Is the Low Volatility Anomaly Universal?

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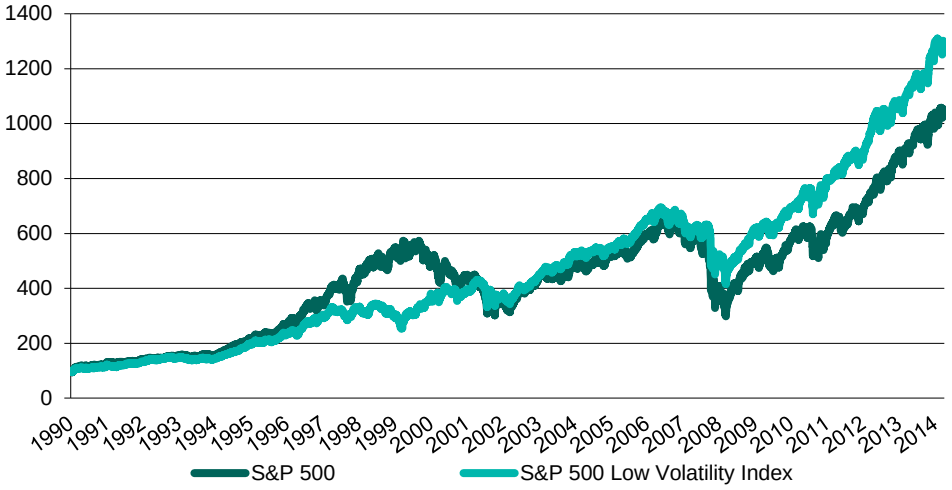
In the U.S., low volatility investing has gained immense popularity in recent years. Given the backdrop of market volatility since the financial crisis, it's not surprising to see the proliferation of new investment vehicles based on this concept and the assets that they've attracted.[1]

The low volatility phenomenon, however, is far from a new concept; academics first wrote about it more than four decades ago.[2] Low volatility is also far from foreign to the investment world; active managers have sought volatility reduction, explicitly or otherwise, for as long as there have been active managers.

In the U.S., the S&P 500® Low Volatility Index was the first passive vehicle to exploit this phenomenon systematically.[3] Since 1991, the index has outperformed the S&P 500 (see Exhibit 1). But more importantly, it has done so at a substantially lower level of volatility.

Exhibit 1: Relative Performance of the S&P 500 Low Volatility Index Versus the S&P 500



Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 1990, to March 31, 2015. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance for the S&P 500 Low Volatility Index. Please see the Performance Disclosures at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

[1] See Weisbruch, Paul, "Surveying Low-Volatility ETFs," ETF Trends, July 2013.

[2] Jensen, Michael C., Fischer Black, and Myron S. Scholes, "The Capital Asset Pricing Model: Some Empirical Tests", Studies in the theory of Capital Markets, Praeger Publishers Inc., 1972; see also Fama, Eugene F. and James D. MacBeth, "Risk, Return, and Equilibrium: Empirical Tests", *The Journal of Political Economy*, Vol. 81, No. 3. (May – Jun., 1973), pp. 607–636.

[3] The index comprises the least volatile stocks in the S&P 500, as measured by their historical standard deviation. For complete methodology see S&P Low Volatility Index Methodology.

WHY AN ANOMALY?

There are different ways to construct a low volatility portfolio, and they will, of course, produce different portfolio characteristics.[4] One common assumption of these methodologies is that **low volatility is a factor of return**, in the same sense that small size or cheap valuation are regarded as factors of return.[5] This is a difficult—indeed, anomalous—assumption, since it seems to contradict what "everyone knows" about risk and return. Anyone who studies finance learns early on that risk and reward go hand in hand and that with higher expected returns come higher risks. Therefore, low volatility portfolios, which are by definition less risky than the market average, should underperform.

Against this logical theory we have only some inconvenient facts. Exhibit 1, for example, shows that the S&P 500 Low Volatility Index outperformed the S&P 500, but it also did so with a 24% *lower* monthly standard deviation. Other examples abound. It's no wonder that academics regard "the long-term outperformance of low-risk portfolios [as] **perhaps the greatest anomaly in finance**."[6]

PERSISTENCE

The methodology underlying the S&P 500 Low Volatility Index is almost painfully simple. Based on the standard deviation of daily returns, we identify the 100 least-volatile stocks in the S&P 500 and weight them inversely to their volatility. The index is rebalanced quarterly. No quadratic formulae need apply.

This simple procedure does not require the construction of risk models or the artful use of complicated optimization routines. What it does require, however, is the conviction that **low volatility persists**. Otherwise said, the methodology assumes that the stocks which have been least volatile for the past year will continue to be of below-average volatility for at least the next quarter.

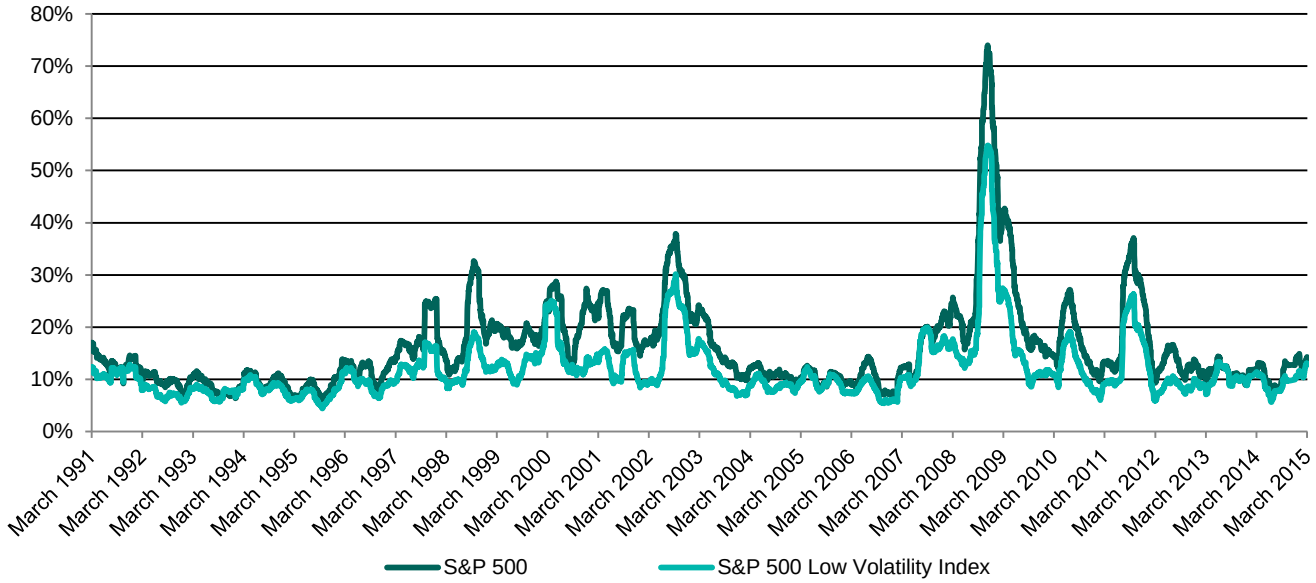
Is this assumption correct? The most obvious evidence for it is that the S&P 500 Low Volatility Index has been, over its entire history, 24% less volatile than the S&P 500. Moreover, Exhibit 2 shows that the low volatility index has been *consistently* less volatile than its parent index. When the S&P 500's volatility rises (as in 2002 or 2008), the S&P 500 Low Volatility Index has also tended to be more volatile, but its volatility is *consistently lower* than that of the S&P 500. In other words, **the evidence that low volatility persists, at least in the short to medium term, is strong**.

[4] See Soe, Aye M., "The Low-Volatility Effect: A Comprehensive Look," S&P Dow Jones Indices, Aug. 2012.

[5] Think of a "factor" as a quality or attribute with which excess returns are associated. See Fama, Eugene F. and Kenneth R. French, "Common risk factors in the returns on stocks and bonds," *Journal of Financial Economics* 33 (February 1993), pp 3-56.

[6] Baker, Malcolm, Brendan Bradley, and Jeffrey Wurgler, "Benchmarks as Limits to Arbitrage: Understanding the Low-Volatility Anomaly," *Financial Analysts Journal* 67 (2011), pp 40-54.

Exhibit 2: 60-Day Rolling Volatility for S&P 500 and S&P 500 Low Volatility Indices



Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 1990, to March 31, 2015. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance for the S&P 500 Low Volatility Index. Please see the Performance Disclosures at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

Why does this happen? It's instructive to observe how a low volatility index performs in different market environments.[7] Exhibit 3 shows the monthly performance of both the S&P 500 Low Volatility Index and the S&P 500 from 1991 through the first quarter of 2015. There were a total of 291 months in the period; the S&P 500 declined in 101 of them and rose in 190. We divided both the positive and negative months in half, which gives us an appreciation for the *magnitude* of market moves, as well as their *direction*.

For example, in the 50 months during which the S&P 500 declined the most, the S&P 500 Low Volatility Index outperformed by an average of 2.89%. Moreover, it outperformed the S&P 500 in 44 of those months, or 88% of the time. As we move down the rows of Exhibit 3, the spread between the S&P 500 Low Volatility Index and the S&P 500 diminishes, and the hit rates decline as well. In the 95 best months, the S&P 500 Low Volatility Index underperformed 82% of the time, by an average of -1.73%. Results are analogous in the smaller negative and smaller positive months.

We can therefore surmise that the **low volatility strategy attenuates the market's return, in both directions**. The S&P 500 Low Volatility Index tends to rise less than the market when the market is up, and tends to decline less than the market when the market is down—and that's why its overall volatility is lower than that of the S&P 500.

Exhibit 3: Monthly Performance in Different Market Environments (U.S. Large-Cap)

	# Months	S&P 500 (%)	S&P 500 Low Volatility Index (%)	Spread (%)	Hit Rate (%)
Largest Negatives	50	-5.77	-2.88	2.89	88
Smaller Negatives	51	-1.43	-0.62	0.81	76
Smaller Positives	95	1.39	1.24	-0.15	47
Largest Positives	95	5.11	3.38	-1.73	18

Source: S&P Dow Jones Indices LLC. Data from January 1991 through March 2015. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance for the S&P 500 Low Volatility Index. Please see the Performance Disclosures at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

[7] We've long argued that it's vital to understand how index performance can be contingent on the market environment. See Lazzara, Craig J., "The Limits of History," S&P Dow Jones Indices, Feb. 2013.

PREVALENCE

If the low volatility story ended there, it would be an interesting strategy for U.S. portfolio managers, but not much more. However, there is more to the story; applying the methodology originally developed for the S&P 500 produces **similar results in a range of other markets**. The critical elements of this methodology are simple:

- Measure volatility with daily returns over a one-year lookback period;
- Select approximately one-fifth of the stocks in the parent index as constituents of the low volatility index;
- Weight the constituents inverse to their volatility; and
- Rebalance quarterly.

As in the U.S., all regional low volatility indices must make the critical assumption that **low volatility persists**.

Exhibit 4 demonstrates that for mid- and small-cap U.S. stocks, as well as for a range of international markets, this methodology tends to produce substantial reductions in volatility relative to the parent index to which the low volatility strategy was applied. With one exception, it has also generated superior returns.

Exhibit 4: Return and Volatility Spreads Between Low Volatility Indices and Their Benchmarks

Market Segment	Compound Annual Growth Rate			Standard Deviation		
	Low Volatility (%)	Benchmark (%)	Return Difference (%)	Low Volatility (%)	Benchmark (%)	Volatility Reduction (%)
U.S. Large-Cap	11.10	10.12	0.99	11.03	14.47	-23.81
U.S. Mid-Cap	11.94	12.56	-0.62	11.74	16.77	-29.97
U.S. Small-Cap	14.20	11.65	2.56	13.49	18.84	-28.43
Developed Markets	10.51	6.73	3.79	11.79	16.35	-27.87
Emerging Markets	10.04	7.32	2.72	16.85	24.75	-31.93
Europe	8.93	4.81	4.12	15.32	15.87	-3.48
Nordic	14.36	12.93	1.43	15.71	19.30	-18.61
Pan Asia	9.87	3.51	6.35	12.49	17.54	-28.78
Canada	11.99	7.74	4.25	10.41	15.51	-32.89
Korea	18.01	9.30	8.71	26.80	30.43	-11.92

Source: S&P Dow Jones Indices LLC. Data through March 2015. Index start date varies for each asset class (see Appendix A). Standard deviations are computed by annualizing the standard deviation of monthly returns. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosures at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

Of course, it's particularly important, when comparing low volatility strategies from different markets, to be aware of the differential impact of each market environment. For example, Exhibit 4 tells us that the S&P 500 Low Volatility Index outperformed in Pan Asia by a much greater amount than in the U.S. But that could be because the Asian markets did not perform as well during our test period as the U.S. market. (Exhibit 3 demonstrates that low volatility indices tend to look relatively good in weak markets and relatively bad in strong ones.)

To exclude the possibility that the low volatility strategy's performance in Pan Asia is simply due to the relatively weak performance of the parent index, we constructed Exhibit 5, which shows the impact of the market environment on Pan Asia's low volatility strategy. Comparing Exhibits 3 and 5 shows that in Pan Asia, the low volatility strategy works almost identically to its S&P 500-based counterpart. As market conditions improve, the low volatility strategy tends to underperform. In weak markets, the low volatility strategy tends to outperform.

Exhibit 5: Monthly Performance in Different Market Environments (Pan Asia)					
	# Months	Benchmark (%)	Low Volatility Index (%)	Spread (%)	Hit Rate (%)
Largest Negatives	40	-6.81	-3.57	3.24	85
Smaller Negatives	41	-1.41	-0.16	1.25	80
Smaller Positives	52	1.70	1.89	0.20	58
Largest Positives	51	6.18	3.97	-2.21	16

Source: S&P Dow Jones Indices LLC. Data from December 1999 through March 2015. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance for the S&P Pan Asia LargeMidCap and the S&P Pan Asia Low Volatility Index. Please see the Performance Disclosures at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

In summary, wherever we've looked, **simple, rankings-based low volatility strategies have attenuated the volatility of their parent indices, typically while recording higher levels of total return**.[8] Whatever one might say about the low volatility anomaly, it is clearly not a function of the large-cap segment of the U.S. market.

ONE EXPLANATION

There are a number of (non-mutually exclusive) explanations for the existence of a low volatility effect or anomaly. Perhaps the simplest and most intuitive comes from behavioral finance, specifically from the cognitive bias that behavioral economists call the "preference for lotteries." Their argument is that no rational person would ever buy a lottery ticket, since the expected return of such a purchase is negative. But we know that billions of lottery tickets are sold all over the world every day. Why do so many people behave in a way that classical economics can only regard as completely irrational? The behavioral argument is that some people are willing to risk a known amount of money in exchange for the possibility, however slim, of a gigantic payoff.

If this happens in a game of pure chance, how does it apply to financial markets? What's the analogy to a lottery ticket in the stock market? The stock market's lottery tickets are the stocks of highly volatile, potentially untested companies. Ultimately, they may not amount to much, but one of them could be the next Apple. Some investors are willing to pay up for the chance of that sort of large reward. Where there are more lottery-like stocks, or where gambling is more culturally prevalent, there are more opportunities for investors to take those chances.

This tendency, which amounts to buying volatility for volatility's sake, drives the price of lottery-like stocks above their fair value. This means that **a portfolio that systematically excludes the most-volatile stocks**—exactly what our low volatility indices do—**is more likely to outperform over time, globally**.

[8] Appendix B applies the environmental analysis of Exhibit 3 to each of these other markets, with results that are highly similar to those we found in the S&P 500.

APPENDIX A: LOW VOLATILITY INDICES

Exhibit 6: Low Volatility Indices		
Index | # Stocks	**First Value Date (FVD)**	**Benchmark Index | # Stocks**
S&P 500 Low Volatility Index | 100	Dec. 31, 1990	S&P 500 | 500
S&P MidCap 400 Low Volatility Index | 80	Aug. 16, 1991	S&P MidCap 400 | 400
S&P SmallCap 600 Low Volatility Index | 120	Feb. 17, 1995	S&P SmallCap 600 | 600
S&P BMI International Developed Low Volatility Index | 200	June 28, 1991	S&P Developed Ex-U.S. and South Korea LargeMidCap | 1159
S&P BMI Emerging Markets Low Volatility Index | 200	Sept. 30, 1997	S&P Emerging Plus LargeMidCap | 1231
S&P Europe 350 Low Volatility Index | 100	March 31, 1998	S&P Europe 350 | 350
S&P Nordic Low Volatility Index | 30	Dec. 20, 2002	S&P Nordic BMI | 345
S&P Pan Asia Low Volatility Index | 50	Nov. 30, 1999	S&P Pan Asia LargeMidCap | 1446
S&P/TSX Composite Low Volatility Index | 50	March 31, 1997	S&P/TSX Composite | 248
S&P Korea Low Volatility Index | 50	April 21, 2000	S&P Korea BMI | 570

Source: S&P Dow Jones Indices LLC.

APPENDIX B: MONTHLY PERFORMANCE IN DIFFERENT MARKET ENVIRONMENTS

Exhibit 7: U.S. Market Performance					
Large-Cap	**# Months**	**Benchmark (%)**	**Low Volatility Index (%)**	**Spread (%)**	**Hit Rate (%)**
Largest Negatives	50	-5.77	-2.88	2.89	88
Smaller Negatives	51	-1.43	-0.62	0.81	76
Smaller Positives	95	1.39	1.24	-0.15	47
Largest Positives	95	5.11	3.38	-1.73	18
Mid-Cap					
Largest Negatives	52	-6.18	-3.39	2.79	87
Smaller Negatives	52	-1.35	-0.06	1.29	75
Smaller Positives	90	1.71	1.47	-0.24	48
Largest Positives	89	6.12	3.62	-2.50	9
Small-Cap					
Largest Negatives	44	-7.34	-4.06	3.28	98
Smaller Negatives	44	-1.75	-0.78	0.97	66
Smaller Positives	77	1.94	2.00	0.05	56
Largest Positives	76	6.61	4.45	-2.15	9

Source: S&P Dow Jones Indices LLC. Data through March 2015. Index start date varies for each asset class (see Appendix A). Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance for the S&P 500 Low Volatility Index. Please see the Performance Disclosures at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

Exhibit 8: International Market Performance					
Developed Markets	**# Months**	**Benchmark (%)**	**Low Volatility Index (%)**	**Spread (%)**	**Hit Rate (%)**
Largest Negatives	57	-6.17	-3.51	2.66	93
Smaller Negatives	58	-1.52	-0.19	1.32	84
Smaller Positives	85	1.57	1.45	-0.12	47
Largest Positives	85	5.74	3.96	-1.78	19
Emerging Markets					
Largest Negatives	43	-9.67	-6.10	3.57	93
Smaller Negatives	44	-1.66	-0.31	1.35	80
Smaller Positives	62	2.12	1.95	-0.17	47
Largest Positives	61	8.62	5.59	-3.03	11
Europe					
Largest Negatives	42	-6.37	-3.65	2.72	79
Smaller Negatives	42	-1.19	-0.58	0.61	69
Smaller Positives	60	1.72	1.93	0.20	60
Largest Positives	60	5.20	3.59	-1.61	33
Nordic					
Largest Negatives	28	-6.95	-5.06	1.89	79
Smaller Negatives	29	-0.77	0.15	0.92	76
Smaller Positives	45	1.66	1.91	0.25	60
Largest Positives	45	6.88	5.02	-1.86	16
Pan Asia					
Largest Negatives	40	-6.81	-3.57	3.24	85
Smaller Negatives	41	-1.41	-0.16	1.25	80
Smaller Positives	52	1.70	1.89	0.20	58
Largest Positives	51	6.18	3.97	-2.21	16
Single Country					
Canada	**# Months**	**Benchmark (%)**	**Low Volatility Index (%)**	**Spread (%)**	**Hit Rate (%)**
Largest Negatives	40	-6.27	-2.69	3.58	95
Smaller Negatives	41	-1.15	0.75	1.90	88
Smaller Positives	68	1.56	1.66	0.10	62
Largest Positives	67	5.13	2.57	-2.57	7
South Korea					
Largest Negatives	38	-10.81	-8.12	2.69	82
Smaller Negatives	39	-2.52	-1.57	0.95	64
Smaller Positives	51	2.53	2.73	0.20	59
Largest Positives	51	11.17	10.15	-1.01	39

Source: S&P Dow Jones Indices. Data through March 2015. Index start date varies for each asset class (see Appendix A). Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosures at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

ABOUT S&P DOW JONES INDICES

S&P Dow Jones Indices LLC, a part of McGraw Hill Financial, Inc., is the world's largest, global resource for index-based concepts, data and research. Home to iconic financial market indicators, such as the S&P 500® and the Dow Jones Industrial Average™, S&P Dow Jones Indices LLC has over 115 years of experience constructing innovative and transparent solutions that fulfill the needs of institutional and retail investors. More assets are invested in products based upon our indices than any other provider in the world. With over 1,000,000 indices covering a wide range of assets classes across the globe, S&P Dow Jones Indices LLC defines the way investors measure and trade the markets. To learn more about our company, please visit www.spdji.com.

PERFORMANCE DISCLOSURES

For some of the charts and graphs discussed in this paper, the asset classes noted were represented by the following indices: U.S. Large Cap is represented by the S&P 500®, U.S. Mid Cap is represented by the S&P MidCap® 400, U.S. Small Cap is represented by the S&P SmallCap® 600, Developed Markets are represented by the S&P Developed Ex-U.S. BMI and the S&P South Korea LargeMidCap, Emerging Markets are represented by the S&P Emerging Plus LargeMidCap, Europe is represented by the S&P Europe 350®, Nordic is represented by the S&P Nordic BMI, Pan Asia is represented by the S&P Pan Asia LargeMidCap, Canada is represented by the S&P/TSX Composite and Korea is represented by the S&P Korea BMI.

The launch date of the S&P 500 Low Volatility Index is April 4, 2011. The launch date of the the S&P MidCap 400 Low Volatility Index and the S&P SmallCap 600 Low Volatility Index is September 24, 2012. The launch date of the S&P BMI International Developed Low Volatility Index, the S&P BMI Emerging Markets Low Volatility Index, and the S&P South Korea LargeMidCap is December 5, 2011. The launch date of the S&P Emerging Plus LargeMidCap is December 31, 2003. The launch date of the S&P Developed Ex-U.S. BMI is December 31, 1992. The launch date of the S&P Europe 350 Low Volatility Index is July 9, 2012. The launch date of the S&P Nordic Low Volatility Index is May 17, 2013.The launch date of the S&P Pan Asia Low Volatility Index is November 19, 2012. The launch date of the S&P/TSX Composite Low Volatility Index is April 10, 2012. The launch date of the S&P Korea Low Volatility Index is May 8, 2013.

S&P Dow Jones Indices defines various dates to assist our clients in providing transparency on their products. 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 Web site 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.

Another limitation of using back-tested information is that the back-tested calculation is generally prepared with the benefit of hindsight. Back-tested 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 (or 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.

Additionally, it is not possible to invest directly in an Index. The Index returns shown do not represent the results of actual trading of investable assets/securities. S&P Dow Jones Indices maintains the Index and calculates the Index levels and performance shown or discussed, but does not manage actual assets. Index returns do not reflect payment of any sales charges or fees an investor may pay to purchase the securities underlying the Index or investment funds that are intended to track the performance of the Index. The imposition of these fees and charges would cause actual and back-tested performance of the securities/fund to be lower than the Index performance shown. For example, if an index returned 10% on a US $100,000 investment for a 12-month period (or US$ 10,000) and an actual asset-based fee of 1.5% was imposed at the end of the period on the investment plus accrued interest (or US$ 1,650), the net return would be 8.35% (or US$ 8,350) for the year. Over a three-year period, an annual 1.5% fee taken at year end with an assumed 10% return per year would result in a cumulative gross return of 33.10%, a total fee of US$ 5,375, and a cumulative net return of 27.2% (or US$ 27,200).

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