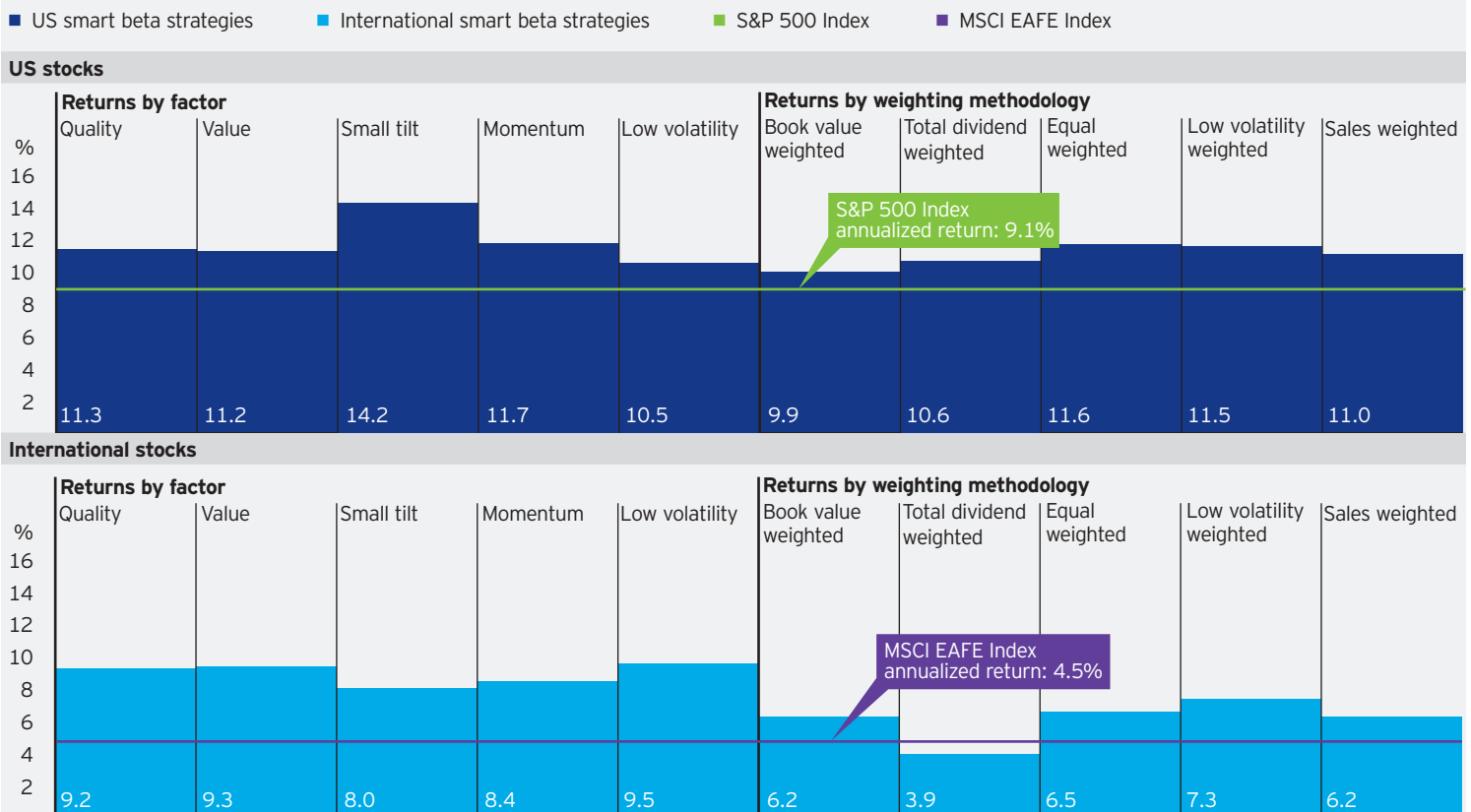
1 Peak to peak	July 1998 through March 2000
2 Trough to trough	October 1998 through September 2002
3 Peak to peak	April 2000 through October 2007
4 Trough to trough	October 2002 through February 2009
5 Peak to present	November 2007 through December 2016

### Key takeaways

- **Excess return.** Among US stocks, from December 1991 through December 2016, all five factors and all five alternative weighting strategies that we studied delivered excess returns relative to the market-cap-weighted S&P 500 Index, as depicted in **Figure 2**. Among international stocks, from June 1995 through December 2016, all five factors and four of the five alternative weighting methodologies outpaced the market-cap-weighted MSCI EAFE Index.

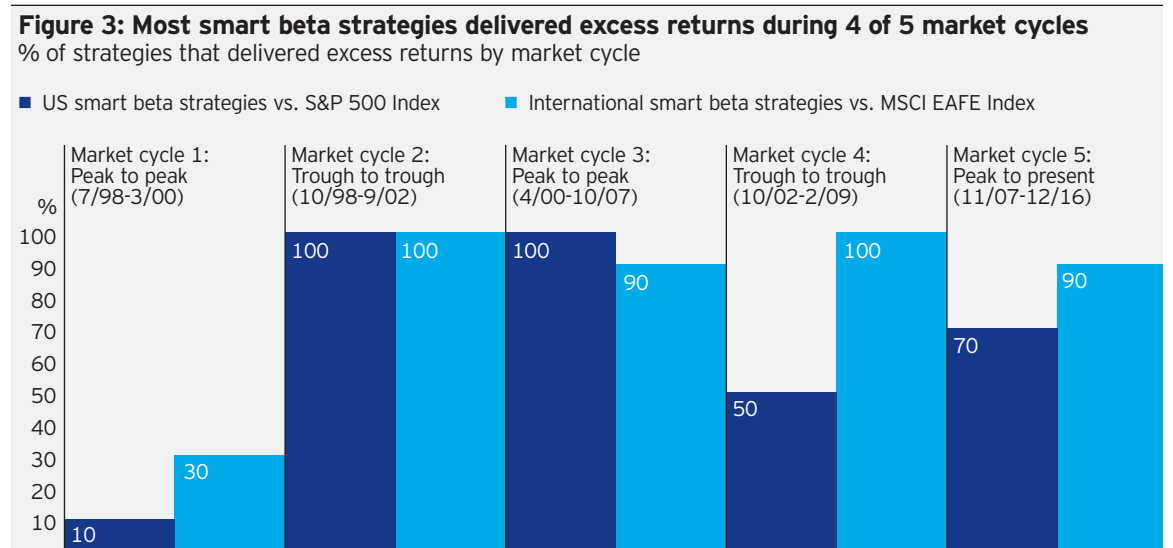
**Figure 2: Smart beta strategies generally outperformed the S&P 500 Index and MSCI EAFE Index during the study period**

Annualized returns from December 1991 through December 2016 for S&P 500 Index and from June 1995 through December 2016 for MSCI EAFE Index

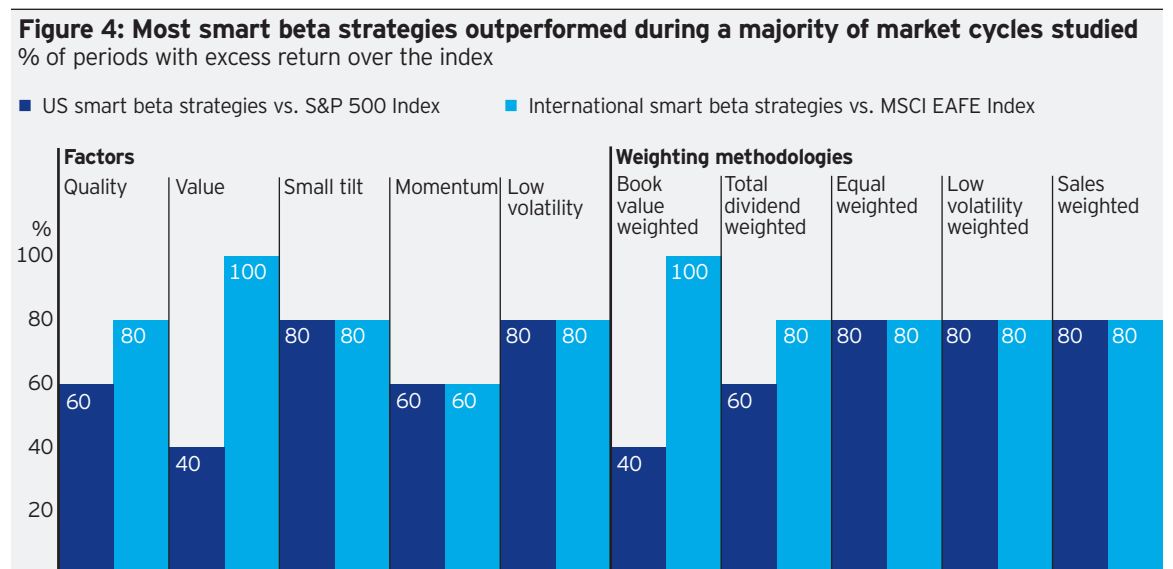


Source: FactSet Research Systems as of Dec. 31, 2016. Past performance does not guarantee future results. An investment cannot be made directly into an index. Index returns do not reflect any fees, expenses or sales charges.

**Figures 3 and 4** depict excess returns by market cycle. **Figure 3** shows that in four of the five market cycles studied, a large majority of the smart beta strategies delivered excess returns over both the S&P 500 Index and the MSCI EAFE Index. (Annual returns for each strategy and both benchmark indexes can be found in the appendix.) Versus the MSCI EAFE Index, every international strategy delivered excess return in more than half of the market cycles tested except market cycle one. **Figure 4** breaks down the results by strategy. It shows that every US strategy except the value factor and book value weighting delivered excess return over the S&P 500 Index in more than half of market cycles tested.



Source: FactSet Research Systems as of Dec. 31, 2016. Past performance does not guarantee future results. An investment cannot be made directly into an index. Index returns do not reflect any fees, expenses or sales charges.

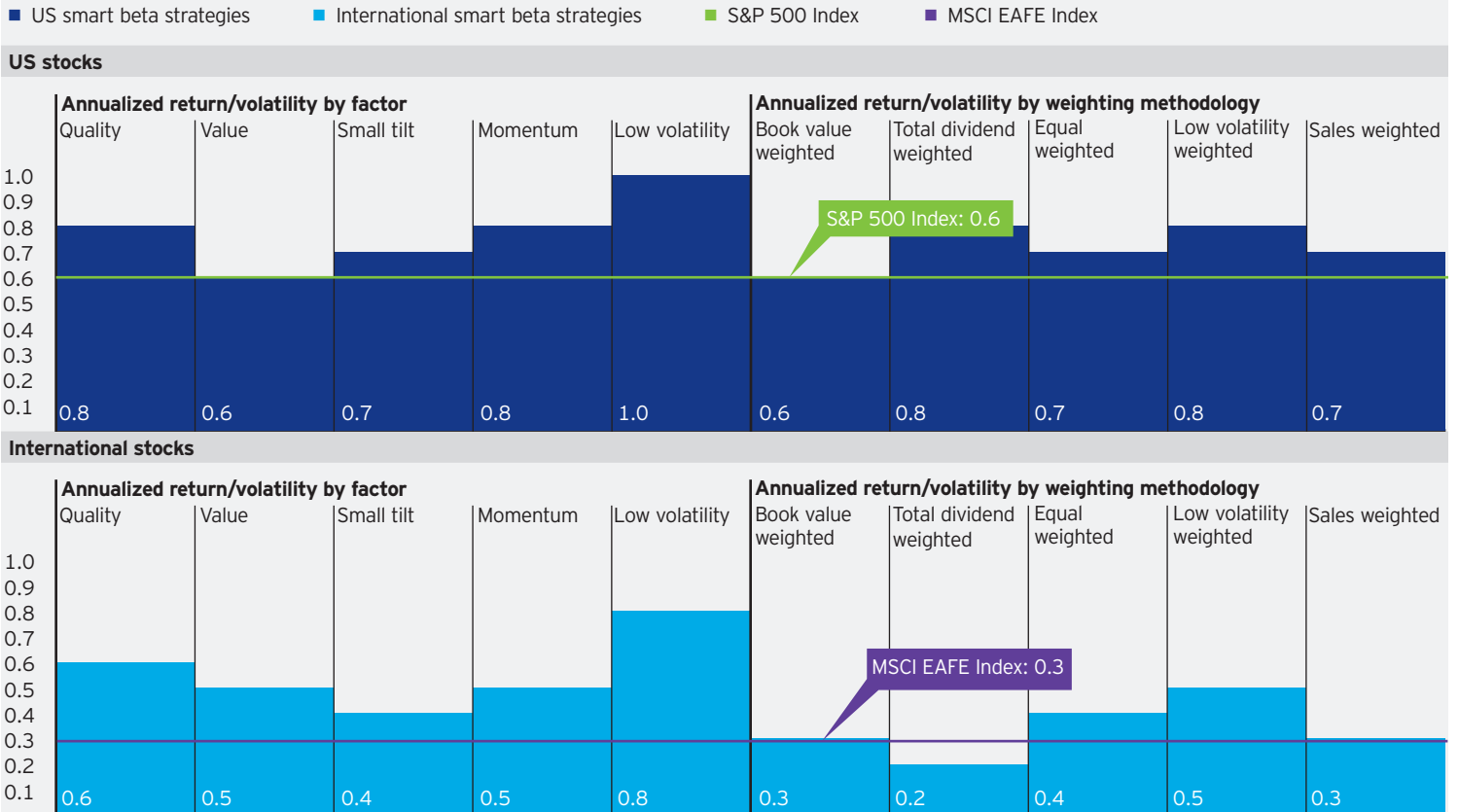


Source: FactSet Research Systems as of Dec. 31, 2016. Past performance does not guarantee future results. An investment cannot be made directly into an index. Index returns do not reflect any fees, expenses or sales charges.

■ **Risk-adjusted returns.** When returns were adjusted for risk, the majority of smart beta strategies continued to outperform market-cap-weighted exposure during most market cycles. As shown in **Figure 5**, all of the five factors and alternative weighting methodologies had the same or higher risk-adjusted returns (return per unit of risk) than the S&P 500 Index during the testing period. During this same time, all five factors and four of the five weighting methodologies generated the same or higher risk-adjusted returns than the MSCI EAFE Index.

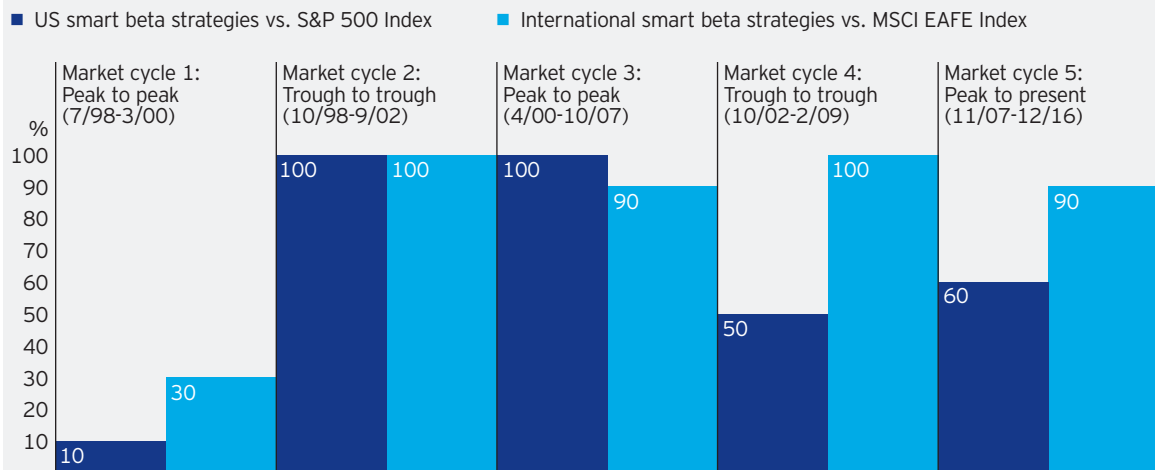
**Figure 6** shows that in every market cycle except the first, at least half of the US and international smart beta strategies generated higher risk-adjusted returns than the Index.

**Figure 5: Most smart beta strategies delivered higher risk-adjusted returns than the S&P 500 Index and the MSCI EAFE Index**  
 Risk-adjusted returns from December 1991 through December 2016 for S&P 500 Index and from June 1995 through December 2016 for MSCI EAFE Index



Source: FactSet Research Systems as of Dec. 31, 2016. Past performance does not guarantee future results. An investment cannot be made directly into an index. Index returns do not reflect any fees, expenses or sales charges.

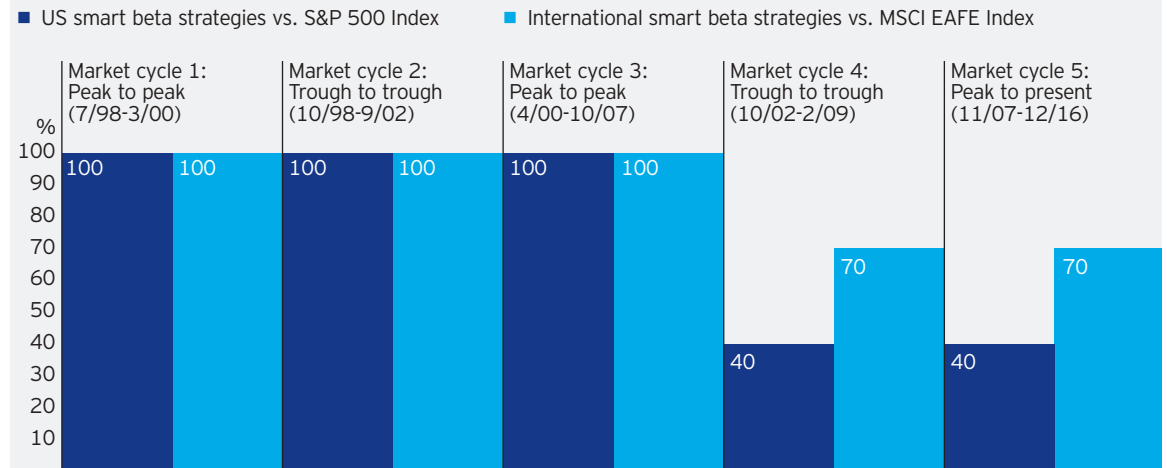
**Figure 6: Smart beta strategies generally delivered higher risk-adjusted returns**  
 % of strategies that delivered higher risk-adjusted returns by market cycle



Source: FactSet Research Systems as of Dec. 31, 2016. Past performance does not guarantee future results. An investment cannot be made directly into an index. Index returns do not reflect any fees, expenses or sales charges.

■ **Downside capture.** We analyzed downside capture to gauge how smart beta factors and alternative weighting methodologies performed during periods of weakness for the S&P 500 and MSCI EAFE indexes. Simply put, how much of the market's loss did each strategy realize? As depicted in **Figure 7**, we found that most-to-all US smart beta strategies exhibited lower downside capture ratios than the S&P 500 Index in three of the five market cycles, and most-to-all international smart beta strategies had lower downside capture than the MSCI EAFE Index during all of the market cycles.

**Figure 7: Generally, most-to-all smart beta strategies outperformed during down periods**  
 % of strategies with lower downside capture ratios, by market cycle



Source: FactSet Research Systems as of Dec. 31, 2016. Past performance does not guarantee future results. An investment cannot be made directly into an index. Index returns do not reflect any fees, expenses or sales charges.

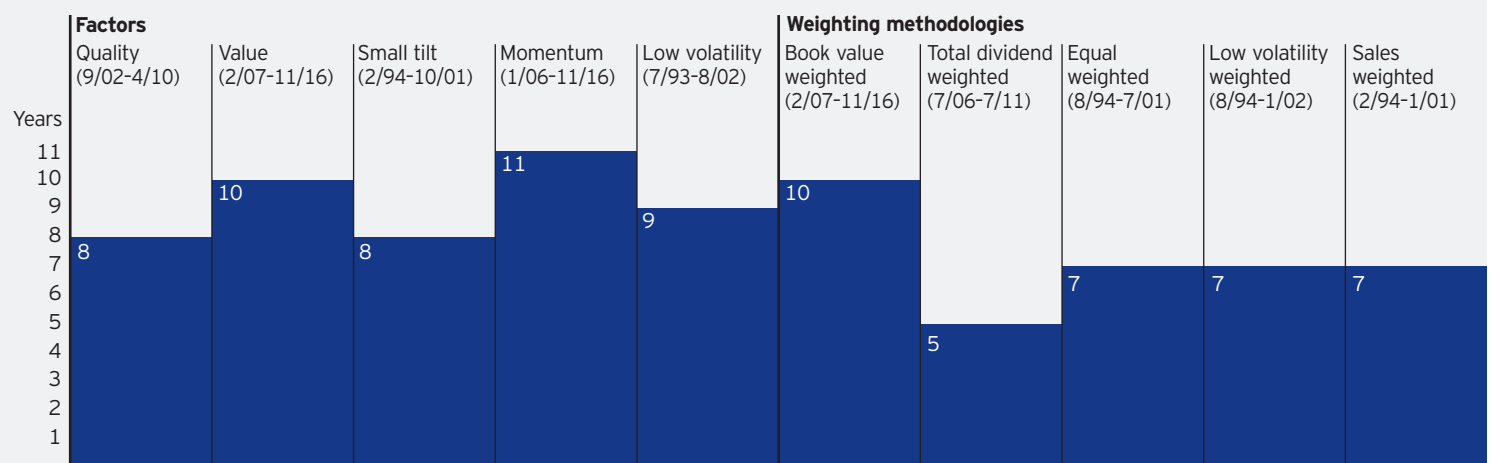
■ **Periods of underperformance.** While long-term excess returns may be generated by utilizing smart beta strategies, there are times when these strategies can underperform a market-cap-weighted benchmark. In order to demonstrate periods of smart beta underperformance, we used the example of the S&P 500 Index in our research.

As **Figure 8** depicts, each factor and weighting methodology we tested underperformed the S&P 500 Index for at least five years. The dates for each strategy's longest period of underperformance are indicated. **Figure 9** shows that each strategy also underperformed the S&P 500 Index by at least 12% over a 12-month period during the study. In this figure, dates for each strategy's largest amount of underperformance are shown.

Here it is important to note that the longest and largest relative periods of underperformance occurred at different times. This underscores the importance of diversification across strategies, which may help mitigate the overall effect of underperformance on a portfolio.

**Figure 8: The longest period of underperformance per strategy varied from 5 to 11 years**

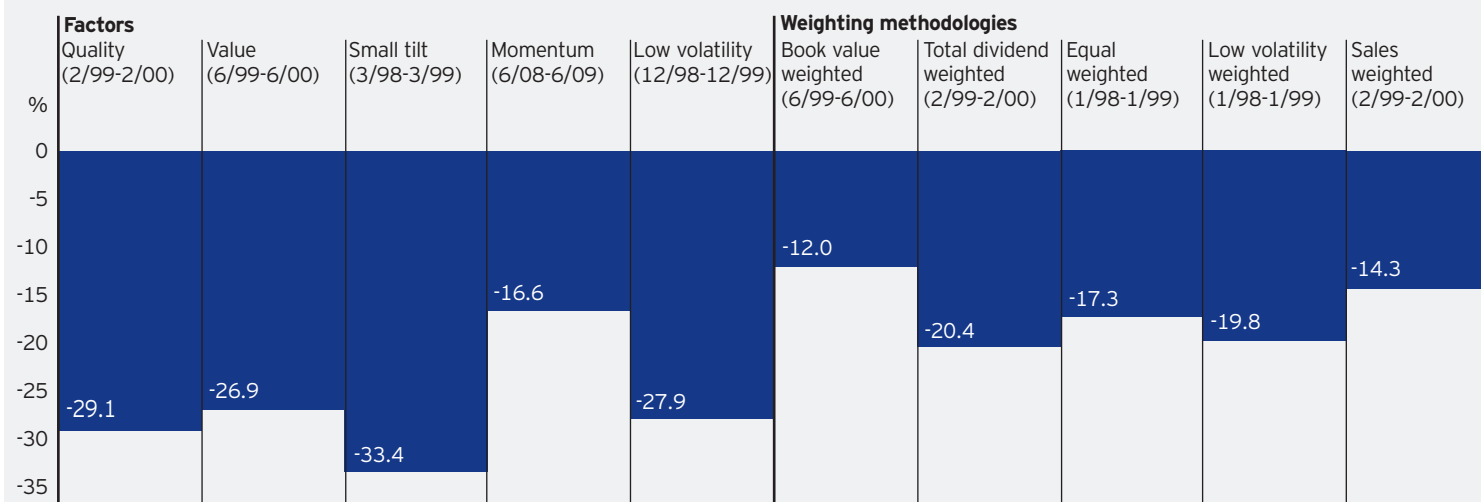
Each strategy's longest period of underperformance relative to the S&P 500 Index, in years, over the study period



Source: FactSet Research Systems as of Dec. 31, 2016. Past performance does not guarantee future results. An investment cannot be made directly into an index. Index returns do not reflect any fees, expenses or sales charges. Diversification does not guarantee a profit or eliminate the risk of loss.

**Figure 9: The largest amount of 12-month underperformance per strategy ranged from 12% to 33%**

Each strategy's largest amount of 12-month underperformance relative to the S&P 500 Index



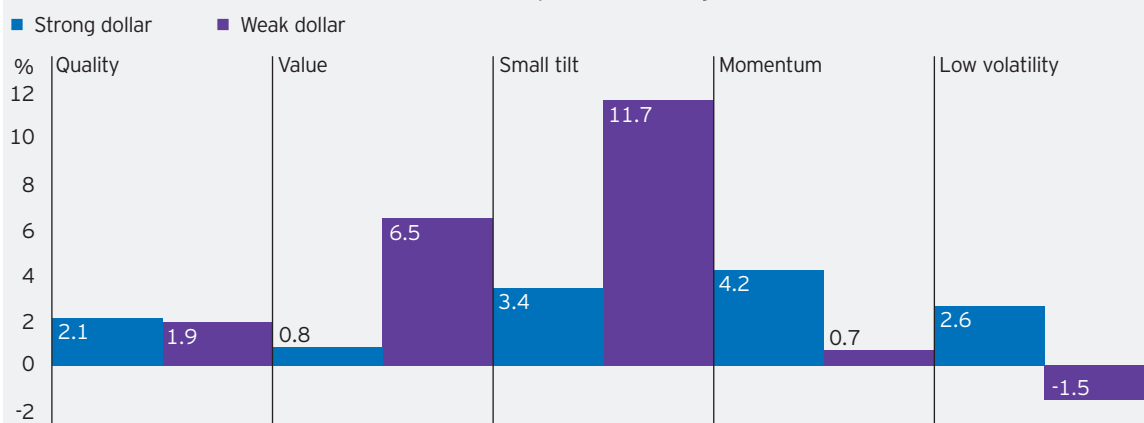
Source: FactSet Research Systems as of Dec. 31, 2016. Past performance does not guarantee future results. An investment cannot be made directly into an index. Index returns do not reflect any fees, expenses or sales charges.

■ **Economic environments.** Smart beta factors performed differently depending on economic conditions. However, considered as an aggregate, smart beta factors demonstrated a clear pattern of outperformance relative to the S&P 500 Index. We excluded alternative weighting methodologies, as the differentiation among these strategies was not as significant as between various factors. Below, we examine how smart beta factors performed against different US dollar trends, changes in interest rates and volatility environments. In this analysis, we categorize each quarter since 1991 into a particular market environment and show the annualized excess returns generated by each factor during those periods.

1 **US dollar environment.** A strong dollar tends to attract investments from around the globe, but it also makes dollar-denominated goods more expensive in foreign markets. Trends in the US dollar also have had an impact on factor performance. **Figure 10** shows that during strong-dollar environments, momentum factors fared the best, while small-tilt factors tended to do best in weak-dollar regimes.

**Figure 10: Momentum stocks led in strong-dollar environments, while small-tilt stocks led in weak-dollar environments**

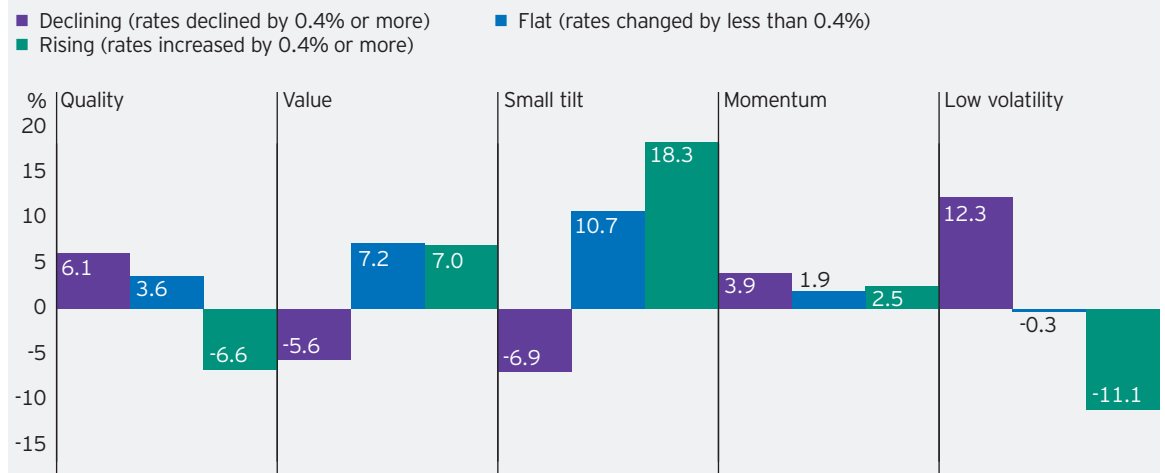
Annualized excess return over the S&P 500 Index by factor in strong- and weak-dollar environments



Source: FactSet Research Systems as of Dec. 31, 2016. Past performance does not guarantee future results. An investment cannot be made directly into an index. Index returns do not reflect any fees, expenses or sales charges.

2 **Interest rate environment.** The study period coincided with a decline in interest rates to historically low levels, as the Federal Reserve attempted to stimulate economic growth through accommodative monetary policy. The benchmark 10-year Treasury note began the testing period at 6.69% and ended the period at 2.44%, although rates fluctuated within this time frame. As shown in **Figure 11**, we found that declining rate environments tended to favor low volatility stocks, while the small-tilt factor led when rates were rising.

**Figure 11: Low volatility stocks led when rates fell, while small-tilt stocks led when rates rose**  
Annualized excess return over the S&P 500 Index by factor, based on the direction and magnitude of change in 10-year interest rates

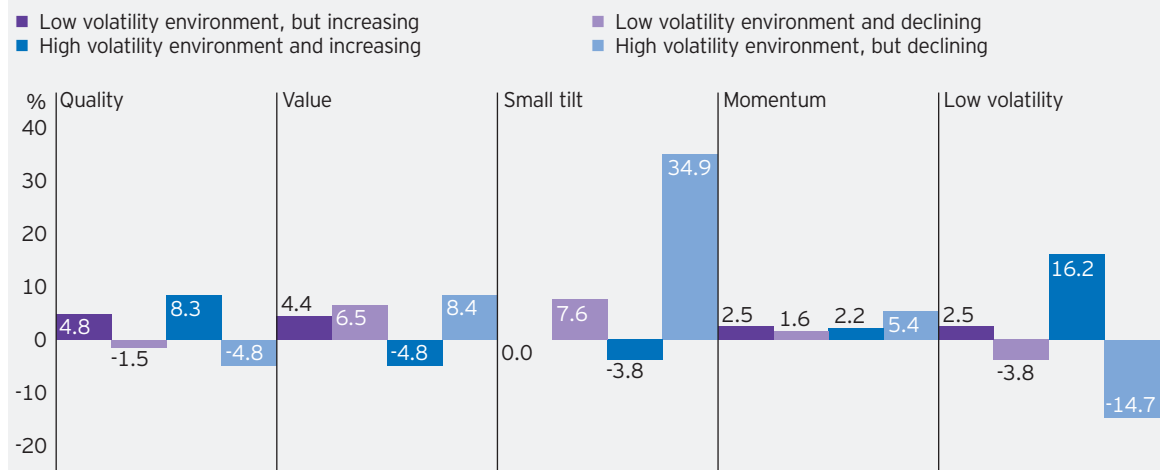


Source: FactSet Research Systems as of Dec. 31, 2016. Past performance does not guarantee future results. An investment cannot be made directly into an index. Index returns do not reflect any fees, expenses or sales charges.

**3 Volatility environment.** Our research found that low volatility and quality stocks performed best when volatility was high and increasing, while value-oriented and small-tilt stocks performed well when volatility was declining. **Figure 12** depicts factor performance in various volatility environments, as measured by the CBOE Volatility Index® (VIX®) – a measure of near-term volatility expectations.

**Figure 12: Low volatility stocks led when volatility rose, while value and small-tilt stocks led when volatility fell**

Annualized excess return over the S&P 500 Index by factor, based on the level and direction of the VIX Index



Low volatility = VIX below 20, high volatility = VIX above 20. Source: FactSet Research Systems as of Dec. 31, 2016. Past performance does not guarantee future results. An investment cannot be made directly into an index. Index returns do not reflect any fees, expenses or sales charges.

### Applying smart beta to your portfolio decisions

We believe that smart beta strategies offer a stronger investment foundation than market-cap weighting by:

- Providing exposure to specific investment factors that may result in outperformance.
- Breaking the link between a stock's price and its weight in a portfolio through alternative weighting methodologies.

The wide variety of options may be daunting for some investors. We would urge investors to consider these three points:



**Diversification.** Various factors and methodologies performed differently across market and economic environments. While each strategy experienced periods of underperformance, each strategy's greatest degree and length of underperformance versus the S&P 500 and MSCI EAFE indexes occurred at different times. In addition, each strategy provided varying results across different market environments. For these reasons, we believe diversification across strategies may help mitigate the overall effect of underperformance on a portfolio.

**Figure 13** illustrates the diversification potential of factor investing by depicting the correlation of smart beta factors to each other during the testing period. (1.00 reflects perfect correlation, -1.00 reflects perfect negative correlation, and 0 reflects no correlation.) Low levels of correlation indicate that one factor outperformed or underperformed the S&P 500 Index at different times than another factor. Note the relatively low level of correlation between most of the factors studied, indicating a potential diversification benefit.

**Figure 13: Most smart beta factors exhibit low correlation with each other**  
Excess return correlation from December 1991 through December 2016

	Quality	Value	Small tilt	Momentum	Low volatility
Quality	1.00				
Value	0.52	1.00			
Small tilt	0.36	0.84	1.00		
Momentum	-0.09	-0.19	-0.21	1.00	
Low volatility	0.78	0.23	0.09	0.05	1.00

Source: FactSet Research Systems, Inc. as of Dec. 31, 2016. Correlations below 0.50 are highlighted in dark gray and represent increased diversification potential.

**Market cycles.** Commonly, investment performance is examined on a trailing basis, such as one year, three years or five years. However, we believe full market cycles provide the proper context in which to evaluate long-term performance, as opposed to snapshots in time. This is because full market cycles capture all of the ups, downs and inflection points that affect overall performance. Snapshots in time may only reflect one particular market environment (e.g., a long bull market), rather than a truly comprehensive view. In short, individuals typically don't invest in one-, three- and five-year increments, so we believe the market cycle view better represents the typical investor experience. When considered over full market cycles, smart beta strategies have exhibited strong absolute and risk-adjusted performance.

**Cost of executing smart beta strategies.** While smart beta strategies can be accessed through a variety of investment vehicles, including mutual funds, ETFs are the primary vehicles through which smart beta strategies are implemented. ETFs are designed to track underlying indexes, and there are costs involved with the tracking process. Our analysis did not include implementation or management costs. Had these costs been included, results may have varied, but we do not believe the inclusion of these costs would have materially affected the results. (See appendix for more information.)

## Conclusion

The results of our study show that smart beta strategies displayed a clear pattern of outperformance relative to the market-cap-weighted S&P 500 and MSCI EAFE indexes over more than two decades – a period that included five different market cycles and other forms of market uncertainty.

While conventional wisdom dictates that higher returns generally come with added risk, the majority of the smart beta strategies we studied outperformed their market-cap-weighted benchmark, even when adjusted for risk. This is meaningful for investors who use smart beta strategies in their core portfolios with the goal of generating excess returns.

Investors should take into account their own considerations before investing in any strategy. We encourage investors to talk to their financial advisors about their ideal exposure to any single methodology and to discuss the optimal way to combine various factors in order to pursue their objectives across market cycles.

## Appendix

### US annual returns by factor and weighting methodology

	Annual returns by factor (%)					Annual returns by weighting methodology (%)				
	Quality	Value	Small tilt	Momentum	Low volatility	Book weighted	Total dividend weighted	Equal weighted	Low volatility weighted	Sales weighted
1992	13.3	24.1	20.6	10.0	9.8	14.2	8.3	15.9	14.0	17.2
1993	6.3	19.9	19.2	25.7	10.7	14.7	12.0	14.4	13.7	18.2
1994	-1.4	-1.3	2.1	0.6	-1.2	1.1	1.8	1.1	0.7	0.6
1995	41.8	27.5	25.1	33.5	36.5	38.9	41.3	32.2	33.2	34.5
1996	27.0	16.8	16.9	28.4	17.4	23.3	22.1	19.7	19.6	23.0
1997	38.9	27.7	28.5	34.3	31.7	33.0	35.1	29.6	29.8	33.6
1998	14.6	9.8	-0.4	30.5	7.5	21.0	21.6	13.7	12.2	24.4
1999	-4.4	-0.5	12.6	35.2	-6.8	11.1	1.1	12.0	6.4	9.5
2000	23.0	24.8	10.6	1.3	21.7	2.3	15.2	9.9	13.4	6.0
2001	4.2	13.8	34.0	-2.5	2.8	-3.3	-0.9	2.8	3.5	-1.1
2002	-9.3	-21.4	-16.5	-7.1	-5.1	-23.8	-14.8	-18.0	-12.9	-21.8
2003	28.0	49.2	68.4	32.7	23.0	31.4	27.0	41.3	34.9	34.6
2004	13.6	26.0	19.9	19.4	16.9	13.7	12.4	17.4	17.7	15.0
2005	4.3	11.9	1.7	16.7	3.7	6.9	4.5	8.2	7.9	5.2
2006	17.7	21.5	19.3	8.5	19.1	18.5	21.2	16.4	17.4	18.3
2007	-3.4	-14.0	-9.1	5.1	0.6	-0.7	1.3	1.6	1.4	3.4
2008	-33.1	-50.3	-42.7	-41.3	-23.7	-40.4	-36.1	-39.5	-35.4	-40.4
2009	31.1	54.5	99.0	14.6	18.8	31.6	23.4	46.7	39.0	32.9
2010	17.7	22.2	26.9	15.6	13.1	15.0	16.3	22.2	20.0	17.7
2011	10.6	-8.0	-1.1	-1.5	13.0	-3.9	10.2	0.6	3.5	1.0
2012	13.4	22.2	21.6	17.3	11.7	22.4	13.6	17.6	16.3	19.5
2013	31.0	45.7	44.3	36.6	24.4	34.8	29.1	36.6	34.6	38.8
2014	15.5	10.5	12.6	9.9	19.5	12.9	14.4	14.5	15.0	13.8
2015	-1.4	-10.9	-6.1	3.3	5.5	-2.8	-1.7	-2.6	-0.9	-1.3
2016	14.4	23.9	23.0	2.9	11.3	18.3	16.9	14.9	13.5	13.5

Source: FactSet Research Systems as of Dec. 31, 2016. Past performance does not guarantee future results. An investment cannot be made directly into an index. Index returns do not reflect any fees, expenses or sales charges.

### International annual returns by factor and weighting methodology

	Annual returns by factor (%)					Annual returns by weighting methodology (%)				
	Quality	Value	Small tilt	Momentum	Low volatility	Book weighted	Total dividend weighted	Equal weighted	Low volatility weighted	Sales weighted
1996	20.6	17.8	14.6	26.3	19.5	7.4	-9.9	9.2	10.6	2.9
1997	-4.7	-11.4	-31.8	10.8	7.9	-1.4	-26.0	-16.0	-11.3	-5.8
1998	22.7	13.1	12.5	24.7	16.5	20.2	14.0	16.2	16.3	19.9
1999	20.6	21.4	14.9	20.7	3.5	29.6	43.9	20.8	17.0	29.7
2000	-0.4	0.3	-0.3	-24.5	7.7	-7.0	-10.6	-3.9	-0.2	-6.6
2001	-10.4	-5.8	-4.6	-10.2	-8.5	-17.9	-23.6	-14.0	-12.3	-18.3
2002	-3.2	0.6	-4.4	5.3	5.9	-12.7	-4.4	-9.4	-5.2	-11.2
2003	39.2	73.4	72.5	50.0	43.7	48.4	39.5	55.7	51.2	53.3
2004	28.3	38.6	38.1	29.9	36.7	23.4	18.8	28.3	30.0	22.8
2005	13.8	20.2	20.7	20.7	10.5	13.6	20.7	18.4	16.7	16.5
2006	33.5	29.3	27.0	36.4	37.7	28.4	13.3	27.1	30.2	28.6
2007	9.6	3.4	1.1	14.6	11.7	10.0	0.7	7.0	7.4	11.6
2008	-35.2	-36.2	-43.6	-37.0	-26.0	-44.4	-28.4	-42.6	-39.5	-44.6
2009	39.0	38.7	45.8	7.9	16.2	37.7	11.3	37.5	32.6	37.7
2010	18.2	14.0	24.5	17.7	9.8	7.2	18.4	14.8	14.7	9.1
2011	-4.7	-22.1	-11.2	-20.4	-7.9	-14.7	-11.8	-13.7	-12.3	-15.3
2012	17.6	15.3	11.1	18.4	13.6	20.0	9.5	16.8	16.0	16.4
2013	18.5	26.6	25.5	30.5	23.7	25.5	23.3	23.9	24.0	28.4
2014	-2.6	-0.5	1.6	-4.9	0.5	-4.2	-2.0	-2.1	-1.1	-5.0
2015	5.5	3.7	9.0	4.6	1.7	-2.1	11.6	3.4	3.3	-2.5
2016	-0.5	4.7	10.9	-3.3	-1.4	5.1	4.7	4.4	2.7	7.1

Source: FactSet Research Systems as of Dec. 31, 2016. Past performance does not guarantee future results. An investment cannot be made directly into an index. Index returns do not reflect any fees, expenses or sales charges.

**US equity factor and alternative weighting methodology returns by period**  
Annualized returns (%)

Period	Quality	Value	Small tilt	Momentum	Low volatility	S&P 500 Index
1 Peak to peak (7/98-3/00)	-5.9	-2.8	-1.6	30.9	-6.9	18.8
2 Trough to trough (10/98-9/02)	6.2	2.7	6.8	10.3	3.9	-4.1
3 Peak to peak (4/00-10/07)	11.7	14.9	16.9	7.8	11.8	2.1
4 Trough to trough (10/02-2/09)	-0.1	-2.1	3.5	0.1	3.2	0.3
5 Peak to present (11/07-12/16)	8.2	5.9	12.4	3.9	9.0	6.4

Period	Book value weighted	Total dividend weighted	Equal weighted	Low volatility weighted	Sales weighted	S&P 500 Index
1 Peak to peak (7/98-3/00)	9.6	3.8	7.0	2.9	7.9	18.8
2 Trough to trough (10/98-9/02)	-2.9	1.1	2.2	3.8	-0.1	-4.1
3 Peak to peak (4/00-10/07)	5.6	9.1	10.4	11.3	7.8	2.1
4 Trough to trough (10/02-2/09)	-0.8	-0.9	2.6	2.8	0.4	0.3
5 Peak to present (11/07-12/16)	6.2	6.8	8.5	8.6	7.1	6.4

Source: FactSet Research Systems as of Dec. 31, 2016. Past performance does not guarantee future results. An investment cannot be made directly into an index. Index returns do not reflect any fees, expenses or sales charges.

**International factor and alternative weighting methodology returns by period**  
Annualized returns (%)

Period	Quality	Value	Small tilt	Momentum	Low volatility	MSCI EAFE Index
1 Peak to peak (7/98-3/00)	15.6	17.7	15.1	11.1	0.6	16.8
2 Trough to trough (10/98-9/02)	3.4	9.7	4.9	-1.5	3.7	-5.0
3 Peak to peak (4/00-10/07)	14.0	20.2	18.0	14.8	18.8	6.3
4 Trough to trough (10/02-2/09)	9.2	10.8	9.2	11.3	13.2	4.1
5 Peak to present (11/07-12/16)	3.5	1.4	4.0	-1.6	1.9	-0.9

Period	Book value weighted	Total dividend weighted	Equal weighted	Low volatility weighted	Sales weighted	MSCI EAFE Index
1 Peak to peak (7/98-3/00)	17.6	32.6	13.7	10.1	16.5	16.8
2 Trough to trough (10/98-9/02)	-0.7	5.6	1.0	2.4	0.5	-5.0
3 Peak to peak (4/00-10/07)	10.4	5.5	13.4	14.8	11.7	6.3
4 Trough to trough (10/02-2/09)	5.6	4.6	7.3	8.2	6.2	4.1
5 Peak to present (11/07-12/16)	-0.2	2.3	1.1	1.4	-0.2	-0.9

Source: FactSet Research Systems as of Dec. 31, 2016. Past performance does not guarantee future results. An investment cannot be made directly into an index. Index returns do not reflect any fees, expenses or sales charges.

## Definitions

- The **CBOE Volatility Index®** (VIX®) is a key measure of market expectations of near-term volatility conveyed by S&P 500 stock index option prices. VIX is the ticker symbol for the Chicago Board Options Exchange (CBOE) Volatility Index, which shows the market's expectation of 30-day volatility.
- The **MSCI EAFE Index** is an unmanaged index considered representative of stocks of Europe, Australasia and the Far East.
- The **S&P 500® Index** is an unmanaged index considered representative of the US stock market.
- **Beta** is a measure of risk representing how a security is expected to respond to general market movements. For example, a beta of one means that the security is expected to move with the market. A beta of less than one means the security is expected to be less volatile than the overall market. Betas greater than one are expected to exhibit more volatility or movement than the general market.
- **Book value** is a company's total assets minus liabilities and intangible assets.
- **Return on equity** is a measure of profitability that shows how much profit a company has generated using shareholders' invested capital.

- **Smart beta** An alternative and selection index based methodology that seeks to outperform a benchmark or reduce portfolio risk, or both.
- **Standard deviation** is a measure of the dispersion of a set of data from its mean. The more spread apart the data, the higher the deviation.
- **Volatility** is the amount of fluctuation in the price of a security or portfolio over time, as measured by standard deviation.

---

## Notes

- **Risk-adjusted returns.** Risk-adjusted returns reflect risk per unit of volatility. In this paper, risk-adjusted returns were calculated by taking a strategy's total return and dividing it by annualized volatility in the form of standard deviation.
- **Strong dollar vs. weak dollar.** We define "strong dollar" and "weak dollar" as periods when the US dollar increased or decreased in value, respectively, against a basket of currencies encompassing the euro, Canadian dollar, Japanese yen, British pound, Swiss franc and Swedish krona. The performance of each smart beta strategy was measured during what were determined to be strong-dollar or weak-dollar quarters. The returns for each strategy were then averaged, compared against the benchmark index and expressed on an annualized basis.
- **Implementation and management costs.** Our analysis did not include implementation costs or management fees; however, we do not believe these would have materially affected results. The smart beta strategies tested exhibited excess returns of 2.5% on average, while we estimate these costs to be 50 basis points (.50%) or less for most ETFs. The costs to implement smart beta strategies vary by structure, methodology and provider. To determine the average fees and implementation costs for smart beta strategies, we considered ETFs categorized by Morningstar as "strategic beta" – strategic beta is another common term used for smart beta strategies. We compared the five-year annualized returns for each ETF relative to its underlying index. The difference between these returns provides a proxy for the costs associated with implementation and management of smart beta strategies. On average, ETFs in this category trailed their underlying index by 50 basis points (.50%), with less than two-thirds of the ETFs lagging their underlying index by less than 62 basis points (.62%).

---

## About risk

There are risks involved with investing in ETFs, including possible loss of money. Shares are not actively managed and are subject to risks similar to those of stocks, including those regarding short selling and margin maintenance requirements. Ordinary brokerage commissions apply. The Fund's return may not match the return of the Underlying Index.

The risks of investing in securities of foreign issuers can include fluctuations in foreign currencies, political and economic instability, and foreign taxation issues.

Stocks of small- and mid-sized companies tend to be more vulnerable to adverse developments and may be more volatile than larger, more established companies. Investments in real estate related instruments may be affected by economic, legal, or environmental factors.

**Foreign securities risk.** Foreign investments may be affected by changes in a foreign country's exchange rates, political and social instability, changes in economic or taxation policies, difficulties when enforcing obligations, decreased liquidity, and increased volatility. Foreign companies may be subject to less regulation resulting in less publicly available information about the companies.

**Market risk.** The prices of and the income generated by securities may decline in response to, among other things, investor sentiment, general economic and market conditions, regional or global instability, and currency and interest rate fluctuations.

**Small- and mid-capitalization risks.** Stocks of small- and mid-sized companies tend to be more vulnerable to adverse developments and may have little or no operating history or track record of success, and limited product lines, markets, management and financial resources. The securities of small- and mid-sized companies may be more volatile due to less market interest and less publicly available information about the issuer. They also may be illiquid or restricted as to resale, or may trade less frequently and in smaller volumes, all of which may cause difficulty when establishing or closing a position at a desirable price.

The Morningstar information contained herein is proprietary to Morningstar and/or its content providers. It may not be copied or distributed and is not warranted to be accurate, complete or timely. Neither Morningstar nor its content providers are responsible for any damages or losses arising from any use of this information.

PowerShares® is a registered trademark of Invesco PowerShares Capital Management LLC, investment adviser. Invesco PowerShares Capital Management LLC (PowerShares) and Invesco Distributors, Inc., ETF distributor, are indirect, wholly owned subsidiaries of Invesco Ltd.