

TRIMMING EFFECTS AND MOMENTUM INVESTING

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ABSTRACT

This study tests the effects of outlier trimming (or truncation) on the performance of momentum portfolios. We test the hypothesis that outliers are essential and possess carry-over effects applicable to momentum investing. Our results support the hypothesis. We find momentum portfolios formed using untrimmed data produce higher returns than those formed using outlier trimmed data. Risk-adjusted results show the same results. Moreover, we find that the less the data are trimmed, the larger the resulting spread between the winner and loser portfolios formed from momentum. Finally, our results show that the trimming effect continues to exist even after distinguishing between UP and DOWN market states.

JEL: G11, G12, G14, G17

KEYWORDS: Trimming Level, Trading Strategies, Investment Strategies

INTRODUCTION

Momentum is one of the strongest factors among the myriad of factors presented in the recent finance literature. In the vast majority of studies, momentum portfolios are formed using data from the previous year, which longs a winner portfolio and contemporaneously shorts a loser portfolio. The seminal paper by Jegadeesh and Titman (1993, JT hereafter) demonstrate the presence of momentum in stock returns over intermediate horizons. Their conclusions show that the self-financed portfolio that buys the winner 10% and sells the loser 10% of stocks ranked by past six months returns and holds the portfolios for six months generates an average performance of approximately 1% per month.

The effects of outlier trimming on momentum portfolio performance have not been thoroughly investigated. A review of the momentum literature shows that nearly all previous studies deal with outliers in an ad-hoc fashion without much explanation. Many studies, simply remove outliers from their dataset by an ad-hoc trimming level before momentum portfolio formation but without any justification.

Asness et al. (2013), for example, exclude stock prices less than \$1 at the beginning of each month. Chuang and Ho (2014) exclude stocks with prices less than \$1 during the formation period. Adrian et al. (2014) excludes the smallest decile of firms based on market capitalization on the formation date. Hwang and Rubesam (2015) exclude all stocks with prices below \$5 at the portfolio formation date and all stocks whose sizes would place them in the smallest NYSE decile. Chen and Yang (2016) investigate the echo effect on momentum. They employ the entire sample of stocks (which means trimmed at 0% level) for their dataset. Daniel and Titman (1997) exclude firms with book-to-market values below zero. Fama and French (2012) show the results of excluding microcap portfolios. Menkhoff et al. (2012) exclude many smaller emerging markets from their sample. Kelly and Pruitt (2013) form their own data sets which exclude dividend nonpayers. None of these papers analyze the trimming effect on momentum investing described in this study.

Methodologically, we use monthly data and form momentum portfolios using the traditional JT strategy based on different levels of outlier trimming. Translated to the framework of the trimming effect; our hypothesis is then, the momentum portfolios formed from higher percentage outlier trimming may inadvertently also removed the outlier stocks with the most trimming effect and thus will underperform momentum portfolios formed from lower percentage outlier trimming or no outlier trimming. The methodology section will provide more details of the testing methodology. Our main results show that the performance proxy associated with a portfolio formed from stocks using the untrimmed momentum strategy is about 38% better than that of the different trimmed strategies investigated in this study.

The results, moreover, are robust to different subsamples and testing methodologies. Our study shows that the untrimmed strategy leads to higher performance, and captures more overreaction to previous information from investors when new information substantiates. To sum up, the momentum portfolio formed from untrimmed data outperforms those formed from trimmed data.

Our results show several additional details. First, the performance of the winner portfolios will reduce when the trimming level is increased. Second, the performance of the loser portfolios will increase when the trimming level is increased. Third, the winner minus loser (self-financed) portfolios' performance will also reduce when the trimming level is raised. Finally, our results show that the trimming effect continues to exist even after distinguishing between UP and DOWN market states.

The rest of this paper is organized as follows. In the next section, literature on the relative trimming are presented. In the following section, we provide a discussion of the data and methodology applied in the study. Analysis of Profit from Trimmed Strategies are provided in the results section. The final section, this study closes with some concluding comments and suggestions for future research.

LITERATURE REVIEW

Ledolter (1989) finds an additive outlier through the carryover effect affects the forecasts. Chen and Liu (1993) find Outliers in time series may have a mild to significant impact on the effectiveness for time series analysis. Daniel and Titman (1997) exclude firms with book-to-market values below zero. Their evidence show that the return premia on small size stocks and high book-to-market stocks does not arise because of the comovement of these stocks with common factors. Fama and French (2012) show the results of excluding microcap portfolios. They show that empirical asset pricing models capture the value and momentum patterns in international average returns. They further find the asset pricing seems to be integrated across North America, Europe, and Japan. Menkhoff et al. (2012) exclude many smaller emerging markets from their sample. They find excess returns of up to 10% per annum significantly between past self-financing currencies momentum portfolios. This spread in excess returns partially is explained by transaction costs and shows behavior consistent with investor under-reaction and over-reaction. Kelly and Pruitt (2013) form their own data sets which exclude dividend nonpayers. They construct forecasts of returns and cash flow growth rates both in-sample and out-of-sample by extracting information from disaggregate valuation ratios. Their results imply that discount rates are much less persistent, and their shocks more volatile, than previous literature suggests.

A review of the momentum literature shows that nearly all previous studies deal with outliers in an ad-hoc fashion without much explanation. Asness et al. (2013), for example, exclude stock prices less than \$1 at the beginning of each month. Their result find that the significant performance to value and momentum portfolios in every asset class with a linkage strongly. Chuang and Ho (2014) exclude stocks with prices less than \$1 during the formation period. They form an implied price risk (IPR) momentum strategy. They find IPR-momentum strategy is nearly orthogonal to the value investing strategy. They conclude that the performance of IPR-momentum strategy do not come from the value investing strategy because if the both strategies are similar, then their portfolio returns present a positive correlation. Adrian et al. (2014) excludes

the smallest decile of firms based on market capitalization on the formation date. They find that the broker-dealer leverage factor can interpret the average excess returns on a wide variety assets, including equity portfolios sorted by size, book-to-market, momentum, and the Treasury bond portfolios sorted by maturity. Hwang and Rubesam (2015) exclude all stocks with prices below \$5 at the portfolio formation date and all stocks whose sizes would place them in the smallest NYSE decile. They show that momentum has disappeared since the late 1990s, and the risk-adjusted momentum premium is only during certain periods in the past, notably from 1940 to 1960 and from 1970 to 1990. Chen and Yang (2016) investigate the echo effect on momentum. They employ the entire sample of stocks (which means trimmed at 0% level) for their dataset. They show the length of the skip-period in the 52-week high portfolios differs from the length of the skip- period in JT (Jegadeesh and Titman, 1993) momentum portfolios that found by Novy-Marx (2012).

None of these papers analyze the trimming effect on momentum investing described in this study. This study investigates the effects of outlier trimming on momentum profits. The effects of outlier trimming on momentum portfolio performance have not been thoroughly investigated.

DATA AND METHODOLOGY

This study uses monthly data. The data includes 23802 firms of all NYSE, AMEX, and NASDAQ stocks' prices (share codes 10 and 11) listed in the Center for Research in Securities Prices (CRSP) monthly file and contains all such stocks from December 1927 through December 2013. We compute the momentum portfolio following the procedures described by Jegadeesh and Titman (1993, JT hereafter) based on past 12-month return. Stocks are ranked using their past 12-month return. We then adopt various approaches of trimming level to the past return of the formation period. We use 10% cutoff to distinguish winner and loser portfolios in the analyses and hold positions for one month. Trimming removes outliers from samples. For instance, samples in the formation period that are trimmed 1% mean that we remove stocks with the largest 1% returns in the prior 12 months and also stocks with the smallest 1% returns in the prior 12 months. We denote this as T1%. Trimmed 0.5% level means removing stocks with the largest 0.5% returns in the prior 12 months and stocks with the smallest 0.5% returns in the prior 12 months. We denote this as T0.5% in this paper.

In this study, we examine the trimming effect on the JT momentum portfolio by varying trimming, from 0% to 1% level. This method produces eleven different formation patterns. We skip one month between portfolio formation and portfolios purchase to avoid lagged reaction effects, price pressure, and bid-ask spread by as in Jegadeesh (1990) and Lehmann (1990). We then hold the portfolios for one month. The resulting profits are calculated as the equally weighted average returns of the portfolios established one month ago.

For clarity of illustration, in the remainder of this paper, we denote momentum portfolios formed from the various trimming analyzed in this study using the Tx% notation. The "T" refers to trimming. Tx% denotes that the sample is trimmed at x% and 1-x% levels. The no-trimmed momentum strategy is denoted as T0% strategy using this notation. The 1%-trimmed momentum strategy is denoted as T1% strategy.

RESULTS

Analysis of Profit from Trimmed Strategies

In this section, we describe the monthly returns of the trimming strategies discussed in the last section — the analyzed period spans from 1927 to 2013 which covers most contemporary financial crises. Table 1 displays the average monthly raw returns of equally weighted decile portfolios and self-financed decile portfolios of eleven different trimmed JT (Jegadeesh and Titman, 1993) strategies over the one month

holding period, with winners (the top decile) and losers (the bottom decile) identified using 10% cutoffs. The first row lists the eleven trimmed strategies. Table 1 also shows the results for self-financed portfolios, decile-based, long the top decile and short the bottom decile portfolios. Consistent with Jegadeesh and Titman (1993), our results show strong evidence of momentum based past 12-month return.

The second row shows the return of winner portfolios. It exhibits a descending pattern as the trimming level is raised. The T0% winner portfolio generates a return of 0.76% per month. The winner returns of the T0.5% and the T1% strategies reduce its return to 0.74% and 0.71%, respectively. It can be seen that the performance of the winner portfolios will reduce when the trimming level is raised.

The second to the last row expresses the return of loser portfolios. These portfolios exhibit an ascending pattern as the trimming level is raised. The T0% loser portfolio generates a return of -0.19% per month. The loser return of the T0.5% strategy has a higher return of -0.05%, and the loser returns of the T1% strategy gives an even higher return of positive 0.03%. It can be seen that after increases in trimming, a loser is not similar to a loser anymore and the performance of the loser portfolios will appreciate when the trimming level is raised.

The last row shows results of decile-based self-financed portfolios of eleven different trimmed strategies. The results also exhibit a descending pattern as the trimming level is raised. For the various trimmed strategies, the T0% self-financed portfolio provides the best returns, a positive monthly return of 0.95%, statistically significant with a t-statistic of 3.43 which is similar to Jegadeesh and Titman (1993). The T0.5% and the T1% self-financed portfolios reduce its returns to 0.8% and 0.69%, statistically significant with t-statistic of 2.94 and 2.56, respectively. The results show that performance will reduce when the trimming level is raised. Most notably, we find that the return of the T0% self-financed portfolio which is 38% greater than that of the T1% self-financed portfolio.

Table 1: Returns of Portfolios with Various Levels of Outlier Trimming

Portfolios	Trimming										
	T0%	T0.1%	T0.2%	T0.3%	T0.4%	T0.5%	T0.6%	T0.7%	T0.8%	T0.9%	T1%
Winner	0.76	0.76	0.75	0.74	0.74	0.74	0.74	0.73	0.72	0.72	0.71
2	0.69	0.69	0.69	0.70	0.70	0.70	0.71	0.71	0.72	0.72	0.72
3	0.74	0.74	0.74	0.73	0.74	0.73	0.73	0.74	0.73	0.73	0.73
4	0.68	0.68	0.68	0.69	0.68	0.69	0.69	0.68	0.68	0.68	0.67
5	0.73	0.72	0.73	0.72	0.73	0.72	0.72	0.73	0.72	0.72	0.73
6	0.60	0.59	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.59
7	0.61	0.61	0.61	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
8	0.49	0.48	0.48	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47
9	0.40	0.40	0.41	0.42	0.43	0.44	0.44	0.44	0.44	0.45	0.45
Loser	-0.19	-0.15	-0.12	-0.09	-0.08	-0.05	-0.03	-0.01	0.00	0.02	0.03
Winner-Loser	0.95*** (3.43)	0.91*** (3.25)	0.87*** (3.14)	0.83*** (3.03)	0.82*** (3.02)	0.80*** (2.94)	0.77*** (2.85)	0.74*** (2.73)	0.71*** (2.64)	0.70*** (2.59)	0.69** (2.56)

*This table reports the average monthly returns from March 1927 through December 2013 for eleven momentum strategies of various trimming. Momentum portfolios are formed based on past 12-month return. Stocks are sorted into ten portfolios. The winner (loser) portfolio in momentum strategy is the equally weighted portfolio of 10% of stocks with the highest (lowest) past 12-month return. All portfolios are held for one month. The Trimming denotes that the portfolio is formed from a sample that is trimmed at T percent. Momentum strategy of T1% corresponds to portfolios formed from the sample of stocks that are trimmed each month at the top 1% and bottom 99% during the observation period. The sample includes all stocks on CRSP and t-statistics are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% level, respectively.*

To summarize, Table 1 shows three notable aspects. First, the performance of the winner portfolios will reduce when the trimming level is raised. Second, the performance of the loser portfolios will appreciate

when the trimming level is raised. Finally, the winner minus loser (self-financed) portfolio's performance will reduce when the trimming level is raised.

Risk-adjusted Returns

We next run time series regression of the average monthly excess returns on the Fama-French three factors to hedge out the effects of these factors. The dependent variable, $R_{(Td,t)}$, in these regressions is the month t excess return corresponding to the various trimmed $Tx\%$ strategies. The independent variables are Fama-French three factors. The constant term in the regressions will then be the risk-adjusted performance measure which will allow us to compare the performance of the different trimming strategies from the following regression:

$$R_{Td,t} = b_{0,Td,t} + b_{1,Td,t}X_{FF3F,t-1} + e_{Td,t} \quad (1)$$

$b_{(0,Td,t)}$ is risk-adjusted performance can be interpreted as the return of outliers to a neutral portfolio that has hedged out the Fama-French three factors identified by one of the eleven strategies. $X_{(FF3F,t-1)}$ is Fama-French three factors in month $t-1$ include risk premium factor, size factor and book-to-market factor. In our regression, there is no overlapping effect because the portfolios are held for only one month.

Table 2 shows the estimated results for risk-adjusted performances and the associated t -statistics from the time series regressions. The sample period for Table 2 is from March 1927 to December 2013. The second row shows that the risk-adjusted performance of winner portfolios exhibits a descending pattern as the trimming level is raised. The risk-adjusted performance of T0% winner portfolio is 0.54% per month, statistically significant with a t -statistic of 2.24. The winner risk-adjusted performances of the T0.5% and the T1% winner portfolios are reduced to 0.53% and 0.51%, statistically significant with t -statistic of 2.24 and 2.16, respectively. It can be seen that the risk-adjusted performance of the winner portfolios is reduced when the trimming level is raised.

The second to the last row shows the risk-adjusted performance of loser portfolios. It shows an ascending pattern as the trimming level is raised. The T0% the loser portfolio generates a risk-adjusted performance of -0.64% per month, statistically significant with a t -statistic of -1.72. On the other hand, the loser risk-adjusted performances of the T0.5% and the T1% loser portfolios are higher, -0.05% and -0.42%, but not statistically significant. Overall pattern shows that the loser portfolios' the risk-adjusted performance tend to increase when the trimming level is raised.

The last row shows that the self-financed portfolios display a descending pattern in performance as the trimming level is raised. For the various trimmed strategies, the T0% self-financed portfolio provides the best risk-adjusted performances, a positive monthly risk-adjusted performance of 1.16%, statistically significant with a t -statistic of 4.24 which is 29% (15%) greater than that of T1% (T0.5%) self-financed portfolios (9% (1.01%)). The T0.5% and the T1% strategies exhibit lower risk-adjusted performances of 1.01% and 0.9%, statistically significant with t -statistics of 3.76 and 3.42, respectively. In short, the risk-adjusted performance of the self-financed portfolios will also reduce when the trimming level is raised.

Table 2: Comparison of Risk-adjusted performances of Momentum Portfolios with Various Trimming

Portfolios	Trimming					
	T0%	T0.1%	T0.2%	T0.3%	T0.4%	T0.5%
Winner	0.54** (2.24)	0.55** (2.27)	0.54** (2.27)	0.54** (2.25)	0.53** (2.24)	0.53** (2.24)
2	0.49** (2.35)	0.49** (2.34)	0.49** (2.33)	0.49** (2.36)	0.49** (2.36)	0.49** (2.36)
3	0.53*** (2.73)	0.53*** (2.72)	0.53*** (2.72)	0.53*** (2.71)	0.54*** (2.74)	0.53*** (2.72)
4	0.47** (2.34)	0.48** (2.35)	0.48** (2.34)	0.48** (2.37)	0.47** (2.33)	0.48** (2.36)
5	0.48** (2.29)	0.48** (2.27)	0.48** (2.28)	0.47** (2.26)	0.48** (2.28)	0.47** (2.26)
6	0.35 (1.63)	0.35 (1.62)	0.35 (1.63)	0.35 (1.63)	0.35 (1.64)	0.35 (1.64)
7	0.32 (1.35)	0.32 (1.36)	0.32 (1.37)	0.32 (1.38)	0.32 (1.38)	0.32 (1.39)
8	0.21 (0.85)	0.21 (0.85)	0.21 (0.84)	0.20 (0.81)	0.20 (0.80)	0.20 (0.78)
9	0.07 (0.24)	0.08 (0.27)	0.09 (0.30)	0.10 (0.34)	0.11 (0.38)	0.11 (0.39)
Loser	-0.64* (-1.72)	-0.60 (-1.62)	-0.57 (-1.53)	-0.54 (-1.45)	-0.53 (-1.43)	-0.50 (-1.36)
Winner-Loser	1.16*** (4.24)	1.13*** (4.09)	1.09*** (3.99)	1.05*** (3.88)	1.04*** (3.87)	1.01*** (3.76)

This table reports the average monthly risk-adjusted performances from March 1927 through December 2013 for eleven momentum strategies of various trimming. In each month t , common stocks listed on NYSE, AMEX, and Nasdaq are sorted into portfolios based on their returns over the past one year. Portfolios are obtained using 10% cutoff and then divide it into ten trimming portfolios. $R_{T_d,t} = b_{0,T_d,t} + b_{1,T_d,t}X_{FF3F,t-1} + e_{T_d,t}$ where $R_{T_d,t}$ is the return of portfolio d decile in month t . $X_{FF3F,t-1}$ is the Fama-French three factors in month $t-1$. To obtain risk-adjusted performances, we run the times series regressions of portfolios averages (one for each average) on the Fama-French factor realizations to hedge out the factor predictability. The numbers reported for risk-adjusted performances are the constant from these time-series regressions. The sample includes all stocks on CRSP and t -statistics are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% level, respectively.

The last two columns provide the difference of risk-adjusted results for the difference between two portfolios of different trimming levels. The T0%-T0.5% and T0%-T1% loser portfolios generate risk-adjusted performances of -0.17% and -0.25% per month, statistically significant with t -statistic of -6.95 and -7.23, respectively. The difference in the risk-adjusted performance of the T0%-T0.5% and T0%-T1% self-financed portfolios generate 0.13% and 0.24% per month, statistically significant with t -statistic of 4.58 and 6.04, respectively. Results again show that the risk-adjusted performance of the T0% self-financed portfolio is greater than the risk-adjusted performance associated with all other trimmed self-financed portfolios. Indeed, the T0% strategy dominates the T0.5% and the T1% strategies as well.

To summarize, Table 2 denotes three notable aspects. First, the risk-adjusted performance of the winner portfolios and self-financed portfolios will reduce when the trimming level is raised. Second, the risk-adjusted performance of the loser portfolios will increase when the trimming level rises. Finally, the difference in the risk-adjusted performance of the self-financed portfolios indicates the T0% strategy dominates those of the T0.5% and the T1% strategies.

Table 2: Comparison of Risk-adjusted performances of Momentum Portfolios with Various Trimming (Continued)

Portfolios	Trimming						
	T0.6%	T0.7%	T0.8%	T0.9%	T1%	T0%-T0.5%	T0%-T1%
Winner	0.52** (2.21)	0.52** (2.19)	0.51** (2.15)	0.51** (2.15)	0.51** (2.16)	-0.01 (-0.73)	0.01 (0.58)
2	0.50** (2.40)	0.50** (2.41)	0.50** (2.41)	0.51** (2.44)	0.51** (2.43)	-0.03*** (-2.95)	-0.04*** (-2.92)
3	0.53*** (2.71)	0.54*** (2.74)	0.53*** (2.74)	0.53*** (2.74)	0.54*** (2.76)	-0.02*** (-3.51)	-0.03*** (-2.95)
4	0.48** (2.36)	0.47** (2.31)	0.47** (2.31)	0.47** (2.31)	0.46** (2.28)	-0.03*** (-6.06)	-0.01* (-1.88)
5	0.47** (2.27)	0.48** (2.28)	0.48** (2.27)	0.47** (2.26)	0.48** (2.28)	-0.02*** (-5.64)	-0.02*** (-4.35)
6	0.35 (1.63)	0.35 (1.64)	0.35 (1.63)	0.35 (1.63)	0.35 (1.61)	-0.03*** (-8.09)	-0.02*** (-4.14)
7	0.33 (1.40)	0.33 (1.40)	0.32 (1.39)	0.33 (1.40)	0.33 (1.44)	-0.03*** (-5.30)	-0.04*** (-4.87)
8	0.19 (0.77)	0.19 (0.78)	0.20 (0.79)	0.20 (0.79)	0.20 (0.79)	-0.01 (-0.67)	-0.01 (-0.69)
9	0.11 (0.39)	0.12 (0.42)	0.12 (0.44)	0.13 (0.47)	0.13 (0.47)	-0.07*** (-5.78)	-0.09*** (-5.26)
Loser	-0.48 (-1.32)	-0.46 (-1.26)	-0.45 (-1.23)	-0.44 (-1.20)	-0.42 (-1.16)	-0.17*** (-6.95)	-0.25*** (-7.23)
Winner-Loser	0.98*** (3.68)	0.95*** (3.57)	0.93*** (3.49)	0.92*** (3.45)	0.90*** (3.42)	0.13*** (4.58)	0.24*** (6.04)

This table reports the average monthly risk-adjusted performances from March 1927 through December 2013 for eleven momentum strategies of various trimming. In each month t , common stocks listed on NYSE, AMEX, and Nasdaq are sorted into portfolios based on their returns over the past one year. Portfolios are obtained using 10% cutoff and then divide it into ten trimming portfolios. $R_{T_d,t} = b_{0,T_d,t} + b_{1,T_d,t}X_{FF3F,t-1} + e_{T_d,t}$ where $R_{T_d,t}$ is the return of portfolio d decile in month t . $X_{FF3F,t-1}$ is the Fama-French three factors in month $t-1$. To obtain risk-adjusted performances, we run the times series regressions of portfolios averages (one for each average) on the Fama-French factor realizations to hedge out the factor predictability. The numbers reported for risk-adjusted performances are the constant from these time-series regressions. The sample includes all stocks on CRSP and t -statistics are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% level, respectively.

Analysis Risk-adjusted Performance across Different Market States

To test the robustness of the effect of outlier trimming on momentum returns, we test to see if market states affect the results. Methodologically, we separate the whole sample period into two groups by market states using the market states definitions in Cooper et al. (2004). This market state definition is relevant to this study because Cooper et al. (2004) show market states when defined as such significantly influence momentum returns. In particular, they find positive average monthly momentum return is more likely to associate with UP market, and the negative average monthly momentum return is more likely to be associated with DOWN market. Following Cooper et al. (2004), we distinguish states of the market at the beginning of holding period of each portfolio. We employ the Dow Jones Industrial Average over the three years prior to the beginning of the strategy’s holding period. Specifically, the returns on the Dow Jones Industrial Average are computed over the period $t-36$ to $t-1$, then non-negative (negative) returns of the Dow Jones Industrial Average index will define the UP (DOWN) market states. We also proffer a one-year definition of the market’s state.

Table 3 presents the average monthly risk-adjust returns from March 1927 through December 2013 for various outlier trimmed momentum strategies in UP and DOWN markets, respectively. We employ the

prior three-year return of the market as the market state proxy in Panel A and Panel B. In Panel C and Panel D; we employ the prior one-year return of the market as the market state proxy.

Panel A shows the results corresponding to UP markets based on three-year return. The Panel shows that the risk-adjusted performance of the winner portfolios exhibits a descending pattern as the outlier trimming level is increased. The risk-adjusted performance of T0% winner portfolio is 0.84% per month, statistically significant with a t-statistic of 3.43. The risk-adjusted performance of the T0.5% and the T1% winner portfolios are lower than the T0% winner portfolio (0.82% and 0.79%, statistically significant with t-statistic of 3.43 and 3.36, respectively). The results show that as the trimming level increases, the winner portfolio behaves less and less like a winner portfolio. Moreover, the risk-adjusted performance of the winner portfolios also reduces when the trimming level is increased. In comparison, the risk-adjusted performances of the loser portfolios exhibit an ascending pattern. The T0% loser portfolio generates a risk-adjusted performance of -0.78% per month, statistically significant with a t-statistic of -2.46. The loser risk-adjusted performances of the T0.5% and the T1% strategies show an increasing risk-adjusted performance of -0.61% and -0.53%, statistically significant with t-statistic of -1.98 and -1.75, respectively. The results show that as the trimming level increases, the loser becomes less like a loser, and its risk-adjusted performance will increase.

Table 3 Panel A: Comparison of Risk-Adjusted Performances in the Different Market State-Results for 3 Years UP Market

Panel A: 3 Years UP Market Portfolios	Trimming				
	T0%	T0.5%	T1%	T0%-T0.5%	T0%-T1%
Winner	0.84*** (3.43)	0.82*** (3.43)	0.79*** (3.36)	-0.01 (-0.45)	0.02 (0.78)
2	0.73*** (3.71)	0.74*** (3.77)	0.76*** (3.89)	-0.04*** (-3.83)	-0.06*** (-3.75)
3	0.77*** (4.22)	0.76*** (4.17)	0.77*** (4.21)	-0.01** (-2.02)	-0.02** (-2.27)
4	0.70*** (3.98)	0.71*** (4.01)	0.69*** (3.92)	-0.03*** (-6.60)	-0.02** (-2.19)
5	0.69*** (3.92)	0.68*** (3.90)	0.68*** (3.89)	-0.02*** (-6.26)	-0.02*** (-3.60)
6	0.58*** (3.22)	0.58*** (3.24)	0.58*** (3.21)	-0.03*** (-8.56)	-0.02*** (-4.47)
7	0.47** (2.46)	0.48** (2.51)	0.49** (2.56)	-0.04*** (-6.38)	-0.04*** (-4.81)
8	0.28 (1.39)	0.27 (1.33)	0.28 (1.37)	-0.01* (-1.74)	-0.02* (-1.94)
9	0.11 (0.48)	0.14 (0.60)	0.16 (0.69)	-0.05*** (-4.39)	-0.07*** (-4.35)
Loser	-0.78** (-2.46)	-0.61** (-1.98)	-0.53* (-1.75)	-0.19*** (-7.11)	-0.28*** (-7.18)
Winner-Loser	1.60*** (6.57)	1.41*** (6.03)	1.30*** (5.70)	0.16*** (5.18)	0.27*** (6.39)

This table reports the average monthly risk-adjusted performances from March 1927 through December 2013 for various trimmed momentum strategies in UP and DOWN markets. Returns on the Dow Jones Industrial Average are computed over the period $t-m$ to $t-1$ (where $m=36$ or 12), and non-negative (negative) returns of the Dow Jones Industrial Average indicate UP (DOWN) market. Panel A shows the results for 3 years UP market. In each month t , common stocks listed on NYSE, AMEX, and Nasdaq are sorted into portfolios based on their returns over the past one year. Portfolios are obtained using 10% cutoff and then divide it into ten trimming portfolios. $R_{T,d,t} = b_{0,T,d,t} + b_{1,T,d,t}X_{FF3F,t-1} + e_{T,d,t}$ where $R_{T,d,t}$ is the return of portfolio d decile in month t . $X_{FF3F,t-1}$ is the Fama-French three factors in month $t-1$. To obtain risk-adjusted performances, we run the times series regressions of portfolios averages (one for each average) on the Fama-French factor realizations to hedge out factors. The numbers reported for risk-adjusted performances are the constant from these time-series regressions. The sample includes all stocks on CRSP and t-statistics are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% level, respectively.

The last row shows the results of self-financed portfolios of three different outlier-trimmed portfolios. They show a descending pattern. Of the various trimmed strategies, the T0% strategy provides the best risk-adjusted performance; a positive monthly risk-adjusted performance of 1.6%, statistically significant with a t-statistic of 6.57 which is 23% (13%) higher than the 1.3% (1.41%) of the T1% (T0.5%) strategy. The T0.5% and the T1% strategies both show lower risk-adjusted performance than the T0% strategy; they provide 1.41% and 1.3%, statistically significant with t-statistic of 6.03 and 5.7, respectively. Overall, it can be seen that the risk-adjusted performance of strategies will reduce when the trimming level is raised. The last two columns in Panel A show the difference between the loser portfolios T0%-T0.5% and T0%-T1% correspond to risk-adjusted performances of -0.19% and -0.28% per month, statistically significant with t-statistic of -7.11 and -7.18, respectively. These results show that risk-adjusted performance of T0% loser portfolio behaves more like a loser compared to the T0.5% and the T1% portfolios. The difference between the risk-adjusted performance of the T0%-T0.5% and T0%-T1% portfolios yield 0.16% and 0.27% per month, statistically significant with t-statistics of 5.18 and 6.39, respectively. Here again, the risk-adjusted performance of the T0% strategy is higher than the risk-adjusted performance associated with the other two different trimmed strategies. We find the T0% strategy dominates the T0.5% and the T1% strategies as well.

In short, Table 3 Panel A shows five main patterns result when the UP market is defined from previous three-year market returns. First, the risk-adjusted performance of the winner portfolios will reduce when the trimming level is increased. Second, the risk-adjusted performance of the loser portfolios will appreciate when the trimming level is increased. Third, the zero investment strategy's risk-adjusted performance will reduce when the trimming level is increased. Fourth, the difference between the risk-adjusted performance of the various loser portfolios indicates that the T0% loser portfolio performs significantly worse than the T0.5% and the T1% loser portfolios. Finally, the difference in the risk-adjusted performance of the strategies indicates the T0% self-financed portfolio dominates the other T0.5% and the T1% self-financed portfolios as well.

Panel B shows that there is no evidence of significant risk-adjusted performance for the various momentum strategies following DOWN states. The last two columns in Panel B, show the difference in the risk-adjusted performance of different outlier trimmed strategies. The difference of the loser portfolios T0%-T0.5% and T0%-T1% strategies generate risk-adjusted performances of -0.12% and -0.19% per month, statistically significant with t-statistic of -2.09 and -2.55, respectively. The difference indicates that the risk-adjusted performance of T0% loser portfolio behaves more like a loser than the T0.5% and the T1% loser portfolios. The risk-adjusted performance of the T0%-T1% self-financed portfolio generates 0.18% per month, statistically significant with a t-statistic of 1.97. Here, the risk-adjusted performance of the T0% self-financed portfolio is higher than the risk-adjusted performance associated with T1% self-financed portfolio.

Table 3 Panel B shows three main patterns result when the DOWN market is defined from previous three-year market returns. First, there is no evidence of significant risk-adjusted performance from any of the decile portfolios and self-financed portfolios following DOWN states. Second, the difference between the risk-adjusted performances of the loser portfolios indicates that the T0% loser portfolio is significantly worse than the T0.5% and the T1% loser portfolios. Finally, the risk-adjusted performance of the T0%-T1% self-financed portfolio indicates that the T0% self-financed portfolio dominates the T1% self-financed portfolio.

To further check the robustness of the results, we evaluate the risk-adjusted performance of our portfolios when the market state indicator is based on the previous one-year return. Panel C shows the results following UP markets based on previous one-year return. The panel shows that the risk-adjusted performance of the winner portfolios still exhibits a descending pattern. The risk-adjusted performance of T0% winner portfolio is 1.56% per month, statistically significant with a t-statistic of 5.31. The winner risk-

adjusted performances of the T0.5% and the T1% strategies are lower than this, 1.52% and 1.47%, statistically significant with t-statistic of 5.33 and 5.24, respectively. It can be seen that outlier trimming causes the winner portfolio to behave less and less like a winner. In short, the risk-adjusted performance of the winner portfolios will reduce when the trimming level is increased.

Table 3 Panel B: Comparison of Risk-adjusted Performances in the Different Market State-Results for 3 Years DOWN Market

Panel B: 3 Years DOWN Market Portfolios	Trimming				
	T0%	T0.5%	T1%	T0%-T0.5%	T0%-T1%
Winner	-0.04 (-0.06)	-0.05 (-0.09)	-0.08 (-0.12)	-0.01 (-0.11)	0.02 (0.23)
2	0.05 (0.09)	0.04 (0.07)	0.07 (0.11)	-0.01 (-0.44)	-0.04 (-1.13)
3	0.14 (0.25)	0.17 (0.29)	0.14 (0.24)	-0.04** (-2.48)	-0.02 (-0.59)
4	0.14 (0.23)	0.15 (0.25)	0.14 (0.22)	-0.03** (-2.32)	-0.02 (-0.91)
5	0.32 (0.48)	0.31 (0.47)	0.33 (0.50)	-0.01 (-1.26)	-0.03*** (-2.88)
6	0.18 (0.27)	0.18 (0.27)	0.17 (0.25)	-0.02** (-2.12)	-0.01 (-0.68)
7	0.37 (0.49)	0.35 (0.47)	0.38 (0.51)	-0.01 (-0.41)	-0.04 (-1.61)
8	0.54 (0.68)	0.52 (0.65)	0.51 (0.63)	0.00 (0.03)	0.01 (0.30)
9	0.67 (0.73)	0.73 (0.81)	0.70 (0.79)	-0.09*** (-2.91)	-0.06 (-1.42)
Loser	0.86 (0.75)	0.96 (0.85)	1.03 (0.92)	-0.12** (-2.09)	-0.19** (-2.55)
Winner-Loser	-0.92 (-1.15)	-1.04 (-1.31)	-1.13 (-1.43)	0.09 (1.28)	0.18** (1.97)

This table reports the average monthly risk-adjusted performances from March 1927 through December 2013 for various trimmed momentum strategies in UP and DOWN markets. Returns on the Dow Jones Industrial Average are computed over the period $t-m$ to $t-1$ (where $m=36$ or 12), and non-negative (negative) returns of the Dow Jones Industrial Average indicate UP (DOWN) market. Panel B shows the results for 3 years DOWN market. In each month t , common stocks listed on NYSE, AMEX, and Nasdaq are sorted into portfolios based on their returns over the past one year. Portfolios are obtained using 10% cutoff and then divide it into ten trimming portfolios. $R_{T_d,t} = b_{0,T_d,t} + b_{1,T_d,t}X_{FF3F,t-1} + e_{T_d,t}$ where $R_{T_d,t}$ is the return of portfolio d decile in month t . $X_{FF3F,t-1}$ is the Fama-French three factors in month $t-1$. To obtain risk-adjusted performances, we run the times series regressions of portfolios averages (one for each average) on the Fama-French factor realizations to hedge out factors. The numbers reported for risk-adjusted performances are the constant from these time-series regressions. The sample includes all stocks on CRSP and t-statistics are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% level, respectively

The last row shows of Panel C shows the results of self-financed portfolios of three different outlier trimmed strategies. It can be seen that they exhibit a descending pattern. Compared to the other trimmed strategies, the T0% self-financed portfolio provides the best risk-adjusted performances, a positive monthly risk-adjusted return of 1.79%, statistically significant with a t-statistic of 6.83 which is 25% (12%) higher than 1.43% (1.6%) of the T1% (T0.5%) self-financed portfolio. In comparison, the T0.5% and the T1% strategies exhibit lower risk-adjusted returns of 1.6% and 1.43%, statistically significant with t-statistic of 6.35 and 5.78, respectively. Again, the results continue to show that the risk-adjusted performance of strategies will reduce when the trimming level is increased.

The last two columns in Panel C, show the difference in the risk-adjusted performance between different outlier trimmed strategies. The difference between the winner portfolios T0%-T1% generates a risk-

adjusted performance of 0.06% per month, statistically significant with a t-statistic of 1.82. The results show that T0% winner portfolio behaves more like a winner than the T1% winner portfolio.

Table 3 Panel C: Comparison of Risk-adjusted Performances in the Different Market State- Results for 1 Years UP Market

Panel C: 1 Years UP Market Portfolios	Trimming				
	T0%	T0.5%	T1%	T0%-T0.5%	T0%-T1%
Winner	1.56*** (5.31)	1.52*** (5.33)	1.47*** (5.24)	0.02 (0.66)	0.06* (1.82)
2	1.28*** (5.27)	1.27*** (5.27)	1.29*** (5.34)	-0.02* (-1.71)	-0.04** (-2.13)
3	1.25*** (5.61)	1.25*** (5.60)	1.26*** (5.69)	-0.02*** (-3.01)	-0.04*** (-2.90)
4	1.26*** (5.69)	1.26*** (5.69)	1.24*** (5.58)	-0.03*** (-4.65)	-0.01 (-0.62)
5	1.20*** (5.59)	1.20*** (5.57)	1.20*** (5.58)	-0.02*** (-4.24)	-0.02*** (-2.80)
6	1.06*** (4.84)	1.06*** (4.84)	1.05*** (4.83)	-0.02*** (-5.93)	-0.02*** (-4.49)
7	0.95*** (4.11)	0.97*** (4.19)	0.97*** (4.18)	-0.04*** (-5.40)	-0.04*** (-3.83)
8	0.86*** (3.38)	0.84*** (3.31)	0.84*** (3.32)	-0.01 (-0.90)	-0.01 (-0.92)
9	0.73*** (2.61)	0.79*** (2.84)	0.80*** (2.93)	-0.08*** (-5.75)	-0.10*** (-5.03)
Loser	-0.25 (-0.69)	-0.10 (-0.29)	0.02 (0.06)	-0.18*** (-5.84)	-0.30*** (-7.24)
Winner-Loser	1.79*** (6.83)	1.60*** (6.35)	1.43*** (5.78)	0.17*** (4.50)	0.34*** (6.65)

This table reports the average monthly risk-adjusted performances from March 1927 through December 2013 for various trimmed momentum strategies in UP and DOWN markets. Returns on the Dow Jones Industrial Average are computed over the period $t-m$ to $t-1$ (where $m=36$ or 12), and non-negative (negative) returns of the Dow Jones Industrial Average indicate UP (DOWN) market. Panel C shows the results for 1 years UP market. In each month t , common stocks listed on NYSE, AMEX, and Nasdaq are sorted into portfolios based on their returns over the past one year. Portfolios are obtained using 10% cutoff and then divide it into ten trimming portfolios. $R_{T,d,t} = b_{0,T,d,t} + b_{1,T,d,t}X_{FF3F,t-1} + e_{T,d,t}$ where $R_{T,d,t}$ is the return of portfolio d decile in month t . $X_{FF3F,t-1}$ is the Fama-French three factors in month $t-1$. To obtain risk-adjusted performances, we run the times series regressions of portfolios averages (one for each average) on the Fama-French factor realizations to hedge out factors. The numbers reported for risk-adjusted performances are the constant from these time-series regressions. The sample includes all stocks on CRSP and t -statistics are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% level, respectively.

The difference between the loser portfolios T0%-T0.5% and T0%-T1% generate risk-adjusted performances of -0.18% and -0.3% per month, statistically significant with t-statistic of -5.84 and -7.24, respectively. These results show that T0% loser portfolio behaves more like a loser compared to the T0.5% and the T1% loser portfolios.

The risk-adjusted performance of the T0%-T0.5% and T0%-T1% self-financed portfolios generate 0.17% and 0.34% per month, statistically significant with t-statistic of 4.5 and 6.65, respectively. Here, the risk-adjusted performance of the T0% self-financed portfolio is higher than the risk-adjusted performance associated with the other two outlier trimmed self-financed portfolios. The T0% strategy dominates T0.5% and T1% strategies.

When the UP market is defined from previous one-year market returns, the results of Table 3 Panel C show five main patterns. First, the risk-adjusted performance of the winner portfolios will reduce when the

trimming level is increased. Second, the zero investment strategy’s risk-adjusted performance will reduce when the trimming level is increased. Third, the difference between the risk-adjusted performance of different loser portfolios indicates that the T0% loser portfolio performs significantly worse than the T0.5% and the T1% loser portfolios. Forth, the difference between the risk-adjusted performances of the various winner portfolios indicates that the T0% winner portfolio performs significantly better than the T1% winner portfolio. Finally, the difference between the risk-adjusted performances of the various self-financed portfolios indicate that the T0% self-financed portfolio dominates the corresponding T0.5% and the T1% self-financed portfolios.

Panel D shows the risk-adjusted performance of the winner portfolios following DOWN markets calculated using previous one-year return. The results exhibit an ascending pattern. The risk-adjusted performance of the T0% winner portfolio is -1.75% per month, statistically significant with a t-statistic of -3.83. The risk-adjusted performances of the T0.5% and the T1% winner portfolios are higher than it, both -1.71%, statistically significant with t-statistic of -3.79 and -3.85, respectively. Following DOWN market states increasing outlier trimming levels makes the winner portfolios’ performance less negative compared to the untrimmed counterpart.

Table 3 Panel D: Comparison of Risk-adjusted Performances in the Different Market State- Results for 1 Years DOWN Market

Panel D: 1 Years DOWN Market	Trimming				
	T0%	T0.5%	T1%	T0%-T0.5%	T0%-T1%
Winner	-1.75*** (-3.83)	-1.71*** (-3.79)	-1.71*** (-3.85)	-0.07** (-2.47)	-0.07* (-1.76)
2	-1.39*** (-3.32)	-1.38*** (-3.31)	-1.36*** (-3.27)	-0.03** (-2.29)	-0.05** (-2.36)
3	-1.03** (-2.55)	-1.03** (-2.55)	-1.03** (-2.54)	-0.02 (-1.58)	-0.03 (-1.49)
4	-1.18*** (-2.70)	-1.17*** (-2.67)	-1.19*** (-2.70)	-0.03*** (-3.25)	-0.02 (-1.39)
5	-0.97** (-2.02)	-0.98** (-2.03)	-0.97** (-2.02)	-0.02*** (-3.98)	-0.02*** (-3.32)
6	-1.13** (-2.24)	-1.13** (-2.24)	-1.14** (-2.27)	-0.03*** (-4.07)	-0.01 (-0.87)
7	-1.15** (-2.07)	-1.14** (-2.06)	-1.11** (-2.00)	-0.03** (-2.41)	-0.06*** (-3.20)
8	-1.19** (-2.02)	-1.21** (-2.05)	-1.21** (-2.06)	-0.01 (-0.29)	0.00 (-0.02)
9	-1.29* (-1.84)	-1.25* (-1.79)	-1.26* (-1.83)	-0.06*** (-2.61)	-0.05 (-1.61)
Loser	-1.47 (-1.63)	-1.35 (-1.53)	-1.29 (-1.47)	-0.14*** (-2.98)	-0.20*** (-3.01)
Winner-Loser	-0.31 (-0.47)	-0.38 (-0.58)	-0.44 (-0.68)	0.05 (0.92)	0.11 (1.62)

This table reports the average monthly risk-adjusted performances from March 1927 through December 2013 for various trimmed momentum strategies in UP and DOWN markets. Returns on the Dow Jones Industrial Average are computed over the period $t-m$ to $t-1$ (where $m=36$ or 12), and non-negative (negative) returns of the Dow Jones Industrial Average indicate UP (DOWN) market. Panel D shows the results for 1 years DOWN market. In each month t , common stocks listed on NYSE, AMEX, and Nasdaq are sorted into portfolios based on their returns over the past one year. Portfolios are obtained using 10% cutoff and then divide it into to ten trimming portfolios. $R_{T_d,t} = b_{0,T_d,t} + b_{1,T_d,t}X_{FF3F,t-1} + e_{T_d,t}$ where $R_{T_d,t}$ is the return of portfolio d decile in month t . $X_{FF3F,t-1}$ is the Fama-French three factors in month $t-1$. To obtain risk-adjusted performances, we run the times series regressions of portfolios averages (one for each average) on the Fama-French factor realizations to hedge out factors. The numbers reported for risk-adjusted performances are the constant from these time-series regressions. The sample includes all stocks on CRSP and t -statistics are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% level, respectively.

The risk-adjusted performance of the loser portfolios also exhibits an ascending pattern following DOWN markets calculated using previous one-year return. The T0% loser portfolio generates a risk-adjusted performance of -1.47% per month, marginally significant with a t-statistic of -1.63. The loser risk-adjusted performances of the T0.5% and the T1% strategies show higher risk-adjusted performance, -1.35% and -1.29%, insignificantly different from zero. It can be seen that a loser behaves less like a loser, and the risk-adjusted performance of the loser portfolios will increase when the trimming level is increased. The last row of this Panel shows that there is no evidence significant returns for the self-financed portfolios corresponding to the three differently trimmed strategies following DOWN states.

The last two columns in Panel D show the difference in the risk-adjusted performance between the different outlier-trimmed portfolios and the untrimmed portfolio. For the winner portfolios, the T0%-T0.5% and T0%-T1% strategies generate risk-adjusted performances both of -0.07% per month, statistically significant with t-statistic of -2.47 and -1.76. These results indicate that the risk-adjusted performance of T0% winner portfolio now behaves less like a winner compared with the other two outlier trimmed portfolios.

The difference between the loser portfolios T0%-T0.5% and T0%-T1% strategies generate a risk-adjusted performance of -0.14% and -0.2% per month, statistically significant with t-statistic of -2.98 and -3.01, respectively. The results indicate that the risk-adjusted performance of T0% loser portfolio behaves more in line with a lower portfolio compared to the other two outlier-trimmed portfolios. The difference in the risk-adjusted performance of the T0%-T1% self-financed portfolio is 0.11% per month, marginally significant with a t-statistic of 1.62. Here, the risk-adjusted performance of the T0% strategy is higher than the risk-adjusted performance associated with T1% self-financed portfolio.

When the DOWN market state is calculated from previous one-year market returns, the results of Table 3 Panel D show five main patterns. First, the risk-adjusted performance of the winner portfolios increases with the outlier trimming level. Second, the risk-adjusted performance of the loser portfolios also increases when the trimming level is increased. Third, the difference between the risk-adjusted performance of the winner portfolios indicates that the T0% winner portfolio performs significantly worse than the T0.5% and the T1% strategies following the DOWN market state. Forth, the difference between the risk-adjusted performance of various pairs of loser portfolios indicates that the T0% loser portfolio performs significantly worse than the T0.5% and the T1% loser portfolios. Finally, the difference in the risk-adjusted performance of the self-financed portfolios indicates the T0% self-financed portfolio outperforms the T1% self-financed portfolio.

As a whole, Table 3 shows the effect of outlier trimming for a spectrum of momentum strategies in different two market states. In the UP market state, the risk-adjusted performances of the T0%-T0.5% and T0%-T1% self-financed portfolios are both positive and statistically significant. In the DOWN market state, the difference between the T0%-T1% self-financed portfolios' risk-adjusted performance is positive but marginally significant.

CONCLUDING COMMENTS

The seminal paper by Jegadeesh and Titman (1993, JT hereafter) reveals the presence of momentum in stock returns over intermediate horizons. Their conclusions show that the self-financed portfolio that buys the winner 10% and sells the loser 10% of stocks ranked by past six months returns and holds the portfolios for six months generates an average performance of approximately 1% per month. This study tests the hypothesis that in momentum investing, outliers are essential and may possess carryover effects. We compare the performances of momentum portfolios under different levels of outlier trimming. The effects of outlier trimming are tested using empirical results from momentum investing. We compare the performances of portfolios constructed using the standard JT methodology with those constructed using our

proposed $T_x\%$ measure. This comparison permits us to explore whether there is a “trimming effect” under the framework of momentum investing.

Previous research on momentum almost always excludes outliers from their analysis without much discussion. For example, Asness et al. (2013) exclude stock prices inferior to \$1 at the beginning of each month. Chuang and Ho (2014) exclude stocks with prices less than \$1 during the formation period. Adrian et al. (2014) exclude the smallest decile of firms based on market capitalization on the formation date. Hwang and Rubesam (2015) exclude all stocks with prices below \$5 at the portfolio formation date and all stocks whose sizes would place them in the smallest NYSE decile. There is no previous literature that analyzes the effects of outlier trimming on momentum returns. This study shows that outliers are important in momentum investing. We find that momentum portfolios formed from outlier trimmed data perform worse than momentum portfolios formed from the original untrimmed data that includes the outlier observations. Moreover, the performance decreases monotonically as a higher percentage of outliers are trimmed from the dataset.

Our results show that the no-trimmed (including outlier) momentum strategies lead to higher performance, captures more under-reaction and over-reaction to previous information from investors when new information substantiates. The portfolios constructed using untrimmed data are shown to outperform those from alternative trimming strategies. The performance of momentum strategies will reduce when the trimming level is raised. Outliers are important and possess trimming effects. In sum, the empirical findings of this study provide evidence of the existence of the trimming effect in stocks that manifests as the subsets of JT momentum strategy. The performance results show that the no-trimmed momentum self-financed portfolio provides the most robust performance, outperforming other trimmed self-financed portfolios.

For robustness, we additionally test whether the outlier trimming effect continues to exist under different market states. Our results show that the trimming effect continues to exist, even after controlling for the different market states. In the UP market state, the difference between the risk-adjusted performance of the T0%-T0.5% and T0%-T1% self-financed portfolios are both positive and statistically significant. In the DOWN market state, the difference between the T0%-T1% self-financed portfolio's risk-adjusted performance is positive but only marginally significant. The results suggest that outliers are somewhat more important for momentum investing in UP market states compared to DOWN market states.

The document of this study does not allow us to discriminate between under-reaction and over-reaction about investor behavior. In addition, these results may have other interpretations. In the light of our results suggest further research that attempts to determine interpretations for these empirical phenomena will be of interest.

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BIOGRAPHY

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