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# DO STYLE MOMENTUM STRATEGIES PRODUCE ABNORMAL RETURNS: EVIDENCE FROM INDEX INVESTING

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**ABSTRACT**

*In this study, we investigate the return enhancement ability of style momentum strategy: a strategy that switches between value and growth styles based on previous performance. We explore the variation in abnormal returns of long-only and long-short momentum strategies using various style based indexes (Russell value/growth indexes, Fama-French value/growth indexes, and MSCI value/growth indexes) where value and growth stocks are classified using different criteria. Our results show that the performance of style momentum does vary across different index families. We first find that in general the long-only strategies create significant positive abnormal returns whereas the long-short strategies do not. Second, for a fixed formation period, abnormal returns of the strategies tend to decrease when the length of holding periods increase. Third, abnormal returns are stronger and more significant when rotating within large cap value and growth indexes while abnormal returns are weaker and inconsistent when rotating within small cap value and growth indexes. Fourth, strategies based on rotating across all market cap levels do not generate consistently significant positive abnormal returns for Russell indexes or Fama-French indexes but they do for MSCI indexes. Fifth, individual stock momentum only explains a very small portion of the returns of style moment strategies.*

**JEL:** G11

**KEYWORDS:** Style Momentum, Value, Growth, Large Cap, Small Cap

## INTRODUCTION

Investment styles refer to the categories that stocks are grouped into based on their book to market ratio, dividend yield, market capitalization and other attributes. Labels such as value/growth, and small cap/large cap are widely used investment styles by money managers. Given the tremendous growth of value/growth funds, style based investment strategies have obtained increasing attention from both academics and practitioners. Early studies focus on the different risk and return characteristics of various styles. Recently, strategies involving more active trading such as style momentum have started to draw more attentions. Stock return momentum, which was originally documented by Jegadeesh and Titman (1993), refers to the phenomena that past winner stocks tend to continue to have higher returns in the next period than past loser stocks. As a result, investors can achieve abnormal returns by buying stocks that are in favor and selling stocks that are out of favor, commonly known as momentum strategy. So do styles exhibit return momentum? Can investors earn abnormal returns by chasing the winning styles and selling the losing styles based on past performance? Those questions have received consideration attention recently (Lewellen (2002), Chen and Bondt (2004), Arshanapalli et al. (2007), Froot and Teo (2008)). Those studies find evidence for style momentum. However, the trading costs for the strategies illustrated in those studies are expensive since they involve creating style portfolios using individual stocks. With the increasing growth of style indexes, a natural question to ask is whether style

indexes exhibit return momentum. Index based style momentum strategies are much easier to implement and considerably less expensive compared style momentum based on individual stocks. In addition, which one is better: long-only strategy or long-short strategy? Is there variation in return momentum when different formation and holding periods are used? Should we rotate between large value and large growth or small value and small growth or at all market cap levels (all four combined)? Do the results differ if we use style indexes from different fund families where value and growth stocks are classified using different criteria?

Those are the questions we seek to answer. We utilize value/growth indexes from three fund families: Russell indexes, Fama-French Indexes and MSCI indexes and test the performance of two style momentum strategies "long-only" vs. "long-short" using various combinations of formation period and holding period. The reason we use the three fund families is that each family has their own classification rule for value and growth styles. For example, the Russell value and growth indexes are constructed based on the book to market (BM) ratio and I/B/E/S forecasted long-term growth mean; the Fama-French value and growth indexes are defined solely based on the BM ratio; and the MSCI value and growth indexes are constructed using a number of variables including, the BM ratio, 12-month forward earnings to price ratio, dividend yield, long term earnings per share growth rate, etc. Do the results differ across all three index families? We find that although the performance of the return momentum strategy does vary across those three fund families, they exhibit considerable commonality. First, we find that in general the long-only strategies provide significant positive abnormal returns whereas the long-short strategies do not. Second, for a fixed formation period, the abnormal returns tend to decrease when the length of holding periods increase. Third, abnormal returns are stronger and more significant when rotating within large cap value and growth indexes while abnormal returns are less significant and inconsistent when rotating within small cap value and growth indexes. Fourth, strategies based on rotating across all market cap levels do not generate consistently significant positive abnormal returns for Russell indexes and Fama-French indexes but they do for MSCI indexes. Fifth, individual stock momentum only explains a very small portion of the returns of the style moment strategies. In other words, chasing winning styles does provide additional benefits to chasing winning stocks. The reminder of the article is organized as follows. The next section reviews related literature. Section 3 describes data and methodology. Section 4 presents empirical results and discussion. The fifth section concludes.

## LITERATURE REVIEW

The seminal paper by Jegadeesh and Titman (1993) documented that past winning stocks tend to outperform past losing stocks in the next period, which is also known as momentum phenomena. Since then, tremendous attention has been given to momentum strategy. Conrad and Kaul (1998) test about 120 strategies and find evidence that supports momentum strategy. Daniel, Hirshleifer and Subrahmanyam (1998) explore the relationship between investor psychology (over/under reaction) to profits of momentum strategy. Cooper, Gutierrez and Hameed (2004) find performance of momentum strategy depend on the state of market. From 1929 to 1995, the mean monthly momentum profit following positive market returns is 0.93%, whereas the mean profit following negative market returns is− 0.37%. Antoniou, Lam and Paudyal (2007) explores profitability of momentum strategy in international markets; Asem and Tian (2010), Cheng and Wu (2010) find evidence supporting momentum strategy using data from the Hong Kong market. Another line of research focuses on style momentum rather than momentum of individual stocks. Lewellen (2002) showed that portfolios constructed based on size and book-to-market ratio exhibited momentum as strong as in individual stocks and industries. Chen and Bondt (2004) reported that style momentum existed within the S&P 500 stocks and was distinct from the price momentum and the industry momentum. Arshanapalli et al. (2007) utilized a timing model based on macroeconomic and fundamental public information to conduct style rotation using Russell style index data. Froot and Teo (2008) demonstrated that institutional investors reallocate across stock groupings based on styles more intensively than across randomly generated stock groupings. The authors also

showed that at the firm level, the weekly returns exhibited strong style momentum. Liu and Wang (2010) investigates the impact of time horizon on style momentum. Those studies involve creating style portfolio from individual stocks and thus incur high trading expenses. With the dramatic growth of style indexes, exchange traded funds, there is a need to explore the performance of style momentum using style indexes, that is the contribution of this paper.

## DATA AND METHODOLOGY

In our analysis, we use the monthly returns of style indexes from three index families: Russell, Fama-French and MSCI for the period from June 1995 to December 2010 during which data are available for all three index families. This fifteen years are very rich in significant financial market events: 1997 Asian Financial Market Crisis, 1998 Russian Default, 2000 Tech Bubble Bust and 2008 Subprime market crisis, thus provide an interesting window to study the performance of a trading strategy. We used four Russell indexes: Russell 1000 value/growth and Russell 2000 value/growth; six Fama-French indexes: Fama-French large cap value/blend/growth and Fama-French small cap value/blend/growth; and four MSCI indexes: MSCI U.S. prime market value/growth and MSCI U.S. small cap value/growth. In the next three paragraphs, we briefly describe how the three families of indexes are constructed, respectively.

The Russell U.S. index family covers all stocks listed on NYSE, AMEX, and NASDAQ. The stocks are first ranked based on their market capitalization. The Russell 1000 index contains the largest 1000 stocks and is generally considered as a large cap index; and the Russell 2000 index includes the next 2000 stocks and is generally considered as a small cap index. Within each cap-based index, the stocks are classified into value index and growth index based on the BM ratio and the I/B/E/S forecast long-term growth mean using a non-linear probability function. The details regarding the classification function can be found on the website of Russell Investments. Four Russell style indexes used in this study are known as Russell 1000 growth, Russell 1000 value, Russell 2000 growth, and Russell 2000 value, which correspond to large cap growth, large cap value, small cap growth, and small cap value styles, respectively.

The Fama-French style indexes are formed based on size and the BM ratio as follows. All the stocks traded on NYSE, NASDAQ, and AMEX are first divided into large and small cap portfolios where the size breakpoint is equal to the median market capitalization for stocks listed on NYSE. Note that the numbers of stocks in the portfolios vary over time. The average numbers of firms in the large cap and small cap portfolios are 968 and 3868, respectively. The stocks are then divided into three value-growth portfolios based on the BM ratio where breakpoints are the $30^{th}$ and $70^{th}$ NYSE BM ratio percentiles. The six Fama-French indexes used in this study are the intersections of the size and the BM ratio portfolios and namely, they are large growth, large blend, large value, small growth, small blend, and small value indexes. The MSCI style indexes are constructed as follows. All the stocks traded on NYSE, AMEX, and NASDAQ are first sorted based on market capitalization where the top 750 stocks are used to form the U.S. prime market index (MSCI750) and the next 1750 stocks are used to form the small cap index (MSCI1750). Within each cap-based index the stocks are divided into value and growth segments using a two-dimensional framework. The MSCI indexes define the value and growth investment style characteristics using the following variables:1) book value to price ratio, 2) 12-month forward earnings to price ratio, 3) dividend yield, 4) long-term forward earnings per share growth rate, 5) short-term forward EPS growth rate, 6) current Internal Growth Rate, 7) long-term historical EPS growth trend, 8) long-term historical sales per share growth trend.

The details of the classification method can be found on the MSCI index website. The four MSCI style indexes used in this study are: MSCI U.S. prime market growth, prime market value, small cap growth and small cap value indexes. We implement long-only and long-short style momentum strategies. We use F and H to denote the formation and holding periods, respectively. We use formation periods of three, six, and twelve months (F= 3, 6, 12). For each formation period, we consider the holding periods that are less

than or equal to the length of the formation period. For example, if the formation period F=6 months, the holding periods are one, three, and six months (H=1, 3, and 6). Following Jegadeesh and Titman (1993), we use overlapping holding periods to increase the power of the test and rebalance the portfolio on a monthly basis. Our strategy is constructed according to the following rule. At the beginning of each month t, we rank the style indexes based on their returns in the past F months where the single best performing style is the winner and the single worst performing style is the loser. The long-only strategy will only purchase the winner style while the long-short strategy will buy the winner style and go short the loser style. At the same time, we close out the position initiated in month t-F. The new positions will be held for H months. Portfolio returns are equally weighted monthly returns for each position.

For each index family we test our strategies using three groups: the large cap indexes, the small cap indexes, and across market cap indexes. Take the Russell indexes as an example. First, we implement the strategy based on the two large cap indexes: Russell 1000 growth vs. Russell 1000 value; Second, we implement our strategy using two small cap indexes: Russell 2000 growth vs. Russell 2000 value; Finally, we test the strategy by rotating among all of the four Russell indexes: Russell 1000 growth, Russell 1000 value, Russell 2000 growth, and Russell 2000 value. To estimate abnormal returns, we use Carhart four-factor model (Fama-French three factors plus momentum) as our benchmark, which is specified as follows:

$$r_t - r_f = \alpha + \beta_1(r_m - r_f) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 WML_t + \varepsilon_t \quad (1)$$

where: $r_t$ is the return of the style momentum strategy in period t; $r_f$ is the risk free rate in period t; $r_m$ is the market return in period t; $SMB_t$: the Fama-French large minus small factor in period t; $HML_t$ is the Fama-French high minus low factor in period t; $HML_t$ is the winner minus loser factor in period t; $\varepsilon_t$ is the disturbance in period t; $\alpha$ is the abnormal return; $\beta_1$ is the market beta; $\beta_2$ is the coefficient for *SMB*; $\beta_3$ is the coefficient for *HML*; $\beta_4$ is the coefficient for *WML*. The risk-free rate and the Fama-French factors were obtained from Kenneth French's data library.

## RESULTS AND DISCUSSION

Table 1 presents the descriptive statistics for the monthly returns of the selected indexes. Panel 1 of Table 1 focuses on the Russell indexes. We can see that for each market cap level the average return of the growth index is less than that of the value index: 0.0069 and 0.0078 at the large cap level; 0.0075 vs.0.0097 at the small cap level. At each market cap level, the return standard deviation of the growth index is higher than that of the value index: 0.0543 vs. 0.0458 at the large cap level; 0.0721 vs. 0.0530 at the small cap level. As a consequence, at each market cap level, the Sharpe ratio of the value index is higher than that of the growth index. Moreover, for both value and growth indexes, the small cap indexes have higher returns and higher standard deviations than the large cap indexes. Panel 2 of Table 1 focuses on the Fama-French indexes. The average returns of the large cap growth, blend, and value indexes are 0.0078, 0.0084, and 0.0078, respectively while the average returns of the small cap growth, blend, and value indexes are 0.0076, 0.0123, and 0.0133, respectively. The mean returns indicate that large cap growth is more profitable than small cap growth, but large cap blend and large cap value are less profitable than their small cap counterparts for the Fama French indexes. Panel 3 of Table 1 focuses on the MSCI indexes. We can see that at each market cap level, the value index has higher mean returns, lower standard deviations, and higher Sharpe ratios. Moreover, similar to the Russell indexes, small cap growth and small cap value have higher returns and higher standard deviations than large cap growth and large cap value, respectively.

Table 1: Descriptive Statistics

| **Panel 1: Russell Indexes** | | | | | | |
|---|---|---|---|---|---|---|
| | **Russell 1000 Growth** | | **Russell 1000 Value** | **Russell 2000 Growth** | | **Russell 2000 Value** |
| Mean | 0.0069 | | 0.0078 | 0.0075 | | 0.0097 |
| S.D. | 0.0543 | | 0.0458 | 0.0721 | | 0.0530 |
| Sharpe Ratio | 0.0739 | | 0.1084 | 0.0637 | | 0.1289 |
| **Panel 2: Fama-French Indexes** | | | | | | |
| | **Large Growth** | **Large Blend** | **Large Value** | **Small Growth** | **Small Blend** | **Small Value** |
| Mean | 0.0078 | 0.0084 | 0.0078 | 0.0076 | 0.0123 | 0.0133 |
| S.D. | 0.0478 | 0.0478 | 0.0524 | 0.0760 | 0.0561 | 0.0595 |
| Sharpe Ratio | 0.1025 | 0.1151 | 0.0945 | 0.0622 | 0.1684 | 0.1749 |
| **Panel 3: MSCI Indexes** | | | | | | |
| | **Prime Market Growth** | | **Prime Market Value** | **Small Cap Growth** | | **Small Cap Value** |
| Mean | 0.0073 | | 0.0078 | 0.0101 | | 0.0103 |
| S.D. | 0.0573 | | 0.0444 | 0.0718 | | 0.0519 |
| Sharpe Ratio | 0.0780 | | 0.1109 | 0.1008 | | 0.1440 |

*Notes: Table 1 shows the descriptive statistics of the monthly returns for the style indexes for June 1995 – Dec 2010.*

Empirical results on the performance of style momentum strategies are presented in Tables 2 to 10. Throughout the paper, we use FiHj to denote the strategy that forms the portfolio based on the return of the past i months and holds the portfolio for j months. Tables 2, 3, and 4 present results based on the Russell indexes at the large cap, small cap and cross market caps levels respectively. For long only strategies at the large cap level (Panel 1 of Table 2), average returns range from 0.0052 to 0.0074; standard deviations are between 0.0490 and 0.0523; and Sharpe ratios vary between 0.0464 and 0.0919. All strategies except F3H3 generate significant positive abnormal returns. Interestingly, for a fixed formation window, abnormal returns tend to decline when the holding period increases. For example, with a 3 months formation period, abnormal returns are 0.0026 and 0.0014 for holding periods of 1 month and 3 months, respectively. With a 6 months formation period, abnormal returns change from 0.0037 to 0.0023 when holding periods change from 1 month to 6 months.

With a 12 months formation period, abnormal returns change from 0.0031 to 0.0026 when holding periods change from 1 month to 12 months. The market betas across all strategies are around 1. For all strategies the coefficient of the SMB factor is negative and is close to zero since the style indexes are within large cap stocks. The coefficient of HML is negative. The coefficients of the momentum factor, WML, range from 0.0349 to 0.1432, which implies that the individual stock momentum factor only explains a small portion of the returns of the style momentum strategies. For long-short strategies at the large cap level (Panel 2 of Table 2), average returns range from 0.0037 to 0.0080 and tend to be lower compared to the long-only strategy; and none of abnormal returns are significant, which indicates that the long-only strategy outperforms the long-short strategy at the large cap level for Russell indexes. Results for the small cap Russell indexes are presented in Table 3. Interestingly, all abnormal returns are insignificant except for the F3H1 strategy. The long-only F3H1 provides a monthly abnormal return of 0.0031 and the long-short F3H1 provides a monthly abnormal return of 0.0056, both are significant only at the 10% level.

Table 2: Style Momentum with Russell 1000 Value / Growth Indexes

| **Panel 1: Long-Only** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **F3H1** | **F3H3** | **F6H1** | **F6H3** | **F6H6** | **F12H1** | **F12H3** | **F12H6** | **F12H12** |
| Mean | 0.0061 | 0.0052 | 0.0074 | 0.0064 | 0.0058 | 0.0070 | 0.0064 | 0.0058 | 0.0053 |
| S.D. | 0.0502 | 0.0507 | 0.0491 | 0.0493 | 0.0490 | 0.0515 | 0.0516 | 0.0518 | 0.0523 |
| Sharpe | 0.0642 | 0.0465 | 0.0919 | 0.0709 | 0.0599 | 0.0800 | 0.0678 | 0.0566 | 0.0464 |
| Alpha | 0.0026* | 0.0014 | 0.0037*** | 0.0025** | 0.0023** | 0.0031*** | 0.0026** | 0.0027*** | 0.0026*** |
| Rm-Rf | 1.0072 | 1.0406 | 0.9948 | 1.0159 | 1.0092 | 1.0495 | 1.0452 | 1.0286 | 1.0183 |
| SMB | -0.1192 | -0.0724 | -0.0779 | -0.0778 | -0.0990 | -0.0626 | -0.0569 | -0.0698 | -0.0738 |
| HML | -0.8818 | -0.8935 | -0.8934 | -0.8701 | -0.9168 | -0.9562 | -0.9668 | -1.0644 | -1.1226 |
| WML | 0.0889 | 0.1105 | 0.1201 | 0.1229 | 0.0995 | 0.1432 | 0.1238 | 0.0769 | 0.0349 |
| **Panel 2: Long-Short** | | | | | | | | | |
| | **F3H1** | **F3H3** | **F6H1** | **F6H3** | **F6H6** | **F12H1** | **F12H3** | **F12H6** | **F12H12** |
| Mean | 0.0054 | 0.0037 | 0.0080 | 0.0060 | 0.0049 | 0.0072 | 0.0060 | 0.0048 | 0.0038 |
| S.D. | 0.0538 | 0.0477 | 0.0519 | 0.0505 | 0.0461 | 0.0468 | 0.0453 | 0.0376 | 0.0332 |
| Sharpe | 0.0476 | 0.0173 | 0.0989 | 0.0615 | 0.0430 | 0.0930 | 0.0686 | 0.0526 | 0.0292 |
| Alpha | 0.0002 | -0.0022 | 0.0024 | 0.0000 | -0.0004 | 0.0013 | 0.0003 | 0.0004 | 0.0002 |
| Rm-Rf | 0.0491 | 0.1158 | 0.0242 | 0.0664 | 0.0529 | 0.1337 | 0.1250 | 0.0917 | 0.0712 |
| SMB | 0.0846 | 0.1782 | 0.1671 | 0.1673 | 0.1249 | 0.1978 | 0.2092 | 0.1832 | 0.1754 |
| HML | 0.1860 | 0.1625 | 0.1628 | 0.2094 | 0.1160 | 0.0371 | 0.0160 | -0.1793 | -0.2956 |
| WML | 0.2272 | 0.2703 | 0.2894 | 0.2951 | 0.2483 | 0.3358 | 0.2969 | 0.2032 | 0.1192 |

*Notes: Table 2 shows the performance measures of the monthly returns for the momentum strategies based on Russell 1000 indexes (large cap indexes). The long-only strategy invests in the style with greater previous returns out of the two indexes: Russell 1000 Value and Russell 1000 Growth. The long-short strategy invests in the winner style and takes a short position in the loser style. F denotes formation periods. H denotes holding periods. For example, F3H1 denote the strategies with a 3 months formation period and a 1 one month holding period. Alpha is estimated based on the Carhart four factor model. The coefficients for the four factors are reported: Rm-Rf represents the market beta; SMB represents the beta for small minus big factor; HML represents beta for high minus low factor; WML represents winner minus loser factor. *,**,*** indicate statistical significance at 0.1, 0.05 and 0.01 level.*

Table 3: Style Momentum with Russell 2000 Value / Growth Indexes

| **Panel 1: Long-Only** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **F3H1** | **F3H3** | **F6H1** | **F6H3** | **F6H6** | **F12H1** | **F12H3** | **F12H6** | **F12H12** |
| Mean | 0.0108 | 0.0083 | 0.0096 | 0.0094 | 0.0094 | 0.0092 | 0.0076 | 0.0067 | 0.0064 |
| S.D. | 0.0632 | 0.0642 | 0.0637 | 0.0643 | 0.0629 | 0.0653 | 0.0657 | 0.0658 | 0.0661 |
| Sharpe Ratio | 0.1250 | 0.0853 | 0.1064 | 0.1010 | 0.1033 | 0.0966 | 0.0727 | 0.0577 | 0.0542 |
| Alpha | 0.0031* | 0.0003 | 0.0015 | 0.0010 | 0.0012 | 0.0008 | -0.0006 | -0.0011 | -0.0008 |
| Rm-Rf | 0.9391 | 0.9785 | 0.9756 | 0.9783 | 0.9577 | 0.9982 | 1.0187 | 1.0067 | 0.9992 |
| SMB | 0.8257 | 0.8621 | 0.8278 | 0.8780 | 0.8770 | 0.8757 | 0.8599 | 0.8606 | 0.8503 |
| HML | -0.6310 | -0.6306 | -0.5782 | -0.5870 | -0.5988 | -0.6386 | -0.6856 | -0.7633 | -0.8402 |
| WML | 0.0950 | 0.1122 | 0.1315 | 0.1291 | 0.1285 | 0.1625 | 0.1656 | 0.1279 | 0.0818 |
| **Panel 2: Long-Short** | | | | | | | | | |
| | **F3H1** | **F3H3** | **F6H1** | **F6H3** | **F6H6** | **F12H1** | **F12H3** | **F12H6** | **F12H12** |
| Mean | 0.0106 | 0.0058 | 0.0084 | 0.0078 | 0.0078 | 0.0074 | 0.0044 | 0.0024 | 0.0020 |
| S.D. | 0.0580 | 0.0519 | 0.0597 | 0.0556 | 0.0532 | 0.0552 | 0.0505 | 0.0448 | 0.0395 |
| Sharpe Ratio | 0.1338 | 0.0562 | 0.0925 | 0.0888 | 0.0930 | 0.0828 | 0.0301 | -0.0101 | -0.0224 |
| Alpha | 0.0056* | 0.0001 | 0.0024 | 0.0015 | 0.0018 | 0.0011 | -0.0017 | -0.0028 | -0.0022 |
| Rm-Rf | -0.1196 | -0.0408 | -0.0465 | -0.0411 | -0.0824 | -0.0015 | 0.0396 | 0.0157 | 0.0006 |
| SMB | 0.2220 | 0.2948 | 0.2263 | 0.3267 | 0.3246 | 0.3220 | 0.2905 | 0.2918 | 0.2713 |
| HML | 0.1756 | 0.1765 | 0.2813 | 0.2636 | 0.2401 | 0.1605 | 0.0664 | -0.0888 | -0.2428 |
| WML | 0.2020 | 0.2365 | 0.2751 | 0.2703 | 0.2691 | 0.3371 | 0.3433 | 0.2679 | 0.1757 |

*Notes: Table 3 shows the performance measures of the monthly returns for the momentum strategies based on Russell 2000 indexes (small cap indexes). The long-only strategy invests in the style with greater previous returns out of the two indexes: Russell 2000 Value and Russell 2000 Growth. The long-short strategy invests in the winner style and takes a short position in the loser style. F denotes formation periods. H denotes holding periods. For example, F3H1 denote the strategies with a 3 months formation period and a 1 one month holding period. Alpha is estimated based on the Carhart four factor model. The coefficients for the four factors are reported: Rm-Rf represents the market beta; SMB represents the beta for small minus big factor; HML represents beta for high minus low factor; WML represents winner minus loser factor. *,**,*** indicate statistical significance at 0.1,0.05 and 0.01 level.*

Table 4 presents the results based on the strategies that rotate among all four Russell indexes based on past performances. Similar to the results using the small cap indexes, neither long-only strategy nor the long-short strategy provides any significant abnormal returns, which indicates that style momentum cannot generate abnormal returns when implemented across market cap levels using Russell indexes.

Table 4: Style Momentum: Russell 1000 Value / Growth and Russell 2000 Value / Growth Indexes

| **Panel 1: Long-Only** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **F3H1** | **F3H3** | **F6H1** | **F6H3** | **F6H6** | **F12H1** | **F12H3** | **F12H6** | **F12H12** |
| Mean | 0.0080 | 0.0059 | 0.0094 | 0.0089 | 0.0092 | 0.0089 | 0.0075 | 0.0069 | 0.0068 |
| S.D. | 0.0588 | 0.0590 | 0.0599 | 0.0593 | 0.0577 | 0.0613 | 0.0619 | 0.0593 | 0.0578 |
| Sharpe Ratio | 0.0878 | 0.0512 | 0.1090 | 0.1019 | 0.1097 | 0.0977 | 0.0754 | 0.0674 | 0.0673 |
| Alpha | 0.0021 | -0.0006 | 0.0022 | 0.0018 | 0.0024 | 0.0019 | 0.0006 | 0.0008 | 0.0017 |
| Rm-Rf | 0.9358 | 0.9945 | 0.9630 | 0.9930 | 1.0008 | 1.0164 | 1.0516 | 1.0523 | 1.0449 |
| SMB | 0.4721 | 0.5225 | 0.6199 | 0.5886 | 0.5342 | 0.5494 | 0.5485 | 0.4387 | 0.3318 |
| HML | -0.8022 | -0.8047 | -0.6979 | -0.7140 | -0.7326 | -0.8156 | -0.8421 | -0.8911 | -0.9538 |
| WML | 0.1286 | 0.1566 | 0.1784 | 0.1813 | 0.1633 | 0.2298 | 0.2284 | 0.1548 | 0.0813 |
| **Panel 2: Long-Short** | | | | | | | | | |
| | **F3H1** | **F3H3** | **F6H1** | **F6H3** | **F6H6** | **F12H1** | **F12H3** | **F12H6** | **F12H12** |
| Mean | 0.0086 | 0.0044 | 0.0064 | 0.0066 | 0.0074 | 0.0072 | 0.0057 | 0.0044 | 0.0045 |
| S.D. | 0.0660 | 0.0563 | 0.0621 | 0.0580 | 0.0521 | 0.0556 | 0.0520 | 0.0455 | 0.0416 |
| Sharpe Ratio | 0.0867 | 0.0273 | 0.0575 | 0.0648 | 0.0872 | 0.0771 | 0.0537 | 0.0335 | 0.0388 |
| Alpha | 0.0028 | -0.0020 | -0.0008 | -0.0004 | 0.0009 | 0.0005 | -0.0010 | -0.0009 | 0.0008 |
| Rm-Rf | -0.1299 | -0.0235 | -0.0549 | 0.0071 | 0.0277 | 0.0751 | 0.1430 | 0.1295 | 0.1008 |
| SMB | 0.3876 | 0.3860 | 0.4897 | 0.3965 | 0.3288 | 0.3546 | 0.3147 | 0.1813 | 0.0429 |
| HML | 0.1670 | 0.1960 | 0.2667 | 0.2863 | 0.2089 | 0.0078 | 0.0134 | -0.0911 | -0.2044 |
| WML | 0.2467 | 0.2766 | 0.3463 | 0.3259 | 0.3148 | 0.4163 | 0.3988 | 0.2910 | 0.1726 |

*Notes: Table 4 shows the performance measures of the monthly returns for the momentum strategies based on all four Russell indexes. The long-only strategy invests in the style with greater previous returns out of the four indexes: Russell 1000 Value/Growth, Russell 2000 Value/Growth. The long-short strategy invests in the winner style and takes a short position in the loser style. For example, F3H1 denote the strategies with a 3 months formation period and a 1 one month holding period. Alpha is estimated based on the Carhart four factor model. The coefficients for the four factors are reported: Rm-Rf represents the market beta; SMB represents the beta for small minus big factor; HML represents beta for high minus low factor; WML represents winner minus loser factor. *,**,*** indicate statistical significance at 0.1,0.05 and 0.01 level.*

In summary, for Russell indexes, the long-only strategies using the large cap value and the large cap growth indexes provide the highest and significant abnormal returns while the long-short strategies do not. Second, strategies using Russell small cap value/growth indexes or all four Russell indexes (large cap value/growth and small cap value/growth) do not create significant abnormal returns. Third, abnormal returns tend to decline when holding periods increase. Fourth, the individual stock momentum factor only explains a small portion of the returns of style momentum strategies. The results based on the Fama-French indexes are shown in Tables 5, 6, and 7 and are consistent with those from the Russell indexes. At the large cap level, we choose winning/losing styles out of three indexes: large cap value, large cap blend, and large cap growth. The results are presented in Table 5. For the long-only strategy (Panel 1 of Table 5), average returns range from 0.0051 to 0.0082; standard deviations vary between 0.0485 and 0.0502; and Sharpe ratios range from 0.0461 to 0.1054. Abnormal returns vary from 0.0009 per month to 0.0039 per month and all of them are significant except for F12H6. Similarly to Russell 1000 indexes, for a fixed formation window, abnormal returns tend to decline as holding periods increase. For example, abnormal returns are 0.0035, 0.0034 and 0.0019 for strategies F6H1, F6H3 and F6H6 respectively. Abnormal returns are 0.0035, 0.0021, 0.0009 and 0.0018 for strategies F12H1, F12H3, F12H6 and F12H12

respectively. It is worth-noting that the coefficients of the momentum factor, WML, range from 0.0391 to 0.1424, which indicates that the individual stock momentum only explains a very small portion of the returns of the long-only strategy. For the long-short strategies (Panel 2 of Table 5), again, they underperform the long-only strategy. None of the alphas are significant. In addition, the market betas across all strategies are close to zero since buying winner and shorting loser cancels out the market risk.

Table 6 presents the results based on the three Fama-French small cap indexes: small cap value/blend/growth. The long-only strategies provide greater average returns and greater abnormal returns than the long-short strategies. Five out of nine abnormal returns for the long-only strategies are significant with the F3H1 being the highest (alpha=0.0036) while none of the long-short strategies provide a significant alpha. If we compare Panel 1 of Table 6 with Panel 1 of Table 5, it shows abnormal returns of the long-only strategies based on large cap indexes are more significant, and tend to be greater than those based on the small cap indexes, which is consistent with the Russell indexes. In addition, those significant abnormal returns tend to decline when holding periods increase. For example, long-only strategies provide abnormal returns of 0.0036, 0.0028 and 0.0022 for strategies F6H1, F6H3, and F6H6, respectively. Similarly, the coefficients for WML are low and ranges from 0.0636 to 0.1429, which indicates that individual momentum cannot explain profitability of style momentum. Table 7 presents the results based on the six Fama-French style indexes: large cap value/blend/growth and small cap value/blend/growth. For the long-only strategies, five out of nine alphas are significant. However, four out of the five are only significant at 10% level. None of the long-short strategies generate significant alphas. Those results indicate that style momentum strategies do not provide consistently significant abnormal returns when implemented across various market cap levels for Fama-French indexes.

Table 5: Style Momentum with Fama-French Large- Cap Value / Blend / Growth Indexes

| **Panel 1: Long-Only** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **F3H1** | **F3H3** | **F6H1** | **F6H3** | **F6H6** | **F12H1** | **F12H3** | **F12H6** | **F12H12** |
| Mean | 0.0077 | 0.0082 | 0.0076 | 0.0078 | 0.0065 | 0.0079 | 0.0066 | 0.0051 | 0.0053 |
| S.D. | 0.0494 | 0.0502 | 0.0491 | 0.0488 | 0.0487 | 0.0485 | 0.0492 | 0.0494 | 0.0494 |
| Sharpe Ratio | 0.0983 | 0.1054 | 0.0967 | 0.1008 | 0.0754 | 0.1041 | 0.0764 | 0.0461 | 0.0502 |
| Alpha | 0.0039*** | 0.0039*** | 0.0035** | 0.0034*** | 0.0019* | 0.0035** | 0.0021* | 0.0009 | 0.0018** |
| Rm-Rf | 0.9784 | 1.0136 | 0.9786 | 0.9869 | 1.0078 | 0.9799 | 1.0129 | 1.0208 | 1.0032 |
| SMB | -0.1241 | -0.0853 | -0.0903 | -0.0564 | -0.0613 | -0.0425 | -0.0499 | -0.0449 | -0.0595 |
| HML | -0.7209 | -0.6860 | -0.6893 | -0.6704 | -0.6437 | -0.7163 | -0.7305 | -0.7615 | -0.8586 |
| WML | 0.0687 | 0.0931 | 0.0946 | 0.1067 | 0.1176 | 0.1424 | 0.1435 | 0.1040 | 0.0391 |
| **Panel 2: Long-Short** | | | | | | | | | |
| | **F3H1** | **F3H3** | **F6H1** | **F6H3** | **F6H6** | **F12H1** | **F12H3** | **F12H6** | **F12H12** |
| Mean | 0.0067 | 0.0077 | 0.0081 | 0.0083 | 0.0063 | 0.0076 | 0.0052 | 0.0029 | 0.0027 |
| S.D. | 0.0511 | 0.0473 | 0.0498 | 0.0487 | 0.0458 | 0.0465 | 0.0442 | 0.0386 | 0.0326 |
| Sharpe Ratio | 0.0750 | 0.1024 | 0.1048 | 0.1112 | 0.0742 | 0.1014 | 0.0536 | -0.0003 | -0.0052 |
| Alpha | 0.0029 | 0.0030 | 0.0033 | 0.0031 | 0.0011 | 0.0025 | 0.0002 | -0.0017 | -0.0008 |
| Rm-Rf | -0.0625 | 0.0325 | -0.0045 | 0.0137 | 0.0223 | 0.0154 | 0.0500 | 0.0607 | 0.0586 |
| SMB | -0.0031 | 0.0712 | 0.0876 | 0.1242 | 0.1238 | 0.1348 | 0.1425 | 0.1499 | 0.1223 |
| HML | 0.0427 | 0.0804 | 0.0917 | 0.1144 | 0.1102 | -0.0098 | -0.0269 | -0.1054 | -0.2388 |
| WML | 0.1630 | 0.2125 | 0.2448 | 0.2617 | 0.2600 | 0.3149 | 0.2968 | 0.2172 | 0.1115 |

*Notes: Table 5 shows the performance measures of the monthly returns for the momentum strategies based on three Fama-French large cap indexes. The long-only strategy invests in the style with greater previous returns out of the three indexes: Fama-French Large Cap Value/Blend/Growth. The long-short strategy invests in the winner style and takes a short position in the loser style. For example, F3H1 denote the strategies with a 3 months formation period and a 1 one month holding period. Alpha is estimated based on the Carhart four factor model. The coefficients for the four factors are reported: Rm-Rf represents the market beta; SMB represents the beta for small minus big factor; HML represents beta for high minus low factor; WML represents winner minus loser factor. *,**,*** indicate statistical significance at 0.1,0.05 and 0.01 level.*

Table 6: Style Momentum with Fama-French Small Cap Value / Blend / Growth Indexes

| **Panel 1: Long-Only** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **F3H1** | **F3H3** | **F6H1** | **F6H3** | **F6H6** | **F12H1** | **F12H3** | **F12H6** | **F12H12** |
| Mean | 0.0120 | 0.0102 | 0.0128 | 0.0121 | 0.0114 | 0.0114 | 0.0102 | 0.0093 | 0.0096 |
| S.D. | 0.0698 | 0.0697 | 0.0697 | 0.0698 | 0.0691 | 0.0687 | 0.0694 | 0.0697 | 0.0694 |
| Sharpe Ratio | 0.1312 | 0.1054 | 0.1422 | 0.1325 | 0.1233 | 0.1246 | 0.1054 | 0.0927 | 0.0964 |
| Alpha | 0.0036** | 0.0014 | 0.0036** | 0.0028** | 0.0022* | 0.0026* | 0.0012 | 0.0007 | 0.0016 |
| Rm-Rf | 0.9810 | 1.0025 | 0.9995 | 0.9921 | 0.9787 | 0.9645 | 0.9912 | 0.9887 | 0.9660 |
| SMB | 1.0186 | 1.0493 | 1.0509 | 1.0888 | 1.0902 | 1.0628 | 1.0630 | 1.0588 | 1.0463 |
| HML | -0.6415 | -0.6170 | -0.5214 | -0.5329 | -0.5466 | -0.6259 | -0.6345 | -0.6900 | -0.7950 |
| WML | 0.0664 | 0.0930 | 0.1169 | 0.1283 | 0.1222 | 0.1315 | 0.1429 | 0.1174 | 0.0636 |
| **Panel 2: Long-Short** | | | | | | | | | |
| | **F3H1** | **F3H3** | **F6H1** | **F6H3** | **F6H6** | **F12H1** | **F12H3** | **F12H6** | **F12H12** |
| Mean | 0.0094 | 0.0059 | 0.0109 | 0.0093 | 0.0081 | 0.0078 | 0.0048 | 0.0033 | 0.0037 |
| S.D. | 0.0567 | 0.0524 | 0.0617 | 0.0587 | 0.0575 | 0.0564 | 0.0538 | 0.0498 | 0.0433 |
| Sharpe Ratio | 0.1153 | 0.0581 | 0.1306 | 0.1097 | 0.0910 | 0.0874 | 0.0365 | 0.0077 | 0.0190 |
| Alpha | 0.0043 | -0.0002 | 0.0043 | 0.0023 | 0.0012 | 0.0014 | -0.0017 | -0.0025 | -0.0007 |
| Rm-Rf | -0.0691 | -0.0052 | -0.0414 | -0.0362 | -0.0490 | -0.0667 | -0.0076 | -0.0216 | -0.0680 |
| SMB | 0.2283 | 0.2899 | 0.2814 | 0.3540 | 0.3486 | 0.3114 | 0.3032 | 0.2982 | 0.2744 |
| HML | 0.1827 | 0.2599 | 0.4210 | 0.4102 | 0.3942 | 0.2331 | 0.1942 | 0.0651 | -0.1233 |
| WML | 0.1734 | 0.2395 | 0.2803 | 0.3075 | 0.3004 | 0.3457 | 0.3610 | 0.2924 | 0.1801 |

*Notes: Table 6 shows the performance measures of the monthly returns for the momentum strategies based on three Fama-French small cap indexes. The long-only strategy invests in the style with greater previous returns out of the three indexes: Fama-French Small Cap Value/Blend/Growth. The long-short strategy invests in the winner style and takes a short position in the loser style. F denotes formation periods. H denotes holding periods. For example, F3H1 denote the strategies with a 3 months formation period and a 1 one month holding period. Alpha is estimated based on the Carhart four factor model. The coefficients for the four factors are reported: Rm-Rf represents the market beta; SMB represents the beta for small minus big factor; HML represents beta for high minus low factor; WML represents winner minus loser factor.*

Table 7: Style Momentum with Fama-French Large -Cap Value / Blend / Growth and Small Cap Value / Blend/ Growth Indexes

| **Panel 1: Long-Only** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **F3H1** | **F3H3** | **F6H1** | **F6H3** | **F6H6** | **F12H1** | **F12H3** | **F12H6** | **F12H12** |
| Mean | 0.0096 | 0.0091 | 0.0121 | 0.0122 | 0.0109 | 0.0109 | 0.0094 | 0.0079 | 0.0079 |
| S.D. | 0.0637 | 0.0630 | 0.0660 | 0.0650 | 0.0624 | 0.0637 | 0.0646 | 0.0612 | 0.0569 |
| Sharpe Ratio | 0.1052 | 0.0994 | 0.1395 | 0.1437 | 0.1282 | 0.1258 | 0.1015 | 0.0822 | 0.0891 |
| Alpha | 0.0029 | 0.0019 | 0.0034* | 0.0039** | 0.0027* | 0.0033* | 0.0016 | 0.0008 | 0.0022* |
| Rm-Rf | 0.9313 | 0.9907 | 1.0170 | 0.9817 | 1.0089 | 0.9561 | 1.0048 | 1.0052 | 0.9836 |
| SMB | 0.6110 | 0.6520 | 0.7995 | 0.8356 | 0.7427 | 0.7584 | 0.7493 | 0.6482 | 0.4767 |
| HML | -0.7310 | -0.7372 | -0.5814 | -0.6519 | -0.6079 | -0.7957 | -0.7891 | -0.7815 | -0.8340 |
| WML | 0.1296 | 0.1754 | 0.2355 | 0.2057 | 0.1989 | 0.2269 | 0.2331 | 0.1582 | 0.0564 |
| **Panel 2: Long-Short** | | | | | | | | | |
| | **F3H1** | **F3H3** | **F6H1** | **F6H3** | **F6H6** | **F12H1** | **F12H3** | **F12H6** | **F12H12** |
| Mean | 0.0094 | 0.0064 | 0.0111 | 0.0112 | 0.0095 | 0.0082 | 0.0057 | 0.0046 | 0.0043 |
| S.D. | 0.0717 | 0.0619 | 0.0670 | 0.0635 | 0.0592 | 0.0594 | 0.0570 | 0.0507 | 0.0425 |
| Sharpe Ratio | 0.0909 | 0.0569 | 0.1235 | 0.1306 | 0.1119 | 0.0891 | 0.0503 | 0.0338 | 0.0347 |
| Alpha | 0.0036 | -0.0007 | 0.0026 | 0.0028 | 0.0014 | 0.0007 | -0.0018 | -0.0018 | 0.0003 |
| Rm-Rf | -0.1494 | -0.0282 | -0.0154 | -0.0397 | 0.0125 | 0.0074 | 0.0449 | 0.0369 | 0.0043 |
| SMB | 0.3946 | 0.5248 | 0.7081 | 0.7609 | 0.6282 | 0.6425 | 0.6519 | 0.5265 | 0.1917 |
| HML | 0.1378 | 0.1754 | 0.2181 | 0.1629 | 0.1836 | -0.1061 | -0.1049 | -0.1396 | -0.2018 |
| WML | 0.2592 | 0.3391 | 0.4602 | 0.4226 | 0.4332 | 0.4849 | 0.4538 | 0.3448 | 0.1734 |

*Notes: Table 7 shows the performance measures of the monthly returns for the momentum strategies based on all six Fama-French indexes. The long-only strategy invests in the style with greater previous returns out of the six indexes: Fama-French Large Cap Value/Blend/Growth and Small Cap Value/Blend/Growth. The long-short strategy invests in the winner style and takes a short position in the loser style. F denotes formation periods. H denotes holding periods. For example, F3H1 denote the strategies with a 3 months formation period and a 1 one month holding period. Alpha is estimated based on the Carhart four factor model. The coefficients for the four factors are reported: Rm-Rf represents the market beta; SMB represents the beta for small minus big factor; HML represents beta for high minus low factor; WML represents winner minus loser factor.*

Overall, the results using Fama-French indexes are consistent with those using Russell indexes, long-only strategies can generate significant abnormal returns while long-short strategies cannot. Abnormal returns tend to decline when holding period increases. Strategies implemented at the large cap level generate greater and more significant abnormal returns compare to those implemented at the small cap level or across all market cap levels. The results based on the MSCI indexes are provided in Tables 8, 9, and 10. Table 8 presents the results using two large cap indexes: MSCI U.S. prime market value index, MSCI U.S. prime market growth index. The long-only strategies provide average returns that range from 0.0056 to 0.0082 and abnormal returns that range from 0.0018 per month to 0.0040 per month. All of the alphas except for F3H3 are significant. Abnormal returns tend to decline when holding periods increase. The coefficients of the momentum factor, WML, range from 0.1031 to 0.1954 which indicates that the individual stock momentum only explains a very small portion of the returns of the buy winner strategy. Panel 2 of Table 8 presents the results for the long-short strategies. Similar to other indexes, long-short strategies underperform long-only strategies and none of the alphas are significant. Table 9 presents the results based on the two small cap indexes: MSCI U.S. small cap value and MSCI U.S. small cap growth. Again, in general, average returns and abnormal returns from the long-only strategies are higher than those from the long-short strategies. Six out of nine alphas are significant for the long-only strategies with three significant only at 10% level. None of the long-short strategies provide significant alphas. Table 10 presents the results based on the strategy rotating among all the four MSCI indexes: MSCI U.S. prime market value, MSCI U.S. prime market growth, MSCI U.S. small cap value, and MSCI U.S. small cap growth. Long-only strategies invest in the best performing index out of the four based on past returns. Similarly, the long-only strategies outperform the long-short strategies and generate positive alphas that range from 0.0024 to 0.0047. All of them are significant except for the F3H1 strategy. None of the alphas from the long-short strategies are significant. It is worth noting that MSCI is the only index family that can provide consistently significant abnormal returns when the long-only strategies are implemented across different market cap levels. This may be partially explained by the description in the data section, that is, the stocks covered by the MSCI small cap indexes are relatively larger than those included in the Russell 2000 indexes and Fama-French small cap indexes.

Table 8: Style Momentum with MSCI U.S. Prime Market Value / Growth Indexes

| **Panel 1: Long-Only** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **F3H1** | **F3H3** | **F6H1** | **F6H3** | **F6H6** | **F12H1** | **F12H3** | **F12H6** | **F12H12** |
| Mean | 0.0071 | 0.0056 | 0.0076 | 0.0079 | 0.0074 | 0.0082 | 0.0074 | 0.0070 | 0.0062 |
| S.D. | 0.0505 | 0.0505 | 0.0520 | 0.0521 | 0.0512 | 0.0525 | 0.0532 | 0.0535 | 0.0546 |
| Sharpe Ratio | 0.0845 | 0.0546 | 0.0912 | 0.0965 | 0.0889 | 0.1020 | 0.0855 | 0.0766 | 0.0618 |
| Alpha | 0.0038** | 0.0018 | 0.0034** | 0.0036*** | 0.0034*** | 0.0040*** | 0.0033*** | 0.0034*** | 0.0032*** |
| Rm-Rf | 0.9835 | 1.0194 | 1.0358 | 1.0486 | 1.0316 | 1.0476 | 1.0647 | 1.0474 | 1.0471 |
| SMB | -0.1004 | -0.0511 | -0.0311 | -0.0233 | -0.0234 | -0.0153 | -0.0211 | -0.0289 | -0.0404 |
| HML | -0.9545 | -0.9230 | -0.9439 | -0.9345 | -0.9933 | -0.9857 | -1.0257 | -1.1162 | -1.1995 |
| WML | 0.1031 | 0.1223 | 0.1828 | 0.1847 | 0.1672 | 0.1954 | 0.1910 | 0.1459 | 0.1040 |
| **Panel 2: Long-Short** | | | | | | | | | |
| | **F3H1** | **F3H3** | **F6H1** | **F6H3** | **F6H6** | **F12H1** | **F12H3** | **F12H6** | **F12H12** |
| Mean | 0.0071 | 0.0040 | 0.0080 | 0.0086 | 0.0076 | 0.0092 | 0.0076 | 0.0067 | 0.0053 |
| S.D. | 0.0568 | 0.0508 | 0.0540 | 0.0525 | 0.0467 | 0.0509 | 0.0468 | 0.0407 | 0.0346 |
| Sharpe Ratio | 0.0740 | 0.0231 | 0.0955 | 0.1089 | 0.1019 | 0.1251 | 0.1016 | 0.0946 | 0.0697 |
| Alpha | 0.0024 | -0.0016 | 0.0017 | 0.0020 | 0.0017 | 0.0028 | 0.0014 | 0.0017 | 0.0012 |
| Rm-Rf | -0.0068 | 0.0651 | 0.0979 | 0.1234 | 0.0895 | 0.1214 | 0.1558 | 0.1211 | 0.1205 |
| SMB | 0.0521 | 0.1507 | 0.1906 | 0.2062 | 0.2060 | 0.2223 | 0.2107 | 0.1950 | 0.1721 |
| HML | 0.1370 | 0.2000 | 0.1583 | 0.1771 | 0.0595 | 0.0746 | -0.0054 | -0.1863 | -0.3530 |
| WML | 0.2147 | 0.2529 | 0.3740 | 0.3779 | 0.3427 | 0.3992 | 0.3904 | 0.3003 | 0.2164 |

*Notes: Table 8 shows the performance measures of the monthly returns for the momentum strategies based on MSCI US prime market indexes (large cap indexes). The long-only strategy invests in the style with greater previous returns out of the two indexes: MSCI US Prime Market Value and US Prime Market Growth. The long-short strategy invests in the winner style and takes a short position in the loser style. F denotes formation periods. H denotes holding periods. For example, F3H1 denote the strategies with a 3 months formation period and a 1 one month holding period. Alpha is estimated based on the Carhart four factor model. The coefficients for the four factors are reported: Rm-Rf represents the market beta; SMB represents the beta for small minus big factor; HML represents beta for high minus low factor; WML represents winner minus loser factor.*

Table 9: Style Momentum with MSCI U.S. Small Cap Value / Growth Indexes

| **Panel 1: Long-Only** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **F3H1** | **F3H3** | **F6H1** | **F6H3** | **F6H6** | **F12H1** | **F12H3** | **F12H6** | **F12H12** |
| Mean | 0.0119 | 0.0101 | 0.0110 | 0.0111 | 0.0114 | 0.0104 | 0.0095 | 0.0085 | 0.0085 |
| S.D. | 0.0625 | 0.0635 | 0.0648 | 0.0647 | 0.0636 | 0.0658 | 0.0655 | 0.0658 | 0.0657 |
| Sharpe Ratio | 0.1443 | 0.1131 | 0.1248 | 0.1280 | 0.1339 | 0.1146 | 0.1017 | 0.0853 | 0.0860 |
| Alpha | 0.0046** | 0.0024* | 0.0030* | 0.0032** | 0.0036*** | 0.0026* | 0.0018 | 0.0012 | 0.0017 |
| Rm-Rf | 0.9918 | 1.0367 | 1.0512 | 1.0417 | 1.0317 | 1.0815 | 1.0717 | 1.0657 | 1.0496 |
| SMB | 0.6959 | 0.7436 | 0.7410 | 0.7594 | 0.7525 | 0.7204 | 0.7305 | 0.7267 | 0.7193 |
| HML | -0.6556 | -0.6810 | -0.6662 | -0.6504 | -0.6884 | -0.7503 | -0.7463 | -0.8173 | -0.8773 |
| WML | 0.0889 | 0.1210 | 0.1646 | 0.1386 | 0.1396 | 0.1842 | 0.1636 | 0.1204 | 0.0794 |
| **Panel 2: Long-Short** | | | | | | | | | |
| | **F3H1** | **F3H3** | **F6H1** | **F6H3** | **F6H6** | **F12H1** | **F12H3** | **F12H6** | **F12H12** |
| Mean | 0.0095 | 0.0058 | 0.0076 | 0.0080 | 0.0085 | 0.0065 | 0.0047 | 0.0027 | 0.0027 |
| S.D. | 0.0588 | 0.0483 | 0.0557 | 0.0545 | 0.0498 | 0.0510 | 0.0501 | 0.0442 | 0.0402 |
| Sharpe Ratio | 0.1124 | 0.0606 | 0.0849 | 0.0936 | 0.1122 | 0.0712 | 0.0373 | -0.0049 | -0.0038 |
| Alpha | 0.0042 | -0.0003 | 0.0009 | 0.0014 | 0.0022 | 0.0001 | -0.0015 | -0.0027 | -0.0017 |
| Rm-Rf | -0.1059 | -0.0163 | 0.0129 | -0.0061 | -0.0261 | 0.0735 | 0.0539 | 0.0418 | 0.0096 |
| SMB | 0.2987 | 0.3940 | 0.3888 | 0.4257 | 0.4119 | 0.3477 | 0.3679 | 0.3602 | 0.3456 |
| HML | 0.1124 | 0.0615 | 0.0912 | 0.1227 | 0.0467 | -0.0771 | -0.0691 | -0.2111 | -0.3311 |
| WML | 0.2333 | 0.2976 | 0.3848 | 0.3328 | 0.3349 | 0.4240 | 0.3828 | 0.2964 | 0.2145 |

*Notes: Table 9 shows the performance measures of the monthly returns for the momentum strategies based on MSCI US small cap indexes. The long-only strategy invests in the style with greater previous returns out of the two indexes: MSCI US Small Cap Value and US Small Cap Growth. The long-short strategy invests in the winner style and takes a short position in the loser style. F denotes formation periods. H denotes holding periods. For example, F3H1 denote the strategies with a 3 months formation period and a 1 one month holding period. Alpha is estimated based on the Carhart four factor model. The coefficients for the four factors are reported: Rm-Rf represents the market beta; SMB represents the beta for small minus big factor; HML represents beta for high minus low factor; WML represents winner minus loser factor.*

Table 10: Style Momentum with MSCI U.S. Prime Market Value / Growth and Small Cap Value / Growth Indexes

| **Panel 1: Long-Only** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **F3H1** | **F3H3** | **F6H1** | **F6H3** | **F6H6** | **F12H1** | **F12H3** | **F12H6** | **F12H12** |
| Mean | 0.0103 | 0.0086 | 0.0112 | 0.0114 | 0.0112 | 0.0113 | 0.0101 | 0.0093 | 0.0087 |
| S.D. | 0.0569 | 0.0579 | 0.0624 | 0.0615 | 0.0614 | 0.0639 | 0.0631 | 0.0615 | 0.0600 |
| Sharpe Ratio | 0.1314 | 0.0996 | 0.1333 | 0.1393 | 0.1350 | 0.1311 | 0.1150 | 0.1039 | 0.0981 |
| Alpha | 0.0047** | 0.0024 | 0.0040** | 0.0043*** | 0.0042*** | 0.0042** | 0.0032** | 0.0032** | 0.0034*** |
| Rm-Rf | 0.9615 | 1.0139 | 1.0721 | 1.0597 | 1.0637 | 1.1161 | 1.1024 | 1.0967 | 1.0785 |
| SMB | 0.3674 | 0.4605 | 0.5230 | 0.5252 | 0.5293 | 0.4881 | 0.4985 | 0.4200 | 0.3533 |
| HML | -0.8552 | -0.8406 | -0.7970 | -0.8024 | -0.8436 | -0.8835 | -0.8893 | -0.9518 | -1.0048 |
| WML | 0.1532 | 0.1751 | 0.2465 | 0.2470 | 0.2257 | 0.2804 | 0.2597 | 0.1740 | 0.1250 |
| **Panel 2: Long-Short** | | | | | | | | | |
| | **F3H1** | **F3H3** | **F6H1** | **F6H3** | **F6H6** | **F12H1** | **F12H3** | **F12H6** | **F12H12** |
| Mean | 0.0103 | 0.0064 | 0.0093 | 0.0104 | 0.0104 | 0.0115 | 0.0097 | 0.0078 | 0.0068 |
| S.D. | 0.0636 | 0.0547 | 0.0597 | 0.0587 | 0.0535 | 0.0575 | 0.0548 | 0.0466 | 0.0407 |
| Sharpe Ratio | 0.1166 | 0.0651 | 0.1073 | 0.1281 | 0.1415 | 0.1497 | 0.1249 | 0.1067 | 0.0970 |
| Alpha | 0.0046 | -0.0003 | 0.0013 | 0.0023 | 0.0028 | 0.0035 | 0.0018 | 0.0014 | 0.0018 |
| Rm-Rf | -0.1000 | -0.0035 | 0.0983 | 0.0869 | 0.0735 | 0.1490 | 0.1610 | 0.1388 | 0.0957 |
| SMB | 0.3133 | 0.4362 | 0.4792 | 0.5024 | 0.5013 | 0.4578 | 0.4792 | 0.3759 | 0.2878 |
| HML | 0.1314 | 0.1653 | 0.1703 | 0.2107 | 0.1156 | 0.0976 | 0.0855 | -0.0698 | -0.2213 |
| WML | 0.2919 | 0.3235 | 0.4855 | 0.4607 | 0.4391 | 0.5116 | 0.4839 | 0.3655 | 0.2556 |

*Notes: Table 10 shows the performance measures of the monthly returns for the momentum strategies based on all four MSCI indexes. The long-only strategy invests in the style with greater previous returns out of the four indexes: MSCI US Prime Mraket Value/Growth, MSCI Small Cap Value/ Growth. The long-short strategy invests in the winner style and takes a short position in the loser style. F denotes formation periods. H denotes holding periods. For example, F3H1 denote the strategies with a 3 months formation period and a 1 one month holding period. Alpha is estimated based on the Carhart four factor model. The coefficients for the four factors are reported: Rm-Rf represents the market beta; SMB represents the beta for small minus big factor; HML represents beta for high minus low factor; WML represents winner minus loser factor.*

## CONCLUDING COMMENTS

In this study, we investigate the return enhancement ability of style momentum strategy. We explore the variation in abnormal returns estimated based on the Carhart four-factor model (Fama-French three factors plus momentum) of long-only and long-short momentum strategies using various style based indexes (Russell value/growth indexes, Fama-French value/growth indexes, and MSCI value/growth indexes) where the value and growth stocks are classified using different criteria. Such strategies are much easier to implement and considerably less expensive compared to the style momentum strategies based on individual stocks. We did cross-style analysis by comparing the performance of the strategy using large cap value/growth vs. small cap value/growth indexes. Although results from three index families do vary, the primary results are robust. We first find that in general the long-only strategies create significant positive abnormal returns whereas the long-short strategies do not. This result is consistent with the literature on stock momentum (see, Griffin et al. (2005), Ammann et al. (2011)). Second, for a fixed formation period, abnormal returns of style momentum tend to decrease when the length of holding periods increases. Third, rotating value/growth styles at the large cap level tend to generate more consistent and more significant abnormal returns than rotating at the small cap level or across all market cap levels. Fourth, our strategies based on rotating across all market cap levels do not generate consistently significant abnormal returns for Russell indexes or Fama-French indexes, but they do for MSCI indexes. Fifth, individual stock momentum only explains a very small portion of the returns of the style moment strategies. In other words, chasing winning styles does provide additional benefits to chasing winning stocks. Those findings are of great interest to individual investors and portfolio managers and will help them enhance their investment performance. Our findings also bring up questions for future research. For example, why style momentum exists? Under what market it may be the strongest? And so on. We plan to explore those questions in future.

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