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S&P 500[®] Bond Index Sector Rotation Strategies

INTRODUCTION

At the heart of sector rotation strategies lay trend-following relative strength signals, which select the best-performing sectors over a specified period of time. The concept of trend-following as an investment strategy can be traced back to practitioners from more than a century ago. Since the 1990s, there has been increased attention from academics and practitioners, resulting in a wealth of empirical work being published on the subject.¹ The effectiveness of the strategy in consistently generating positive excess returns over relevant market benchmarks has been well documented for many asset classes, including commodities, equities, and foreign exchange strategies.² More recently, these types of factor strategies have been proposed in fixed income and empirical work focusing on particular asset types has appeared, such as the cross-sectional ranking of 10-year government bonds.³

The concept of trend-following as an investment strategy can be traced back to practitioners more than a century ago.

Broadly, trend-following strategies generally take on two forms. “Absolute momentum” is based on the price trend of a single asset, typically in the form of holding long the asset when price appreciation is signaled and holding short otherwise. “Relative momentum” or “relative strength” is based on a cross-sectional analysis of multiple asset price series, in which each asset is scored and ranked in terms of expected performance. One simple example of the former is to use 12-month price returns as the trading signal; on each rebalance day, if the asset shows a positive 12-month trailing return, the investor would buy the asset, otherwise, they would short sell the asset (or hold Libor).

The same signals used in the single asset strategies can be used to rank a universe of assets in relation to one another. Assets with the highest historical returns, for example, are preferred over those with the lowest returns. One example of a relative strength fixed income strategy is to select from 10-year government bonds from the G10 countries, and hold a

¹ Jegadeesh, Narasimhan and Sheridan Titman, “Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency,” *The Journal of Finance*, Vol. 48, No. 1, March 1993, pp. 65-91.

² Blitz, David and Pim Van Vliet, “Global Tactical Cross-Asset Allocation: Applying Value and Momentum Across Asset Classes,” *Journal of Portfolio Management*, Fall 2008, pp. 23-28.

³ Asness, Clifford S., Tobias J. Moskowitz, and Lasse Heje Pedersen, “Value and Momentum Everywhere,” *The Journal of Finance*, Vol. 68, No. 3, June 2013, pp. 929-986.

long position in the three 10-year government bonds with the highest 12-month returns and a short position in the three 10-year government bonds with the lowest 12-month returns.

In this paper, we examine a stylized sector rotation framework using a relative strength signal, which selects from industry sectors of the [S&P 500 Bond Index](#). We specify a simple prototype model that produces a score for each of the 10 industry sectors of the index based on historical price changes. The score is used to rank the sectors in relative terms of expected performance over the following month. The portfolio takes long positions in the top three ranking sectors. We compare the performance of this hypothetical portfolio with the headline S&P 500 Bond Index, which consists of long positions in all 10 industry sectors.

METHODOLOGY

Our goal in this first implementation is to demonstrate that applying a relative strategy for industry sector rotation may be successful in delivering higher returns than the S&P 500 Bond Index. Having specified the type of strategy (cross-sectional) and the investment universe (the sectors of the S&P 500 Bond Index), we choose a simple prototype model (period return) to score each of the 10 sectors according to the clean price return indices.

A sector rotation strategy can take on a number of forms.

A sector rotation strategy can take on a number of forms, depending on a number of input decisions that range from the lookback window used to calculate period return, rebalance frequency, number of best-performing sectors to invest in, as well as long only versus long/short. In our analysis, we found that the approach is fairly robust across subsample periods and the various choices for parameters available.

We focused on a model lookback window of three months in which the portfolio is rebalanced on a monthly basis and holds long the three best-performing sectors. We test the strategy using three weighting mechanisms – market cap weighting, equal weighting, momentum score weighting.

Absent turnover concerns, the portfolio will likely better capture turning points if the rebalance frequency is high and the lookback window is short. The tradeoff is that this approach will misidentify short-term jitters for turning points. By the same token, a longer holding period between rebalances may miss turning points at times and result in larger drawdowns. Monthly rebalancing seems to be a natural choice; it matches the rebalance frequency of the underlying indices and provides a sufficient holding period to reduce turnover while allowing the flexibility to capture sudden trends

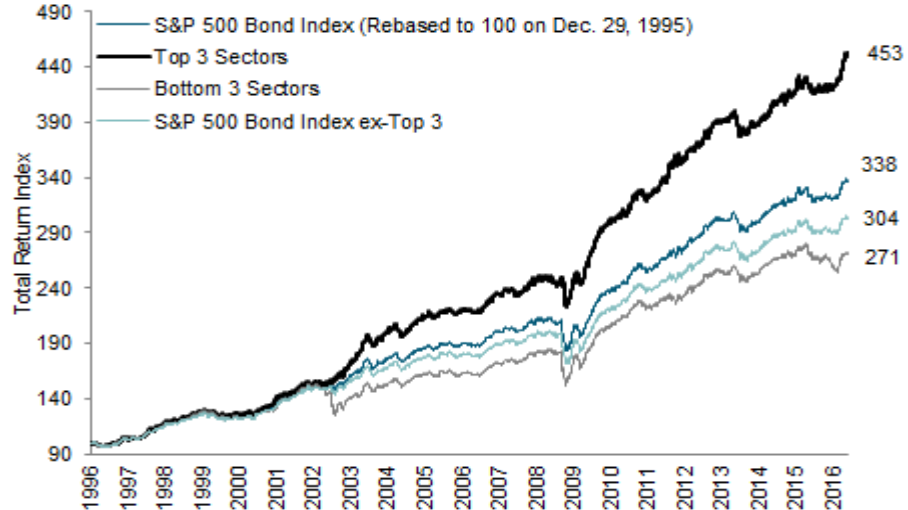
The analysis was conducted using daily time series data from the index base date of Dec. 30, 1994, through May 30, 2016.

PERFORMANCE

Our simple approach of selecting the three best performers among the 10 S&P 500 Bond Index sectors, based on their three-month returns at each monthly rebalance date, resulted in a cumulative outperformance of 26.4% over the past 20 years (1.3% annualized). Exhibits 1 and 2 show the total return and clean price return performance of the top three, bottom three, and baseline index of all 10 sectors.

Exhibit 1: Total Return Performance

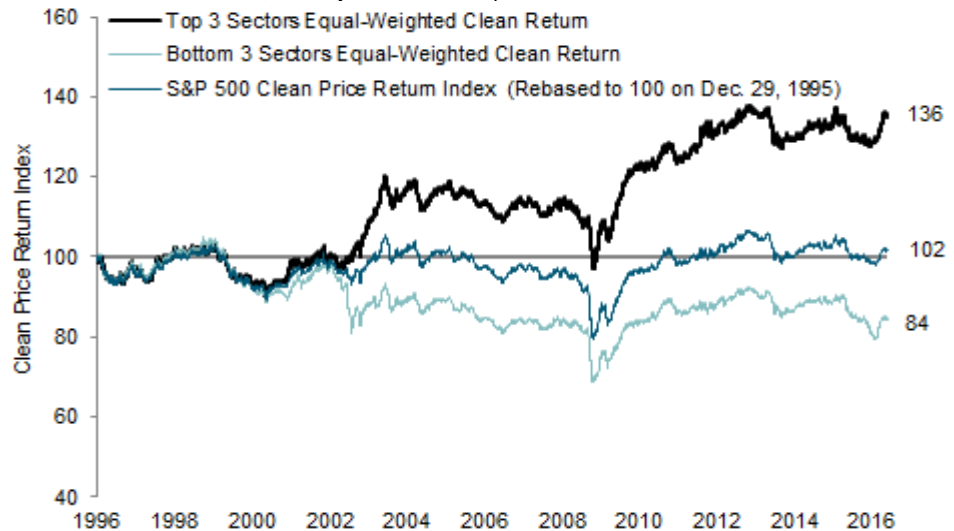
3-Month Lookback Window, Monthly Rebalance, Top 3 Sectors



Source: S&P Dow Jones Indices LLC. Data from December 1995 to May 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. Chart includes data from hypothetical portfolios.

Exhibit 2: Clean Price Return Performance

3-Month Lookback Window, Monthly Rebalance, Top 3 Sectors

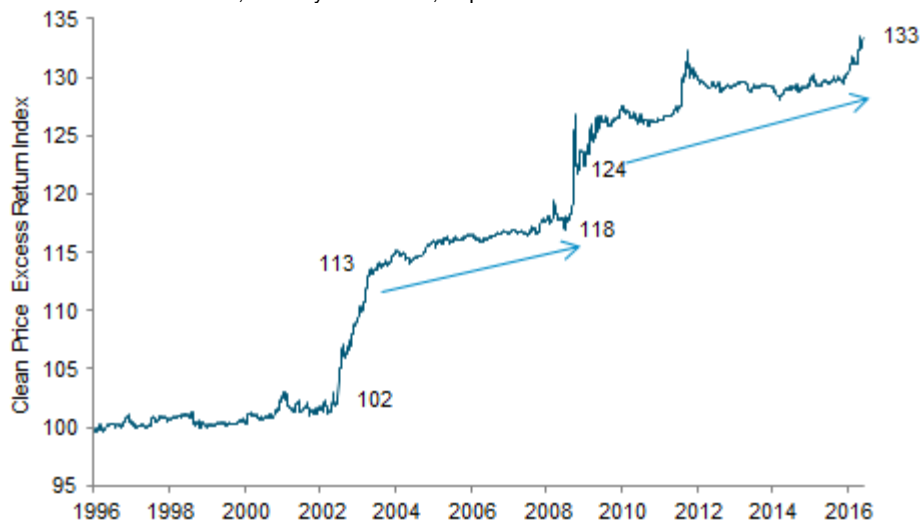


Source: S&P Dow Jones Indices LLC. Data from December 1995 to May 2016. Index performance based on total return in USD. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance. Chart includes data from hypothetical portfolios.

Our simple approach of selecting the three best performers among the 10 S&P 500 Bond Index sectors resulted in a cumulative outperformance of 26.4% over the past 20 years (1.3% annualized).

Exhibit 3: Clean Price Return Outperformance of Strategy Versus the S&P 500 Bond Index

3-Month Lookback Window, Monthly Rebalance, Top 3 Sectors



Source: S&P Dow Jones Indices LLC. Data from December 1995 to May 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. Chart includes data from hypothetical portfolios.

Although a bulk of the outperformance seems to occur over periods of acute stress, the strategy does steadily provide marginal gains during calm markets.

Although a bulk of the outperformance seems to occur over periods of acute stress, the strategy illustrates steady marginal gains during calm markets. Exhibit 3 shows the excess return of the clean price index of the strategy over the benchmark. For example, in the five-year period between the dot-com market crash and the 2008 crisis, the strategy produced an annualized excess return of about 1%.

Exhibit 4: Performance

| PERIOD | BENCHMARK | STRATEGY | | |
|------------|------------------------|-------------------|------------------|------------------|
| | S&P 500 BOND INDEX (%) | MARKET WEIGHT (%) | EQUAL WEIGHT (%) | SCORE WEIGHT (%) |
| 1-Month | -0.1 | -0.1 | -0.1 | -0.1 |
| 3-Month | 1.4 | 3.3 | 3.1 | 3.5 |
| 6-Month | 4.9 | 6.7 | 6.8 | 6.9 |
| 9-Month | 4.4 | 7.4 | 7.4 | 7.6 |
| 1-Year | 5.0 | 7.8 | 8.0 | 8.1 |
| 2-Year | 3.4 | 6.7 | 6.5 | 6.9 |
| 3-Year | 8.4 | 12.6 | 12.3 | 12.9 |
| 5-Year | 28 | 36 | 35 | 37 |
| 10-Year | 79 | 108 | 109 | 109 |
| 12-Year | 92 | 126 | 127 | 128 |
| 15-Year | 141 | 215 | 224 | 219 |
| 20-Year | 249 | 367 | 376 | 372 |
| Annualized | 6.44 | 8.01 | 8.11 | 8.07 |

Source: S&P Dow Jones Indices LLC. Data as of May 31, 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. Table includes data from hypothetical portfolios.

Exhibit 5: Performance Analysis—Best-Worst Monthly Return

| ANALYSIS | BENCHMARK | STRATEGY | | |
|--------------|------------------------|----------------------|----------------------|----------------------|
| | S&P 500 BOND INDEX (%) | MARKET WEIGHT (%) | EQUAL WEIGHT (%) | SCORE WEIGHT (%) |
| Best | 7.2 in December 2008 | 6.4 in December 2008 | 6.4 in December 2008 | 6.4 in December 2008 |
| Second Best | 3.9 in July 1997 | 5.6 in July 1997 | 4.8 in July 1997 | 5.6 in July 1997 |
| Third Best | 3.7 in July 2009 | 4.4 in April 2009 | 4.7 in November 2008 | 4.6 in April 2009 |
| Third Worst | -3.9 in July 2003 | -2.9 in April 2004 | -3.0 in April 2004 | -2.9 in April 2004 |
| Second Worst | -5.4 in October 2008 | -3.4 in July 2003 | -3.4 in July 2003 | -3.4 in July 2003 |
| Worst | -7.7 in September 2008 | -7.6 in October 2008 | -7.9 in October 2008 | -7.7 in October 2008 |

Source: S&P Dow Jones Indices LLC. Data from January 1996 to May 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. Table includes data from hypothetical portfolios.

These results are shown absent of transaction costs and presented to help guide our understanding of the choices for each input.

Exhibit 6: Tracking Indicators 5-Year Horizon

| INDICATORS | BENCHMARK | STRATEGY | | |
|--|------------------------|-------------------|------------------|------------------|
| | S&P 500 BOND INDEX (%) | MARKET WEIGHT (%) | EQUAL WEIGHT (%) | SCORE WEIGHT (%) |
| Alpha | 0.00 | 0.10 | 0.08 | 0.11 |
| Beta | 100 | 99 | 104 | 100 |
| Correlation | 100 | 92 | 94 | 92 |
| R-Squared | 100 | 85 | 88 | 85 |
| Volatility (Sample Standard Deviation, Annualized) | 3.90 | 4.20 | 4.32 | 4.23 |
| Mean Excess Monthly Return | N/A | 0.10 | 0.09 | 0.11 |
| Monthly Tracking Error | N/A | 0.46 | 0.44 | 0.47 |
| Sharpe Ratio (Excess Over Investment-Grade Index) | N/A | 0.31 | 0.26 | 0.33 |

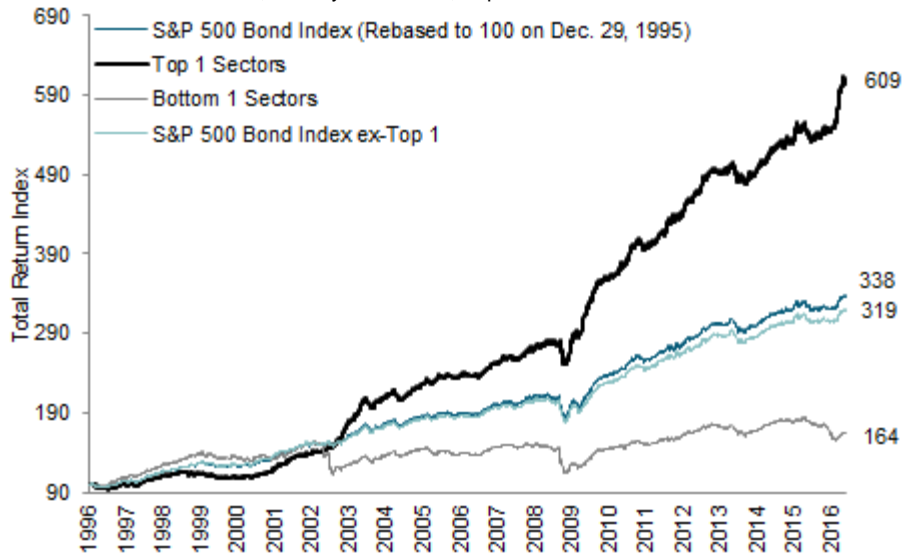
Source: S&P Dow Jones Indices LLC. Data from May 2011 to May 2016. Index performance based on total return in USD. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance. Table includes data from hypothetical portfolios.

PERFORMANCE IN VARIOUS MARKET CONDITIONS

In this section, we further decompose the strategy returns during various market conditions over the 20-year period ending May 2016 and analyze the risk/return tradeoff stemming from various rebalancing frequencies and lookback periods. It is important to note that the results are shown absent of transaction costs and presented to help guide our understanding of the choices for each input.

Exhibits 7 and 8 show the strategy using a weekly rebalancing frequency while selecting the top-performing sector over a one-month period.

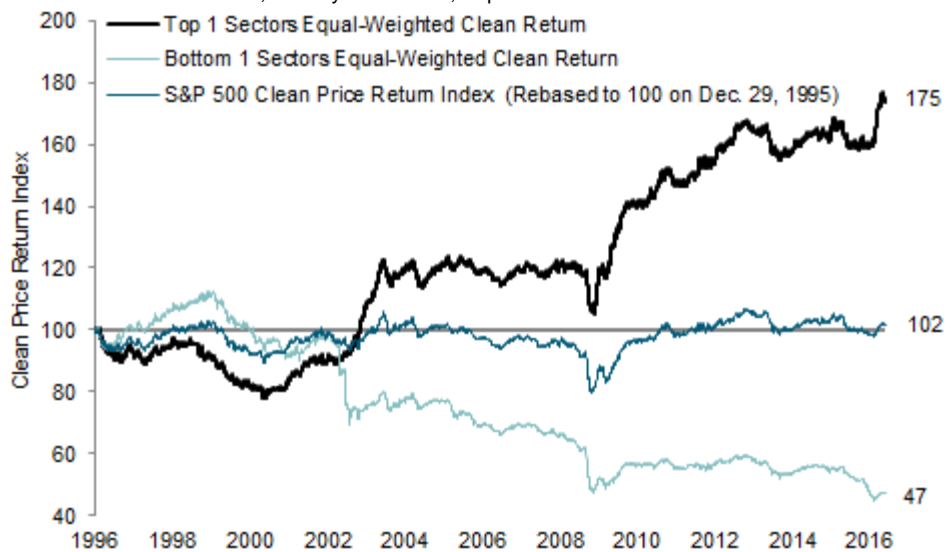
Exhibit 7: Total Return Performance,
1-Month Lookback Window, Weekly Rebalance, Top 1 Sector



In the bull market of the late 1990s, the strategy underperformed the index

Source: S&P Dow Jones Indices LLC. Data from December 1995 to May 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. Chart includes data from hypothetical portfolios.

Exhibit 8: Clean Price Return Performance,
1-Month Lookback Window, Weekly Rebalance, Top 1 Sector

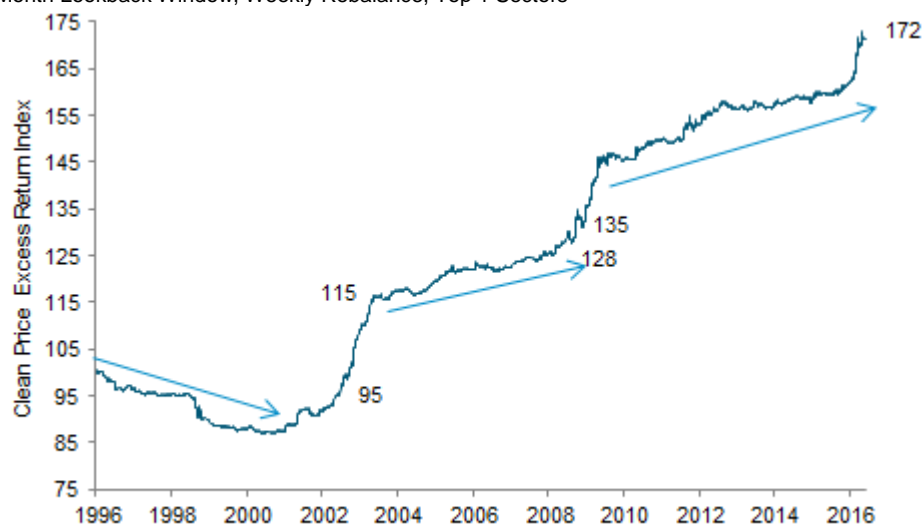


Source: S&P Dow Jones Indices LLC. Data from December 1995 to May 2016. Index performance based on price return in USD. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance. Chart includes data from hypothetical portfolios.

Over the 20-year period studied, this strategy outperformed the [S&P 500 Bond Index](#) by 61.9% (3% annualized outperformance). Exhibit 7 also illustrates that the worst-performing sector (contrarian/mean reversion) underperformed the broader index. Exhibit 8 shows the clean price return of the rotation strategy and illustrates two interesting points about trend-following strategies in fixed income. In the bull market of the late 1990s,

the strategy underperformed the index. In fact, the rank order for the sectors was inversely related to performance in this period, suggesting that bond markets may have had a higher degree of mean reversion over the period. However, the strategy tended to perform particularly well in periods of acute stress, such as the dot-com crash in the early 2000s and the global crisis in 2008. Exhibit 9 illustrates the outperformance of the strategy during less eventful periods—the strategy gained 11% between Q4 2003 and Q3 2008.

Exhibit 9: Clean Price Outperformance Strategy Versus S&P 500 Bond Index
1-Month Lookback Window, Weekly Rebalance, Top 1 Sectors



If we believe that during strong bull periods, prices tend to revert more frequently, then the strategy can benefit from being less short sighted.

Source: S&P Dow Jones Indices LLC. Data from December 1995 to May 2016. Index performance based on price 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. Chart includes data from hypothetical portfolios.

If we believe that during strong bull periods, prices tend to revert more frequently, then the strategy can benefit from being less short sighted. Increasing the lookback window and decreasing the frequency of rebalances comes at a cost. Comparing the results in Exhibits 7 through 9 shows that reducing the rebalance frequency and increasing the lookback window helped improve the performance of the strategy during the bull market in the late 1990s. Over the 20-year period ending May 2016, this new rotation strategy (quarterly rebalance, six-month lookback window) outperformed the [S&P 500 Bond Index](#) by only 29.4% (1.4% annualized outperformance).

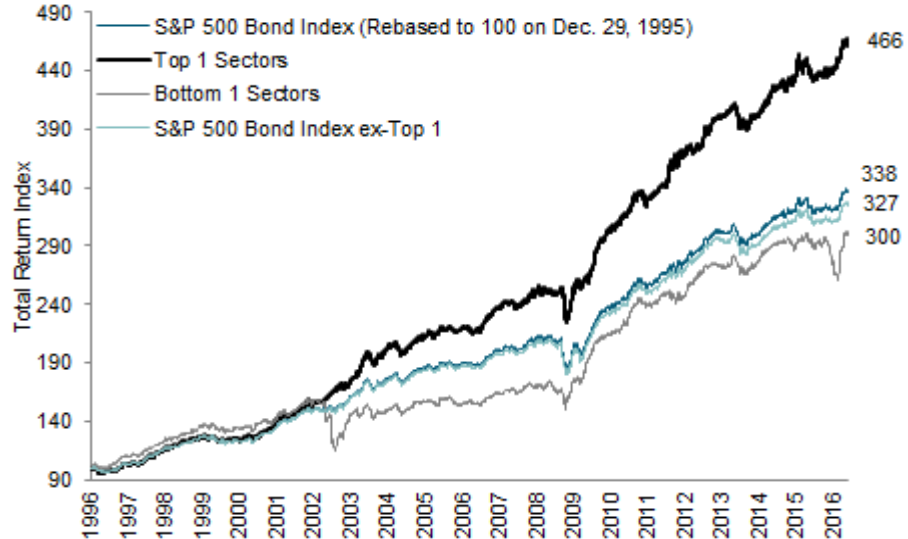
Although this strategy can see through short-term market jitters, it is less effective in detecting the onset of severe market stress and less flexible holding periods. In the bull market of the late 1990s, this new strategy performed in line with the index and we can still see remnants of mean reversion at play, as the bottom sector outperformed in this period. Over the periods of acute stress, such as the dot-com crash in the early 2000s

and the global crisis in 2008, the new strategy seemed to require some time to identify the turning point. The strategy initially declined along with the index before switching to the best-performing sector and outperforming the benchmark. Furthermore, the strategy also required additional time to detect the post-crisis recovery, causing a period of underperformance.

In the bull market of the late 1990s, this new strategy performed in line with the index, and we can still see remnants of mean reversion at play, as the bottom sector outperformed in this period.

Exhibit 10: Total Return Performance

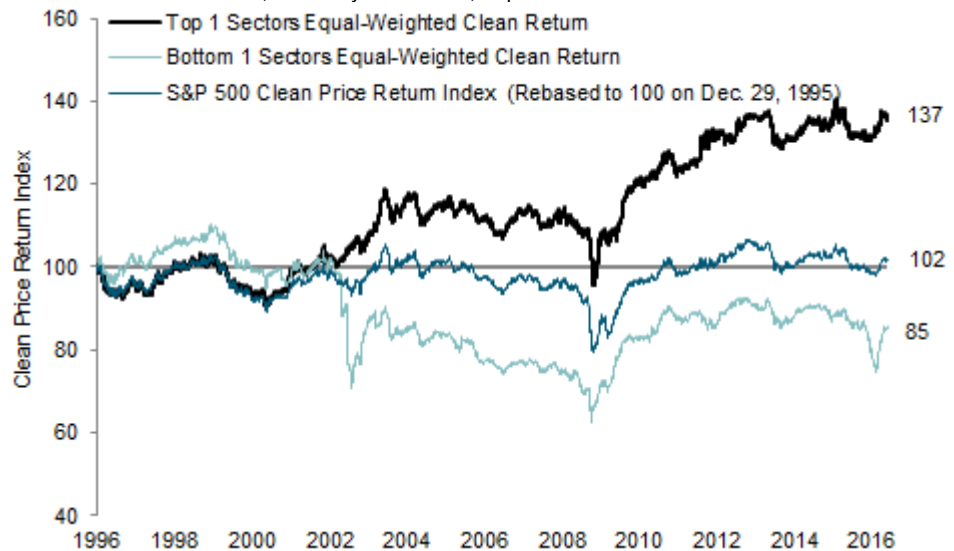
6-Month Lookback Window, Quarterly Rebalance, Top 1 Sectors



Source: S&P Dow Jones Indices LLC. Data from December 1995 to May 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. Chart includes data from hypothetical portfolios.

Exhibit 11: Clean Price Return Performance

6-Month Lookback Window, Quarterly Rebalance, Top 1 Sectors



Source: S&P Dow Jones Indices LLC. Data from December 1995 to May 2016. Index performance based on price 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. Chart includes data from hypothetical portfolios.

Exhibit 12: Clean Price Outperformance Strategy versus S&P 500 Bond Index
6-Month Lookback Window, Quarterly Rebalance, Top 1 Sectors



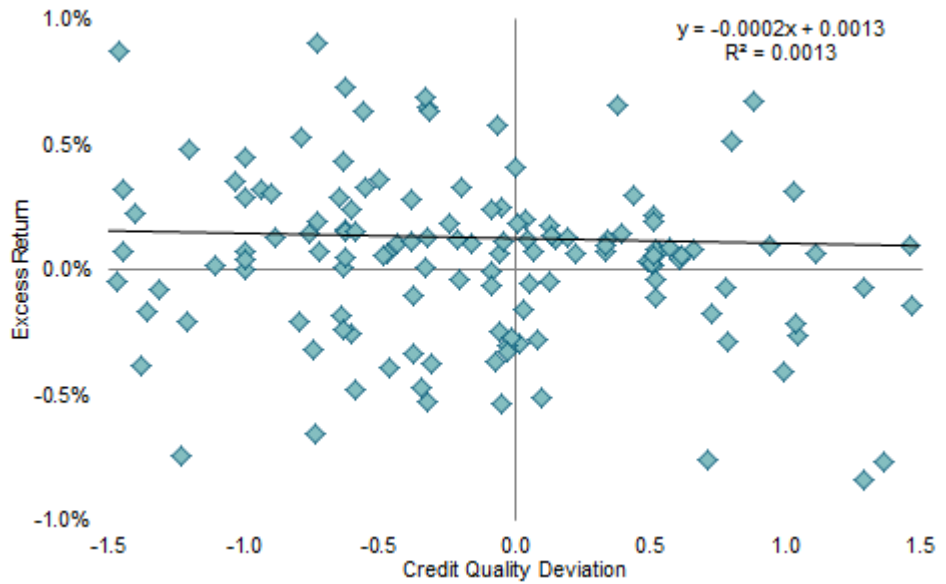
Source: S&P Dow Jones Indices LLC. Data from December 1995 to May 2016. Index performance based on price return in USD. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance. Chart includes data from hypothetical portfolios.

Generally, both excess returns and hit ratios seem to decline as we extend the holding period, increase the lookback windows, and increase the number of sectors to hold long.

Despite the vast difference noted in performance between the original weekly rebalanced, one-month lookback strategy and the quarterly rebalanced, six-month lookback strategy, Exhibits 9 and 12 show that the two strategies had a positive trend in excess performance versus the benchmark. A look at the sensitivity of the strategy to its somewhat subjective inputs reveals that both the hit ratio and excess return over the [S&P 500 Bond Index](#) are consistently positive for reasonable choices (see Appendix). Generally, both excess returns and hit ratios seem to decline as we extend the holding period (for example, a semiannual rebalance), increase the lookback windows (beyond one year), and increase the number of sectors to hold long.

Furthermore, the strategy's deviations in credit quality and duration from the headline index do not seem to be driving the outperformance. By construction, the signal used in the strategy is based on the clean price return. Exhibits 13 and 14 are scatterplots of excess return versus credit quality and duration, respectively. Although visually we see a bias in the incidence of the portfolio being of lower quality and higher duration, there is little directional relationship.

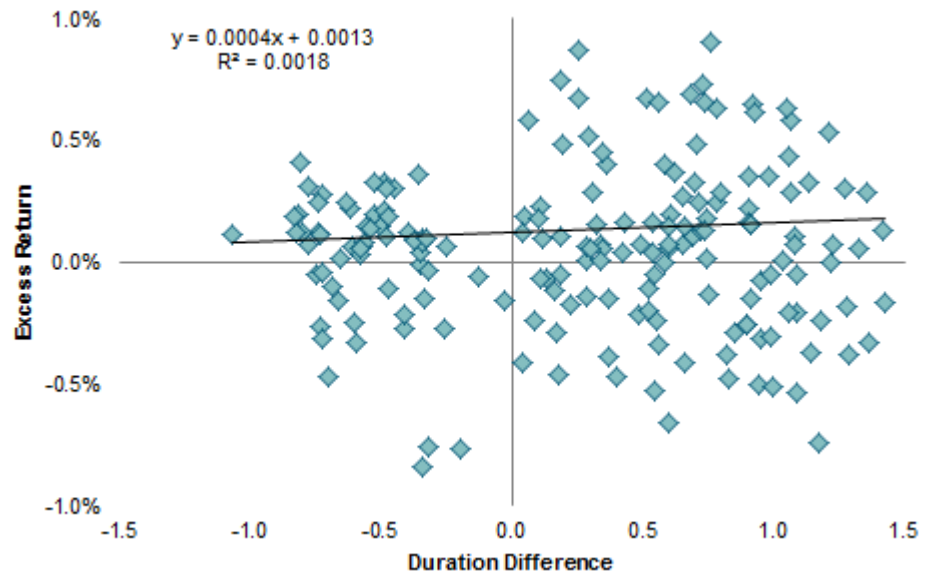
Exhibit 13: Monthly Excess Return Versus Credit Quality Deviation



Source: S&P Dow Jones Indices LLC. Data from December 1995 to May 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. Chart includes data from hypothetical portfolios.

Our simple approach of holding long the top-performing industry sectors of the S&P 500 Bond Index consistently delivered excess returns over the broad-based benchmark.

Exhibit 14: Monthly Excess Return Versus Duration Difference



Source: S&P Dow Jones Indices LLC. Data from December 1995 to May 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. Chart includes data from hypothetical portfolios.

CONCLUSION

Our simple approach of holding long the top-performing industry sectors of the [S&P 500 Bond Index](#) suggests consistent excess returns over the broad-based benchmark (based on hypothetical back-tested performance). The choice of parameters affects returns and characteristics of the strategy in various market conditions. Careful consideration is warranted for parameters, particularly when accounting for turnover costs.

Additionally, despite producing higher risk-adjusted returns over a long-term investment horizon, the strategy can result in large drawdowns. Therefore, further enhancements can be made by overlaying risk-management mechanisms and designing a more sophisticated statistical model and rebalance scheme. For example, a maximum drawdown limit could trigger the portfolio to rebalance (stop loss).

APPENDIX

Exhibit 15: Hit Ratio

| WEEKLY REBALANCE | NUMBER OF SECTORS | | | | | BI-WEEKLY REBALANCE | NUMBER OF SECTORS | | | | |
|------------------|-------------------|-----------|-----------|-----------|-----------|---------------------|-------------------|-----------|-----------|-----------|-----------|
| | TOP 1 (%) | TOP 2 (%) | TOP 3 (%) | TOP 4 (%) | TOP 5 (%) | | TOP 1 (%) | TOP 2 (%) | TOP 3 (%) | TOP 4 (%) | TOP 5 (%) |
| 1-Month | 63 | 63 | 64 | 67 | 66 | 1-Month | 64 | 64 | 64 | 64 | 64 |
| 2-Month | 63 | 63 | 61 | 59 | 62 | 2-Month | 60 | 60 | 62 | 62 | 61 |
| 3-Month | 60 | 60 | 64 | 61 | 62 | 3-Month | 62 | 62 | 63 | 61 | 62 |
| 4-Month | 62 | 62 | 63 | 63 | 62 | 4-Month | 62 | 62 | 60 | 62 | 61 |
| 5-Month | 59 | 59 | 60 | 64 | 62 | 5-Month | 63 | 63 | 62 | 65 | 61 |
| 6-Month | 60 | 60 | 61 | 63 | 60 | 6-Month | 61 | 61 | 64 | 61 | 60 |
| 7-Month | 60 | 60 | 62 | 62 | 60 | 7-Month | 61 | 61 | 62 | 59 | 60 |
| 8-Month | 61 | 61 | 61 | 62 | 62 | 8-Month | 62 | 62 | 62 | 60 | 60 |
| 9-Month | 60 | 60 | 62 | 61 | 60 | 9-Month | 62 | 62 | 62 | 60 | 59 |
| 10-Month | 59 | 59 | 59 | 62 | 59 | 10-Month | 60 | 60 | 60 | 59 | 58 |
| 11-Month | 62 | 62 | 60 | 62 | 58 | 11-Month | 62 | 62 | 60 | 59 | 57 |
| 12-Month | 63 | 63 | 59 | 61 | 61 | 12-Month | 63 | 63 | 60 | 59 | 56 |
| 13-Month | 63 | 63 | 59 | 60 | 61 | 13-Month | 63 | 63 | 60 | 60 | 58 |
| 14-Month | 62 | 62 | 58 | 60 | 59 | 14-Month | 62 | 62 | 60 | 60 | 58 |
| 15-Month | 61 | 61 | 58 | 60 | 59 | 15-Month | 62 | 62 | 57 | 60 | 58 |
| 16-Month | 60 | 60 | 58 | 58 | 57 | 16-Month | 60 | 60 | 57 | 57 | 55 |
| 17-Month | 60 | 60 | 59 | 56 | 56 | 17-Month | 59 | 59 | 58 | 56 | 55 |
| 18-Month | 61 | 61 | 58 | 55 | 56 | 18-Month | 60 | 60 | 55 | 56 | 56 |
| 19-Month | 59 | 59 | 58 | 56 | 56 | 19-month | 59 | 59 | 54 | 56 | 56 |
| 20-Month | 60 | 60 | 56 | 57 | 56 | 20-Month | 59 | 59 | 55 | 56 | 56 |
| 21-Month | 58 | 58 | 56 | 56 | 57 | 21-Month | 58 | 58 | 56 | 55 | 56 |
| 22-Month | 58 | 58 | 57 | 58 | 56 | 22-Month | 58 | 58 | 56 | 56 | 55 |
| 23-Month | 57 | 57 | 58 | 56 | 56 | 23-Month | 57 | 57 | 56 | 55 | 54 |
| 24-Month | 57 | 57 | 58 | 55 | 55 | 24-Month | 57 | 57 | 56 | 55 | 53 |

Source: S&P Dow Jones Indices LLC. Data from December 1995 to May 2016. Past performance is no guarantee of future results. Table is provided for illustrative purposes.

Exhibit 15: Hit Ratio (cont.)

| MONTHLY REBALANCE | NUMBER OF SECTORS | | | | | QUARTERLY REBALANCE | NUMBER OF SECTORS | | | | |
|-------------------|-------------------|-----------|-----------|-----------|-----------|---------------------|-------------------|-----------|-----------|-----------|-----------|
| | TOP 1 (%) | TOP 2 (%) | TOP 3 (%) | TOP 4 (%) | TOP 5 (%) | | TOP 1 (%) | TOP 2 (%) | TOP 3 (%) | TOP 4 (%) | TOP 5 (%) |
| 1-Month | 57 | 59 | 58 | 60 | 58 | 1-Month | 62 | 62 | 58 | 55 | 54 |
| 2-Month | 61 | 59 | 62 | 63 | 60 | 2-Month | 65 | 65 | 61 | 62 | 60 |
| 3-Month | 62 | 59 | 64 | 62 | 60 | 3-Month | 65 | 65 | 63 | 62 | 59 |
| 4-Month | 63 | 59 | 63 | 63 | 63 | 4-Month | 65 | 65 | 58 | 59 | 58 |
| 5-Month | 62 | 59 | 62 | 62 | 60 | 5-Month | 66 | 66 | 59 | 59 | 57 |
| 6-Month | 61 | 59 | 61 | 61 | 60 | 6-Month | 64 | 64 | 60 | 58 | 57 |
| 7-Month | 62 | 59 | 59 | 59 | 62 | 7-Month | 62 | 62 | 58 | 59 | 58 |
| 8-Month | 62 | 59 | 61 | 59 | 63 | 8-Month | 63 | 63 | 59 | 58 | 60 |
| 9-Month | 63 | 59 | 61 | 60 | 61 | 9-Month | 60 | 60 | 59 | 58 | 60 |
| 10-Month | 64 | 59 | 60 | 61 | 61 | 10-Month | 62 | 62 | 57 | 59 | 56 |
| 11-Month | 64 | 59 | 61 | 60 | 60 | 11-Month | 62 | 62 | 60 | 58 | 57 |
| 12-Month | 63 | 59 | 61 | 62 | 60 | 12-Month | 61 | 61 | 60 | 58 | 56 |
| 13-Month | 62 | 59 | 59 | 60 | 60 | 13-Month | 60 | 60 | 58 | 58 | 56 |
| 14-Month | 62 | 59 | 58 | 60 | 60 | 14-Month | 62 | 62 | 57 | 58 | 56 |
| 15-Month | 62 | 59 | 57 | 59 | 57 | 15-Month | 62 | 62 | 56 | 58 | 54 |
| 16-Month | 61 | 59 | 58 | 58 | 57 | 16-Month | 60 | 60 | 56 | 57 | 53 |
| 17-Month | 61 | 59 | 59 | 57 | 56 | 17-Month | 58 | 58 | 57 | 57 | 53 |
| 18-Month | 60 | 59 | 58 | 59 | 56 | 18-Month | 58 | 58 | 55 | 58 | 54 |
| 19-Month | 59 | 59 | 57 | 57 | 55 | 19-Month | 58 | 58 | 55 | 55 | 53 |
| 20-Month | 59 | 58 | 56 | 57 | 55 | 20-Month | 57 | 57 | 55 | 53 | 53 |
| 21-Month | 59 | 58 | 56 | 57 | 54 | 21-Month | 60 | 60 | 55 | 53 | 51 |
| 22-Month | 59 | 59 | 57 | 56 | 54 | 22-Month | 60 | 60 | 55 | 52 | 51 |
| 23-Month | 59 | 58 | 56 | 56 | 54 | 23-Month | 59 | 59 | 55 | 52 | 51 |
| 24-Month | 59 | 59 | 55 | 55 | 54 | 24-Month | 59 | 59 | 54 | 52 | 51 |

Source: S&P Dow Jones Indices LLC. Data from December 1995 to May 2016. Past performance is no guarantee of future results. Table is provided for illustrative purposes.

Exhibit 15: Hit Ratio (cont.)

| SEMIANNUAL REBALANCE | NUMBER OF SECTORS | | | | | ANNUAL REBALANCE | NUMBER OF SECTORS | | | | |
|----------------------|-------------------|-----------|-----------|-----------|-----------|------------------|-------------------|-----------|-----------|-----------|-----------|
| | TOP 1 (%) | TOP 2 (%) | TOP 3 (%) | TOP 4 (%) | TOP 5 (%) | | TOP 1 (%) | TOP 2 (%) | TOP 3 (%) | TOP 4 (%) | TOP 5 (%) |
| 1-Month | 62 | 62 | 55 | 55 | 54 | 1-Month | 60 | 60 | 56 | 54 | 55 |
| 2-Month | 60 | 60 | 56 | 56 | 55 | 2-Month | 58 | 58 | 55 | 54 | 55 |
| 3-Month | 59 | 59 | 57 | 54 | 53 | 3-Month | 56 | 56 | 54 | 56 | 56 |
| 4-Month | 60 | 60 | 54 | 56 | 56 | 4-Month | 55 | 55 | 57 | 55 | 53 |
| 5-Month | 59 | 59 | 57 | 56 | 56 | 5-Month | 54 | 54 | 53 | 55 | 53 |
| 6-Month | 56 | 56 | 58 | 54 | 57 | 6-Month | 53 | 53 | 54 | 54 | 53 |
| 7-Month | 59 | 59 | 56 | 56 | 56 | 7-Month | 54 | 54 | 55 | 53 | 52 |
| 8-Month | 60 | 60 | 58 | 55 | 58 | 8-Month | 53 | 53 | 54 | 52 | 54 |
| 9-Month | 60 | 60 | 56 | 56 | 58 | 9-Month | 53 | 53 | 54 | 52 | 54 |
| 10-Month | 61 | 61 | 54 | 55 | 54 | 10-Month | 54 | 54 | 53 | 50 | 53 |
| 11-Month | 58 | 58 | 56 | 55 | 53 | 11-Month | 54 | 54 | 51 | 50 | 52 |
| 12-Month | 58 | 58 | 54 | 53 | 51 | 12-Month | 55 | 55 | 53 | 50 | 51 |
| 13-Month | 58 | 58 | 51 | 51 | 51 | 13-Month | 56 | 56 | 53 | 49 | 51 |
| 14-Month | 60 | 60 | 51 | 52 | 51 | 14-Month | 56 | 56 | 52 | 49 | 51 |
| 15-Month | 60 | 60 | 51 | 51 | 51 | 15-Month | 56 | 56 | 51 | 49 | 51 |
| 16-Month | 58 | 58 | 53 | 50 | 51 | 16-Month | 55 | 55 | 54 | 50 | 51 |
| 17-Month | 58 | 58 | 54 | 50 | 50 | 17-Month | 55 | 55 | 54 | 50 | 51 |
| 18-Month | 58 | 58 | 53 | 51 | 51 | 18-Month | 55 | 55 | 54 | 50 | 51 |
| 19-Month | 58 | 58 | 53 | 50 | 51 | 19-Month | 55 | 55 | 54 | 49 | 52 |
| 20-Month | 58 | 58 | 53 | 50 | 52 | 20-Month | 56 | 56 | 54 | 49 | 52 |
| 21-Month | 58 | 58 | 53 | 51 | 52 | 21-Month | 56 | 56 | 53 | 50 | 52 |
| 22-Month | 57 | 57 | 52 | 51 | 51 | 22-Month | 56 | 56 | 52 | 51 | 50 |
| 23-Month | 56 | 56 | 52 | 51 | 51 | 23-Month | 56 | 56 | 52 | 47 | 51 |
| 24-Month | 57 | 57 | 52 | 51 | 49 | 24-Month | 54 | 54 | 52 | 47 | 51 |

Source: S&P Dow Jones Indices LLC. Data from December 1995 to May 2016. Past performance is no guarantee of future results. Table is provided for illustrative purposes.

Exhibit 16: Annualized Excess Return

| WEEKLY REBALANCE | NUMBER OF SECTORS | | | | | BI-WEEKLY REBALANCE | NUMBER OF SECTORS | | | | |
|------------------|-------------------|-----------|-----------|-----------|-----------|---------------------|-------------------|-----------|-----------|-----------|-----------|
| | TOP 1 (%) | TOP 2 (%) | TOP 3 (%) | TOP 4 (%) | TOP 5 (%) | | TOP 1 (%) | TOP 2 (%) | TOP 3 (%) | TOP 4 (%) | TOP 5 (%) |
| 1-Month | 3.0 | 3.0 | 2.1 | 1.9 | 1.5 | 1-Month | 2.5 | 2.5 | 1.5 | 1.2 | 1.0 |
| 2-Month | 2.4 | 2.4 | 1.8 | 1.4 | 1.1 | 2-Month | 2.2 | 2.2 | 1.6 | 1.3 | 0.9 |
| 3-Month | 1.8 | 1.8 | 1.6 | 1.1 | 1.0 | 3-Month | 2.0 | 2.0 | 1.3 | 1.0 | 0.8 |
| 4-Month | 2.3 | 2.3 | 1.4 | 1.1 | 1.0 | 4-Month | 2.0 | 2.0 | 1.2 | 1.0 | 0.8 |
| 5-Month | 1.6 | 1.6 | 1.3 | 1.1 | 0.8 | 5-Month | 1.7 | 1.7 | 1.3 | 0.9 | 0.7 |
| 6-Month | 1.3 | 1.3 | 1.3 | 1.0 | 0.8 | 6-Month | 1.4 | 1.4 | 1.3 | 0.9 | 0.6 |
| 7-Month | 1.0 | 1.0 | 1.1 | 0.8 | 0.7 | 7-Month | 1.3 | 1.3 | 1.0 | 0.8 | 0.6 |
| 8-Month | 0.9 | 0.9 | 1.1 | 0.9 | 0.7 | 8-Month | 1.2 | 1.2 | 1.1 | 0.8 | 0.5 |
| 9-Month | 0.8 | 0.8 | 1.0 | 0.8 | 0.6 | 9-Month | 1.2 | 1.2 | 0.9 | 0.7 | 0.5 |
| 10-Month | 0.7 | 0.7 | 0.9 | 0.7 | 0.6 | 10-Month | 1.0 | 1.0 | 0.8 | 0.6 | 0.5 |
| 11-Month | 0.7 | 0.7 | 0.9 | 0.7 | 0.6 | 11-Month | 1.0 | 1.0 | 0.7 | 0.6 | 0.5 |
| 12-Month | 0.8 | 0.8 | 0.9 | 0.6 | 0.7 | 12-Month | 1.1 | 1.1 | 0.7 | 0.5 | 0.5 |
| 13-Month | 0.9 | 0.9 | 0.8 | 0.6 | 0.6 | 13-Month | 1.0 | 1.0 | 0.7 | 0.5 | 0.4 |
| 14-Month | 0.8 | 0.8 | 0.6 | 0.5 | 0.5 | 14-Month | 0.8 | 0.8 | 0.6 | 0.4 | 0.4 |
| 15-Month | 0.6 | 0.6 | 0.6 | 0.4 | 0.4 | 15-Month | 0.7 | 0.7 | 0.5 | 0.4 | 0.3 |
| 16-Month | 0.6 | 0.6 | 0.5 | 0.5 | 0.4 | 16-Month | 0.6 | 0.6 | 0.5 | 0.4 | 0.3 |
| 17-Month | 0.7 | 0.7 | 0.6 | 0.4 | 0.4 | 17-Month | 0.8 | 0.8 | 0.6 | 0.3 | 0.3 |
| 18-Month | 0.7 | 0.7 | 0.4 | 0.4 | 0.3 | 18-Month | 0.8 | 0.8 | 0.3 | 0.3 | 0.2 |
| 19-Month | 0.6 | 0.6 | 0.4 | 0.3 | 0.3 | 19-Month | 0.6 | 0.6 | 0.3 | 0.2 | 0.2 |
| 20-Month | 0.5 | 0.5 | 0.3 | 0.3 | 0.3 | 20-Month | 0.6 | 0.6 | 0.3 | 0.3 | 0.2 |
| 21-Month | 0.5 | 0.5 | 0.4 | 0.3 | 0.3 | 21-Month | 0.5 | 0.5 | 0.3 | 0.2 | 0.2 |
| 22-Month | 0.5 | 0.5 | 0.4 | 0.3 | 0.3 | 22-Month | 0.5 | 0.5 | 0.3 | 0.2 | 0.2 |
| 23-Month | 0.4 | 0.4 | 0.4 | 0.4 | 0.2 | 23-Month | 0.5 | 0.5 | 0.3 | 0.2 | 0.2 |
| 24-Month | 0.5 | 0.5 | 0.3 | 0.3 | 0.2 | 24-Month | 0.4 | 0.4 | 0.3 | 0.1 | 0.2 |

Source: S&P Dow Jones Indices LLC. Data from December 1995 to May 2016. Past performance is no guarantee of future results. Table is provided for illustrative purposes.

Exhibit 16: Annualized Excess Return (cont.)

| MONTHLY REBALANCE | NUMBER OF SECTORS | | | | | QUARTERLY REBALANCE | NUMBER OF SECTORS | | | | |
|-------------------|-------------------|-----------|-----------|-----------|-----------|---------------------|-------------------|-----------|-----------|-----------|-----------|
| | TOP 1 (%) | TOP 2 (%) | TOP 3 (%) | TOP 4 (%) | TOP 5 (%) | | TOP 1 (%) | TOP 2 (%) | TOP 3 (%) | TOP 4 (%) | TOP 5 (%) |
| 1-Month | 0.8 | 0.7 | 0.6 | 0.4 | 0.4 | 1-Month | 1.3 | 1.3 | 0.2 | 0.1 | 0.1 |
| 2-Month | 1.8 | 0.7 | 1.2 | 1.0 | 0.7 | 2-Month | 1.5 | 1.5 | 0.9 | 0.6 | 0.5 |
| 3-Month | 2.0 | 0.7 | 1.3 | 0.9 | 0.6 | 3-Month | 1.9 | 1.9 | 1.0 | 0.4 | 0.3 |
| 4-Month | 2.1 | 0.7 | 1.3 | 1.0 | 0.7 | 4-Month | 1.9 | 1.9 | 0.4 | 0.4 | 0.3 |
| 5-Month | 1.3 | 0.7 | 1.1 | 0.9 | 0.6 | 5-Month | 2.1 | 2.1 | 0.5 | 0.4 | 0.2 |
| 6-Month | 1.2 | 0.7 | 1.1 | 0.8 | 0.6 | 6-Month | 1.4 | 1.4 | 0.7 | 0.4 | 0.2 |
| 7-Month | 1.2 | 0.7 | 1.0 | 0.6 | 0.6 | 7-Month | 1.1 | 1.1 | 0.7 | 0.4 | 0.2 |
| 8-Month | 1.2 | 0.7 | 0.9 | 0.5 | 0.5 | 8-Month | 1.3 | 1.3 | 0.6 | 0.3 | 0.3 |
| 9-Month | 1.2 | 0.7 | 1.0 | 0.5 | 0.5 | 9-Month | 0.9 | 0.9 | 0.7 | 0.3 | 0.4 |
| 10-Month | 1.1 | 0.7 | 0.7 | 0.5 | 0.5 | 10-Month | 0.9 | 0.9 | 0.5 | 0.2 | 0.1 |
| 11-Month | 1.0 | 0.7 | 0.8 | 0.5 | 0.5 | 11-Month | 0.9 | 0.9 | 0.5 | 0.2 | 0.2 |
| 12-Month | 1.0 | 0.7 | 0.7 | 0.5 | 0.5 | 12-Month | 0.7 | 0.7 | 0.4 | 0.2 | 0.1 |
| 13-Month | 1.0 | 0.7 | 0.6 | 0.4 | 0.5 | 13-Month | 0.6 | 0.6 | 0.3 | 0.1 | 0.1 |
| 14-Month | 0.9 | 0.7 | 0.5 | 0.5 | 0.5 | 14-Month | 0.7 | 0.7 | 0.3 | 0.2 | 0.1 |
| 15-Month | 0.8 | 0.7 | 0.4 | 0.4 | 0.4 | 15-Month | 0.7 | 0.7 | 0.2 | 0.1 | 0.1 |
| 16-Month | 0.6 | 0.7 | 0.5 | 0.3 | 0.4 | 16-Month | 0.6 | 0.6 | 0.3 | 0.1 | 0.1 |
| 17-Month | 0.8 | 0.7 | 0.5 | 0.3 | 0.3 | 17-Month | 0.6 | 0.6 | 0.3 | 0.1 | 0.1 |
| 18-Month | 0.8 | 0.7 | 0.4 | 0.3 | 0.3 | 18-Month | 0.7 | 0.7 | 0.2 | 0.1 | 0.1 |
| 19-Month | 0.7 | 0.7 | 0.3 | 0.2 | 0.3 | 19-Month | 0.7 | 0.7 | 0.2 | 0.0 | 0.1 |
| 20-Month | 0.7 | 0.7 | 0.3 | 0.2 | 0.2 | 20-Month | 0.6 | 0.6 | 0.2 | -0.1 | 0.1 |
| 21-Month | 0.7 | 0.7 | 0.3 | 0.2 | 0.3 | 21-Month | 1.0 | 1.0 | 0.2 | -0.1 | 0.1 |
| 22-Month | 0.7 | 0.8 | 0.3 | 0.2 | 0.3 | 22-Month | 1.0 | 1.0 | 0.2 | -0.1 | 0.0 |
| 23-Month | 0.7 | 0.7 | 0.3 | 0.2 | 0.2 | 23-Month | 0.9 | 0.9 | 0.2 | -0.2 | 0.0 |
| 24-Month | 0.7 | 0.7 | 0.3 | 0.2 | 0.1 | 24-Month | 0.8 | 0.8 | 0.2 | -0.2 | 0.0 |

Source: S&P Dow Jones Indices LLC. Data from December 1995 to May 2016. Past performance is no guarantee of future results. Table is provided for illustrative purposes.

Exhibit 16: Annualized Excess Return (cont.)

| SEMIANNUAL REBALANCE | NUMBER OF SECTORS | | | | | ANNUAL REBALANCE | NUMBER OF SECTORS | | | | |
|----------------------|-------------------|-----------|-----------|-----------|-----------|------------------|-------------------|-----------|-----------|-----------|-----------|
| | TOP 1 (%) | TOP 2 (%) | TOP 3 (%) | TOP 4 (%) | TOP 5 (%) | | TOP 1 (%) | TOP 2 (%) | TOP 3 (%) | TOP 4 (%) | TOP 5 (%) |
| 1-Month | 0.5 | 0.5 | -0.3 | -0.3 | -0.1 | 1-Month | 0.6 | 0.6 | 0.0 | -0.2 | 0.0 |
| 2-Month | 0.6 | 0.6 | -0.1 | -0.1 | 0.1 | 2-Month | 0.1 | 0.1 | -0.2 | -0.2 | -0.1 |
| 3-Month | 0.8 | 0.8 | -0.2 | -0.2 | -0.1 | 3-Month | 0.1 | 0.1 | -0.4 | -0.1 | -0.1 |
| 4-Month | 1.0 | 1.0 | -0.2 | -0.2 | -0.2 | 4-Month | 0.1 | 0.1 | -0.2 | -0.1 | -0.1 |
| 5-Month | 1.0 | 1.0 | -0.2 | -0.2 | 0.0 | 5-Month | 0.0 | 0.0 | -0.3 | -0.1 | 0.0 |
| 6-Month | 0.2 | 0.2 | 0.6 | -0.1 | 0.0 | 6-Month | -0.1 | -0.1 | 0.2 | -0.1 | 0.0 |
| 7-Month | 0.4 | 0.4 | 0.6 | -0.1 | -0.1 | 7-Month | -0.2 | -0.2 | 0.3 | -0.2 | -0.1 |
| 8-Month | 0.9 | 0.9 | 0.6 | -0.2 | 0.0 | 8-Month | -0.2 | -0.2 | 0.2 | -0.3 | -0.2 |
| 9-Month | 0.8 | 0.8 | 0.4 | -0.3 | 0.0 | 9-Month | -0.2 | -0.2 | 0.1 | -0.3 | -0.2 |
| 10-Month | 0.8 | 0.8 | 0.2 | -0.3 | -0.2 | 10-Month | -0.2 | -0.2 | 0.0 | -0.4 | -0.2 |
| 11-Month | 0.5 | 0.5 | 0.2 | 0.0 | -0.2 | 11-Month | -0.2 | -0.2 | -0.1 | -0.1 | -0.2 |
| 12-Month | 0.4 | 0.4 | 0.1 | -0.1 | -0.3 | 12-Month | -0.3 | -0.3 | -0.1 | -0.1 | -0.3 |
| 13-Month | 0.4 | 0.4 | 0.0 | -0.6 | -0.3 | 13-Month | -0.2 | -0.2 | -0.1 | -0.5 | -0.3 |
| 14-Month | 0.5 | 0.5 | -0.1 | -0.1 | -0.3 | 14-Month | -0.2 | -0.2 | -0.1 | -0.1 | -0.3 |
| 15-Month | 0.5 | 0.5 | -0.1 | -0.1 | -0.3 | 15-Month | -0.2 | -0.2 | -0.1 | -0.1 | -0.3 |
| 16-Month | 0.6 | 0.6 | 0.1 | -0.2 | 0.0 | 16-Month | -0.3 | -0.3 | 0.0 | -0.1 | 0.0 |
| 17-Month | 0.6 | 0.6 | 0.2 | -0.2 | 0.0 | 17-Month | -0.1 | -0.1 | 0.0 | -0.1 | 0.0 |
| 18-Month | 0.6 | 0.6 | 0.1 | -0.2 | 0.0 | 18-Month | -0.1 | -0.1 | 0.0 | -0.1 | 0.0 |
| 19-Month | 0.6 | 0.6 | 0.0 | -0.2 | 0.0 | 19-Month | -0.1 | -0.1 | 0.0 | -0.1 | 0.0 |
| 20-Month | 0.6 | 0.6 | 0.1 | -0.2 | 0.0 | 20-Month | -0.1 | -0.1 | 0.1 | -0.1 | 0.0 |
| 21-Month | 0.6 | 0.6 | 0.1 | -0.2 | 0.0 | 21-Month | -0.1 | -0.1 | 0.0 | -0.1 | 0.0 |
| 22-Month | 0.5 | 0.5 | 0.0 | -0.2 | 0.0 | 22-Month | -0.1 | -0.1 | 0.0 | -0.1 | -0.1 |
| 23-Month | 0.4 | 0.4 | 0.0 | -0.2 | 0.0 | 23-Month | -0.1 | -0.1 | 0.0 | -0.2 | -0.1 |
| 24-Month | 0.3 | 0.3 | 0.0 | -0.2 | 0.0 | 24-Month | -0.2 | -0.2 | 0.1 | -0.2 | -0.1 |

Source: S&P Dow Jones Indices LLC. Data from December 1995 to May 2016. Past performance is no guarantee of future results. Table is provided for illustrative purposes.

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