Low Volatility and High Beta: A Study in Backtest Integrity

“The past is never dead. It’s not even past.”

– William Faulkner

EXECUTIVE SUMMARY

- In April 2011, S&P Dow Jones Indices launched the S&P 500® Low Volatility Index (Low Volatility) and the S&P 500 High Beta Index (High Beta). Their recent 10th “birthday” allows us to compare the backtested performance with which they were introduced with actual live performance.
- Low volatility and high beta strategies are designed to access specific patterns of returns relative to the market. Low volatility should attenuate the market’s returns (in both directions), while high beta should amplify them.
- The actual performance of both Low Volatility and High Beta has been consistent with these expectations.

Exhibit 1: Two Strategies Delivered Comparable Returns via Different Paths

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 1990, to June 30, 2021. Past performance is no guarantee of future results. Charts are provided for illustrative purposes and reflect hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with backtested performance.
INTRODUCTION

The 10th anniversary of the launch of the S&P 500 Low Volatility Index\(^1\) and S&P 500 High Beta Index\(^2\) holds more than just commemorative significance. The milestone is also an opportunity to compare the live performance of each index to its backtested history.

Between January 1991 and June 2021, Low Volatility outperformed the S&P 500 with lower risk, while High Beta underperformed with higher risk. Return margins were slim in both cases. But this period is a combination of backtested (January 1991 through March 2011) and live (April 2011 through June 2021) history. Has live performance confirmed what the backtest suggested? The 10+ years of live performance will let us make assessments about whether the indices achieved their stated goals, whether their behavior in the live period was consistent with their behavior in the backtested period, and whether environments in the backtested period and the live period were consistent with each other.

GOALS AND ACHIEVEMENTS

Before comparing track records, it is important to define what success looks like for strategies like low volatility and high beta. Low volatility strategies are designed to attenuate, and high beta strategies to amplify, the market’s performance. Those are their explicit goals and the indices, regardless of market environment, should perform consistently with those goals. This means, for example, that in a strongly rising market, Low Volatility should be expected to underperform; analogously, in a falling market High Beta should be expected to underperform. To an unusual degree, the expected relative performance of both strategies is highly dependent on the market’s performance.

Backtested performance is often, and rightly, viewed with a healthy dose of skepticism. Live history, however, can also be deceiving, especially if it does not reflect the full range of possible market environments.\(^3\) This is particularly true for strategies like low volatility and high beta that explicitly seek to provide a specific risk profile, and therefore result in a pattern of relative returns.

Exhibit 2 shows the history of the S&P 500 from January 1991 through June 2021. The vertical green line marks the division between backtest and live periods of the history of Low Volatility and High Beta. An immediate observation is that the two periods present very different market environments in the backtested period and the live period were consistent with each other.

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\(^1\) The S&P 500 Low Volatility Index is designed to reflect the performance of the 100 stocks in the S&P 500 with the lowest historical standard deviation of returns.

\(^2\) The S&P 500 High Beta Index is designed to reflect the performance of the 100 stocks in the S&P 500 that are most sensitive to changes in market returns.

environments. The backtest period encompassed two sustained market drawdowns: the bursting of the technology bubble after 2000 and the global financial crisis of 2007-2009. Both were long-lasting and substantial declines; the S&P 500 lost approximately one-half its value in each period.

Exhibit 2: Performance History of Low Volatility and High Beta Can Be Viewed in Two Parts – Backtested and Live

In the backtest period, unsurprisingly, Low Volatility and High Beta delivered on their stated goals. Exhibit 3 shows that the volatility of Low Volatility in the backtest was 11.4%, a 24% reduction compared with the S&P 500’s 15.0%. Similarly, the beta of High Beta was 1.76, which qualifies as “high” by anyone’s definition.

The S&P 500 gained 9.33% during this period. Low Volatility outperformed the benchmark by 0.90% annually, despite its lower volatility. Academics have cited this surprising combination of lower relative risk with higher relative return as perhaps “the greatest anomaly in finance.”


INDEX INVESTMENT STRATEGY

For use with institutions only, not for use with retail investors.
Exhibit 3: Both Low Volatility and High Beta Outperformed in the Backtest Period

Source: S&P Dow Jones Indices LLC. Data from Dec. 21, 1990, to March 31, 2011. Past performance is no guarantee of future results. Charts are provided for illustrative purposes and reflect hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with backtested performance.

Exhibit 4 presents data for the live performance period; before considering Low Volatility and High Beta, it is important to observe the market environment. In the backtest period, the S&P 500’s compound return was 9.33% annually, with 15.0% volatility, for a return/risk ratio of 0.62. In the live period, the S&P 500 rose 14.59%, with 13.4% volatility and a return/risk ratio of 1.09. The live period, in other words, was a substantially more favorable environment in which to bear equity risk.

That said, in the live performance period, Low Volatility underperformed the S&P 500 but still achieved its risk reduction goal. High Beta, surprisingly, underperformed with significantly higher risk levels.

Exhibit 4: Both Low Volatility and High Beta Underperformed in the Live Period

Source: S&P Dow Jones Indices LLC. Data from March 31, 2011, to June 30, 2021. Past performance is no guarantee of future results. Charts are provided for illustrative purposes and reflect hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with backtested performance.

There was clearly a contrast in outcome between the backtest and live windows. This raises the obvious question of whether the two strategies behaved differently in the two periods.
BREAKING DOWN PERFORMANCE PATTERNS

In rising markets, a low volatility index should lag its benchmark; in falling markets, it should decline less. A plot of the relative performance of Low Volatility against the performance of the S&P 500 should slope downward, with the reverse expected of High Beta. In Exhibit 5, we have separated the backtest and live periods for both indices. The relationships for Low Volatility and High Beta exhibited the same patterns in both periods.

Exhibit 5a: Relative Performance of Low Volatility Had a Strong Inverse Relationship with the Performance of the Benchmark, Regardless of Market Environment

Exhibit 5b: The Opposite Was True of the Relative Performance of High Beta

The relationships for low volatility and high beta exhibited the same patterns in the live and backtest periods.
Sorting the months in Exhibit 5 into different market environments offers more insight into the magnitude of Low Volatility and High Beta’s relative performance. We first separate the months in our data into positive or negative categories, depending on the performance of the S&P 500. We then divide each category in half, producing four distinct market environments: large declines, moderate declines, moderate gains, and large gains. Separating backtest and live periods lets us see if their behavior patterns were consistent.

Exhibit 6a: Relative Performance for Low Volatility Was Consistent in Backtest and Live Periods

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 1990, to June 30, 2021. Past performance is no guarantee of future results. Charts are provided for illustrative purposes and reflect hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with backtested performance.

The spreads in the top half of each time period in the chart represent the magnitude by which Low Volatility out- or underperformed. The hit rate in the bottom half of the chart shows the frequency with which Low Volatility out- or underperformed. In both periods, Low Volatility’s behavior was the same.
outperformed by the most in the worst market environments and, monotonically, its performance differentials declined as the market environments improved. Hit rates followed a similar pattern. Low Volatility outperformed most often in the worst market environments and the frequency of outperformance declined monotonically as market environments improved.

**Exhibit 6b: Relative Performances for High Beta Were Also Consistent in Backtest and Live Periods**

**High Beta Backtest**
(January 1991-March 2011)

<table>
<thead>
<tr>
<th>Spread (%)</th>
<th>High Beta Index</th>
<th>Benchmark</th>
<th>Spread</th>
</tr>
</thead>
<tbody>
<tr>
<td>-4.78%</td>
<td>-10.79%</td>
<td>-6.01%</td>
<td>-1.72%</td>
</tr>
<tr>
<td>-3.53%</td>
<td>-9.11%</td>
<td>-5.58%</td>
<td>0.06%</td>
</tr>
</tbody>
</table>

**Hit Rate (%)**

- Biggest Declines: Less than -2.51%
  - 43 months
- Moderate Declines: Between 0 and -2.51%
  - 41 months
- Moderate Gains: Between 0 and 2.58%
  - 77 months
- Biggest Gains: Greater than 2.58%
  - 82 months

**High Beta Live**
(April 2011-June 2021)

<table>
<thead>
<tr>
<th>Spread (%)</th>
<th>High Beta Index</th>
<th>Benchmark</th>
<th>Spread</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3.53%</td>
<td>-9.11%</td>
<td>-5.58%</td>
<td>-1.66%</td>
</tr>
<tr>
<td>3.41%</td>
<td>8.55%</td>
<td>5.14%</td>
<td>3.41%</td>
</tr>
</tbody>
</table>

**Hit Rate (%)**

- Biggest Declines: Less than -2.51%
  - 17 months
- Moderate Declines: Between 0 and -2.51%
  - 19 months
- Moderate Gains: Between 0 and 2.58%
  - 47 months
- Biggest Gains: Greater than 2.58%
  - 41 months

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 1990, to June 30, 2021. Past performance is no guarantee of future results. Charts are provided for illustrative purposes and reflect hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with backtested performance.

High Beta’s performance differentials were almost the mirror image of Low Volatility’s and, again, consistent in backtest and live periods. The index underperformed by the most in the worst months and improved monotonically as the market environment improved, with its best relative performance concentrated in the months with the biggest gains.
DISPARITIES IN MARKET DYNAMICS

Another observation we can make from Exhibits 6a and 6b is that for both Low Volatility and High Beta, performance spreads were smaller in the live period than in the backtest period. That is because dispersion was lower in the backtest period compared to the live period.

Dispersion measures the degree of stock returns’ variability in a given market.\(^5\) The higher dispersion is, the greater the opportunity for difference between the returns of a capitalization-weighted index and the returns of factor indices such as Low Volatility and High Beta.\(^6\)

Weak markets tend to occur in times of relatively high volatility, and high volatility is typically associated with high dispersion.\(^7\) One notable difference between the backtest period and the live period is that dispersion was significantly lower in the latter.

The average monthly dispersion in the S&P 500 from January 1991 through March 2011 was 25.4%, much higher than the 19.8% in the period from April 2011 through June 2021 (see Exhibit 7). This means that the magnitude of performance spreads was more constrained in the live period than the backtest period.

Exhibit 7: Average Dispersion Level for the S&P 500 Was Higher in the Backtest Period than the Live History Performance

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CONCLUSION

Subject to market constraints, Low Volatility and High Beta behaved exactly as they were designed to behave. While both indices outperformed in the backtest period and underperformed in the live period, the two periods were significantly different market environments. The backtest period between January 1991 and March 2011 contained two major market crises—the rupture of the technology bubble and the global financial crisis of 2008—complete with aftermaths that took years for the market to digest. Since then, the U.S. equity market, aside from the short-lived COVID-19 ripple, has not experienced a sustained trauma. In the proper context, the performances of Low Volatility and High Beta were in line with defined goals.
PERFORMANCE DISCLOSURE/BACKTESTED DATA

The S&P 500 Low Volatility Index and S&P 500 High Beta Index were launched April 4, 2011. All information presented prior to an index’s Launch Date is hypothetical (backtested), not actual performance. The back-test calculations are based on the same methodology that was in effect on the index Launch Date. However, when creating backtested history for periods of market anomalies or other periods that do not reflect the general current market environment, index methodology rules may be relaxed to capture a large enough universe of securities to simulate the target market the index is designed to measure or strategy the index is designed to capture. For example, market capitalization and liquidity thresholds may be reduced. Complete index methodology details are available at www.spglobal.com/sdji. Past performance of the Index is not an indication of future results. Backtested performance reflects application of an index methodology and selection of index constituents with the benefit of hindsight and knowledge of factors that may have positively affected its performance, cannot account for all financial risk that may affect results and may be considered to reflect survivor/look ahead bias. Actual returns may differ significantly from, and be lower than, backtested returns. Past performance is not an indication or guarantee of future results. Please refer to the methodology for the Index 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. Backtested performance is for use with institutions only; not for use with retail investors.

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 backtested) for a given index. The Base Date is the date at which the index is set to a fixed value for calculation purposes. The Launch Date designates the date when 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 backtested. 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 data feed 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.

Typically, when S&P DJI creates backtested index data, S&P DJI uses actual historical constituent-level data (e.g., historical price, market capitalization, and corporate action data) in its calculations. As ESG investing is still in early stages of development, certain datapoints used to calculate S&P DJI’s ESG indices may not be available for the entire desired period of backtested history. The same data availability issue could be true for other indices as well. In cases when actual data is not available for all relevant historical periods, S&P DJI may employ a process of using “Backward Data Assumption” (or pulling back) of ESG data for the calculation of backtested historical performance. “Backward Data Assumption” is a process that applies the earliest actual live data point available for an index constituent company to all prior historical instances in the index performance. For example, Backward Data Assumption inherently assumes that companies currently not involved in a specific business activity (also known as “product involvement”) were never involved historically and similarly also assumes that companies currently involved in a specific business activity were involved historically too. The Backward Data Assumption allows the hypothetical back-test to be extended over more historical years than would be feasible using only actual data. For more information on “Backward Data Assumption” please refer to the FAQ. The methodology and factsheets of any index that employs backward assumption in the backtested history will explicitly state so. The methodology will include an Appendix with a table setting forth the specific data points and relevant time period for which backward projected data was used.

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