

Time Series Reversal in Trend Following Strategies[☆]

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Abstract

A reversal pattern in the time series context from 12 to 24 months after the formation of trend following signals is observed in a universe of 55 liquid futures instruments. We find that instruments with sell signals in the trend following portfolio (i.e. “losers”) contribute to this type of reversal, even if their profits are not realised. The instruments with buy signals in the trend following portfolio (i.e. “winners”) contribute much less. A double-sorted strategy based on both return continuation and reversal yields to an average return of 18% per annum, which is significantly higher compared to its corresponding trend following strategy.

Keywords: Reversal, Trend Following, Market Timing, Time Series Momentum, Returns Signal Momentum

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1. Introduction

The time series continuation of financial asset returns¹ has been widely studied in the academic literature, through investigating serial correlation (Fama and French, 1988; Lo and MacKinlay, 1988; Lewellen, 2002; DeMiguel et al., 2014), and time series momentum (Moskowitz et al., 2012; Menkhoff et al., 2012; Georgopoulou and Wang, 2016). One practical application of time series continuation is trend following strategy which is increasingly popular among hedge funds or so called Commodity Trading Advisors (CTAs) in recent years. However, the reversal effect that presents after the continuation pattern, although has been mentioned in some studies in the literature², has yet to be examined exhaustively.

This paper empirically investigates the reversal property of various financial assets and its relationship with continuation in the time series context. This type of reversal differs from reversals in traditional momentum literature, or cross-sectional momentum and reversals, which focuses on the relative returns of stocks, see, e.g., Bondt and Thaler (1985), Lo and MacKinlay (1990), Jegadeesh and Titman (1993), Jegadeesh and Titman (1995) and Fama and French (1996). It is caused by a security's own time series autocorrelation rather than cross-sectional correlation. Therefore, we call it time series reversal.

Return continuation and reversals are usually closely related and discussed simultaneously in literature. Historically, the majority of studies focus on cross-sectional momentum and reversals, which have been documented internationally and in various financial assets³. Theoretically, according to a number of well-known behavioural theories by Barberis et al. (1998), Daniel et al. (1998) and Hong and Stein (1999) among others, the rationale behind momentum and reversals is related to the short-

¹Return continuation is seen in finance literature as an analogue of momentum; see, among others, Rouwenhorst (1998) and Fama (1998). Sometimes these two words are used interchangeably. However, return continuation is applicable across a wider range of dynamics.

²For example, Moskowitz et al. (2012) uncover a long term reversal beyond one year of time series momentum signals.

³Cross-sectional momentum and reversals are extensively studied, not only in the previously mentioned US stock markets, but also in international stock markets; see, e.g., Fama and French (1998) and Rouwenhorst (1998), country indices see, e.g., Bhojraj and Swaminathan (2006), various asset classes see, e.g., Asness et al. (2013) and commodities see, e.g., Miffre and Rallis (2007) and Gorton et al. (2013).

term under-reaction and delayed over-reaction. In the time series context, [Moskowitz et al. \(2012\)](#) also attribute time series momentum effect to these behavioural explanations. Hence, we believe there exists a certain linkage between time series continuation and time series reversal as well.

Recently, [Conrad and Yavuz \(2017\)](#) show that the cross-sectional momentum and reversals are not pervasively linked to each other, which raises our interest in investigating time series continuation and reversals. This finding contradicts the conventional view that, if momentum and reversals are linked, the securities which exhibit momentum, should also exhibit reversals after that. Through our empirical study based on a portfolio consisting of 55 of the world’s most liquid commodity and financial futures, we arrive at conclusion similar to [Conrad and Yavuz \(2017\)](#). Interestingly, by exercising a portfolio segmentation, we observe that the instruments with sell signals (past losers) contribute to this type of reversal, no matter whether their profits are realised or not. However, the instruments with buy signals (past winners) contribute much less.

One of the simplest way to examine time series reversal in financial assets is to employ contrarian trend following strategies. This is due to the fact that the trading signals depend on its own past returns without a cross-sectional comparison. Moving average is one of the simplest and most intuitive trend following strategies based on technical analysis. Recently, researchers attribute the profitability of trend following strategies to time series continuation, and introduce more advanced methods such as time series momentum by [Moskowitz et al. \(2012\)](#) and return signal momentum introduced in [Papailias et al. \(2017\)](#). Therefore, these strategies are also included in our investigation.

To capture the timing of time series reversal, we use different trend following strategies based on simple moving average (SMA), time series momentum (TSM) and return signal momentum (RSM). We find that in most cases, time series reversal occurs from 12 to 24 months after the formation of the trading signals. This finding differs from the traditional cross-sectional momentum reversals which usually last longer, between 2-5 years after the portfolio formation date⁴. [Moskowitz et al.](#)

⁴Cross-sectional reversals require a long term ranking period from 2-5 years in stock markets ([Bondt and Thaler, 1985](#)) and in commodity markets from 1.5-3 years suggested by [Bianchi et al.](#)

(2012) document a strong short-term (1-12 month) time series momentum, but a not statistically significant long-term (2-5 years) reversal.

In a similar fashion to Conrad and Yavuz (2017), we classify instruments in trend following strategies in four groups: “realised winner”, “realised loser”, “contrarian winner” and “contrarian loser”. The “realised winner” sub-portfolio consists of instruments with positive trend following trading signals which realise their profits in the short run investment horizon (1-12 months). The “realised loser” sub-portfolio consists of instruments with negative trading signals and also realise their profits over the investment horizon. Similarly, the “contrarian winner” includes instruments with positive trading signals that fail to gain profits. While the “contrarian loser” includes instruments with negative trading signals that fail to gain profits. The construction of the above four sub-portfolios allows us to see which part of the trend following returns contributes more to time series reversal.

Next, to properly investigate the relationship between time series continuation and reversal in portfolio segmentation, we perform both sign analysis and sub-portfolio evaluation. In the sign analysis, we find that the “losers” sub-portfolios, no matter whether their profits are realised or not, i.e. “realised loser” and “contrarian loser”, experience strong subsequent reversal. In contrast, the results from the “winners” subgroup lead to mixed answers: the “realised winner” exhibits strong reversal, while the “contrarian winner” does not.

Then, we further track the subsequent performance of the four sub-portfolios over a post momentum holding period of 13-60 months. We confirm that the “loser” subgroups, especially the “contrarian loser”, contribute the most to the time series reversal. The results are consistent with the study of Conrad and Yavuz (2017) on cross-sectional reversal who observe not statistically significant returns when performing “realised portfolios” (“realised winner” minus “realised loser”) and significant returns when performing “contrarian portfolios” (“contrarian winner” minus “contrarian loser”). To take a step further, we provide evidence that both the “realised winner” and the “realised loser” exhibit positive returns, but which offset each other when considered together. However, reversal of the “contrarian loser” is much

(2015). Bhojraj and Swaminathan (2006) found that the reversals of country indices occur from 2-3 years after the 1 year momentum effect.

stronger than the “contrarian winner”, which makes “contrarian portfolios” more statistically significant.

A trading strategy is then constructed by holding the four decomposed trend following strategies previously mentioned. We call it “trend following reversal strategy” as it combines time series continuation and reversal. Empirical results suggest that holding the “realised winner” and the “contrarian loser” subgroups can obtain annualised returns as high as 22% and 24% respectively. These strategies are liquid and well diversified when considered in real market trading. We also try to understand the risk exposure of these strategies by running factor regressions on the trend following reversal returns against a series of standard financial market risk factors. The regression output reveals that the trend following reversal returns are highly related to the market as well as the momentum factors. However, certain strategies, especially the “contrarian loser” sub-portfolios, produce significant alphas which are not explained by the popular risk factors. Moreover, the “contrarian loser” subgroups are effective for investors to avoid momentum risks due to its low correlation with trend following factors.

To sum up, the contribution of this paper to the literature is threefold. First, we generalise the concept of time series continuation and reversal to include other trend following strategies apart from momentum. Furthermore, we find that the timing of time series reversal occurs between 12 and 24 months after the formation of trend following strategies. Second, we demystify which part of the trend following component that contributes more to the reversal profits. To do so, we classify instruments in trend following strategies into four subgroups, in order to establish which of the groups generates significant reversal. Third, we document a trend following reversal strategy earning significant abnormal returns based on both time series continuation and reversal.

The rest of the paper is organised as follows. In Section 2 we describe our data collection and transformation methods, and explain the intuitions of different trend following trading signals. Section 3 presents the performance results of multiple trend following strategies and uncovers the timing of time series reversal. Then, in Section 4 we perform two sets of analysis: sign analysis and sub-portfolio performance, to investigate the reversal property of each subgroup via a decomposition of portfolios. Section 5 introduces the trend following reversal strategy and explores its factor

loadings. Finally, Section 6 summarises the conclusions.

2. Data and Trading Signals

2.1. Future Contracts and Other Data

We collect data for 55 of the world’s most liquid exchange traded futures instruments from January, 1985 to March, 2015. Such a dataset is similar to that in TSM studies by [Moskowitz et al. \(2012\)](#), which is also seen in other trend following studies, e.g., [Hutchinson and O’Brien \(2015\)](#), [Kim et al. \(2016\)](#) and [Baltas and Kosowski \(2013\)](#). The pool consists of 24 commodity futures, 9 foreign exchange futures, 9 equity indexes of developed countries, and 13 government bonds of various maturities for 6 developed countries. The data is sourced from Bloomberg and DataStream; see Appendix A for more details.

Futures prices of the nearest contracts are concatenated to form long time series for reasons of tractability. For robustness, we also splice the futures prices based on the trading volume. To mimic a real-life trading situation, once the trading volume of the second nearest contract exceeds the nearest one, we do not allow the nearest contract to be chosen again even if its trading volume subsequently becomes higher. The results show that the descriptive statistics for our spliced data does not vary a lot from that using the nearest contract data.

As in [Moskowitz et al. \(2012\)](#) and [Papailias et al. \(2017\)](#), we compute the daily excess returns for each instrument and calculate its cumulative returns. This allows us to proxy for prices and compute our periodic returns. In this paper, we focus on monthly returns which are calculated from the previously mentioned daily excess cumulative return series. This allows us to directly compare our results with the literature.

In Table 1, we summarise the descriptive statistics of the original series. It presents the date of the first available data for each series, the annualised arithmetic mean, standard deviation, skewness and kurtosis of the monthly excess returns of each individual instrument. The last available month for all series is March, 2015. Most futures have positive long term annualised mean, while some of the currency futures show slightly negative values. Regarding volatility, we find that it varies across different asset classes. The volatility of commodities and equities is much

higher than that of currencies and bonds. To illustrate, Natural Gas futures have a volatility of 54.39% and the two-year maturity US bond (US2) offers the lowest volatility at 2.84%.

For factor regression analysis, we collect from Bloomberg the monthly returns of four major financial asset class indices including MSCI world Index, S&P GSCI, Barclays Aggregate Bond Index and the US Dollar Index. The well-known factors of the percentage changes of Fama and French (1993) small market capitalization minus big (SMB), high book-to-market ratio minus low (HML), Carhart (1997) premium on winners minus losers (UMD) as well as the risk free rate are downloaded from Kenneth French's website⁵. Finally, the Moskowitz et al. (2012) TSM factors are available from the AQR website⁶. Data for all the above is available for January, 1985 to March, 2015. This subsequently is also the time period for the regression analysis.

2.2. Trend Following Trading Signals

Three methods are employed to proxy the trend following strategies in this study, price SMA, TSM and RSM. Previous studies suggest that 12 months is the optimal look-back period (j) for trend following strategies⁷. Hence, in this study we adopt a 12-month look-back period (j) for all the benchmark strategies.

In the SMA strategy, a long position for security s is generated if the current price is above or equal to the average of the last j periods. In our case, we choose the last 12 months ($j = 12$). Hence, the SMA returns are given below:

$$R_t^s | \bar{p}_{t-12,t-1}^s = \begin{cases} +r_t^s, & p_{t-1}^s \geq \bar{p}_{t-12,t-1}^s \\ -r_t^s, & p_{t-1}^s < \bar{p}_{t-12,t-1}^s \end{cases}, \quad (1)$$

where $\bar{p}_{t-12,t-1}^s$ is the arithmetic average of the past 12 prices.

The TSM signals are generated in the same way as in Moskowitz et al. (2012) where a long position is indicated if the period return is positive, i.e. the annual

⁵http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

⁶<https://www.aqr.com/>

⁷See, among others, (Moskowitz et al., 2012; Zhou and Zhu, 2013; Papailias et al., 2017). We also test the trend following strategies with other j values which further confirm our statement. The results are available upon request.

return using $j = 12$ setting, otherwise the investor goes short on security s . The TSM returns are given as follows:

$$R_t^s | PR_{t-12,t-1}^s = \begin{cases} +r_t^s, & PR_{t-12,t-1}^s \geq 0 \\ -r_t^s, & PR_{t-12,t-1}^s < 0 \end{cases}, \quad (2)$$

where $PR_{t-12,t-1}^s$ is the period return of instrument s during time $t - 12$ to $t - 1$ as is suggested by our look-back period $j = 12$.

Finally, the RSM signals are generated when the probability of the positive past 12 months returns exceeds a certain threshold value. Following [Papailias et al. \(2017\)](#), we calculate the RSM returns using the following equation:

$$R_t^s | P_{t-12,t-1}^s, q = \begin{cases} +r_t^s, & P_{t-12,t-1}^s > q \\ -r_t^s, & P_{t-12,t-1}^s < q \end{cases}. \quad (3)$$

where $P_{t-12,t-1}^s$ denotes the past 12 period probability of positive returns, and q is the threshold value. For simplicity, we select the most intuitive value $q = 0.5$ indicating that a long position is established when the probability $P_{t-12,t-1}^s$ is greater than 0.5, whereas a short position is established when this probability is smaller than 0.5.

When studying the post trend following holding period, the portfolios are constructed using an equally weighted method for tractability. However, market practitioners generally calculate the portfolio weights, or the position sizes for individual instrument in a time-varying way. In an effort to improve the strategy performance and align our results with the literature, we control the position sizes of each instrument to be inversely proportional to its volatility⁸. Therefore, the volatility adjusted portfolio weights are used when implementing the trend following reversal strategies.

Following [Moskowitz et al. \(2012\)](#), we use an ex-ante realised volatility method to scale the returns of each instrument. This method is an annualised exponentially weighted variance of the past returns and is calculated as follows:

$$\sigma_t^2 = 261 \sum_{i=0}^{\infty} (1 - \delta) \delta^i (r_{t-1-i} - \bar{r}_t)^2 \quad (4)$$

⁸The volatility scaling method is also used in, see, e.g., [Moskowitz et al. \(2012\)](#) and [Papailias et al. \(2017\)](#).

where the parameter δ is defined when the center of mass is equal to 60 days. The benefit of doing so, i.e. controlling for volatility, is that it can lead to more profitable investment strategies, because it plays a crucial role in adjusting the position size of momentum strategies (Barroso and Santa-Clara, 2015; Kim et al., 2016; Papailias et al., 2017).

To form a portfolio of various instruments we calculate the trend following position signals in the same way as in Equations 1, 2 and 3, and allow the portfolio weight for each instrument to be given as a function of its ex-ante realised volatility σ_t^2 . We use the same critical value for the annual volatility of 40% as in Moskowitz et al. (2012). This aligns our results with the current literature and also mimics a real-world trading scenario with a capital margin of about 5-20%. Then, the SMA, TSM and RSM position returns for asset s are given by:

$$R_t^s | \bar{p}_{t-12,t-1}^s = \begin{cases} +r_t^s \frac{40\%}{\sigma_{t-1}^s}, & p_{t-1}^s \geq \bar{p}_{t-12,t-1}^s \\ -r_t^s \frac{40\%}{\sigma_{t-1}^s}, & p_{t-1}^s < \bar{p}_{t-12,t-1}^s \end{cases}, \quad (5)$$

$$R_t^s | PR_{t-12,t-1}^s = \begin{cases} +r_t^s \frac{40\%}{\sigma_{t-1}^s}, & PR_{t-12,t-1}^s \geq 0 \\ -r_t^s \frac{40\%}{\sigma_{t-1}^s}, & PR_{t-12,t-1}^s < 0 \end{cases}, \quad (6)$$

$$R_t^s | P_{t-12,t-1}^s, q = \begin{cases} +r_t^s \frac{40\%}{\sigma_{t-1}^s}, & P_{t-12,t-1}^s > q \\ -r_t^s \frac{40\%}{\sigma_{t-1}^s}, & P_{t-12,t-1}^s < q \end{cases}. \quad (7)$$

Finally, for a universe of S assets, the portfolio return is calculated as:

$$R_t^p = \frac{1}{S} \sum_{s=1}^S R_t^s | P_{t-12,t-1}^s, q \quad (8)$$

where R_t^s is the risk adjusted return of each trend following strategy for each individual instrument using the above volatility scaling method. And R_t^p is the mean of all the R_t^s .

3. Time Series Reversal

A clear way to motivate this research is to look at Figure 1. In this figure we see the predictive power of RSM signals on these 55 futures contracts subsequent

returns. We run a pooled regression using the same equation as in (Papailias et al., 2017):

$$\frac{r_t^s}{\sigma_{t-1}^s} = \alpha + \beta_h P_{t-h-11,t-h} + \epsilon_t^s \quad (9)$$

where r_t^s is the excess return of asset s in month t adjusted by its available ex ante volatility σ_{t-1}^s . $P_{t-h-11,t-h}$ is the lagged RSM signal, or the probability of positive 12 period returns. 60 models are run based on different lags h from 1 to 60.

In Figure 1, we observe not only a short horizon positive predictive power of RSM signals, but a persistent reversal from month 11 to 22 at the 5% significance level as well. This sheds light on our study of time series reversal effect following the short-term return continuation.

3.1. Return Decays of Multiple Holding Periods Strategies

In an attempt to evaluate trend following strategies with multiple holding periods (i.e. holding the underlying assets for more than 1 month), we find that these strategies never outperform the same strategy using 1 month holding period. A similar result is also found in Moskowitz et al. (2012). The authors test the alphas of different TSM strategies with various holding periods. They demonstrate that the 1 month holding period strategy specification outperforms all other specifications with holding periods more than 1 month. The longer the holding period, the lower the alpha, indicating trend following profits are gradually being offset by the subsequent reversals⁹.

To thoroughly investigate the phenomenon of return decays, we perform three trend following trading strategies including SMA, TSM and RSM based on a look-back period of $j = 12$. Figure 2 illustrates the decay in trend following strategies as the holding period h gets larger. We report the annualised returns of the above strategies under different holding periods, for $h = \{1, 2, 3, 6, 9, 12, 18, 24, 30, 36, 48, 60\}$ months. From this figure we can see that returns gradually decrease when moving from $h = 1$ to $h = 24$, indicating that the benefit of return continuation is largely offset by the subsequent time series reversal. The average returns remain stable after a holding period of more than 24 months, meaning that the reversal pattern

⁹See Table 2 in Moskowitz et al. (2012).

stops after the end of the second year. These results are consistent across the three strategies.

3.2. Timing of Time Series Reversal

If the time series reversal exists after the formation of trend following signals, when does it occur and end? To answer this question, we implement the three aforementioned contrarian trend following strategies using different time lags. We always take the opposite positions as suggested by the trend following strategy signals. Therefore, a total of 105 (35x3) lagged (from 2 to 36 months) contrarian strategies are implemented using the trading signals with a holding period of $h = 1$.

In Figure 3, we plot the annualised mean returns of the 105 strategies which reveal the timing of the time series reversal. In the short run, contrarian strategies produce negative returns (2-10 months for SMA and TSM, 2-12 months for RSM). The negative short-term returns are followed by an intermediate reversal which usually lasts for more than a year (12-28 months for SMA, 12-26 months for TSM and 13-25 months for RSM). The portfolio returns turn back to negative after the intermediate term reversal. More specifically, the reversal pattern of SMA has a double-humped shaped, where the returns from month 18 to 20 are close to zero. TSM and RSM are similar in both their first-year momentum and second-year reversal patterns. Besides, none of these contrarian strategies produce statistically significant returns that outperform a naïve 1/N buy-and-hold strategy. Hence, simple contrarian trend following strategies do not outperform the market.

In summary, time series reversal is a pervasive but not statistically significant phenomenon across different trend following strategies and time spans. Normally, it occurs between the end of the first year and the end of the second year after the trend following signal is generated. The results differ from existing literature where the long term reversals, cross-sectional or time series, usually last 3-5 years. Time series reversal vanishes after 24-28 months depending on different signals.

4. Linkage Between Time Series Momentum and Reversal

4.1. Sign Analysis

To investigate the relationship between time series continuation and reversal, we further track the trend following portfolio beyond the conventional trend following

holding period of 1-12 months. The performance evaluation period is extended to a post-holding period of 13-60 months after the signal¹⁰. Hence, the time horizon is divided into three parts: the 12 months signal formation period prior to month 1 (j), 1-12 months trend following holding period (k) and 13-60 months post trend following holding period. As before, the same three trend following strategies, SMA, TSM and RSM, are performed. A rolling method is employed to generate and renew the trading signals every month.

Analogous to [Conrad and Yavuz \(2017\)](#), we decompose the trend following portfolio into four subgroups: “realised winner”, “realised loser”, “contrarian winner” and “contrarian loser”. The “realised winner” denotes a sub-portfolio with instruments that are past winners during period j , and continue to generate positive returns during period k . The “realised loser” denotes a sub-portfolio that consists of past losers during period j , and that keep generating negative returns during period k . In contrast, the “contrarian winner” denotes a sub-portfolio comprised of past winners during period j , but then fail to generate positive returns during period k . The “contrarian loser” denotes a sub-portfolio with past losers, but then generate positive returns during k . These four subgroups cover all the assets in the trend following portfolio as either a positive (winner) or a negative (loser) signal is assigned to each instrument at each point in time.

Based on the four sub-portfolios for each of the SMA, TSM and RSM trend following strategies, we calculate the probability of positive signs for individual instruments during the post trend following holding period (13-60 months). More specifically, we divide it into four periods representing four years during the post-holding period. These are 13-24 months, 25-36 months, 37-48 months and 49-60 months after the formation of regular SMA, TSM and RSM signals. This allows us to see which subgroup exhibits strong time series reversal, and during which period the reversal occurs.

We leave $k = 1 - 12$ months, i.e. the trend following holding period, as an evaluation period to determine which subgroup an individual instrument falls into.

¹⁰Post-holding period study of momentum strategies is first seen in [Jegadeesh and Titman \(2001\)](#), who track the cross-sectional momentum performance up to 60 months after the formation of momentum signals. This is the first time that post-holding analysis is applied to trend following strategies.

We consider $k = \{1, 2, 3, 6, 12\}$ as SMA, TSM and RSM effects last from 1 to 12 months. The (j, k) sub-portfolios are established for further analysis, where $j = 12$ is the trend following ranking period and k is the trend following holding period. For instance, in a $(12, 12)$ scheme, the trend following signals (winner/loser) at time t is based on the returns during month $t - 11$ to t , which are formed for each individual instrument. Then, we determine whether the winners or losers are realised or not. To do so, we observe whether the period excess returns during the next $k = 12$ periods, i.e. $t + 1$ to $t + 12$ are positive or not. Finally, we calculate how many instruments in each subgroups generate positive returns over $t + 13$ to $t + 60$ months and report the rate of positive returns. The same process is followed for each month from January, 1985 to March 2015.

As shown in Table 2, the “realised winner” accounts for most of the total SMA, TSM and RSM signals. In particular, 31.4-34.1% of SMA signals, 32.3-34.1% of TSM signals and 34-36.2% of the RSM signals belong to the “realised winner” group depending on the value of k . The “realised loser” takes 17.9-21.1% of SMA signals, 16.4-20.6% of TSM signals and 16.4-20.2% of the RSM signals which is the smallest subgroup among the four. The “contrarian winner/loser” portfolios are in-between. The trend following signals do not provide a high success rate when 52-52.5% (SMA), 50.5-52.9% (TSM) and 52.6-54.2% (RSM) of the total observations falling into the “realised winner” or “realised loser” subgroups. The success rates get lower as k increases. This further confirms that trend following signals are more accurate using the $(12, 1)$ scheme¹¹.

The probability analysis show that the “realised loser” and the “contrarian loser” portfolios exhibit around 65-66% and 63% positive rate respectively for the first 12 months of the post trend following holding period (13-24 months). The success rates are much higher than the unconditional positive rate of 58.7%, which is calculated covering all the 55 individual instruments from January, 1985 to March, 2015. We also employ a proportion test developed by Newcombe (1998a,b) to examine if the success rates of these subgroups are statistically different from the unconditional rate.

¹¹Trend following strategies usually renew the signals every month to achieve the optimum performance, see, among others, Moskowitz et al. (2012), Baltas and Kosowski (2013) and Papailias et al. (2017).

Results suggest that the rates of both the “realised loser” and “contrarian loser” sub-portfolios are significant at the 1% level. Moreover, the results are persistent across different $(12, k)$ schemes and strategies. The superior positive rates of the “realised loser” and “contrarian loser” subgroups discontinue during the subsequent holding periods of 25-36 months and 37-48 months. Finally, during 49-60 months, the rates get slightly higher again at around 62% and 61% respectively.

In contrast, the “realised winner” and the “contrarian winner” subgroups experience lower positive rates than the unconditional rate at about 55-56% and 57% respectively. The positive rates of the “realised winner” subgroup are significantly lower than average at the 1% level, while those of the “contrarian winner” are not. As time passes, the rates of the “realised winner” rebound to the unconditional rate during 25-36 months and 37-48 months. Then, they fall back to approximately 57-58% in 49-60 months. However, the positive rates of “contrarian winner” are not statistically significant over the majority of the sample.

Our findings indicate that the instruments which contribute to the trend following profits, or the instruments that fall into “realised winner” and “realised loser” subgroups, do experience a strong reversal during the time series reversal period (13-24 months). The remaining two portfolios, i.e. the “contrarian winner” and “contrarian loser”, which do not generate trend following profits, behave differently to each other. The “contrarian loser” still produces significant reversals, whereas the “contrarian winner” does not.

4.2. Sub-portfolios Performance

To investigate how each sub-portfolio evolves during the 4 years post-holding period (13-60 months), we evaluate the strategy performance holding the underlying instruments of the 4 subgroups for 12 months. Four sets of strategies, 13-24 months, 25-36 months, 37-48 months and 49-60 months holding periods after the formation of SMA, TSM and RSM signals, are run to match the previous analysis. The “realised winner”, “realised loser”, “contrarian winner” and “contrarian loser” groups are determined using the previously described (j, k) schemes, where $j = 12$ and $k = \{1, 3, 6, 12\}$.

Table 3 summarises the performance of SMA, TSM and RSM strategies by sub-

groups categorised using the (12, 12) scheme from January, 1985 to March, 2015¹². Four different 12 months holding period trading signals are performed covering 13-60 months after the formation of original SMA, TSM and RSM signals. Following the methodology in the work of Jegadeesh and Titman (1993), we compute these trend following strategy returns by renewing the signals every month, despite the fact that the holding period h is more than one month (in our case $h = 12$). Then, we calculate the average value of the single month strategy returns, 1st lag of the same series and so on (up to 11th lag), to get the 12 months holding period returns. The average returns at time t consists of the single month returns at time t itself, the single month returns constructed at time $t - 1$ (previous month position but still hold it), and so on up to time $t - 11$. Finally, for reasons of simplicity, we use an equally weighted method to construct each sub-portfolio.

For each strategy, the annualised mean return, annualised volatility, Sharpe Ratio and maximum drawdown are reported¹³. Throughout the strategy evaluation part in this paper, we compute the t-statistics to check if the returns are significant or not using the Newey-West standard error (Newey and West, 1986).

As shown in Table 3, the “contrarian loser” portfolio generates the highest returns and Sharpe Ratio across the four subgroups during the first year of post trend following holding period (13-24 months). The Newey-West t-statistics suggest that all the trend following “contrarian loser” sub-portfolios produce positive returns at 1% level of significance. The “realised loser” also displays strong reversals during both 13-24 months and 25-36 months. However, the reversal pattern is much stronger during 25-36 months, when all the returns of the three strategies are significant at 1% level. Both of the two “loser” groups, which one would expect to perform poorly (short signals) during the trend following holding period, exhibit strong reversal during 13-24 and 13-36 months. These results are consistent with the previous sign analysis.

Next, we move on to the “winner” subgroups. The “realised winner” generally does not exhibit strong returns except in the TSM case, where it barely produces an annualised return of 4.4% (significant at the 10% level). The “contrarian winner”

¹²We also produce the same tables using (12, 1), (12, 3) and (12, 6) schemes which are available in Appendix B. The results are also robust across different trend following holding periods k .

¹³Details of each strategy evaluation criteria is listed in Appendix C.

sub-portfolio which does not produce any significant returns during 13-24 months, produces strong positive returns during 25-36 months. After the first and second year of the post trend following holding period, neither time series continuation nor reversal exists.

Conrad and Yavuz (2017) conclude that the “realised portfolio”, namely “realised winner” minus “realised loser”, which contributes to the momentum profits, does not contribute to the reversal. According to our results, the difference between “realised winner” and “realised loser” during 13-24 months is very small (-0.032 for SMA, 0.002 for TSM and 0.001 for RSM) so that they offset each other when considering both subgroups as a whole. They also claim that the “contrarian portfolio”, namely “contrarian winner” minus “contrarian loser” in our case, generates significant returns. In our view, it is because of the “contrarian loser” solely.

In conclusion, during the first-year post trend following holding period (13-24 months), time series reversal is statistically significant when sub-portfolios are considered. The “realised winner” and the “contrarian winner”, which are supposed to produce high returns, i.e. with buy signals, discontinue to earn significant profits post the trend following holding period. On the other hand, the “realised loser” and the “contrarian loser” generate high returns, indicating strong reversal. Among the four subgroups, the “contrarian loser” subgroup leads to the strongest reversal during 13-24 months. Most of these significant positive returns cease to hold beyond the end of the second year of the post trend following holding period.

5. Trend Following Reversal Strategies

5.1. A Decomposition of Trend Following Strategies

It is clear from the previous section that the time series reversal generates high abnormal returns during 13-24 months after the signals are generated. In order to understand what causes time series reversal, we evaluate the profitability of a new type of strategy based on time series continuation and reversal, called “trend following reversal strategy”. Again we decompose the asset pool into four sub-portfolios: “realised winner”, “realised loser”, “contrarian winner” and “contrarian loser” using a (j, k) scheme, where $j = 12$ and $k = \{1, 3, 6, 12\}$. The trading signals, however, are generated every month, so that the position sizes are rebalanced every month.

The portfolio weight for each individual instrument is inversely proportional to their realised ex-ante volatility.

Trend following reversal strategy is a type of double-sorted strategy in which the trend following ranking (j) is the first sort and the realised/unrealised profit (k) is the second sort¹⁴. The trend following reversal strategy keeps its tractability as the work of [Bianchi et al. \(2015\)](#) which requires no external information other than the price returns. It also makes more sense as the first ranking period is the conventional trend following look-back period, and the second ranking period is the profit window.

Table 4 summarises the performance of the 12 decomposed sub-portfolios under three trend following categories using $(j, k) = \{(12, 1), (12, 3), (12, 6), (12, 12)\}$ double-sorting periods. As suggested by the Newey-West t-statistics, the “realised winner” and the “contrarian loser” sub-portfolios produce statistically significant returns at 1% level in all cases regardless of the trend following strategies and the ranking schemes we choose. The annualised mean returns of the “realised winner” range from 14.4% to 26.6% and the returns of the “contrarian loser” range from 9.8% to 24.4%. The “contrarian winner” subgroup only shows significant profits when (12, 1) and (12, 6) schemes are used. Finally the “contrarian winner” group hardly produces any statistically significant returns. The profitability of the “realised winner” decreases as k increases. On the contrary, the “contrarian loser” performance improves as k value increases.

If investors go long in “realised winner” and “contrarian winner” and go short in “realised loser” and “contrarian loser”, their positions are equivalent to a trend following strategy (SMA, TSM or RSM) holding from 13-24 months. However, trend following reversal strategies suggest that investors only take a long position in the “realised winner” and the “contrarian loser” sub-portfolios. This means that the past trend following winners ($j = 12$), which continue to generate profits ($k = 1 - 12$), will keep the upward trend. While the past trend following losers, which earn positive

¹⁴There are numerous studies which employ and evaluate double-sorted momentum strategies. [Lee and Swaminathan \(2000\)](#), [Sagi and Seasholes \(2007\)](#), [Fuertes et al. \(2010\)](#) and [Conrad and Yavuz \(2017\)](#) combine momentum signals with the other external variables such as term structure, firm-specific attributes, trading volume and value/book-to-market ratios as the second criteria, while [Bianchi et al. \(2015\)](#) combine a long-term momentum ranking to a medium-term momentum ranking and find superior abnormal returns.

returns later, would also increase in the future.

Figure 4 plots the cumulative returns of the “realised winner” and the “contrarian loser” under SMA, TSM and RSM (12, 12) frameworks. Compared to their corresponding trend following benchmarks, these two sub-portfolios exhibit superior performance. A \$1 investment in SMA, SMA realised winner and SMA contrarian loser strategies would be worth \$7.69, \$35.24 and \$631 respectively at the end of the sample period. When following TSM and RSM frameworks, the “realised winner” and the “contrarian loser” show similar performance, but much higher than the original TSM and RSM returns.

Surprisingly, the “realised winner” produces significant returns persistently across different ranking schemes, even though its frequency of positive returns is significantly lower than the average as is shown in the sign analysis. To understand this result, we compare the return densities between “realised winner” and “contrarian loser” across different strategies which are reported in Figure 5. In the cases of SMA and TSM, the distributions of the “realised winner” returns are slightly right skewed when compared to the “contrarian loser”, indicating the majority of the returns are lower. However, the RSM result shows contrary outcome. In addition, the “realised winner” strategies exhibit fat tails when returns are around 30%, while the “contrarian loser” strategies do not. These extreme returns contribute to the statistically significant positive mean of the “realised winner”. Alternatively, we can also attribute these positive returns to the volatility scaling benefit of momentum strategies, see, e.g., [Ahn et al. \(2003\)](#), [Barroso and Santa-Clara \(2015\)](#), [Kim et al. \(2016\)](#) and [Papailias et al. \(2017\)](#).

For a more in-depth insight into the relationship of trend following reversal strategies and standard trend following strategies, we calculate the correlation between different sub-portfolios and their corresponding trend following strategies as reported in Figure 5, Panel A. Results suggest the returns of “realised winner” and “contrarian loser” are always positively related to SMA, TSM and RSM returns, whereas those of “realised loser” and “contrarian winner” show negative relationships. Moreover, the “contrarian loser” exhibits lower correlation with SMA, TSM and RSM (0.44, 0.53 and 0.48) than the “realised winner”. This illustrates that the “contrarian loser” are not as related to the mainstream trend following strategies. We also examine the relationship across these trend following reversal strategies and report the results in

Figure 5, Panel B. We find that there is no obvious co-movement between the two components in the “realised portfolio”, with correlations from -0.07 to -0.05. We observe the same pattern in the case of “contrarian portfolio”, where the correlations are negative from -0.12 to -0.08. The rest of the sub-portfolios are slightly positively correlated with values around 0.2-0.3.

We contend that our trend following reversal strategies can be applied by practitioners. Based on our dataset which consists of 55 instruments, each subgroup has sufficient amount of assets allocated to it across time. As shown in Figure 6, the number of instruments in each sub-portfolios of the TSM (12, 12) scheme almost never drops to 0 which ensures that investors stay in the market over the investment horizon¹⁵. Therefore, trend following reversal strategies are liquid and tradable as the portfolios have at least 5 instruments in most of the cases. Figure 7 illustrates the proportions of individual instruments fall into the 4 sub-portfolios under a TSM trading strategy using (12, 12) scheme¹⁶. Generally, the 4 subgroups are allocated evenly across different instruments, except that the “realised winner” accounts for slightly larger proportion and the “realised loser” accounts for a smaller proportion. This reflects the asset diversification of trend following reversal strategies.

5.2. Risk Exposure Analysis

To understand the dynamics of the trend following reversal strategies, we regress the returns of these sub-portfolios for each of the SMA, TSM and RSM strategies (12, 12) on three classes of market risk factors as shown in Table 6. First, Panel A shows results of Fama-French and Carhart three factor models, representing the size, value and momentum respectively as in Fama and French (1993) and (Carhart, 1997). Second, in Panel B, we detail the global asset class factors consisting of MSCI World Index, S&P GSCI, Barclays US Aggregate Bond Index and US-Dollar Index. Finally, the Time Series Momentum (Moskowitz et al., 2012) regressions are run to examine the risk exposure to conventional trend following strategies.

In general, we observe approximately 40%-60% changes in most of these trend

¹⁵We observe similar patterns under SMA and RSM trading strategies and using different (12, k) schemes. These results are available on request.

¹⁶Similar results observed under SMA and RSM trading strategies and using different (12, k) schemes are also available on request.

following reversal strategies which are due to the change of the stock market as proxied by MSCI. One special case is that the “contrarian loser” strategies reduce this amount to 30% or even lower. In Fama and French three factor models, the SMB and HML explain very little to the changes of these sub-portfolio returns. However, the UMD which represents momentum, shows t-statistics which are statistically significant at 5% and 1% levels. Overall, the “realised winner” and the “contrarian loser” still generate statistically significant alphas which are not explained by the model.

The global asset class factor models allow us to examine how sensitive are these sub-portfolios to changes of the international major asset class indices. It is clear that the model explains the “realised winner” returns better than the others with R-Squares from 0.28-0.33. Except USDI, most coefficients of the rest factors are statistically significant at 5% and 1% levels. However, the explanatory power seems to reduce on the “contrarian loser”. Moreover, the “contrarian loser” still displays statistically significant alphas for SMA and TSM with t-statistics of 2.6 and 1.73, though it is not the case for RSM.

Finally, we consider the TSM factor which is a proxy for trend following returns. As decomposed trend following strategies, these sub-portfolios have strong relationships with the TSM factor with the beta coefficients statistically significant at the 1% level. The coefficients of the “realised winner” and the “contrarian winner” are positively related to the TSM factor, while those of the “realised loser” and the “contrarian loser” show negative relationships. It is worth noting that, the “realised winner” returns are attributed entirely to the TSM factor with beta coefficients almost equal to 1 and the intercepts not being statistically significant. On the contrary, the TSM factor has a smaller impact on the “contrarian loser” returns with lower betas and t-statistics. Moreover, the “contrarian loser” coefficients show significant alphas in SMA and TSM frameworks with t-statistics of 2.829 and 1.854, respectively¹⁷.

To conclude, we see that trend following reversal returns are related to other momentum factors. This is because they are decomposed from the trend following

¹⁷The alphas for the “realised loser” returns are also statistically significant. This is because they are negatively related to the TSM factor. We do not consider them here as they do not generate statistically significant returns.

strategies, which is caused by time series continuation. However, a part of the trend following reversal returns are not explained by the known factors and generate significant alphas. This is particularly true for the “contrarian loser” strategy, as it has the lowest correlation with the market as well as with trend following factors. Due to its relatively low co-movement with the momentum factors, it might be particularly useful for investors who wish to avoid momentum risks¹⁸ and still produces persistent high returns.

6. Concluding Remarks

This paper studies the time horizon and magnitude of time series reversal as well as its relationship to time series continuation in an asset pool consisting of various global commodity and financial futures across a time span of 30 years. By performing multiple trend following strategies, we observe a persistent but not statistically significant reversal between the end of the first year and the end of the second year after the trend following signals are generated. The timing of time series reversal is much shorter than that of conventional cross-sectional reversal.

We show that the time series reversal effect varies across different subgroups when we decompose the trend following portfolio into four sub-portfolios, namely “realised winner”, “realised loser”, “contrarian winner” and “contrarian loser”. Our findings suggest that the “loser” components of the trend following strategies (either realised or not), generate significant post trend following reversal. The sub-portfolio with instruments which are past losers, and later generate positive returns, or the “contrarian loser” subgroup, contributes the most to time series reversal. In contrast, the “winner” sub-portfolios do not show statistically significant reversal patterns. Moreover, the “contrarian loser” strategy also displays a lower volatility and lower maximum drawdown than the other three, indicating that it can potentially form the basis of an efficient trading strategy.

Based on these results, a new type of double-sorted trading strategy is introduced called “trend following reversal strategy”. It removes the part within the traditional trend following strategy that does not produce strong price return continuation/reversal in the time series. The “realised winner” and “contrarian loser”

¹⁸See, e.g., [Barroso and Santa-Clara \(2015\)](#) and [Daniel and Moskowitz \(2016\)](#).

are the two most significant sub-portfolios within our trend following reversal strategies. Moreover, the “contrarian loser” reduces the risk of the position by partially mitigating the impact caused by momentum crashes.

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Table 1: Summary statistics.

Asset	Start Date	Annual Mean	Annual Volatility	Skewness	Kurtosis
Commodity futures					
Aluminum	1987/6/2	0.026	0.206	0.132	3.867
Brent	1988/6/24	0.100	0.322	0.454	6.156
Cocoa	1970/1/6	0.081	0.327	0.517	3.975
Coffee	1972/8/17	0.091	0.387	1.090	6.338
Copper	1986/4/2	0.082	0.254	0.110	6.607
Corn	1970/1/6	0.064	0.279	0.410	6.213
Cotton	1970/1/6	0.067	0.297	-0.402	7.419
Gas Oil	1989/7/4	0.104	0.331	0.327	4.867
Gold	1975/1/3	0.066	0.196	0.528	6.707
Heating Oil	1980/1/3	0.084	0.356	0.739	8.227
Lean Hogs	1986/4/2	0.073	0.343	0.191	4.519
Live Cattle	1970/1/6	0.057	0.197	0.037	4.078
Natural Gas	1990/4/4	0.165	0.544	0.494	4.044
Nickel	1987/1/6	0.135	0.418	2.531	20.747
Platinum	1984/1/27	0.039	0.229	0.024	7.909
RBOB	1986/8/22	0.130	0.401	0.707	6.006
Silver	1970/1/6	0.104	0.342	1.353	14.729
Soy Meal	1970/1/6	0.088	0.349	1.913	18.949
Soy Oil	1970/1/6	0.074	0.316	0.897	7.382
Soybeans	1970/1/6	0.071	0.291	0.776	9.254
Sugar	1970/1/6	0.123	0.459	1.659	9.671
Wheat	1970/1/6	0.069	0.291	0.592	5.091
WTI	1983/3/31	0.068	0.329	0.422	5.980
Zinc	1989/1/5	0.035	0.244	-0.053	4.887
Currency futures					
AUD	1971/1/6	-0.002	0.110	-0.725	7.182
CAD	1971/1/6	-0.003	0.065	-0.289	8.058
EUR	1971/1/6	-0.002	0.111	-0.183	3.821
JPY	1971/1/6	0.022	0.114	0.480	5.175
NZD	1971/1/6	-0.002	0.120	-0.403	9.870
NOK	1971/1/6	0.009	0.104	0.081	4.571
SEK	1971/1/6	0.025	0.110	0.927	7.294
CHF	1971/1/6	0.016	0.124	0.076	4.301
GBP	1971/1/6	-0.005	0.101	-0.078	5.153
Equity index futures					
SPI	1970/1/6	0.075	0.193	-0.670	10.241
CAC	1970/1/6	0.079	0.203	-0.114	3.911
DAX	1970/1/6	0.087	0.197	-0.506	5.119
FTSE/MIB	1970/1/6	0.074	0.238	0.409	4.169
TOPIX	1970/1/6	0.066	0.187	-0.172	4.279
AEX	1970/1/6	0.074	0.192	-0.556	5.474
IBEX	1970/1/6	0.070	0.209	-0.092	4.544
FTSE	1970/1/6	0.086	0.197	1.172	17.689
S&P 500	1970/1/6	0.080	0.154	-0.463	4.773
Bond futures					
AUS3	1986/1/2	0.011	0.063	-3.391	37.454
AUS10	1986/1/2	0.009	0.048	-4.970	85.085
EURO2	1986/1/2	0.018	0.081	0.213	8.129
EURO5	1986/1/2	0.023	0.073	-0.002	9.478
EURO10	1986/1/2	0.037	0.078	0.235	5.771
EURO30	1986/1/2	0.037	0.124	-0.672	10.224
CA10	1986/1/2	0.023	0.074	-1.347	13.016
JP10	1985/10/22	0.016	0.054	-0.323	8.357
UK10	1982/11/19	0.010	0.091	-1.687	16.211
US2	1986/1/2	0.004	0.028	-0.053	8.363
US5	1986/1/2	0.008	0.047	-0.668	8.046
US10	1982/5/4	0.020	0.074	-0.305	6.311
US30	1977/8/23	0.019	0.118	-0.048	6.306

This table reports the start date, mean, volatility/standard deviation, skewness and kurtosis for the 55 instruments from their earliest availability. The arithmetic monthly mean returns and standard deviation are both annualised. The detailed data sources are described in Appendix A.

Table 2: Post SMA, TSM and RSM holding period performance (sign analysis).

	SMA				TSM				RSM			
	Realised Winner	Realised Loser	Contrarian Winner	Contrarian Loser	Realised Winner	Realised Loser	Contrarian Winner	Contrarian Loser	Realised Winner	Realised Loser	Contrarian Winner	Contrarian Loser
Panel A: (12, 1)												
Num.Obs	5020	3370	4060	3520	5159	3281	4141	3370	4402	2608	3400	2513
13-24 Month	0.559	0.655	0.574	0.632	0.561	0.654	0.577	0.634	0.559	0.662	0.571	0.634
25-36 Month	0.588	0.614	0.601	0.587	0.591	0.610	0.605	0.583	0.591	0.609	0.611	0.585
37-48 Month	0.598	0.597	0.597	0.578	0.593	0.604	0.592	0.585	0.584	0.602	0.589	0.591
49-60 Month	0.575	0.609	0.585	0.609	0.571	0.621	0.576	0.615	0.564	0.618	0.576	0.621
Panel B: (12, 2)												
Num.Obs	5071	3306	4010	3585	5224	3232	4078	3419	4427	2523	3375	2599
13-24 Month	0.561	0.664	0.572	0.624	0.559	0.657	0.579	0.631	0.562	0.669	0.567	0.628
25-36 Month	0.584	0.619	0.607	0.583	0.587	0.615	0.610	0.578	0.587	0.621	0.616	0.574
37-48 Month	0.603	0.600	0.591	0.576	0.599	0.608	0.584	0.581	0.595	0.613	0.575	0.581
49-60 Month	0.574	0.617	0.586	0.602	0.571	0.631	0.576	0.607	0.563	0.625	0.577	0.614
Panel C: (12, 3)												
Num.Obs	5131	3228	3951	3663	5281	3152	4022	3499	4506	2470	3296	2653
13-24 Month	0.557	0.663	0.577	0.626	0.555	0.655	0.585	0.634	0.558	0.668	0.573	0.630
25-36 Month	0.592	0.622	0.597	0.581	0.596	0.619	0.599	0.576	0.597	0.623	0.602	0.574
37-48 Month	0.606	0.599	0.587	0.577	0.603	0.610	0.578	0.580	0.600	0.619	0.566	0.576
49-60 Month	0.576	0.621	0.583	0.598	0.574	0.636	0.572	0.602	0.567	0.632	0.573	0.607
Panel D: (12, 6)												
Num.Obs	5265	3123	3820	3768	5326	2959	3980	3692	4525	2375	3278	2748
13-24 Month	0.560	0.658	0.574	0.631	0.558	0.655	0.580	0.635	0.561	0.664	0.568	0.635
25-36 Month	0.586	0.631	0.605	0.574	0.585	0.621	0.614	0.576	0.587	0.631	0.616	0.569
37-48 Month	0.602	0.595	0.592	0.581	0.600	0.607	0.582	0.584	0.597	0.621	0.570	0.575
49-60 Month	0.578	0.624	0.580	0.597	0.578	0.644	0.567	0.598	0.571	0.645	0.567	0.597
Panel E: (12, 12)												
Num.Obs	5455	2860	3630	4031	5441	2615	3865	4036	4677	2119	3126	3004
13-24 Month	0.553	0.653	0.585	0.636	0.551	0.652	0.590	0.639	0.555	0.672	0.577	0.631
25-36 Month	0.570	0.648	0.631	0.566	0.572	0.646	0.633	0.564	0.571	0.656	0.642	0.556
37-48 Month	0.597	0.596	0.599	0.581	0.593	0.606	0.593	0.587	0.587	0.615	0.584	0.584
49-60 Month	0.578	0.621	0.581	0.601	0.575	0.640	0.570	0.604	0.563	0.645	0.578	0.601

Reported are the aggregated rates of positive 12 months cumulative returns for all the 55 instruments when dividing the SMA, TSM and RSM portfolios into 4 subgroups, "realised winner", "realised loser", "contrarian winner" and "contrarian loser", during 13-60 months after the formation of trend following signals. Different panels represent the output by using (j, k) schemes, where j , in our case equals 12, is the trend following look-back period and k is the trend following holding period. Results of different (j, k) schemes are shown in different panels. The post trend following holding period is equally divided into 4 sub-periods with each lasting for 12 months. The rates are computed based on a dataset spanning from January, 1985 to March 2015.

Table 3: Post SMA, TSM and RSM holding period performance (12, 12).

	SMA				TSM				RSM			
	Realised Winner	Realised Loser	Contrarian Winner	Contrarian Loser	Realised Winner	Realised Loser	Contrarian Winner	Contrarian Loser	Realised Winner	Realised Loser	Contrarian Winner	Contrarian Loser
Panel A: 13-24 months												
Annulaised Mean	0.024	0.057	-0.016	0.099	0.044	0.042	0.007	0.084	0.040	0.039	-0.002	0.087
Newey-West t-statistics	1.208	2.010**	-0.218	3.025***	1.906*	1.680*	0.163	3.964***	1.612	1.338	0.019	3.702***
Annualised Volatility	0.028	0.034	0.043	0.030	0.028	0.031	0.042	0.027	0.030	0.030	0.034	0.030
Sharpe Ratio	0.839	1.710	-0.366	3.301	1.535	1.352	0.177	3.139	1.324	1.285	-0.049	2.880
Maximum Drawdown	0.230	0.246	0.689	0.119	0.160	0.150	0.420	0.129	0.188	0.163	0.413	0.118
Panel B: 25-36 months												
Annulaised Mean	-0.003	0.093	0.040	0.055	0.009	0.076	0.056	0.057	0.014	0.063	0.052	0.051
Newey-West t-statistics	-0.107	3.345***	1.783*	0.619	0.259	2.511**	2.469**	0.854	0.334	3.463***	2.023**	0.655
Annualised Volatility	0.030	0.030	0.029	0.041	0.030	0.034	0.030	0.041	0.033	0.026	0.032	0.038
Sharpe Ratio	-0.096	3.101	1.384	1.321	0.310	2.235	1.871	1.387	0.430	2.389	1.640	1.328
Maximum Drawdown	0.268	0.082	0.234	0.195	0.265	0.111	0.152	0.301	0.332	0.080	0.163	0.286
Panel C: 37-48 months												
Annulaised Mean	0.026	0.075	0.063	0.057	0.019	0.057	0.055	0.043	0.029	0.037	0.056	0.030
Newey-West t-statistics	0.856	1.540	0.719	1.435	0.585	1.374	0.899	1.254	0.833	0.979	0.911	0.858
Annualised Volatility	0.035	0.037	0.042	0.035	0.030	0.034	0.037	0.033	0.031	0.029	0.041	0.032
Sharpe Ratio	0.748	2.024	1.484	1.646	0.637	1.686	1.482	1.310	0.947	1.297	1.390	0.939
Maximum Drawdown	0.300	0.145	0.147	0.182	0.255	0.165	0.134	0.203	0.243	0.172	0.178	0.197
Panel D: 49-60 months												
Annulaised Mean	0.023	0.038	0.067	0.051	0.036	0.059	0.040	0.041	0.042	0.057	0.043	0.035
Newey-West t-statistics	0.365	1.149	1.501	1.009	0.601	1.375	1.298	1.516	0.673	1.802*	1.840*	1.915*
Annualised Volatility	0.036	0.031	0.036	0.033	0.038	0.033	0.031	0.027	0.038	0.029	0.029	0.026
Sharpe Ratio	0.637	1.215	1.858	1.522	0.944	1.763	1.296	1.499	1.110	1.937	1.474	1.336
Maximum Drawdown	0.266	0.209	0.178	0.149	0.236	0.112	0.249	0.148	0.215	0.086	0.122	0.154

Reported is the performance of 12 months holding period post trend following strategies for the 4 sub-portfolios during 13-60 months after the formation of the signals. Each subgroup is constructed by evaluating whether the underlying trend following profit is realised or not under a (j, k) scheme, where $j = 12$, is the trend following look-back period and $k = 12$ is the trend following holding period. The post trend following holding period is equally divided into 4 sub-periods which are shown in different panels. We compute the annualised mean, Newey-West t-statistics, annualised volatility/standard error, Sharpe Ratio and maximum drawdown for each strategy which are detailed in Appendix C. The performance is evaluated based on a dataset spanning from January, 1985 to March 2015.

Table 4: Performance of trend following reversal strategies.

	SMA				TSM				RSM			
	Realised Winner	Realised Loser	Contrarian Winner	Contrarian Loser	Realised Winner	Realised Loser	Contrarian Winner	Contrarian Loser	Realised Winner	Realised Loser	Contrarian Winner	Contrarian Loser
Panel A: (12, 1)												
Annalised Mean	0.214	0.067	0.136	0.107	0.218	0.044	0.151	0.098	0.220	0.041	0.141	0.105
Newey-West t-statistics	6.209***	1.574	3.778***	3.125***	5.842***	0.899	4.061***	2.944***	5.510***	0.883	3.709***	2.584***
Annalised Volatility	0.200	0.223	0.195	0.201	0.200	0.224	0.200	0.211	0.204	0.233	0.209	0.235
Sharpe Ratio	1.070	0.300	0.699	0.530	1.087	0.195	0.754	0.465	1.080	0.176	0.678	0.444
Maximum Drawdown	0.222	0.609	0.601	0.442	0.294	0.770	0.515	0.458	0.297	0.755	0.528	0.673
Panel B: (12, 3)												
Annalised Mean	0.266	0.060	0.054	0.164	0.265	0.074	0.036	0.165	0.262	0.085	0.054	0.155
Newey-West t-statistics	8.095***	1.286	1.558	4.318***	7.454***	1.780*	1.008	4.019***	7.216***	2.000**	1.344	3.571***
Annalised Volatility	0.213	0.235	0.181	0.217	0.209	0.219	0.190	0.221	0.213	0.227	0.199	0.224
Sharpe Ratio	1.245	0.255	0.299	0.756	1.269	0.338	0.187	0.749	1.231	0.376	0.272	0.693
Maximum Drawdown	0.249	0.619	0.451	0.379	0.213	0.517	0.614	0.472	0.267	0.530	0.492	0.548
Panel C: (12, 6)												
Annalised Mean	0.206	0.045	0.110	0.110	0.177	0.060	0.092	0.150	0.204	0.028	0.104	0.088
Newey-West t-statistics	4.752***	1.052	3.160***	3.176***	4.027***	1.532	2.705***	4.283***	4.781***	0.678	2.632***	2.103**
Annalised Volatility	0.216	0.220	0.198	0.198	0.217	0.221	0.195	0.207	0.225	0.223	0.217	0.216
Sharpe Ratio	0.954	0.205	0.554	0.553	0.815	0.273	0.473	0.726	0.907	0.124	0.477	0.406
Maximum Drawdown	0.427	0.693	0.448	0.450	0.363	0.558	0.432	0.378	0.448	0.661	0.409	0.527
Panel D: (12, 12)												
Annalised Mean	0.144	0.090	-0.052	0.244	0.193	0.031	0.007	0.207	0.189	0.049	-0.002	0.183
Newey-West t-statistics	3.725***	2.334***	-1.023	7.062***	4.969***	0.738	0.151	5.313***	5.063***	1.157	-0.053	4.462***
Annalised Volatility	0.210	0.214	0.232	0.209	0.212	0.230	0.221	0.216	0.211	0.225	0.228	0.229
Sharpe Ratio	0.686	0.421	-0.223	1.170	0.911	0.137	0.034	0.958	0.899	0.220	-0.010	0.799
Maximum Drawdown	0.336	0.523	0.947	0.262	0.365	0.705	0.776	0.332	0.349	0.596	0.791	0.486

Reported is the performance of 4 sub-portfolios sorted by both time series continuation and reversal using volatility scaling to determine the weight. The strategy signals are renewed every month and the holding period is 1 month. Each subgroup is constructed by evaluating whether the underlying trend following profit is realised or not under a (j, k) scheme, where $j = 12$, is the trend following look-back period and $k = 1, 3, 6, 12$ denotes the trend following holding periods shown in different panels. We compute the annualised mean, Newey-West t-statistics (***) $p < 0.01$; ** $p < 0.05$; * $p < 0.1$), annualised volatility/standard error, Sharpe Ratio and maximum drawdown for each strategy. The performance is evaluated based on a dataset spanning from January, 1985 to March 2015.

Table 5: Correlation structure of trend following reversal strategies.

	Realised Winner	Realised Loser	Contrarian Winner	Contrarian Loser
Panel A: Correlation with trend following strategies				
SMA	0.456	-0.320	-0.385	0.439
TSM	0.583	-0.360	-0.417	0.532
RSM	0.582	-0.205	-0.270	0.478
Panel B: Correlation across sub-portfolios (SMA)				
Realised Winner	1			
Realised Loser	-0.056	1		
Contrarian Winner	0.244	0.270	1	
Contrarian Loser	0.237	0.202	-0.124	1
Panel C: Correlation across sub-portfolios (TSM)				
Realised Winner	1			
Realised Loser	-0.071	1		
Contrarian Winner	0.205	0.251	1	
Contrarian Loser	0.247	0.205	-0.094	1
Panel D: Correlation across sub-portfolios (RSM)				
Realised Winner	1			
Realised Loser	-0.051	1		
Contrarian Winner	0.248	0.183	1	
Contrarian Loser	0.202	0.195	-0.082	1

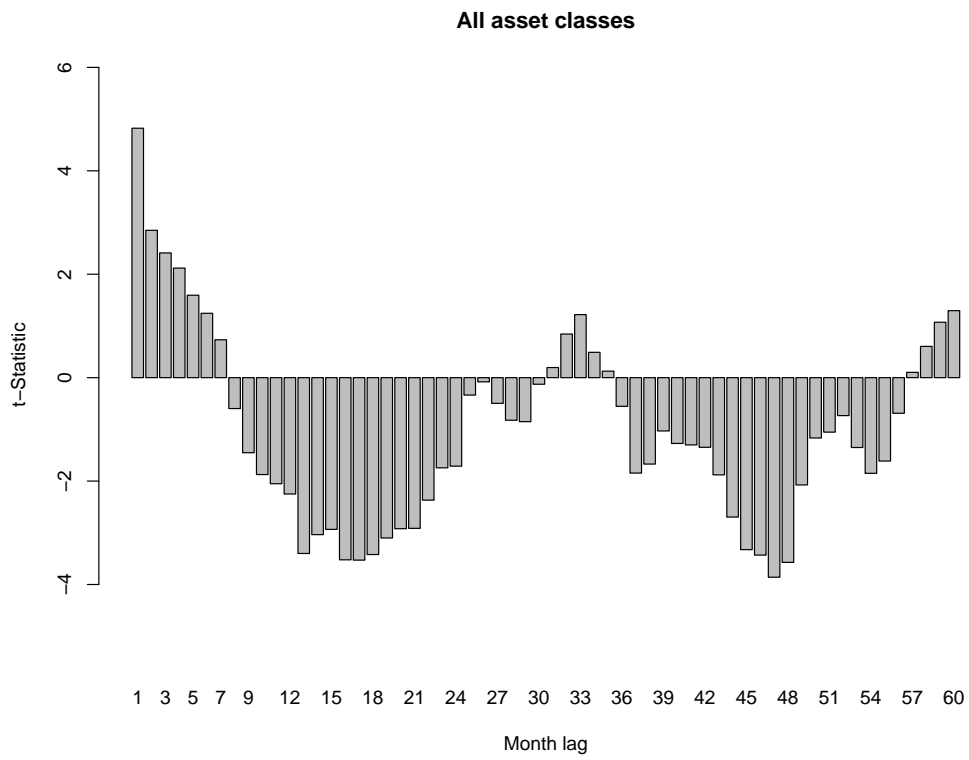
Panel A reports the correlations of different trend following reversal returns with SMA, TSM and RSM returns. Panel B, C and D summarise the correlation structures across different sub-portfolios under SMA, TSM and RSM framework, respectively. The strategy returns are calculated using our data sample from January, 1985 to March 2015.

Table 6: Factor exposure of trend following reversal strategies (12, 12).

SMA						TSM						RSM					
Realised			Contrarian			Realised			Contrarian			Realised			Contrarian		
Winner	Loser		Winner	Loser		Winner	Loser		Winner	Loser		Winner	Loser		Winner	Loser	
Panel A: Fama and French factors																	
Intercept	0.007	0.006	-0.006	0.017		0.011	0.001		-0.001	0.014		0.011	0.002		-0.002	0.012	
ICpt	2.475**	1.809*	-1.821*	5.168***		3.796***	0.145		-0.364	4.082***		3.659***	0.623		-0.474	3.371***	
MSCI	0.547	0.399	0.432	0.341		0.558	0.435		0.392	0.323		0.610	0.373		0.381	0.284	
SMB	7.990***	5.490***	5.381***	4.676***		8.119***	5.529***		5.123***	4.244***		9.095***	4.798***		4.812***	3.481***	
HML	-0.231	0.034	0.030	-0.022		-0.247	0.088		0.001	-0.006		-0.257	0.166		-0.116	0.007	
UMD	-2.387**	0.328	0.263	-0.212		-2.552**	0.794		0.010	-0.060		-2.719***	1.515		-1.039	0.057	
R2	-0.187	0.177	0.052	0.089		-0.204	0.170		0.098	0.069		-0.190	0.203		0.040	0.078	
	-1.779*	1.584	0.418	0.794		-1.930*	1.402		0.834	0.586		-1.847*	1.695*		0.329	0.626	
	0.304	-0.221	-0.153	0.269		0.316	-0.202		-0.161	0.269		0.321	-0.178		-0.176	0.222	
	4.686***	-3.211***	-2.013**	3.880***		4.845***	-2.708***		-2.221**	3.734***		5.046***	-2.414**		-2.349**	2.877***	
	0.201	0.132	0.104	0.082		0.210	0.124		0.100	0.072		0.240	0.104		0.094	0.047	
Panel B: Global asset class factors																	
Intercept	0.000	-0.001	-0.013	0.009		0.002	-0.005		-0.007	0.006		0.001	-0.003		-0.010	0.004	
MSCI	-0.042	-0.260	-3.383***	2.608***		0.562	-1.452		-2.087**	1.729*		0.429	-0.676		-2.605**	1.147	
GSCI	0.332	0.339	0.339	0.180		0.359	0.385		0.293	0.141		0.412	0.354		0.283	0.139	
BOND	4.945***	4.585***	4.209***	2.508**		5.405***	4.807***		3.825***	1.892*		6.332***	4.41***2		3.575***	1.715*	
USDI	0.186	0.236	0.205	0.154		0.208	0.234		0.224	0.142		0.188	0.182		0.227	0.093	
R2	3.649***	4.199***	3.349***	2.819***		4.122***	3.842***		3.859***	2.503**		3.803***	2.990***		3.780***	1.509	
	1.614	0.929	0.935	1.727		1.962	0.817		0.922	1.711		1.942	0.645		1.170	1.694	
	6.496***	3.399***	3.140***	6.490***		7.971***	2.753***		3.255***	6.180***		8.055***	2.173**		4.000***	5.656***	
	-0.303	0.037	-0.176	-0.032		-0.131	0.065		-0.146	-0.172		-0.141	0.126		-0.100	-0.111	
	-2.484**	0.279	-1.202	-0.245		-1.083	0.446		-1.051	-1.266		-1.190	0.865		-0.700	-0.754	
	0.280	0.161	0.156	0.165		0.306	0.147		0.155	0.159		0.328	0.106		0.153	0.120	
Panel C: Time Series Momentum factors																	
Intercept	-0.002	0.013	0.001	0.009		0.001	0.008		0.006	0.006		0.000	0.009		0.004	0.004	
MSCI	-0.804	3.933***	0.264	2.829***		0.301	2.394**		1.705*	1.854*		0.167	2.503**		1.274	1.214	
TSM	0.487	0.426	0.459	0.275		0.496	0.464		0.413	0.261		0.545	0.400		0.401	0.231	
R2	8.338***	6.395***	6.325***	4.315***		8.688***	6.498***		5.934***	3.861***		9.752***	5.555***		5.492***	3.172***	
	0.835	-0.583	-0.616	0.746		0.906	-0.641		-0.579	0.722		0.889	-0.532		-0.542	0.716	
	11.303***	-6.928***	-6.703***	9.250***		12.560***	-7.107***		-6.585***	8.467***		12.596***	-5.843***		-5.874***	7.791***	
	0.363	0.204	0.196	0.231		0.403	0.210		0.184	0.200		0.423	0.157		0.157	0.170	

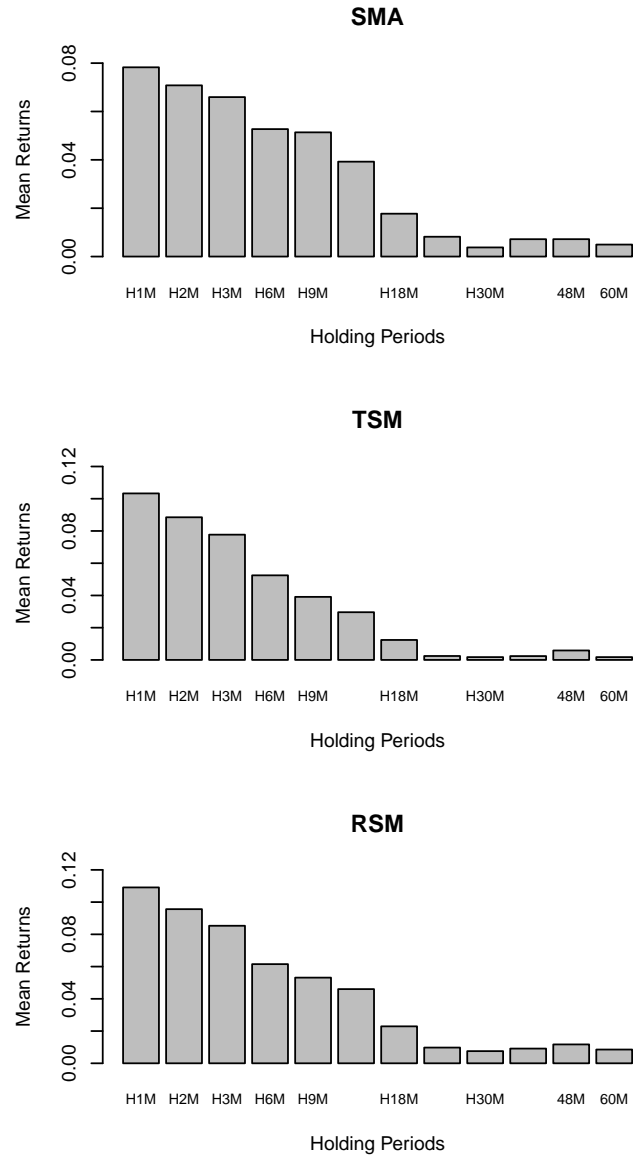
This table reports the factor exposure of the monthly returns of different sub-portfolio strategies decomposed from SMA, TSM and RSM. The regression coefficients are reported in the first row and t-statistics (***) $p < 0.01$; ** $p < 0.05$; * $p < 0.1$ are reported in the row below. Three sets of regressions are run: Fama-French and Carhart factors (Panel A), global asset class factors (Panel B) and Time Series Momentum factors (Panel C). The regressions are conducted with the monthly returns that span from January, 1985 to March 2015.

Figure 1: Predictability of 12 month probability of positive return signs.



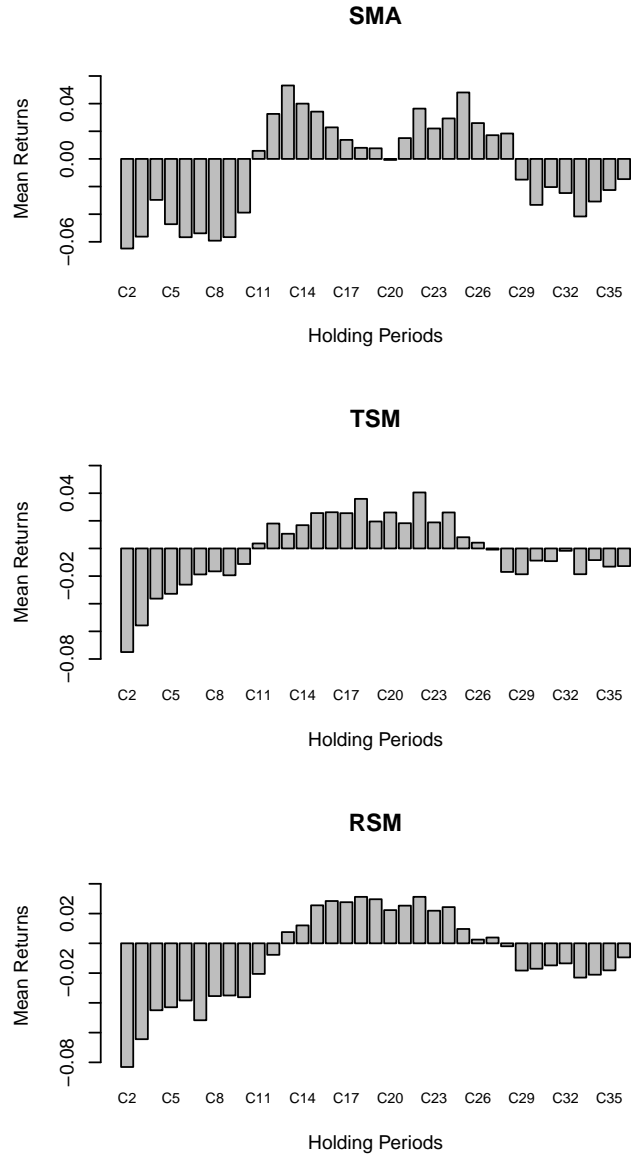
Reporting the t-statistics for lags from $h = 1$ to $h = 60$. The pooled regression consisting of all the 55 instruments as in Equation 9 is run.

Figure 2: Return decays of trend following strategies.



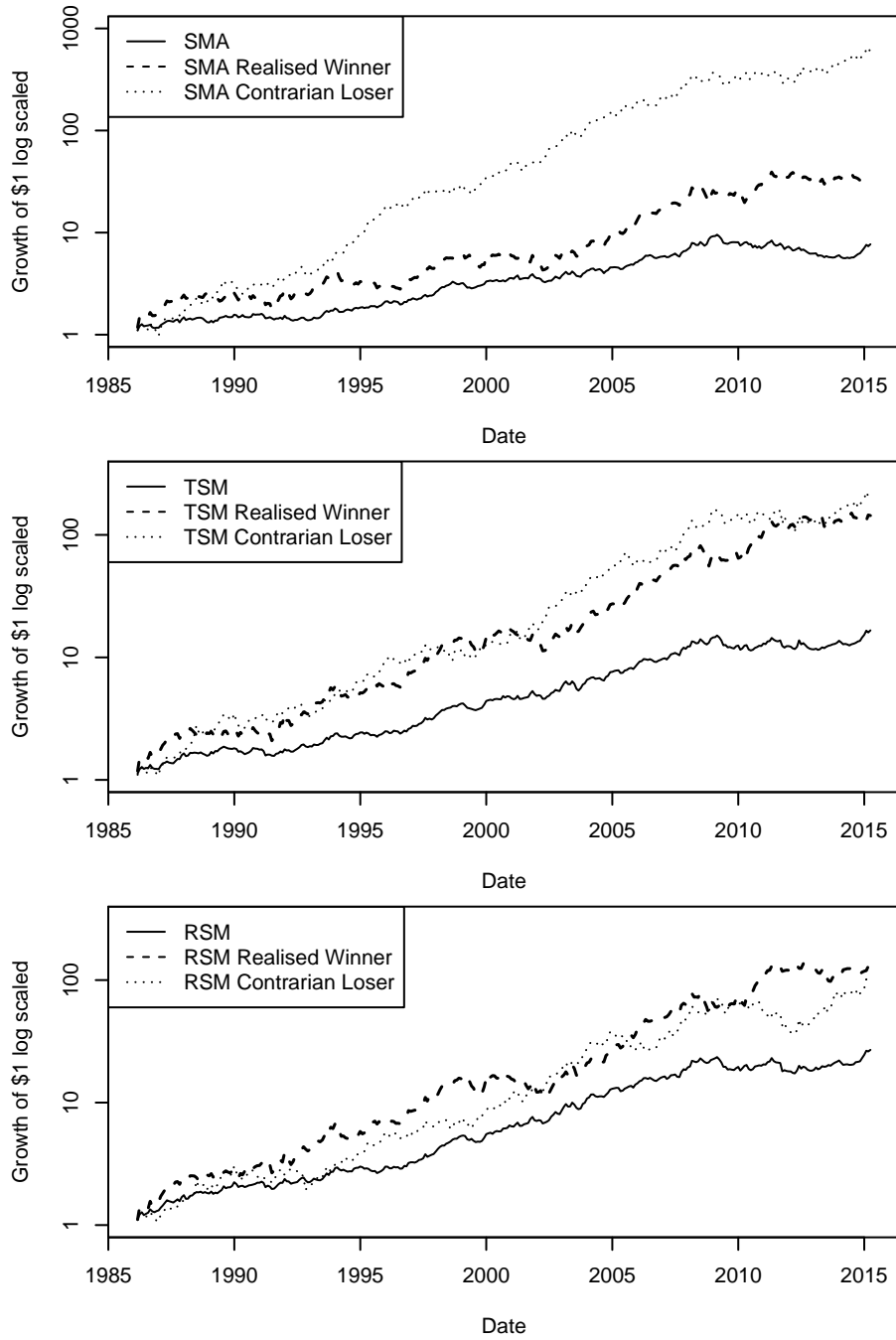
Reported are the annualised mean returns of SMA, TSM and RSM strategies with different holding periods (1,2,3,6,9,12,18,24,30,36,48,60 months). The strategies are performed using an asset pool with 55 futures from January, 1985 to March, 2015.

Figure 3: Timing of time series reversal.



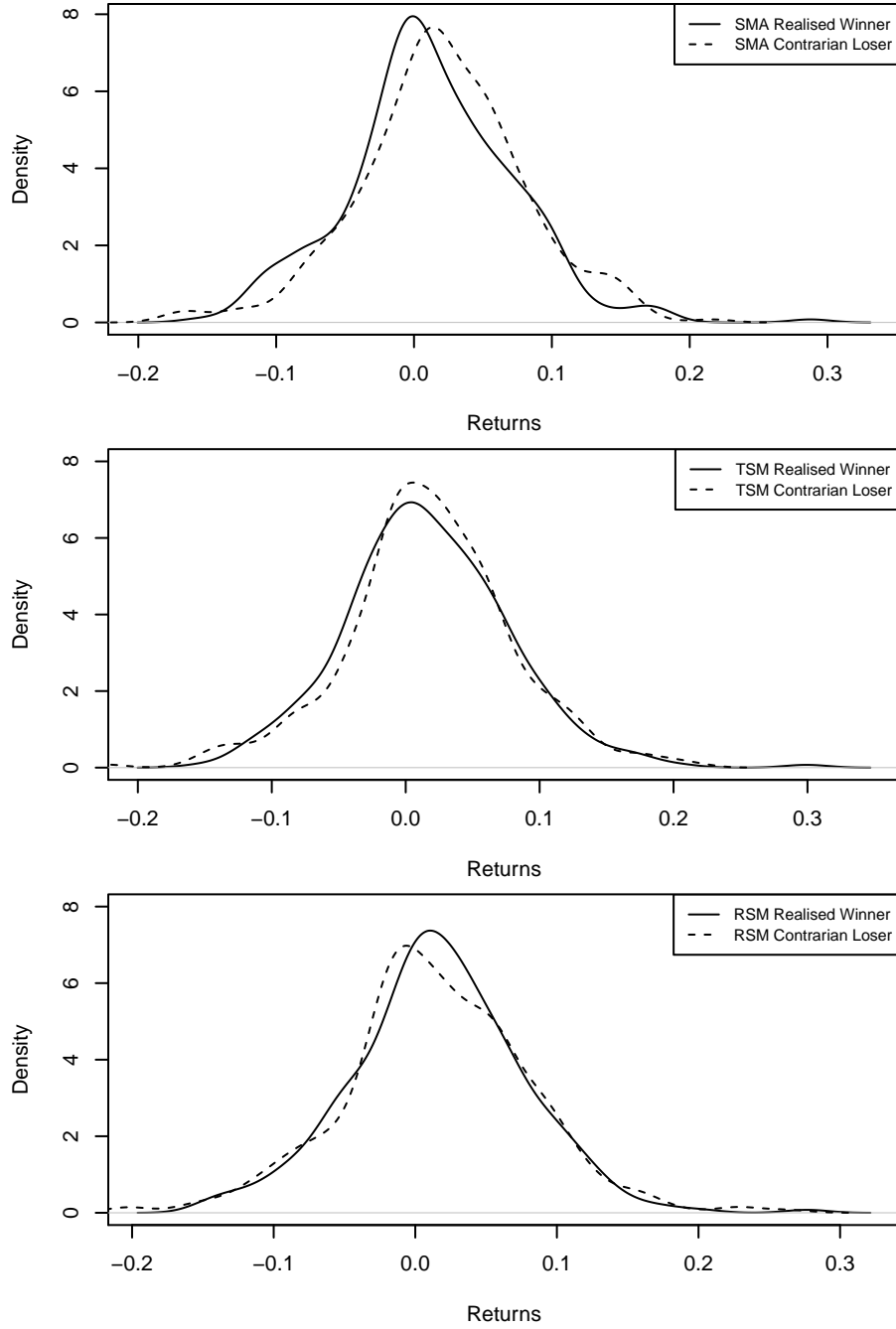
Reported are the annualised mean returns of the contrarian SMA, TSM and RSM strategies with different time lags from $h = 2$ to $h = 36$. The strategies are performed using an asset pool with 55 futures from January, 1985 to March, 2015.

Figure 4: Cumulative returns of trend following reversal strategies versus benchmarks (12,12).



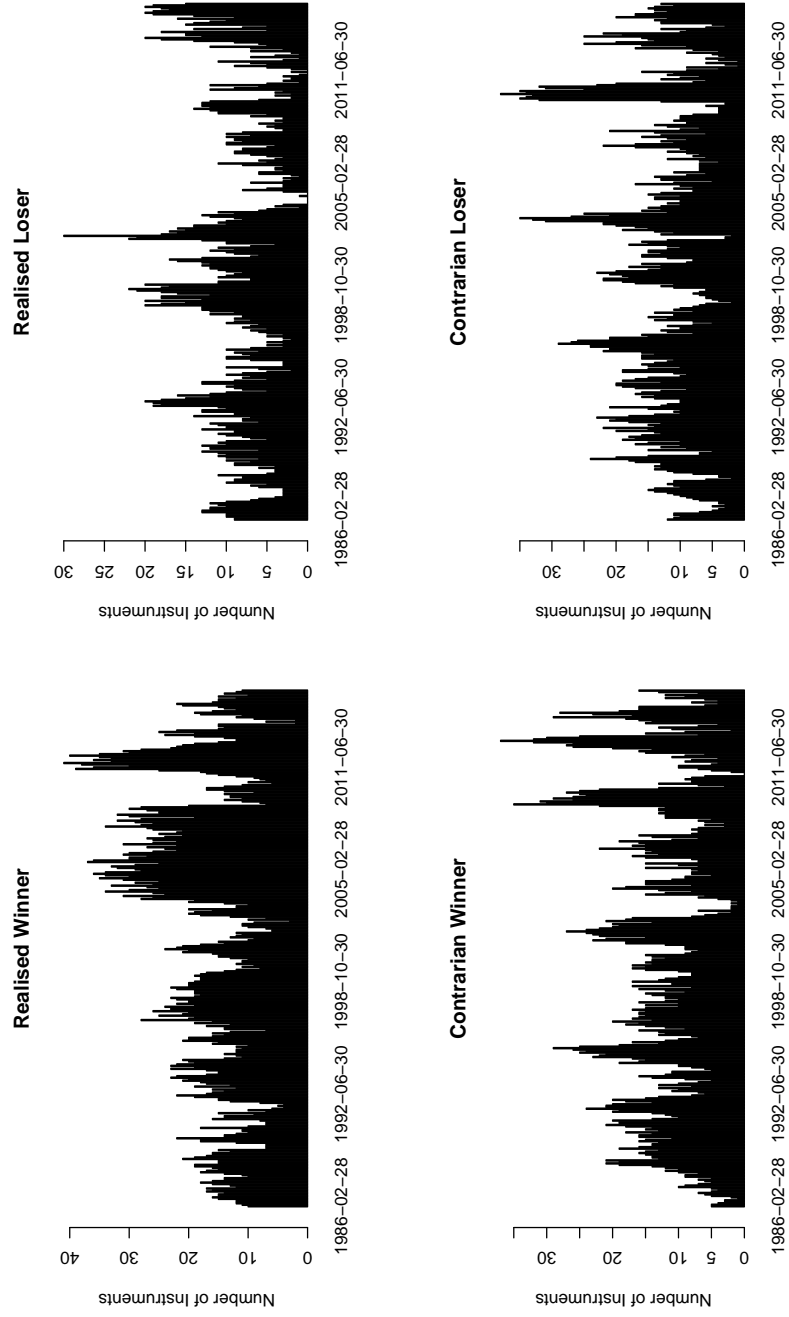
Plotted are the cumulative returns of trend following reversal “realised winner” and “contrarian loser” strategies compared to their corresponding trend following strategies (SMA, TSM and RSM) using (12,12) scheme. The cumulative returns are calculated as shown in Appendix C. The strategies are performed using an asset pool with 55 futures from January, 1985 to March, 2015.

Figure 5: Return densities of trend following reversal strategies (12, 12).



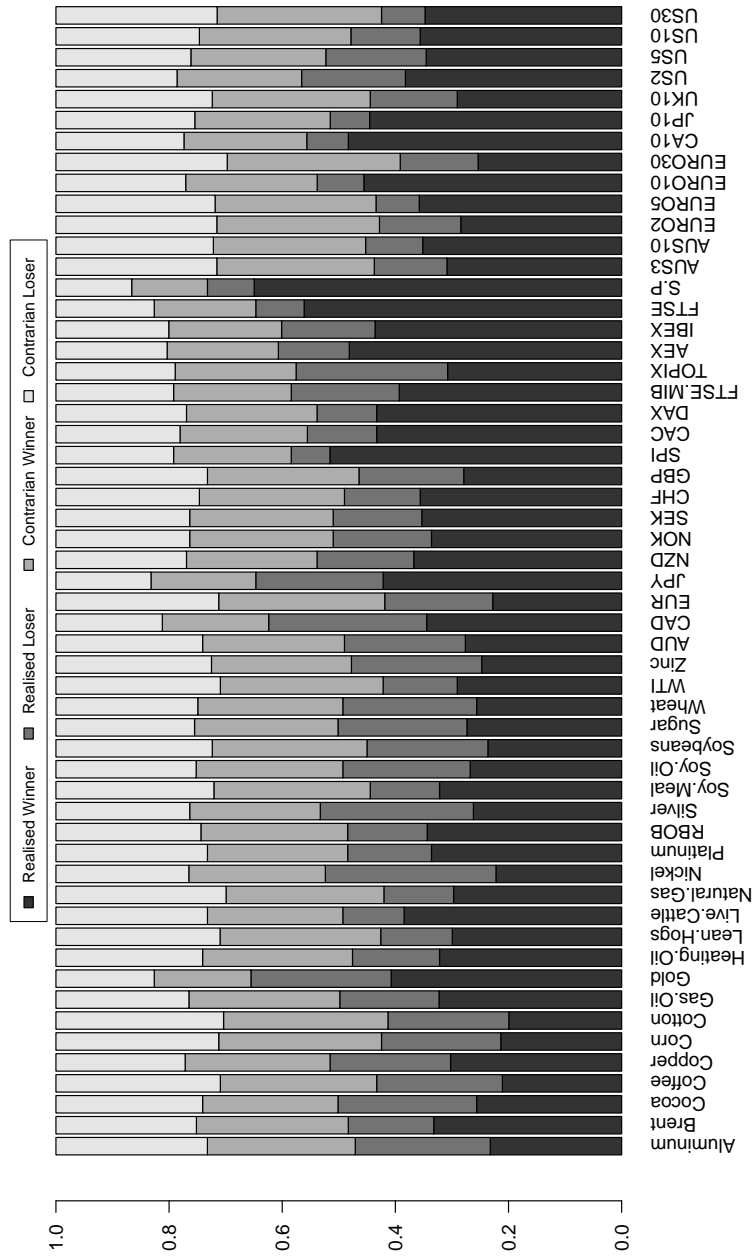
Plotted are the return densities of trend following reversal “realised winner” and “contrarian loser” strategy using (12,12) scheme. The strategies are performed using an asset pool with 55 futures from January, 1985 to March, 2015.

Figure 6: Number of Instruments within TSM trend following reversal sub-portfolios over time (12, 12).



Reported figure shows the number of instruments of the 4 sub-portfolios under a TSM strategy using (12, 12) scheme. The strategies are performed using an asset pool with 55 futures from January, 1985 to March, 2015.

Figure 7: Proportions of TSM trend following reversal signals for individual instruments (12, 12).



This bar chart reports the frequency of an individual instrument to be assigned to the 4 sub-portfolios under a TSM strategy using (12,12) scheme. The strategies are performed using an asset pool with 55 futures from January, 1985 to March, 2015.

Appendices

A. Data Sources

The asset pool consists of futures returns of 4 asset classes: commodity, currency, equity index and government bond. It covers 24 commodity futures from different exchanges (CBOT, CME, COMEX, ICE, LME, NYMEX and TOCOM), 9 developed countries currency futures to USD (AUD, CAD, EUR, JPY, NZD, NOK, SEK, CHF and GBP), 9 equity index futures for 9 different countries (Australia, France, Germany, Italy, Japan, Netherlands, Spain, UK and US), and 13 government bond futures of 6 developed economies (Australia, Eurozone, Canada, Japan, UK and US). Majority of the data is downloaded from Bloomberg and DataStream. We use a similar data concatenation policy to those data who has shorter time availability as [Moskowitz et al. \(2012\)](#). The details of all the data sources and splice method is provided in Table A.1.

B. Sub-portfolio Performance Using Other Ranking Schemes

Tables B1, B2 and B3 report the annualised mean returns, Newey-West t-statistics, annualised standard deviations, Sharp ratios and maximum drawdowns of different trend following sub-portfolios under (12, 1), (12, 3) and (12, 6) schemes. The dataset spans from January, 1985 to March, 2015.

We observe a similar pattern as in table 3, where the "loser" subgroups, and especially the "contrarian loser", exhibit statistically significant reversal during 13-24 months. The "realised winner" also exhibits statistically significant in some cases, whereas the "contrarian winner" does not. The reversal pattern is strong only during 13-24 months, and then becomes statistically insignificant over 25-60 months.

C. Strategy Evaluation

We evaluate the candidate trading strategies by considering both return and risk context. The return measures include average returns, minimize/maximum returns and cumulative net profits. While the risk related measures consist of standard deviation and maximum drawdown. Besides the Sharpe Ratio (reward-to-risk ratio) is also considered. Let R_t^s denotes the return of strategy s at month t ranging from m_1 to m_n , the evaluation measures are calculated as follows:

1. The annualised average return

$$AR^s \stackrel{\text{def}}{=} \frac{1}{n} \sum_{t=m_1}^{m_n} R_t^s \quad (10)$$

2. The cumulative net profit

$$CNP^s \stackrel{\text{def}}{=} \left\{ \prod_{t=m_1}^{t=m_n} (1 + R_t^s) \right\} - 1 \quad (11)$$

3. The annualised volatility/standard deviation

$$SD^s \stackrel{\text{def}}{=} \sqrt{\frac{1}{n} \sum_{t=m_1}^{m_n} (R_t^s - AR^s)^2} \quad (12)$$

4. The gross Sharpe Ratio, annualised

$$SR^s \stackrel{\text{def}}{=} \frac{AR^s}{SD^s} \quad (13)$$

5. The maximum drawdown MDD_t^s measures the maximum historical decline over the investment horizon. The maximum value from an arbitrary peak of the cumulative profit to any subsequent cumulative profit from time 0 to time T is calculated . The formula of maximum drawdown can be expressed as:

$$MDD_t^s = \frac{\max_{T \in (0,t)} \{0, \max CNP_T^s - CNP_t^s\}}{\max_{T \in (0,t)} CNP_T^s} \quad (14)$$

where CNP_t^s denote the cumulative profit at time t . $\max_{T \in (0, t)} CNP_T^s$ is the highest cumulative profit from time 0 to time T .

Table A.1: Data Sources.

Assets	Start Date	Bloomberg Ticker	Splicing Information
Commodity futures			
Aluminum	1987/6/1	LMAHDS03 Comdty	
Brent	1988/6/23	CO1 Comdty	
Cocoa	1959/7/1	CC1 Comdty	
Coffee	1972/8/16	KC1 Comdty	
Copper	1986/4/1	LMCADS03 Comdty	
Corn	1959/7/1	C 1 Comdty	
Cotton	1959/7/1	CT1 Comdty	
Gas Oil	1989/7/3	QS1 Comdty	
Gold	1975/1/2	GC1 Comdty	
Heating Oil	1980/1/2	HO1 Comdty	
Lean Hogs	1986/4/1	LH1 Comdty	
Live Cattle	1964/11/30	LC1 Comdty	
Natural Gas	1990/4/3	NG1 Comdty	
Nickel	1987/1/5	LMNIDS03 Comdty	
Platinum	1984/1/26	JA1 Comdty	
RBOB	2005/10/3	XB1 Comdty	Unleaded Gasoline from 21/08/1986 (Bloomberg)
Silver	1964/3/2	SI1 Comdty	
Soy Meal	1960/1/22	SM1 Comdty	
Soy Oil	1961/9/1	BO1 Comdty	
Soybeans	1959/7/1	S 1 Comdty	
Sugar	1961/1/3	SB1 Comdty	
Wheat	1959/7/1	W 1 Comdty	
WTI	1983/3/30	CL1 Comdty	
Zinc	1989/1/4	LMZSDS03 Comdty	
Currency futures			
AUD/USD	1987/1/13	AD1 Curncy	AUD spot from 05/01/1971 (Bloomberg)
CAD/USD	1977/1/18	CD1 Curncy	CAD spot from 05/01/1971 (Bloomberg)
EUR/USD	1998/5/19	EC1 Curncy	DEM 04/1986, DEM SPOT 01/1971 (Bloomberg)
JPY/USD	1976/8/3	JY1 Curncy	JPY spot from 05/01/1971 (Bloomberg)
NZD/USD	1997/5/7	NV1 Curncy	NZD spot from 05/01/1971 (Bloomberg)
NOK/USD	2002/5/16	NO1 Curncy	NOK spot from 05/01/1971 (Bloomberg)
SEK/USD	2002/5/16	SE1 Curncy	SEK spot from 05/01/1971 (Bloomberg)
CHF/USD	1975/2/14	SF1 Curncy	CHF spot from 05/01/1971 (Bloomberg)
GBP/USD	1975/2/14	BP1 Curncy	GBP spot from 05/01/1971 (Bloomberg)
Equity index futures			
SPI	2000/5/2	XP1 Index	MSCI Australia from 01/01/1970 (DataStream)
CAC	1988/12/7	CD1 Index	MSCI France from 01/01/1970 (DataStream)
DAX	1990/11/23	GX1 Index	MSCI Germany from 01/01/1970 (DataStream)
FTSE MIB	2004/3/22	ST1 Index	MSCI Italy from 01/01/1970 (DataStream)
TOPIX	1990/5/16	TP1 Index	MSCI Japan from 01/01/1970 (DataStream)
AEX	1983/1/3	FXNL Index	MSCI Netherlands from 01/01/1970 (DataStream)
IBEX	1992/7/21	IB1 Index	MSCI Spain from 01/01/1970 (DataStream)
FTSE	1988/2/26	Z 1 Index	MSCI UK from 01/01/1970 (DataStream)
S&P 500	1982/4/21	SP1 Index	MSCI USA from 01/01/1970 (DataStream)
Bond futures			
AUS 3Y	1989/12/18	YM1 Comdty	JPM Australia from 01/01/1986 (DataStream)
AUS 10Y	1987/9/18	XM1 Comdty	JPM Australia from 01/01/1986 (DataStream)
EURO 2Y	1997/3/7	DU1 Comdty	JPM Germany from 01/01/1986 (DataStream)
EURO 5Y	1991/10/4	OE1 Comdty	JPM Germany from 01/01/1986 (DataStream)
EURO 10Y	1990/11/23	RX1 Comdty	JPM Germany from 01/01/1986 (DataStream)
EURO 30Y	1998/10/2	UB1 Comdty	JPM Germany from 01/01/1986 (DataStream)
CA 10Y	1989/9/15	CN1 Comdty	JPM Canada from 01/01/1986 (DataStream)
JP 10Y	1985/10/21	JB1 Comdty	
UK 10Y	1982/11/18	G 1 Comdty	
US 2Y	1990/6/25	TU1 Comdty	JPM USA from 01/01/1986 (DataStream)
US 5Y	1988/5/20	FV1 Comdty	JPM USA from 01/01/1986 (DataStream)
US 10Y	1982/5/3	TY1 Comdty	
US 30Y	1977/8/22	US1 Comdty	

Reported is the detailed data sources used in this paper. The date of the earliest availability on Bloomberg/DataStream and the corresponding tickers are listed for each future contracts. For those futures who has more than one data source, we provide the splicing information prior to the availability of their latest data sources.

Table B.1: Post SMA, TSM and RSM holding period performance (12, 1).

	SMA				TSM				RSM			
	Realised Winner	Realised Loser	Contrarian Winner	Contrarian Loser	Realised Winner	Realised Loser	Contrarian Winner	Contrarian Loser	Realised Winner	Realised Loser	Contrarian Winner	Contrarian Loser
Panel A: 13-24 months												
Annulaised Mean	0.015	0.063	0.002	0.129	0.044	0.050	0.026	0.101	0.044	0.054	0.023	0.092
Newey-West t-statistics	0.587	2.260**	0.099	3.355***	1.366	2.496**	0.484	4.926***	1.780*	2.177**	0.607	3.109***
Annulaised Volatility	0.030	0.037	0.035	0.035	0.031	0.029	0.040	0.029	0.029	0.032	0.039	0.032
Sharpe Ratio	0.505	1.675	0.055	3.716	1.414	1.705	0.639	3.451	1.517	1.717	0.597	2.836
Maximum Drawdown	0.297	0.208	0.542	0.114	0.241	0.172	0.295	0.072	0.277	0.181	0.308	0.081
Panel B: 25-36 months												
Annulaised Mean	0.020	0.067	0.009	0.080	0.037	0.059	0.030	0.056	0.047	0.064	0.019	0.030
Newey-West t-statistics	0.565	2.979***	0.425	1.708*	1.059	1.362	1.114	1.493	1.371	2.383**	0.424	0.654
Annulaised Volatility	0.029	0.029	0.033	0.035	0.030	0.035	0.032	0.035	0.031	0.035	0.039	0.036
Sharpe Ratio	0.680	2.329	0.288	2.273	1.255	1.688	0.924	1.584	1.532	1.833	0.476	0.833
Maximum Drawdown	0.238	0.079	0.293	0.139	0.257	0.186	0.240	0.192	0.284	0.148	0.300	0.325
Panel C: 37-48 months												
Annulaised Mean	0.038	0.046	0.016	0.088	0.057	0.028	0.010	0.054	0.052	0.019	0.006	0.046
Newey-West t-statistics	0.588	0.983	0.492	2.122**	0.992	0.568	0.382	1.377	0.895	0.528	0.184	1.423
Annulaised Volatility	0.042	0.038	0.036	0.037	0.038	0.038	0.031	0.037	0.040	0.032	0.033	0.035
Sharpe Ratio	0.902	1.214	0.455	2.385	1.509	0.730	0.338	1.446	1.305	0.602	0.168	1.312
Maximum Drawdown	0.343	0.191	0.255	0.197	0.247	0.188	0.205	0.255	0.272	0.214	0.303	0.176
Panel D: 49-60 months												
Annulaised Mean	0.055	0.051	0.014	0.080	0.054	0.041	0.021	0.066	0.065	0.058	0.004	0.047
Newey-West t-statistics	1.183	1.613	0.264	1.259	1.156	1.389	0.440	1.696*	1.477	2.305**	0.203	1.212
Annulaised Volatility	0.033	0.035	0.035	0.041	0.034	0.032	0.035	0.037	0.034	0.035	0.037	0.037
Sharpe Ratio	1.704	1.478	0.390	1.974	1.558	1.290	0.611	1.758	1.926	1.681	0.107	1.268
Maximum Drawdown	0.143	0.255	0.311	0.112	0.160	0.273	0.315	0.182	0.130	0.226	0.314	0.171

Reported is the performance of 12 months holding period post trend following strategies for the 4 sub-portfolios during 13-60 months after the formation of the signals. Each subgroup is constructed by evaluating whether the underlying trend following profit is realised or not under a (j, k) scheme, where $j = 12$, is the trend following look-back period and $k = 1$ is the trend following holding period. The post trend following holding period is equally divided into 4 sub-periods which are shown in different panels. We compute the annualised mean, Newey-West t-statistics, annualised volatility/standard error, Sharpe Ratio and maximum drawdown for each strategy which are detailed in Appendix C. The performance is evaluated based on a dataset spanning from January, 1985 to March 2015.

Table B.2: Post SMA, TSM and RSM holding period performance (12, 3).

	SMA				TSM				RSM			
	Realised Winner	Realised Loser	Contrarian Winner	Contrarian Loser	Realised Winner	Realised Loser	Contrarian Winner	Contrarian Loser	Realised Winner	Realised Loser	Contrarian Winner	Contrarian Loser
Panel A: 13-24 months												
Annulaised Mean	0.051	0.053	-0.053	0.132	0.073	0.021	-0.021	0.121	0.065	0.024	-0.003	0.116
Newey-West t-statistics	2.466**	1.700*	-0.758	3.336***	3.196***	1.231	-0.226	5.080***	3.242***	1.106	0.036	2.662***
Annulaised Volatility	0.027	0.035	0.042	0.035	0.028	0.026	0.042	0.030	0.027	0.030	0.037	0.039
Sharpe Ratio	1.896	1.530	-1.286	3.740	2.639	0.818	-0.492	4.027	2.407	0.799	-0.069	2.965
Maximum Drawdown	0.122	0.217	0.816	0.155	0.127	0.171	0.557	0.093	0.156	0.185	0.628	0.076
Panel B: 25-36 months												
Annulaised Mean	0.013	0.069	0.017	0.092	0.034	0.049	0.026	0.076	0.047	0.055	0.008	0.052
Newey-West t-statistics	0.410	3.072***	0.477	1.936**	1.283	1.745*	0.608	2.035**	1.510	2.626***	0.117	1.772*
Annulaised Volatility	0.031	0.031	0.033	0.035	0.028	0.030	0.035	0.035	0.032	0.032	0.036	0.033
Sharpe Ratio	0.411	2.238	0.506	2.624	1.221	1.673	0.754	2.176	1.476	1.710	0.217	1.580
Maximum Drawdown	0.236	0.148	0.284	0.112	0.216	0.155	0.322	0.112	0.275	0.126	0.370	0.221
Panel C: 37-48 months												
Annulaised Mean	0.055	0.056	0.005	0.096	0.068	0.008	0.006	0.083	0.066	0.003	0.005	0.069
Newey-West t-statistics	0.886	0.787	0.204	2.110**	1.374	0.132	0.216	1.532	1.171	0.028	0.284	1.333
Annulaised Volatility	0.037	0.044	0.035	0.036	0.035	0.034	0.033	0.041	0.037	0.032	0.033	0.039
Sharpe Ratio	1.475	1.257	0.137	2.648	1.938	0.240	0.183	2.017	1.754	0.089	0.162	1.763
Maximum Drawdown	0.285	0.245	0.246	0.093	0.226	0.303	0.227	0.148	0.218	0.296	0.201	0.223
Panel D: 49-60 months												
Annulaised Mean	0.075	0.029	0.000	0.082	0.071	0.035	0.004	0.076	0.072	0.041	0.003	0.066
Newey-West t-statistics	1.606	0.749	0.005	1.322	1.532	1.820*	0.083	1.810*	1.610	1.881*	0.149	1.590
Annulaised Volatility	0.031	0.034	0.039	0.040	0.033	0.025	0.040	0.037	0.034	0.026	0.041	0.038
Sharpe Ratio	2.387	0.851	0.003	2.060	2.174	1.426	0.108	2.052	2.145	1.587	0.086	1.744
Maximum Drawdown	0.127	0.276	0.397	0.109	0.132	0.145	0.423	0.112	0.221	0.190	0.434	0.122

Reported is the performance of 12 months holding period post trend following strategies for the 4 sub-portfolios during 13-60 months after the formation of the signals. Each subgroup is constructed by evaluating whether the underlying trend following profit is realised or not under a (j, k) scheme, where $j = 12$, is the trend following look-back period and $k = 3$ is the trend following holding period. The post trend following holding period is equally divided into 4 sub-periods which are shown in different panels. We compute the annualised mean, Newey-West t-statistics, annualised volatility/standard error, Sharpe Ratio and maximum drawdown for each strategy which are detailed in Appendix C. The performance is evaluated based on a dataset spanning from January, 1985 to March 2015.

Table B.3: Post SMA, TSM and RSM holding period performance (12, 6).

	SMA				TSM				RSM			
	Realised Winner	Realised Loser	Contrarian Winner	Contrarian Loser	Realised Winner	Realised Loser	Contrarian Winner	Contrarian Loser	Realised Winner	Realised Loser	Contrarian Winner	Contrarian Loser
Panel A: 13-24 months												
Annulaised Mean	0.041	0.044	-0.040	0.114	0.057	0.016	-0.005	0.098	0.054	0.009	-0.015	0.094
Newey-West t-statistics	1.588	1.339	-0.635	2.364**	2.050**	0.914	-0.071	3.250***	1.942*	0.317	-0.266	3.294***
Annulaised Volatility	0.030	0.032	0.039	0.039	0.029	0.026	0.040	0.032	0.029	0.030	0.036	0.035
Sharpe Ratio	1.373	1.381	-1.013	2.914	1.962	0.632	-0.120	3.053	1.831	0.291	-0.412	2.730
Maximum Drawdown	0.258	0.236	0.784	0.158	0.233	0.132	0.509	0.122	0.240	0.192	0.546	0.111
Panel B: 25-36 months												
Annulaised Mean	0.022	0.063	0.020	0.074	0.048	0.050	0.026	0.074	0.053	0.050	0.018	0.073
Newey-West t-statistics	0.629	2.666***	0.975	0.909	1.191	2.471**	1.077	1.167	1.229	2.294**	0.507	1.468
Annulaised Volatility	0.031	0.028	0.027	0.044	0.032	0.027	0.029	0.042	0.036	0.030	0.031	0.037
Sharpe Ratio	0.704	2.259	0.728	1.677	1.513	1.871	0.882	1.747	1.485	1.684	0.576	1.959
Maximum Drawdown	0.246	0.120	0.226	0.219	0.272	0.188	0.204	0.229	0.322	0.232	0.268	0.168
Panel C: 37-48 months												
Annulaised Mean	0.037	0.047	0.024	0.086	0.049	0.030	0.027	0.070	0.050	0.022	0.031	0.061
Newey-West t-statistics	0.676	0.919	0.573	1.537	1.022	0.785	0.881	1.277	0.999	0.520	0.811	1.197
Annulaised Volatility	0.038	0.037	0.035	0.039	0.035	0.034	0.032	0.039	0.036	0.029	0.033	0.040
Sharpe Ratio	0.987	1.272	0.689	2.197	1.422	0.892	0.843	1.800	1.376	0.766	0.926	1.532
Maximum Drawdown	0.324	0.229	0.222	0.210	0.277	0.315	0.192	0.232	0.270	0.175	0.210	0.264
Panel D: 49-60 months												
Annulaised Mean	0.048	0.032	0.030	0.080	0.060	0.046	0.015	0.062	0.061	0.034	0.015	0.065
Newey-West t-statistics	0.911	1.555	0.658	1.356	1.402	2.324**	0.331	1.371	1.245	1.325	0.654	1.774*
Annulaised Volatility	0.033	0.025	0.036	0.038	0.032	0.023	0.038	0.035	0.034	0.026	0.034	0.035
Sharpe Ratio	1.477	1.271	0.825	2.117	1.853	1.991	0.398	1.785	1.794	1.336	0.434	1.850
Maximum Drawdown	0.166	0.225	0.233	0.151	0.168	0.083	0.322	0.156	0.156	0.143	0.257	0.155

Reported is the performance of 12 months holding period post trend following strategies for the 4 sub-portfolios during 13-60 months after the formation of the signals. Each subgroup is constructed by evaluating whether the underlying trend following profit is realised or not under a (j, k) scheme, where $j = 12$, is the trend following look-back period and $k = 6$ is the trend following holding period. The post trend following holding period is equally divided into 4 sub-periods which are shown in different panels. We compute the annualised mean, Newey-West t-statistics, annualised volatility/standard error, Sharpe Ratio and maximum drawdown for each strategy which are detailed in Appendix C. The performance is evaluated based on a dataset spanning from January, 1985 to March 2015.