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The Predictability and Profitability of Simple Moving Averages and Trading Range Breakout Rules in the Pakistan Stock Market

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This paper inspects whether variable- and fixed-length moving averages (VMA and FMA), and trading range breakout (TRB) rules have prognostic capability and can earn profits superior to buy-and-hold plan, when applied on KSE-100 index of Pakistan stock market during the full sample period January 1, 1997 to December 31, 2013. Full sample results provided empirical evidence for VMA rule that it has significant predictive power and is able to generate profits superior to simple buy-and-hold plan even after inclusion of transaction costs. The highest mean buy returns yielded by VMA, FMA and TRB rules are seen in noncrises periods. The overall implication of this study is that traders in the Pakistan stock market can utilize this information to obtain excess returns on a regular basis.

Keywords: Technical analysis; variable-length moving average; fixed length moving average; trading range breakout; financial crisis; Pakistan stock market.

JEL Classifications: G1, G110, G140

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1. Introduction

Fundamental and technical analyses are the two main methods that are usually employed by researchers to forecast stock price movements in various financial markets. Fundamental analysis generally refers to the methods that analyze listed company's specific industrial and macroeconomic informations, to select the most promising companies to invest in. Technical analysis as compared to the fundamental analysis is much more simpler as it forecasts future stock price movements by studying the historical data on past price movements (Ratner and Leal, 1999).

Technical analysis, inspite of being an advanced technique of stock analysis nowadays, has remained a long debated and controversial subject in the field of finance because of three reasons: First, it lacked financial theoretical background. Second, it contradicted with the efficient market hypothesis according to which it is impossible to outclass any stock market with any trading rule simply on the basis of information inherent in past prices. Third, in early days, technical trading rules employed failed to obtain profits superior than the simple buy-and-hold plan (Jensen and Benington, 1970). Due to these reasons, efficient market theory remained dominant in the academic world up to 1980s (Dimson and Mussavian, 1998). However, in 1992, Brock, Lakonishok and Lebaron (henceforth BLL) provided positive results for Dow Jones Industrial Average (DJIA) by applying variable-length moving average (VMA), fixed-length moving average (FMA) and trading range breakout (TRB) technical trading rules. Since then, technical analysis recouped the attention of academia and studies carried out on stock markets of both developed and developing countries provided pragmatic evidence regarding the predictability and profitability of technical trading rules (Allen and Karjalainen, 1999; Bessembinder and Chan, 1995; Gunasekarage and Power, 2001; Li and Wang, 2007; Ratner and Leal, 1999; Sullivan *et al.*, 1999). In all of these studies, it had been demonstrated that technical trading rules are able to detect buy and sell signals, or have predictive ability and profitability if market inefficiencies are present. This is true for most of the developing countries stock markets which are said to be inefficient in both individual stocks and stock market indicies (Risso, 2008), and for developed stock markets in crunch situation (Ahmed *et al.*, 2000; Bessembinder and Chan, 1995; Gunasekarage and Power, 2001; Mills, 1997; Pauwels *et al.*, 2011).

Technical analysis has now become a stand-alone method of stock analysis in both developed and developing countries (Fang, 2014). In developing countries such as Pakistan, India, Indonesia, etc., institutional investors

have major holdings in stock markets, while a tiny portion of investment comes from individual investors. These individual investors mostly lose their hard earned money owing to lack of knowledge and expertize needed to analyze the market before making any trading decision.

In this paper, VMA, FMA and TRB trading rules are applied on KSE-100 index of Pakistan stock market to find out the predictive ability and profitability of the best performing variants of these rules during both financial crises and noncrises periods. The KSE-100 index is comprised of 100 companies that have been included on the basis of their area representation and highest market capitalization.

The findings regarding the best performing variants of the applied technical trading rules and their behavior during financial crisis and noncrisis periods is expected to help the individual investors in Pakistan stock market to earn maximum revenues with minimum risk of losing their hard earned money. This information can also be profitably exploited by investors and market players on time.

The setting of the rest of this paper is as follows: Section 2 presents the review of literature pertinent to application of MA and TRB technical trading rules on Pakistan stock market. Section 3 defines the data and methodology. Section 4 outlines the empirical results of applied technical trading rules. Section 5 provides comparison of various strategies adopted for moving averages and TRB rules with the simple buy-and-hold strategy, and Sec. 6 gives conclusion.

2. Literature Review

Technical analysis is a procedure of studying charts of past price movements to forecast future share price movements and the financial trends of the market. Pring (2002), a well-known technical analyst, defines technical analysis as a procedural approach used for earlier detection of reversal of trend and cycle on that until it becomes certain that the trend has reversed. The three basic assumptions on which technical analysis is grounded are: (i) share prices move in pattern, (ii) patterns repeat themselves, and (iii) correct recognition of pattern earn profits.

2.1. *Technical trading systems*

Technical trading systems are a group of technical trading rules that correctly detect buy (sell) signals based on trends and patterns in past prices data. Technical trading rules usually involve one or two levels — the short-

term and the long-term, that detect the timing of buy (sell) signals. For instance, moving average (MA) is comprised of two levels — a short-term moving average (SMA) and a long-term moving average (LMA) of past prices.

In this paper, we reviewed only those research papers on Asian stock markets in which the authors have applied either MA or TRB or both trading rules to analyze the stock markets.

2.2. *Technical trading rules applied on Asian stock markets*

Bessembinder and Chan (1995) followed the methodology designed by BLL (1992) to examine Hong Kong, Japan, South Korea, Malaysia, Taiwan and Thailand stock price movements during the period 1975–1989. Based on the results obtained, they concluded that MA and TRB rules performed well in these markets, and were profitable in the absence of transaction costs. However, after inclusion of transaction costs, these rules remained profitable only for Malaysian, Taiwan and Thailand stock markets.

Coutts and Cheung (2000) inspected the performance of MA and TRB trading rules on Hong Kong stock market index over the period 1985–1997. The authors observed that these rules earned marginal profits in the absence of transaction costs, which became vanished for the MA rules on inclusion of transaction costs. Ahmed *et al.* (2000) also noticed predictability and profitability of VMA rules for Taiwan, Thailand, and the Philippines stock markets during the period 1994 to 1999.

Gunasekarage and Power (2001) applied VMA and FMA technical trading rules on index data of Karachi, Bombay, Colombo, and Dhaka stock exchanges for the period 1990 to 2000, to examine whether these rules have predictive capability in these South Asian markets. The authors observed that moving average rules do have prognostic capability in the investigated Asian markets and earned profits more than the buy-and-hold plan.

Lai *et al.* (2002) examined the prognostic capability of VMA, FMA and TRB trading rules on the daily returns of the Kuala Lumpur stock exchange composite index during the period 1977–1999. The authors found that both VMA and FMA rules were profitable even after the inclusion of transaction costs, but TRB rules could not outperform the simple buy-and-hold plan.

Tian *et al.* (2002) applied VMA, FMA and TRB trading rules on the Chinese stock market during the period 1992–2000. The authors provided empirical evidence for the profitability of VMA, FMA and TRB trading rules on the Chinese stock market.

Ming-Ming and Siok-Hwa (2006) investigated the profitability of VMA, FMA and TRB trading rules in nine Asian countries stock indices during the

period 1988–2003. Their results indicated that VMA rules specifically and FMA rules generally performed well in the stock markets of China, Thailand, Taiwan, Malaysia, Singapore, Hong Kong, Korea, and Indonesia.

Chang *et al.* (2006) observed that various strategies of VMA, FMA and TRB rules employed on Taiwan index from 1983 to 2002 exhibited marked prognostic power and yielded profits superior to simple buy-and-hold strategy in the presence of transaction costs.

Li and Wang (2007) inspected the performance of VMA, FMA and TRB trading rules in Chinese domestic A-share and foreign B-share markets during the period October 1992 to March 2003. After adjusting for non-synchronous trading and transaction costs they found predictability and profitability of these rules for B shares only.

Lento and Gradojevic (2007) applied MA, TRB, and filter trading rules on eight Asia-Pacific equity markets, namely Australia, India, Indonesia, Korea, Japan, Hong Kong, Singapore, and Taiwan, covering the period 1987–2005. These researchers concluded that superior earnings after accounting for transaction costs could be obtained on application of MA and TRB trading rules as against the simple buy-and-hold approach for Hong Kong, India, Indonesia, Korea, Taiwan, and Singapore equity markets only.

Lam *et al.* (2007) applied MA and TRB trading rules on data series of daily index returns in Hong Kong stock market index from 1972 to 2008. They found that MA and TRB trading rules after the inclusion of transaction costs generated profits that declined after 1986. Marshall *et al.* (2009) applied MA and TRB technical trading rules on daily index return for 23 established and 26 developing stock markets and observed that both MA and TRB technical trading rules performed better in developing than the established stock markets.

Chen *et al.* (2011) re-inspected the applicability and validity of technical analysis in the Taiwan stock market during the period January 1975 to December 2006, by applying the White Reality Check and the Hansen Superior Productive Ability tests to nullify the data snooping bias. The authors concluded that reasonable returns cannot be obtained from technical analysis in this market.

Mitra (2011) evaluated the profitability of MA-based trading rules on the four index series of Indian stock market for the period January 1998 to March 2008. The author found that these rules were profitable only when transaction cost was either omitted or was at a decreased level. Yu *et al.* (2013) in their study, inspected whether MA and TRB trading rules can outperform the simple buy-and-hold plan in Southeast Asian stock markets

during the period 1991–2008. These investigators observed profitability of MA and TRB trading rules in the stock markets of Malaysia, Thailand, Indonesia, and the Philippines, but not in Singapore. However, after the inclusion of transaction costs, these rules with exception to Thailand stock market, failed to outclass a simple buy-and-hold plan. Zhu *et al.* (2015) investigated the profitability of MA and TRB trading rules in Shanghai and Shenzhen stock exchange composite Indexes for the period 1992–2013 and 1991–2013, respectively. The authors concluded that after the inclusion of transaction costs the profitability of these rules was not significantly higher than the simple buy-and-hold strategy.

Sohail (2015) evaluated simple moving averages (SMA) trading rules on indices of 30 companies listed in KSE-100 index for the period 2006–2014. They found that SMA rules failed to beat the simple buy-and-hold strategy owing to the involvement of high transaction costs.

Khan *et al.* (2017) tested SMA, exponential moving average (EMA), with generalized regression neural network (GRNN) on KSE-100 index data for the period 1997–2014. They examined the forecasting ability of these trading rules individually as well as in combination. The authors concluded that these rules do have predictive power and could outperform the simple buy-and-hold strategy even after adjusting for transaction costs.

In conclusion, majority of the cited studies indicate that the three trading rules tested in emerging Asian stock markets do have predictive capability and can earn significant positive returns even after the inclusion of transaction costs. However, after measurements of risk adjusted returns, the performance of these rules can be correctly assessed (Toríbio *et al.*, 2017).

The difference between the present study and the other studies reported for KSE-100 index is two fold. First, this study offers a more comprehensive inspection of technical trading rules in this market as we have examined more variants of VMA, FMA and TRB trading rules. Second, this is the first study in which the same variants of VMA, FMA and TRB trading rules have been applied on each of the five sub-samples of the data, in order to see the impact of these rules during East Asian countries currency crisis in 1997, and global financial crisis in 2007 and 2008.

3. Data and Methodology

3.1. *Data*

Daily closing prices of the KSE-100 index covering the period 1st January 1997 to 31st December 2013 is obtained from Bloomberg Data-Stream.

The whole sample period is divided into five nonoverlapping sub-sample periods (I to V) on the basis of Asian currency crisis and global financial crisis. The sub-sample periods I and II are of four years duration each and III to V are of three years duration each. The purpose of this division is to find out the behavior of applied trading rules in Pakistan stock market, both during and after financial crises periods, since it is presumed that the performance of these rules will be different in different market situations.

The five sub-sample periods are as follows:

Sub-sample I: 1st January 1997 to 31st December 2000, During Asian currency crisis
Sub-sample II: 1st January 2001 to 31st December 2004, Post Asian currency crisis
Sub-sample III: 1st January 2005 to 31st December 2007, Pre global financial crisis
Sub-sample IV: 1st January 2008 to 31st December 2010, During global financial crisis
Sub-sample V: 1st January 2011 to 31st December 2013, Post global financial crisis

3.2. *Methodology*

Technical trading rules we examined in this study include moving averages (VMA and FMA) and trading range breakout (TRB). Moving averages are the most commonly applied technical trading rules that provide the average value of a security's price over a period of time. According to this rule, buy (sell) signals are produced when the short-term moving average surpasses (is less than) the long-term moving average by a pre-specified zero percent and one percent bands. In case, when the short-term moving average is within the band, no signal is created. The reason of applying one percent band around moving average is to decrease the number of buy (sell) signals by rejecting "whiplash" signals. In this study, we followed BLL (1992), and used long moving average of 50, 100, 150 and 200 days, and short of 1, 2 and 5 days. In this study, VMA trading rule is tested with band of zero percent and one per cent respectively. One percent band is positioned overhead and beneath the long period moving average. A buy signal is produced when short moving average cuts the long moving average from beneath, and sell signal when it cuts the long moving average from above. After the crossover, all the days are classified as either buys or sells till another crossover follows. In all, 12 variants of VMA rules (1,50,0), (1,100,0), (1,150,0), (5,150,0),

(1,200,0), (2,200,0), (1,50,1), (1,100,1), (1,150,1), (5,150,1), (1,200,1) and (2,200,1) are examined in this study.

In FMA trading rule, after crossover, we computed buy (sell) returns for the following 10 days ignoring all the signals created within this 10-day holding period. After the passage of the holding period, returns are again calculated when a new buy (sell) signal is produced. This trading rule is tested with a band of zero percent and one percent, respectively. In all, 12 variants of FMA rules (1,50,0), (1,100,0), (1,150,0), (5,150,0), (1,200,0), (2, 200, 0), (1,50,1), (1,100,1), (1,150,1), (5,150,1), (1,200,1), (2,200,1) are examined in this study.

For TRB trading rule, a buy signal is observed when the stock price surpasses the native highest price and sell signal when the stock price enters the native minimum price. Both minimum and maximum prices are computed on the past 50, 100, 150 and 200 days data. A band of zero percent and one percent, respectively, is applied to test the profitability of TRB rules. In this way, 8 variants of TRB rules (four without band and four with band), using fixed holding period of 10 days, is examined in this study.

3.3. *Buy-and-hold strategy*

In the buy-and-hold strategy, investors buy stocks in the beginning of test period and sell them in the end of the period. We followed Fernando (2014) for the calculation of daily and 10 day nonoverlapping returns. The unconditional buy-and-hold returns of each index for whole sample period are calculated using the following formula:

$$R_t = \log(p_t) - \log(p_{t-1}), \tag{1}$$

where

R_t is the Unconditional mean return at day t;

p_t is the day t closing price;

p_{t-1} is the day $t-1$ closing price.

Unconditional 10- day returns are calculated by using the following formula:

$$R_{t10} = \log(p_{t+10}) - \log(p_t). \tag{2}$$

The conditional mean buy and mean sell returns are computed as follows:

$$\mu_{(b)} = \frac{1}{N(b)} \sum R_b, \tag{3}$$

$$\mu_{(s)} = \frac{1}{N(s)} \sum R_s, \tag{4}$$

where

$\mu_{(b)}$ is the mean buy days returns
$\mu_{(s)}$ is the mean sell days returns
$N(b)$ is the total number of buy days
(s) is the total number of sell days
R_b is the daily returns of buy days
Rs is the daily returns of sell days

The conditional annual return for Pakistan stock market is computed with a fixed trading period of 240 days per year as following:

$$\text{Annual Return} = \text{Exp}(N * R) - 1, \tag{5}$$

where

N is the number of days the investment is kept in (240 days per year)
R is the daily average return.

In our study, we adopted the null and alternative hypotheses developed by Metghalchi *et al.* (2008), for finding out whether VMA, FMA and TRB trading rules generate profits superior to simple buy-and-hold plan as follows:

$$\text{H0}: X(b) - X(h) = 0, X(s) - X(h) = 0, X(b) - X(s) = 0 \tag{6}$$

$$\text{HA}: X(b) - X(h) \neq 0, X(s) - X(h) \neq 0, X(b) - X(s) \neq 0 \tag{7}$$

3.4. *Testing predictability of technical trading rules*

The predictability of technical trading rules applied in this study is assessed by using the simple t-test as proposed by Brock *et al.* (1992). According to Brock *et al.* technical trading rules are considered to have prognostic capability when buy signals generate positive returns and sell signals generate negative returns which on average, are significantly different from the returns earned by a simple buy-and-hold plan. Reverse is true when the applied technical trading rule provides negative excess return in buy days and positive excess return in sell days.

The formula used to calculate the mean buy (sell) returns is given as follows:

$$\frac{\mu_r - \mu}{\sqrt{\frac{\sigma^2}{N} + \frac{\sigma^2}{N_r}}}, \tag{8}$$

where

μ_r is the mean return (buy or sell)
N_r is the number of signals (buy or sell)

μ is the the unconditional mean return
N is the the number of observations
σ^2 is the estimated variance of the entire sample.

The t-statistic for the buy-sell difference is calculated by using the following formula:

$$\frac{\mu_b - \mu_s}{\sqrt{\frac{\sigma^2}{N_b} + \frac{\sigma^2}{N_s}}}, \tag{9}$$

where

μ_b is the mean buy returns
μ_s is the mean sell returns
Ns is the number of sell signals
Nb is the number of buy signals
σ^2 is the estimated variance of the entire sample.

3.5. *Testing profitability of technical trading rules*

The profitability of technical trading rules is examined by comparing the conditional annual returns with relevant simple buy-and-hold returns. For determining the profitability of technical trading rules applied in this study, a "double or out" strategy used by Brock *et al.* (1992) and Bessembinder and Chan (1995, 1998) is adapted. Under this strategy, a trader reacts to the buy signals by borrowing money at a risk-free rate to double his/her investments and to the sell signals by liquidating any equity holdings and investing in risk-free assets. The investor is assumed to take long position when neither buy nor sell signal is generated. The idea underlying this method is that with buy signal, investors make profits by doubling their investment and continuing in the upward trending market, while with sell signal investors earn profits in the form of cost savings by selling out their investments and leaving the downward trending market.

In this study, two assumptions are made regarding determining the profitability of technical trading rules by a "double or out" strategy. First, it is assumed that borrowing and lending rates in the market are same. Second, the risk in buying or selling the assets during buys and sell periods are same.

The excess return (π) produced by technical trading rules, without considering the transaction costs, are computed by using the following formula:

$$\pi = \sum_{b=1}^{N_b} R_b - \sum_{s=1}^{N_s} R_s. \tag{10}$$

As transaction costs incurred under technical trading rules are inevitable, hence, to find out if technical trading rules after inclusion of transaction costs are profitable, the method proposed by Bessembinder and Chan (1995) is followed. Accordingly, the breakeven costs (that are the percentage costs needed to offset the additional returns generated by the technical trading rules compared to the simple buy-and-hold strategy) are determined. The breakeven round-trip cost (C) is calculated by employing the following formula:

$$C = \frac{\pi}{n_b + n_s}. \tag{11}$$

To examine the profitability of technical trading rules, the estimated breakeven costs are then compared with the estimated actual transaction costs. Now, if the breakeven costs are greater than the estimated actual transaction costs, then that technical trading rule is considered to have profitability. But, if the breakeven costs are less than the estimated actual transaction costs, then that technical trading rule is assumed as having no profitability.

4. Results

The descriptive statistics for daily and nonoverlapping 10-day returns for the full sample and five sub-sample periods of KSE-100 index are shown in Table 1. The highest daily and nonoverlapping 10-day mean returns are

Table 1. Descriptive statistics for daily and nonoverlapping 10-day returns.

Pakistan Stock Market	Full Sample Period 1997–2013	Sub-Sample Period I 1997–2000	Sub-Sample Period II 2001–2004	Sub-Sample Period III 2005–2007	Sub-Sample Period IV 2008–2010	Sub-Sample Period V 2011–2013
Section 1: Daily returns						
N	4115	937	940	686	661	695
Mean	0.00067	−0.00005	0.00159	0.00050	−0.00033	0.00107
S.D	0.01613	0.02158	0.01425	0.01622	0.01606	0.00893
Skewness	−0.34731	−0.30399	−0.13625	−0.59252	−0.10412	−0.33138
Kurtosis	5.67933	5.13503	4.28912	1.34737	2.10465	1.88839
Section 2: Nonoverlapping 10-day returns						
N	411	93	93	68	67	69
Mean	0.00730	0.00275	0.01224	0.00232	−0.00568	0.00998
S.D	0.05398	0.06661	0.04600	0.05254	0.07344	0.02643
Skewness	−1.15148	−0.37840	0.11197	−1.37544	−1.79287	−0.39442
Kurtosis	4.53808	0.20210	0.46642	3.92518	5.45859	1.11937

Note: N = Return observations in the sample.

noted in sub-sample period II (post-Asian currency crisis) followed by in sub-sample period V (post-global financial crisis). Similarly, the lowest daily and nonoverlapping 10-day mean returns are observed in sub-sample period IV (during global financial crisis), followed by in sub-sample period I (during Asian currency crisis).

The highest and the lowest standard deviations (volatilities) for daily returns are noticed in sub-sample periods I and V, respectively, while for 10-day returns in sub-sample periods IV and V, respectively. This suggests that KSE-100 index was most volatile during Asian currency crisis and global financial crisis periods, while least volatile after global financial crisis.

Skewness and kurtosis index is used to see the normality of the returns data. The daily and 10-day returns of the data suggest symmetric distribution, since the values of skewness are between -2 to $+2$ and of kurtosis between -7 to $+7$ (Byrne, 2010; Hair *et al.*, 2010). This implies that t-test is appropriate to apply on KSE-100 index data. The negative values of skewness obtained in full as well as five sub-sample periods of both daily and 10-day returns indicate that the returns are negatively leptokurtic.

Our descriptive statistics results for daily returns are in line with the reports of Choe *et al.* (2011) and Khan *et al.* (2017).

The statistical results for 12 VMA trading variants (six each with zero percent and one percent bands, respectively) are summarized in Table 2. It can be seen in column1 of the table that each variant is represented as (short, long), where short and long denote the short and the long moving averages, respectively. Columns 2 and 3 of this table, respectively, show the number of buy and the number of sell signals produced. For every trading variant, daily mean returns obtained during buy and sell days along with standard deviations of returns for buy and sell days are shown in Columns 4, 5 and 7, 8, respectively. In Column 6, the differences between mean buy and mean sell periods returns are presented. The numbers in the parentheses represent t-statistics for a two-tailed test. T-statistics values greater than 2.576, 1.96 and 1.645 represent 1%, 5% and 10% significance levels, respectively.

The number of buy signals produced by each variant of VMA is significantly larger than the number of sell signals, indicating an up trending of the KSE-100 index. Buy signals for all variants of VMA yielded positive returns, while sell signals for all variants of VMA produced negative returns. The mean buy returns for 10 of the 12 VMA variants are statistically significantly higher than the daily mean returns earned through simple buy-and-hold plan. Similarly, the mean sell returns for all VMA variants are statistically significantly different from the mean returns earned through simple

Table 2. Summarized results for variable length moving average variants.

Variant	*Nb*	*Ns*	Buy	Sell	Buy–Sell	SDb	SDs
(a) with zero percent band							
(1,50)	2596	1519	0.0028	−0.0030	0.0058	0.0131	0.0198
			(5.2947)***	(−7.5544)***	(11.1290)***		
(1,100)	2687	1378	0.0022	−0.0023	0.0046	0.0138	0.0197
			(3.9271)***	(−5.9903)***	(8.5666)***		
(1,150)	2824	1191	0.0018	−0.0021	0.0039	0.0139	0.0203
			(2.8505)***	(−5.2339)***	(7.0004)***		
(1,200)	2860	1105	0.0016	−0.0018	0.0034	0.0140	0.0205
			(2.3146)**	(−4.5160)***	(5.9107)***		
(2,200)	2852	1113	0.0013	−0.0011	0.0024	0.0140	0.0206
			(1.6540)*	(−3.2671)***	(4.2634)***		
(5,150)	2822	1193	0.0012	−0.0006	0.0018	0.0141	0.0202
			(1.2928)	(−2.4871)**	(3.2832)***		
Average	2774	1250	0.0018	−0.0018	0.0037	0.0138	0.0202
Annual			54.9494	−35.4992			
(b) with one percent band							
(1,50)	2364	1310	0.0031	−0.0036	0.0067	0.0131	0.0205
			(5.7820)***	(−8.4133)***	(12.0810)***		
(1,100)	2513	1215	0.0023	−0.0026	0.0050	0.0137	0.0204
			(4.0147)***	(−6.3065)***	(8.8016)***		
(1,150)	2732	1104	0.0018	−0.0023	0.0041	0.0140	0.0207
			(2.8073)***	(−5.4113)***	(7.0857)***		
(1,200)	2768	1042	0.0016	−0.0021	0.0037	0.0140	0.0208
			(2.3616)**	(−4.9061)***	(6.2786)***		
(2,200)	2776	1045	0.0014	−0.0012	0.0026	0.0141	0.0210
			(1.7570)*	(−3.4242)***	(4.4574)***		
(5,150)	2722	1098	0.0012	−0.0008	0.0020	0.0141	0.0207
			(1.3845)	(−2.6073)***	(3.4340)***		
Average	2646	1136	0.0019	−0.0021	0.0040	0.0138	0.0207
Annual			57.7269	−39.6421			

Notes: *Nb* represent number of buy signals, *Ns* is number of sell signals and Buy–sell are difference between the mean buy period returns and the mean sell period returns. The numbers in parenthesis represent t values, which test the difference of the mean conditional returns from mean unconditional returns, * represent significance at 10 %, ** at 5% and *** at 1% levels of the t test respectively.

buy-and-hold plan. The buy–sell differences in returns for all variants of VMA are positive and statistically significant at the 0.01 level. This implies that our null hypothesis of equality with zero, i.e., the mean daily buy earnings and the mean daily sell earnings generated through variable length moving average are equal to the mean earnings obtained through simple buy and hold strategy or the equality of mean buy returns with mean sell returns is rejected. These results, therefore, suggest that 10 of the 12 VMA variants

tested in this study do have superior predictive capability to detect future changes in share price movements in Pakistan stock market. VMA variants (1, 50, 1) and (1, 50, 0) performed better than the remaining variants of VMA, which suggests first that the recent past prices as compared to old ones are important for correct prediction of the future movement of stock prices by VMA, and second that VMA variants (1, 50, 1) and (1, 50, 0) can generate higher returns than that of the other VMA variants in the Pakistan stock market.

The average daily buy returns with zero and one percent bands are approximately 0.18% and 0.19%, respectively, that is equivalent to 54.95% and 57.73% annually. Similarly, the average daily sell returns are approximately −0.18% and −0.21%, respectively that is equivalent to −35.50% and −39.64% annually. These returns when compared with buy-and-hold one day mean returns of approximately 0.067% (17.57% annually) show that the annualized returns earned through VMA rule is significantly higher than the annualized returns obtained by simple buy-and-hold plan. The introduction of 1 percent band had although reduced the number of both buy and sell signals, it had increased the profitability in every corresponding variant. Our result is in agreement with the reports of Fernandez *et al.* (1999).

In all VMA variants, it can be observed that the standard deviations (volatilities) for sell days are higher than that of the buy days, indicating that KSE-100 index was riskier during sell than the buy periods.

In Table 3, statistical results for 12 FMA trading variants (6 with zero percent and 6 with one percent bands, respectively) with fixed holding period of ten days are reported in the same setup as in Table 2. It is noticed that the numbers of both buy and sell signals produced by each variant of FMA rule are remarkably less than the corresponding variant of VMA rule. This is understandable, since FMA rule following holding period of 10 days generate new buy or sell signals only when there starts either upward or downward trend in stock prices.

It can be seen that the introduction of one percent band in FMA rule has significantly reduced the number of both buy and sell signals concomitant to reduction in profitability in every analogous variant. However, each variant of FMA compared to corresponding VMA variant had generated higher profits. Our result are in agreement with BLL (1992), (Gunasekarage and Power, 2001; Fernando, 2014).

The average 10-day buy returns with zero percent and one percent bands are approximately 1.02% and 0.01%, respectively that is equivalent to

Table 3. Summarized results for fixed length moving average variants.

Variant	*Nb*	*Ns*	Buy	Sell	Buy–Sell	SDb	SDs
(a) with zero percent band							
(1,50)	43	55	0.0293	−0.0094	0.0387	0.0426	0.0546
			(2.3794)**	(−1.9066)*	(3.2182)***		
(1,100)	33	41	0.0197	0.0059	0.0138	0.0458	0.0492
			(1.2097)	(−0.0918)	(1.0002)		
(1,150)	22	20	−0.0018	0.0039	−0.0058	0.0455	0.0602
			(−0.6657)	(−0.2094)	(−0.3164)		
(1,200)	13	18	0.0133	0.0111	0.0022	0.0392	0.0559
			(0.3926)	(0.3059)	(0.1015)		
(2,200)	12	17	0.0077	0.0092	−0.0014	0.0417	0.0551
			(0.0545)	(0.1635)	(−0.0650)		
(5,150)	20	16	−0.0073	0.0010	−0.0083	0.0511	0.0708
			(−1.0405)	(−0.3847)	(−0.4181)		
Average	24	28	0.0102	0.0036	0.0065	0.0443	0.0576
Annual			1042.9119	137.9649			
(b) with one percent band							
(1,50)	28	27	0.0203	−0.0059	0.0262	0.0486	0.0612
			(1.1688)	(−1.0801)	(1.6420)		
(1,100)	12	24	0.0069	−0.0059	0.0128	0.0330	0.0587
			(0.0084)	(−1.0166)	(0.6108)		
(1,150)	11	13	0.0046	−0.0142	0.0188	0.0388	0.0769
			(−0.1205)	(−1.2605)	(0.7769)		
(1,200)	3	13	0.0226	−0.0041	0.0268	0.0442	0.0557
			(0.4625)	(−0.6556)	(0.7068)		
(2,200)	5	7	0.0103	0.0039	0.0064	0.0228	0.0416
			(0.1308)	(−0.1289)	(0.1844)		
(5,150)	2	3	−0.0638	−0.0084	−0.0555	0.0809	0.1059
			(−1.6848)	(−0.4423)	(−1.0275)		
Average	10	15	0.0001	−0.0058	0.0059	0.0481	0.0666
Annual			3.3041	−74.9968			

Notes: *Nb* represent number of buy signals, *Ns* is number of sell signals and Buy–sell are difference between the mean buy period returns and the mean sell period returns. The numbers in parenthesis represent t values, which test the difference of the mean conditional returns from mean unconditional returns, * represent significance at 10 %, ** at 5% and *** at 1% levels of the t test respectively.

1042.91% and 3.30% annually. Similarly, the average daily sell returns are approximately 0.36% and −0.58%, respectively, that is equivalent to 137.96% and −75.00% annually. In comparison to this the annual 10-day mean unconditional returns are 477.21%.

FMA results indicate that with exception to variant (1, 50, 0), the buy or sell days returns generated by all other FMA variants are not statistically significantly different from the mean buy-and-hold returns. This means our

Table 4. Summarized results for trading range breakout variants.

Variant	*Nb*	*Ns*	Buy	Sell	Buy–Sell	SDb	SDs
(a) with zero percent band							
(1,50)	60	34	0.0143	−0.0137	0.0279	0.0368	0.0906
			(0.9177)	(−1.9373)*	(2.2013)**		
(1,100)	37	9	0.0219	−0.0600	0.0819	0.0399	0.1278
			(1.4900)	(−3.3493)***	(3.7247)***		
(1,150)	31	9	0.0121	−0.0427	0.0548	0.0382	0.0860
			(0.4820)	(−2.4851)**	(2.4486)**		
(1,200)	30	5	0.0194	−0.0579	0.0773	0.0443	0.0849
			(1.1249)	(−2.4325)**	(2.7061)***		
Average	40	14	0.0169	−0.0436	0.0605	0.0398	0.0973
Annual			5672.7467	−99.9971			
(b) with one percent band							
(1,50)	19	20	0.0058	−0.0204	0.0263	0.0456	0.1035
			(−0.0688)	(−2.0098)**	(1.3861)		
(1,100)	10	5	0.0249	−0.0560	0.0809	0.0360	0.1597
			(0.9561)	(−2.3600)**	(2.4973)**		
(1,150)	13	2	0.0024	−0.0283	0.0308	0.0430	0.0296
			(−0.2599)	(−0.8376)	(0.6852)		
(1,200)	7	2	0.0286	−0.0863	0.1149	0.0335	0.1115
			(0.9675)	(−2.2203)**	(2.4228)**		
Average	12	7	0.0154	−0.0478	0.0632	0.0395	0.1011
Annual			3953.1205	−99.9989			

Notes: *Nb* represent number of buy signals, *Ns* is number of sell signals and Buy–sell are difference between the mean buy period returns and the mean sell period returns. The numbers in parenthesis represent t values, which test the difference of the mean conditional returns from mean unconditional returns, * represent significance at 10%, ** at 5% and *** at 1% levels of the t test respectively.

null hypothesis of equality with zero or the equality of mean buy returns with mean sell returns is accepted.

Similar to VMA, almost all the FMA variants also showed higher standard deviations for sell days as against the buy days, confirming that KSE-100 index was more volatile during the sell days than the buy periods.

In Table 4, results for eight variants of TRB (four each with zero percent and one percent bands, respectively) with fixed holding period of 10 days are shown. The number of buy and sell signals produced by each variant of TRB are markedly less than that of the VMA variants, but are considerably more than that of the FMA variants. This is because TRB generate trading signals only when current stock prices surpass either maximum or minimum level of pre-specified number of previous trading days. A buying signal is observed when the stock price surpasses the local maximum price and sell signal when it enters the local minimum price.

The number of buy signals produced by each variant of TRB is significantly greater than the number of sell signals, indicating an upward movement of Pakistan stock market. Similar to VMA variants, buy signals for all variants of TRB yielded positive returns, but none of these generated mean returns significantly higher than the mean 10-day buy-and-hold returns. Likewise, sell signals for all variants of TRB generated negative returns, and seven of these generated mean returns significantly different from the mean 10-day buy-and-hold returns. The buy–sell differences in returns for all variants of TRB are positive and 75% of these are statistically significant at the 0.01 level. Accordingly, our null hypothesis of equality with zero or the equality of mean buy returns with mean sell returns is rejected.

The average 10-day withholding period buy returns with both zero percent and one percent bands are approximately 1.69% and 1.54%, respectively that is equivalent to 5672.75% and 3953.12% annually. Similarly, the average 10-day withholding period sell returns are approximately −4.36% and −4.78%, respectively that is equivalent to −99.99% and 100.00% annually. In comparison to this, the annual 10-day mean unconditional returns are 477.21%. Our result fully supports the reports of BLL (1992) and Hudson *et al.* (1996), who also found TRB rules to be more profitable than both FMA and VMA rules.

TRB variants (1, 200, 1), (1, 100, 1) and (1, 100, 0), respectively yielded the highest mean buy (sell) returns as compared to the remaining variants of TRB. This indicates that these three TRB variants have the capability to generate profits superior to other TRB variants in the KSE-100 index.

In line with BLL (1992), we also observed that introduction of one percent band in VMA, FMA and TRB trading rules appreciably reduced the number of both buy and sell signals. However, unlike VMA but similar to FMA rule, introduction of one percent band in TRB rule had considerably decreased the annual returns.

From Table 4, it can also be noted that seven of the eight variants of TRB have higher standard deviations for sell days as against the buy days, indicating that KSE-100 index was more volatile during sell days than buy periods.

Interestingly, in all variants of VMA, FMA and TRB rules, the standard deviations (volatilities) for sell days are higher than that of the buy days in Pakistan stock market. The highest volatilities for buy days and the highest mean returns for buy days are commonly detected during Asian currency crisis. This result supports the observation of Fuertes, Kalotychou and Todorovic (2015) that buying the stock when the assessed volatility is

extremely high seems to be profitable, suggesting a strong return-risk association in troubled conditions.

Results generated by all variants of VMA, FMA and TRB trading rules applied on five nonoverlapping sub-sample periods (shown in Appendix A) are consistent with their respective full sample period results, hence only important findings of sub-sample period results are described here.

It is noticed that VMA rule with the exception to sub-sample period I (in which VMA produced more sell signals than the buy) has generated considerably more buy than the sell signals. In sub-sample period IV, highest number of VMA variants provides statistically significantly more mean buy returns than the mean returns obtained by simple buy-and-hold plan. The highest and the lowest average buy signals are recorded in sub-sample periods II and IV, respectively. Similarly, the highest and the lowest average sell signals are noticed in sub-sample periods I and V, respectively. The highest and the lowest average daily buy returns generated by VMA are noted in sub-sample periods II (after Asian currency crisis) and III (during post-global financial crisis), respectively. The highest and the lowest buy and sell volatilities are observed in sub-sample periods I (during Asian currency crisis; period of financial instability) and V (after global financial crisis; period of economic and financial stability) respectively. In all sub-sample periods, VMA variants (1, 50, 0) and (1, 50, 1) performed best and provided excess returns than the remaining VMA variants.

Results for FMA rule show that the highest and the lowest average buy returns generated by FMA variants with no band occurred in sub-sample period III (pre-global financial crisis), and V (post-global financial crisis), respectively. The highest and the lowest buy (sell) volatilities are recorded in sub-sample periods I and V, respectively.

Similarly, results for TRB rule demonstrate that the highest and the lowest average buy returns generated by TRB variants without any band occurred in sub-sample periods V and IV, respectively. The highest and the lowest buy volatilities are observed in sub-sample periods I and V, respectively.

Table 5 displays breakeven transaction and estimated actual costs for each variant of VMA, FMA and TRB rules. The estimated actual transaction costs for these rules are reported in the bottom row of the table. We compared the computed round-trip breakeven costs for each variant of VMA, FMA and TRB with their respective estimated actual transaction costs for KSE 100 index. It is observed that 2 of the 12 VMA variants, 6 of the 12 FMA variants, and all of the 8 TRB variants are profitable as their

Table 5. Breakeven transaction and estimated actual costs for VMA, FMA and TRB trading rules.

Rule	VMA (%)	FMA (%)	TRB (%)
(1,50,0)	0.29	1.81	1.41
(1,100,0)	0.23	0.55	2.93
(1,150,0)	0.19	−0.28	1.90
(1,200,0)	0.16	−0.09	2.49
(2,200,0)	0.13	−0.22	
(5,150,0)	0.10	−0.45	
(1,50,1)	0.33	1.32	1.33
(1,100,1)	0.24	0.62	3.52
(1,150,1)	0.19	0.98	0.59
(1,200,1)	0.17	0.76	4.14
(2,200,1)	0.13	0.20	
(5,150,1)	0.11	−2.05	
Average	0.19	0.26	2.29
Estimated Actual Cost	0.25	0.25	0.25

Source: Fatima Farooq (2017).

breakeven costs are greater than the estimated actual transaction costs in Pakistan stock market.

It is worth mentioning that after the inclusion of transaction cost (1, 50, 1) and (1, 50, 0), variants of VMA, FMA and TRB rules are commonly found to be profitable in Pakistan stock market. Our result is in agreement with Lubnau and Todorova (2014) who also found that these variants of MA rules after transaction costs yielded excess returns in most of the Asian countries stock markets.

5. Conclusion

Full sample results obtained by the application of VMA, FMA and TRB trading rules on KSE-100 index provided empirical evidence especially for VMA rule that this has significant predictive power and is able to generate profits superior to simple buy-and-hold plan. However, after the inclusion of transaction costs, only (1, 50, 1) and (1, 50, 0) variants of VMA, FMA and TRB trading rules are commonly found to be profitable in Pakistan Stock market.

Both VMA and TRB trading rules generated significantly more buy than the sell signals indicating an up trending of the KSE-100 index. Buy days returns and buy–sell differences in returns for all variants of VMA and TRB are positive, while sell days returns for all variants of VMA and TRB are negative.

The highest mean buy returns yielded by VMA, FMA and TRB rules are observed in sub-sample period II, III and V, respectively, i.e., periods of economic and financial stabilities.

In all VMA, FMA and TRB variants, volatilities for sell days are higher than that of the buy days, indicating that KSE-100 index was more volatile during sell days than the buy periods. The highest and the lowest volatilities for buy days in KSE-100 index are commonly observed in sub-sample periods I (during Asian currency crisis; period of financial instability) and V (after global financial crisis; period of economic and financial stability), respectively.

Appendix A

A.1. *Sub-sample results of Pakistan stock market*

Table A.1. VMA results for sub-sample period I (1997–2000).

Variant	*Nb*	*Ns*	Buy	Sell	Buy–Sell	SDb	SDs
Zero percent band							
(1,50)	454	483	0.0034	−0.0033	0.0068	0.0186	0.0236
			(2.8312)***	(−2.7168)***	(4.8047)***		
(1,100)	431	456	0.0029	−0.0028	0.0057	0.0196	0.0239
			(2.3603)**	(−2.2003)**	(3.9149)***		
(1,150)	384	453	0.0019	−0.0021	0.0040	0.0201	0.0239
			(1.4539)	(−1.6760)*	(2.6526)***		
(1,200)	353	434	0.0014	−0.0018	0.0032	0.0205	0.0242
			(1.0895)	(−1.3870)	(2.0729)**		
(2,200)	351	436	0.0009	−0.0014	0.0023	0.0207	0.0241
			(0.7304)	(−1.0673)	(1.5002)		
(5,150)	385	452	0.0007	−0.0011	0.0019	0.0204	0.0237
			(0.5770)	(−0.8912)	(1.2395)		
Average	393	452	0.0019	−0.0021	0.0040	0.0200	0.0239
Annual			57.0594	−39.3992			
One percent band							
(1,50)	396	430	0.0041	−0.0042	0.0083	0.0191	0.0245
			(3.2031)***	(−3.2878)***	(5.5062)***		
(1,100)	385	425	0.0031	−0.0028	0.0059	0.0194	0.0242
			(2.4273)**	(−2.1915)**	(3.9101)***		
(1,150)	372	439	0.0019	−0.0022	0.0041	0.0201	0.0241
			(1.4782)	(−1.7201)*	(2.6972)***		
(1,200)	342	425	0.0013	−0.0020	0.0033	0.0206	0.0241
			(1.0093)	(−1.5476)	(2.1237)**		
(2,200)	346	425	0.0009	−0.0014	0.0023	0.0207	0.0242
			(0.6777)	(−1.0847)	(1.4649)		
(5,150)	374	432	0.0006	−0.0013	0.0019	0.0203	0.0241
			(0.4806)	(−1.0289)	(1.2634)		

Table A.1. (*Continued*)

Variant	*Nb*	*Ns*	Buy	Sell	Buy–Sell	SDb	SDs
Average	369	429	0.0020	−0.0023	0.0043	0.0200	0.0242
Annual			61.0784	−42.7442			

Notes: *Nb* is the number of buy signals.
Ns is the number of sell signals.
Buy–Sell is the difference between the mean buy period returns and the mean sell period returns.
* denotes 10% level of significance.
** denotes 5% level of significance.
*** denotes 1% level of significance.

Table A.2. VMA results for sub-sample period II (2001–2004).

Variant	*Nb*	*Ns*	Buy	Sell	Buy–Sell	SDb	SDs
Zero percent band							
(1,50)	638	302	0.0032	−0.0019	0.0051	0.0124	0.0170
			(2.2390)**	(−3.6682)***	(5.1180)***		
(1,100)	666	224	0.0027	−0.0014	0.0041	0.0140	0.0155
			(1.5851)	(−2.8054)***	(3.7400)***		
(1,150)	763	77	0.0022	−0.0009	0.0031	0.0144	0.0173
			(0.9070)	(−1.4848)	(1.8416)*		
(1,200)	779	11	0.0020	−0.0035	0.0054	0.0142	0.0166
			(0.5341)	(−1.1679)	(1.2518)		
(2,200)	777	13	0.0019	0.0007	0.0013	0.0141	0.0191
			(0.4544)	(−0.2367)	(0.3151)		
(5,150)	760	80	0.0019	0.0024	−0.0005	0.0143	0.0176
			(0.4255)	(0.4717)	(−0.2908)		
Average	731	118	0.0023	−0.0008	0.0031	0.0139	0.0172
Annual			74.7287	−16.7440			
One percent band							
(1,50)	601	257	0.0033	−0.0025	0.0058	0.0125	0.0175
			(2.3317)**	(−4.0914)***	(5.4980)***		
(1,100)	636	167	0.0028	−0.0020	0.0049	0.0141	0.0170
			(1.6820)*	(−3.0260)***	(3.9157)***		
(1,150)	753	72	0.0023	−0.0012	0.0035	0.0144	0.0177
			(0.9808)	(−1.6177)	(1.9924)**		
(1,200)	769	8	0.0021	−0.0087	0.0108	0.0140	0.0154
			(0.7278)	(−2.0338)**	(2.1314)**		
(2,200)	770	10	0.0019	0.0019	−0.0001	0.0142	0.0209
			(0.4188)	(0.0773)	(−0.0132)		
(5,150)	751	67	0.0019	0.0016	0.0003	0.0144	0.0184
			(0.4223)	(−0.0034)	(0.1655)		

Table A.2. (*Continued*)

Variant	*Nb*	*Ns*	Buy	Sell	Buy–Sell	SDb	SDs
Average	713	97	0.0024	−0.0018	0.0042	0.0139	0.0178
Annual			77.1876	−35.4069			

Notes: *Nb* is the number of buy signals.
Ns is the number of sell signals.
Buy–Sell is the difference between the mean buy period returns and the mean sell period returns.
* denotes 10% level of significance.
** denotes 5% level of significance.
*** denotes 1% level of significance.

Table A.3. VMA results for sub-sample period III (2005–2007).

Variant	*Nb*	*Ns*	Buy	Sell	Buy–Sell	SDb	SDs
Zero percent band							
(1,50)	473	213	0.0023	−0.0034	0.0057	0.0126	0.0218
			(1.8180)*	(−3.0761)***	(4.2408)***		
(1,100)	437	199	0.0022	−0.0013	0.0036	0.0123	0.0189
			(1.7387)*	(−1.4032)	(2.5655)**		
(1,150)	459	127	0.0018	−0.0017	0.0035	0.0126	0.0199
			(1.3779)	(−1.3746)	(2.1531)**		
(1,200)	450	86	0.0013	−0.0014	0.0027	0.0135	0.0206
			(0.8401)	(−1.0352)	(1.4393)		
(2,200)	450	86	0.0009	0.0007	0.0002	0.0136	0.0201
			(0.4212)	(0.1272)	(0.0935)		
(5,150)	460	126	0.0010	0.0013	−0.0002	0.0130	0.0192
			(0.5538)	(0.4849)	(−0.1355)		
Average	455	140	0.0016	−0.0010	0.0026	0.0129	0.0201
Annual			46.8868	−20.8035			
One percent band							
(1,50)	430	183	0.0024	−0.0036	0.0060	0.0122	0.0218
			(1.9150)*	(−3.0063)***	(4.1684)***		
(1,100)	413	179	0.0022	−0.0015	0.0037	0.0123	0.0195
			(1.6571)*	(−1.4980)	(2.5584)**		
(1,150)	439	106	0.0016	−0.0014	0.0030	0.0126	0.0209
			(1.1441)	(−1.1229)	(1.7291)*		
(1,200)	428	69	0.0014	−0.0024	0.0038	0.0134	0.0220
			(0.9328)	(−1.4155)	(1.8210)*		
(2,200)	429	69	0.0011	0.0003	0.0008	0.0137	0.0219
			(0.5681)	(−0.1090)	(0.3757)		
(5,150)	435	113	0.0009	0.0018	−0.0008	0.0131	0.0195
			(0.4406)	(0.7722)	(−0.4867)		

Table A.3. (*Continued*)

Variant	*Nb*	*Ns*	Buy	Sell	Buy–Sell	SDb	SDs
Average	429	120	0.0016	−0.0011	0.0028	0.0129	0.0210
Annual			47.1069	−23.9892			

Notes: *Nb* is the number of buy signals.
Ns is the number of sell signals.
Buy–Sell is the difference between the mean buy period returns and the mean sell period returns.
* denotes 10% level of significance.
** denotes 5% level of significance.
*** denotes 1% level of significance.

Table A.4. VMA results for sub-sample period IV (2008–2010).

Variant	*Nb*	*Ns*	Buy	Sell	Buy–Sell	SDb	SDs
Zero percent band							
(1,50)	362	299	0.0027	−0.0040	0.0067	0.0125	0.0189
			(2.8877)***	(−3.2800)***	(5.3415)***		
(1,100)	374	237	0.0018	−0.0033	0.0051	0.0120	0.0213
			(2.0236)**	(−2.4659)**	(3.8257)***		
(1,150)	333	228	0.0020	−0.0023	0.0042	0.0106	0.0201
			(2.1140)**	(−1.5916)	(3.0747)***		
(1,200)	335	176	0.0018	−0.0019	0.0037	0.0104	0.0212
			(1.9868)**	(−1.1648)	(2.4926)**		
(2,200)	332	179	0.0013	−0.0009	0.0022	0.0104	0.0212
			(1.4981)	(−0.4116)	(1.4608)		
(5,150)	332	229	0.0012	−0.0012	0.0024	0.0110	0.0200
			(1.4066)	(−0.6821)	(1.7104)*		
Average	345	225	0.0018	−0.0023	0.0041	0.0112	0.0205
Annual			53.5415	−41.9391			
One percent band							
(1,50)	324	269	0.0029	−0.0046	0.0075	0.0127	0.0195
			(2.9561)***	(−3.6722)***	(5.6501)***		
(1,100)	361	229	0.0018	−0.0033	0.0052	0.0120	0.0216
			(2.0720)**	(−2.4220)**	(3.8035)***		
(1,150)	313	204	0.0020	−0.0028	0.0048	0.0106	0.0207
			(2.1157)**	(−1.9200)*	(3.3222)***		
(1,200)	310	159	0.0016	−0.0020	0.0035	0.0105	0.0219
			(1.7124)*	(−1.1678)	(2.2659)*		
(2,200)	308	159	0.0015	−0.0012	0.0028	0.0106	0.0219
			(1.6559)*	(−0.6461)	(1.7543)*		
(5,150)	304	205	0.0015	−0.0013	0.0028	0.0107	0.0207
			(1.6371)	(−0.7616)	(1.9290)*		

Table A.4. (*Continued*)

Variant	*Nb*	*Ns*	Buy	Sell	Buy–Sell	SDb	SDs
Average	320	204	0.0019	−0.0025	0.0044	0.0112	0.0211
Annual			57.1690	−45.6515			

Notes: *Nb* is the number of buy signals.
Ns is the number of sell signals.
Buy–Sell is the difference between the mean buy period returns and the mean sell period returns.
* denotes 10% level of significance.
** denotes 5% level of significance.
*** denotes 1% level of significance.

Table A.5. VMA results for sub-sample period V (2011–2013).

Variant	*Nb*	*Ns*	Buy	Sell	Buy–Sell	SDb	SDs
Zero percent band							
(1,50)	531	164	0.0020	−0.0020	0.0040	0.0079	0.0111
			(1.8189)*	(−3.9101)***	(4.9732)***		
(1,100)	532	113	0.0017	−0.0014	0.0031	0.0081	0.0118
			(1.2086)	(−2.6993)***	(3.3154)***		
(1,150)	500	95	0.0016	−0.0010	0.0026	0.0083	0.0125
			(1.0764)	(−2.0736)**	(2.5907)***		
(1,200)	492	53	0.0016	−0.0009	0.0025	0.0083	0.0109
			(1.0337)	(−1.5273)	(1.9267)*		
(2,200)	491	54	0.0015	−0.0001	0.0016	0.0082	0.0114
			(0.8840)	(−0.9381)	(1.2879)		
(5,150)	498	97	0.0014	0.0004	0.0009	0.0083	0.0125
			(0.5729)	(−0.6409)	(0.9290)		
Average	507	96	0.0016	−0.0008	0.0024	0.0082	0.0117
Annual			48.1427	−17.6542			
One percent band							
(1,50)	480	137	0.0023	−0.0020	0.0042	0.0077	0.0111
			(2.2574)**	(−3.6318)***	(4.8879)***		
(1,100)	510	94	0.0018	−0.0019	0.0037	0.0078	0.0122
			(1.3325)	(−3.0247)***	(3.6535)***		
(1,150)	486	86	0.0016	−0.0016	0.0032	0.0083	0.0122
			(1.0360)	(−2.5764)***	(3.0412)***		
(1,200)	479	49	0.0016	−0.0013	0.0029	0.0083	0.0105
			(1.0683)	(−1.7637)*	(2.1611)**		
(2,200)	481	51	0.0016	0.0000	0.0016	0.0083	0.0114
			(0.9770)	(−0.8103)	(1.1917)		
(5,150)	483	87	0.0015	0.0002	0.0013	0.0082	0.0128
			(0.8740)	(−0.8048)	(1.2304)		

Table A.5. (*Continued*)

Variant	*Nb*	*Ns*	Buy	Sell	Buy–Sell	SDb	SDs
Average	487	84	0.0017	−0.0011	0.0028	0.0081	0.0117
Annual			51.4521	−22.6855			

Notes: *Nb* is the number of buy signals.
Ns is the number of sell signals.
Buy–Sell is the difference between the mean buy period returns and the mean sell period returns.
* denotes 10% level of significance.
** denotes 5% level of significance.
*** denotes 1% level of significance.

Table A.6. FMA results for sub-sample period I (1997–2000).

Variant	*Nb*	*Ns*	Buy	Sell	Buy–Sell	SDb	SDs
Zero percent band							
(1,50)	13	14	0.0178	−0.0226	0.0404	0.0527	0.0667
			(0.8404)	(−0.9909)	(1.3836)		
(1,100)	5	12	0.0376	0.0022	0.0354	0.0690	0.0641
			(1.1120)	(0.1419)	(0.8773)		
(1,150)	2	4	0.0293	−0.0207	0.0500	0.1090	0.0907
			(0.5614)	(−0.5060)	(0.7617)		
(1,200)	3	4	0.0086	−0.0039	0.0125	0.0529	0.0662
			(0.2180)	(−0.0736)	(0.2167)		
(2,200)	2	4	−0.0058	−0.0011	−0.0047	0.0521	0.0625
			(−0.0861)	(−0.0002)	(−0.0709)		
(5,150)	2	4	−0.0406	−0.0026	−0.0381	0.1014	0.0988
			(−0.7297)	(−0.0379)	(−0.5798)		
Average	5	7	0.0078	−0.0081	0.0159	0.0729	0.0748
Annual			552.4837	−85.7580			
One percent band							
(1,50)	7	14	0.0088	−0.0153	0.0241	0.0455	0.0743
			(0.3339)	(−0.6525)	(0.6868)		
(1,100)	1	6	0.0063	−0.0201	0.0265	Nil	0.0706
			(0.0975)	(−0.5963)	(0.3233)		
(1,150)	2	3	0.0313	−0.0528	0.0840	0.0536	0.0961
			(0.5975)	(−1.1621)	(1.2145)		
(1,200)	1	4	0.0317	−0.0224	0.0541	Nil	0.0447
			(0.4307)	(−0.5504)	(0.6387)		
(2,200)	1	1	0.0311	−0.0018	0.0329	Nil	Nil
			(0.4222)	(−0.0090)	(0.3065)		
(5,150)	1	1	−0.1210	0.0039	−0.1249	Nil	Nil
			(−1.5739)	(0.0653)	(−1.1653)		

Table A.6. (*Continued*)

Variant	*Nb*	*Ns*	Buy	Sell	Buy–Sell	SDb	SDs
Average	2	5	−0.0020	−0.0181	0.0161	0.0496	0.0714
Annual			−37.6211	−98.6954			

Notes: *Nb* is the number of buy signals.
Ns is the number of sell signals.
Buy–Sell is the difference between the mean buy period returns and the mean sell period returns.

Table A.7. FMA results for sub-sample period II (2001–2004).

Variant	*Nb*	*Ns*	Buy	Sell	Buy–Sell	SDb	SDs
Zero percent band							
(1,50)	7	11	0.0415	−0.0056	0.0471	0.0507	0.0432
			(1.3067)	(−1.3030)	(1.9185)*		
(1,100)	8	8	0.0058	0.0357	−0.0299	0.0323	0.0389
			(−0.5167)	(1.0788)	(−1.1757)		
(1,150)	2	4	0.0162	0.0359	−0.0197	0.0216	0.0463
			(0.0205)	(0.7863)	(−0.4468)		
(1,200)	0	2	Nil	0.0570	Nil	Nil	0.0417
			Nil	(1.1442)	Nil		
(2,200)	0	2	Nil	0.0570	Nil	Nil	0.0417
			Nil	(1.1442)	Nil		
(5,150)	2	3	0.0010	0.0169	−0.0159	0.0108	0.0689
			(−0.3991)	(0.0458)	(−0.3419)		
Average	3	5	0.0161	0.0328	−0.0046	0.0289	0.0468
Annual			4713.8129	263216.9005			
One percent band							
(1,50)	5	5	0.0617	0.0137	0.0480	0.0485	0.0204
			(1.9801)**	(−0.0788)	(1.4945)		
(1,100)	5	4	0.0131	0.0150	−0.0019	0.0332	0.0482
			(−0.1022)	(−0.0193)	(−0.0552)		
(1,150)	1	3	0.0009	0.0309	−0.0300	Nil	0.0554
			(−0.2847)	(0.5182)	(−0.5111)		
(1,200)	0	2	Nil	0.0570	Nil	Nil	0.0417
			Nil	(1.1442)	Nil		
(2,200)	0	1	Nil	0.0865	Nil	Nil	Nil
			Nil	(1.3905)	Nil		
(5,150)	1	0	−0.0066	Nil	Nil	Nil	Nil
			(−0.4333)	Nil	Nil		
Average	2	3	0.0173	0.0406	0.0054	0.0408	0.0414
Annual			6215.4125	1716360.3164			

Notes: *Nb* is the number of buy signals.
Ns is the number of sell signals.
Buy–Sell is the difference between the mean buy period returns and the mean sell period returns.
* denotes 10% level of significance.
** denotes 5% level of significance.

Table A.8. FMA results for sub-sample period III (2005–2007).

Variant	*Nb*	*Ns*	Buy	Sell	Buy–Sell	SDb	SDs
Zero percent band							
(1,50)	8	11	0.0370	−0.0048	0.0418	0.0374	0.0629
			(1.4999)	(−0.5643)	(1.6012)		
(1,100)	7	5	0.0319	−0.0269	0.0589	0.0409	0.0471
			(1.1860)	(−1.2470)	(1.7908)*		
(1,150)	6	4	0.0104	0.0031	0.0073	0.0413	0.0453
			(0.2037)	(−0.0833)	(0.2008)		
(1,200)	3	4	0.0499	0.0085	0.0414	0.0309	0.0352
			(1.3397)	(0.1019)	(0.9661)		
(2,200)	3	4	0.0496	0.0124	0.0372	0.0312	0.0286
			(1.3302)	(0.2369)	(0.8679)		
(5,150)	5	3	0.0283	−0.0156	0.0439	0.0396	0.0904
			(0.8760)	(−0.6385)	(1.0716)		
Average	5	5	0.0345	−0.0039	0.0384	0.0369	0.0516
Annual			395884.2581	−60.8449			
One percent band							
(1,50)	6	3	0.0072	−0.0217	0.0290	0.0510	0.0581
			(0.0717)	(−0.8229)	(0.7298)		
(1,100)	0	4	Nil	−0.0182	Nil	Nil	0.0503
			Nil	(−0.8209)	Nil		
(1,150)	3	2	0.0277	−0.0070	0.0347	0.0322	0.0176
			(0.6697)	(−0.3114)	(0.6775)		
(1,200)	0	3	Nil	−0.0113	Nil	Nil	0.0182
			Nil	(−0.5070)	Nil		
(2,200)	1	2	−0.0274	−0.0041	−0.0234	Nil	0.0218
			(−0.5823)	(−0.2379)	(−0.3396)		
(5,150)	0	1	Nil	−0.1199	Nil	Nil	Nil
			Nil	(−2.2163)**	Nil		
Average	2	3	0.0025	−0.0304	0.0135	0.0416	0.0332
Annual			82.2094	−99.9316			

Notes: *Nb* is the number of buy signals.
Ns is the number of sell signals.
Buy–Sell is the difference between the mean buy period returns and the mean sell period returns.
* denotes 10% level of significance.
** denotes 5% level of significance.

Table A.9. FMA results for sub-sample period IV (2008–2010).

Variant	*Nb*	*Ns*	Buy	Sell	Buy–Sell	SDb	SDs
Zero percent band							
(1,50)	6	7	0.0431	−0.0138	0.0569	0.0398	0.0452
			(1.4176)	(−0.3281)	(1.3217)		
(1,100)	3	3	0.0502	0.0051	0.0451	0.0768	0.0391
			(1.1790)	(0.1926)	(0.7134)		

Table A.9. (*Continued*)

Variant	*Nb*	*Ns*	Buy	Sell	Buy–Sell	SDb	SDs
(1,150)	7	2	−0.0120	0.0067	−0.0187	0.0492	0.0440
			(−0.2706)	(0.1869)	(−0.3016)		
(1,200)	3	4	0.0251	0.0161	0.0090	0.0195	0.0207
			(0.6299)	(0.4959)	(0.1525)		
(2,200)	3	4	0.0194	0.0272	−0.0077	0.0304	0.0314
			(0.5067)	(0.7751)	(−0.1310)		
(5,150)	6	2	−0.0080	0.0157	−0.0237	0.0569	0.0131
			(−0.1303)	(0.3492)	(−0.3751)		
Average	5	4	0.0196	0.0095	0.0101	0.0455	0.0322
Annual			11003.3606	873.7152			
One percent band							
(1,50)	2	3	0.0502	0.0154	0.0347	0.0802	0.0483
			(0.9694)	(0.4190)	(0.4914)		
(1,100)	2	1	0.0064	0.1222	−0.1158	0.0184	Nil
			(0.1827)	(1.6144)	(−1.2211)		
(1,150)	3	1	−0.0006	−0.0291	0.0285	0.0286	Nil
			(0.0690)	(−0.3249)	(0.3189)		
(1,200)	0	2	Nil	0.0102	Nil	Nil	0.0327
			Nil	(0.2507)	Nil		
(2,200)	2	1	0.0178	−0.0129	0.0306	0.0105	Nil
			(0.3866)	(−0.1175)	(0.3233)		
(5,150)	0	0	Nil	Nil	Nil	Nil	Nil
			Nil	Nil	Nil		
Average	2	1	0.0185	0.0212	−0.0055	0.0344	0.0405
Annual			8282.28	16045.91			

Notes: *Nb* is the number of buy signals.
Ns is the number of sell signals.
Buy–Sell is the difference between the mean buy period returns and the mean sell period returns.

Table A.10. FMA results for sub-sample period V (2011–2013).

Variant	*Nb*	*Ns*	Buy	Sell	Buy–Sell	SDb	SDs
Zero percent band							
(1,50)	6	8	0.0168	−0.0014	0.0182	0.0184	0.0505
			(0.4812)	(−1.1859)	(1.1994)		
(1,100)	4	4	0.0131	−0.0116	0.0247	0.0322	0.0287
			(0.1398)	(−1.5700)	(1.2436)		
(1,150)	3	2	−0.0098	−0.0197	0.0100	0.0167	0.0426
			(−1.2563)	(−1.5275)	(0.3886)		
(1,200)	2	1	−0.0165	0.0090	−0.0255	0.0168	Nil
			(−1.3669)	(−0.0715)	(−0.7417)		
(2,200)	2	1	−0.0070	0.0104	−0.0174	0.0269	Nil
			(−0.8957)	(−0.0228)	(−0.5058)		

Table A.10. (*Continued*)

Variant	*Nb*	*Ns*	Buy	Sell	Buy–Sell	SDb	SDs
(5,150)	3	1	−0.0161	−0.0219	0.0058	0.0387	Nil
			(−1.6419)	(−1.1652)	(0.1778)		
Average	3	3	−0.0032	−0.0059	0.0026	0.0250	0.0406
Annual			−54.1528	−75.5444			
One percent band							
(1,50)	5	1	0.0005	0.0613	−0.0609	0.0391	Nil
			(−0.8121)	(1.7772)*	(−1.9774)**		
(1,100)	3	2	−0.0213	−0.0337	0.0124	0.0286	0.0229
			(−1.9517)*	(−2.2193)**	(0.4829)		
(1,150)	1	1	−0.0456	−0.0499	0.0042	Nil	Nil
			(−2.0027)**	(−2.1528)**	(0.1069)		
(1,200)	0	0	Nil	Nil	Nil	Nil	Nil
			Nil	Nil	Nil		
(2,200)	1	1	0.0121	0.0104	0.0017	Nil	Nil
			(0.0356)	(−0.0228)	(0.0416)		
(5,150)	0	0	Nil	Nil	Nil	Nil	Nil
			Nil	Nil	Nil		
Average	2	1	−0.0136	−0.0029	−0.0106	0.0338	0.0229
Annual			−96.1631	−50.6442			

Notes: *Nb* is the number of buy signals.
Ns is the number of sell signals.
Buy–sell is the difference between the mean buy period returns and the mean sell period returns.
* denotes 10% level of significance.
** denotes 5% level of significance.

Table A.11. TRB results for sub-sample period I (1997–2000).

Variant	*Nb*	*Ns*	Buy	Sell	Buy–Sell	SDb	SDs
Zero percent band							
(1,50)	8	12	0.0245	−0.0183	0.0428	0.0700	0.0777
			(0.9161)	(−0.7406)	(1.2372)		
(1,100)	5	2	0.0647	−0.1211	0.1859	0.0634	0.1249
			(1.8913)*	(−2.2158)**	(2.9305)**		
(1,150)	3	2	−0.0291	−0.1211	0.0921	0.0724	0.1249
			(−0.6290)	(−2.2158)**	(1.3305)		
(1,200)	1	1	0.0345	−0.1651	0.1997	Nil	Nil
			(0.4673)	(−2.1526)**	(1.8624)**		
Average	4	4	0.0237	−0.1064	0.1301	0.0686	0.1092
Annual			29176.2630	−100.000			
One percent band							
(1,50)	4	7	0.0096	−0.0023	0.0119	0.0910	0.0527
			(0.2758)	(−0.0419)	(0.2509)		

Table A.11. (*Continued*)

Variant	*Nb*	*Ns*	Buy	Sell	Buy–Sell	SDb	SDs
(1,100)	1	0	0.1133	Nil	Nil	Nil	Nil
			(1.5005)	Nil	Nil		
(1,150)	3	0	−0.0291	Nil	Nil	0.0724	Nil
			(−0.6290)	Nil	Nil		
(1,200)	1	1	0.0345	−0.1651	0.1997	Nil	Nil
			(0.4673)	(−2.1526)**	(1.8624)*		
Average	2	2	0.0321	−0.0837	0.1058	0.0817	0.0527
Annual			220064.1579	−100.000			

Notes: *Nb* is the number of buy signals.
Ns is the number of sell signals.
Buy–Sell is the difference between the mean buy period returns and the mean sell period returns.
* denotes 10% level of significance.
** denotes 5% level of significance.

Table A.12. TRB results for sub-sample period II (2001–2004).

Variant	*Nb*	*Ns*	Buy	Sell	Buy–Sell	SDb	SDs
Zero percent band							
(1,50)	13	8	0.0142	0.0007	0.0135	0.0567	0.0498
			(−0.0859)	(−0.7911)	(0.5921)		
(1,100)	9	2	0.0047	0.0051	−0.0004	0.0596	0.0318
			(−0.6099)	(−0.2862)	(−0.0107)		
(1,150)	5	1	0.0421	−0.1014	0.1435	0.0275	Nil
			(1.1409)	(−2.2886)**	(2.5785)***		
(1,200)	5	0	0.0241	Nil	Nil	0.0268	Nil
			(0.3679)	Nil	Nil		
Average	8	3	0.0213	−0.0319	0.0522	0.0427	0.0408
Annual			16353.6893	−99.9524			
One percent band							
(1,50)	5	3	−0.0140	−0.0043	−0.0097	0.0757	0.0858
			(−1.2648)	(−0.6637)	(−0.2620)		
(1,100)	3	1	−0.0143	0.0276	−0.0419	0.0897	Nil
			(−0.9996)	(0.2362)	(−0.7135)		
(1,150)	2	1	0.0631	−0.1014	0.1645	0.0256	Nil
			(1.3101)	(−2.2886)**	(2.6431)***		
(1,200)	3	0	0.0240	Nil	Nil	0.0331	Nil
			(0.2840)	Nil	Nil		
Average	3	1	0.0147	−0.0260	0.0376	0.0560	0.0858
Annual			3288.1593	−99.8071			

Notes: *Nb* is the number of buy signals.
Ns is the number of sell signals.
Buy–Sell is the difference between the mean buy period returns and the mean sell period returns.
** denotes 5% level of significance.
*** denotes 1% level of significance.

Table A.13. TRB results for sub-sample period III (2005–2007).

Variant	*Nb*	*Ns*	Buy	Sell	Buy–Sell	SDb	SDs
Zero percent band							
(1,50)	13	4	0.0086	0.0484	−0.0398	0.0355	0.0157
			(0.1806)	(1.4840)	(−1.2397)		
(1,100)	10	0	0.0112	Nil	Nil	0.0418	Nil
			(0.2968)	Nil	Nil		
(1,150)	10	0	0.0324	Nil	Nil	0.0447	Nil
			(1.4122)	Nil	Nil		
(1,200)	10	0	0.0307	Nil	Nil	0.0503	Nil
			(1.3221)	Nil	Nil		
Average	11	1	0.0207	0.0484	−0.0398	0.0431	0.0157
Annual			14244.2793	11046491.5706			
One percent band							
(1,50)	2	3	−0.0273	0.0537	−0.0811	0.0353	0.0142
			(−0.8155)	(1.4550)	(−1.5812)		
(1,100)	1	0	−0.0523	Nil	Nil	Nil	Nil
			(−1.0219)	Nil	Nil		
(1,150)	2	0	0.0207	Nil	Nil	0.1032	Nil
			(0.3766)	Nil	Nil		
(1,200)	1	0	0.0937	Nil	Nil	Nil	Nil
			(1.5583)	Nil	Nil		
Average	2	1	0.0087	0.0537	−0.0811	0.0692	0.0142
Annual			702.3218	39674563.7010			

Notes: *Nb* is the number of buy signals.
Ns is the Number of sell signals.
Buy–Sell = Difference between the mean buy period returns and the mean sell period returns.

Table A.14. TRB results for sub-sample period IV (2008–2010).

Variant	*Nb*	*Ns*	Buy	Sell	Buy–Sell	SDb	SDs
Zero percent band							
(1,50)	9	6	−0.0097	−0.0796	0.0699	0.0267	0.1451
			(−0.2175)	(−2.2994)**	(1.7147)*		
(1,100)	7	2	0.0079	−0.2393	0.2472	0.0290	0.1362
			(0.3761)	(−4.2399)***	(3.9829)***		
(1,150)	5	1	−0.0017	−0.0796	0.0779	0.0346	Nil
			(0.0564)	(−0.9727)	(0.9187)		
(1,200)	8	1	0.0061	−0.3356	0.3417	0.0282	Nil
			(0.3374)	(−4.2554)***	(4.1620)***		
Average	7	3	0.0006	−0.1835	0.1842	0.0296	0.1406
Annual			16.5942	−100.000			
One percent band							
(1,50)	1	4	−0.0519	−0.0820	0.0300	Nil	0.1788
			(−0.6185)	(−1.9629)**	(0.3470)		
(1,100)	1	1	−0.0519	−0.3356	0.2836	Nil	Nil
			(−0.6185)	(−4.2554)***	(2.5914)**		

Table A.14. (*Continued*)

Variant	*Nb*	*Ns*	Buy	Sell	Buy–Sell	SDb	SDs
(1,150)	0	1	Nil	−0.0796	Nil	Nil	Nil
			Nil	(−0.9727)	Nil		
(1,200)	1	1	−0.0519	−0.3356	0.2836	Nil	Nil
			(−0.6185)	(−4.2554)***	(2.5914)***		
Average	1	2	−0.0519	−0.2082	0.1991	Nil	0.1788
Annual			−99.9996	−100.000			

Notes: *Nb* is the number of buy signals.
Ns is the number of sell signals.
Buy–Sell is the difference between the mean buy period returns and the mean sell period returns.
* denotes 10% level of significance.
** denotes 5% level of significance.
*** denotes 1% level of significance.

Table A.15. TRB results for sub-sample period V (2011–2013).

Variant	*Nb*	*Ns*	Buy	Sell	Buy–Sell	SDb	SDs
Zero percent band							
(1,50)	11	1	0.0179	0.0926	−0.0747	0.0369	Nil
			(0.7503)	(2.8827)***	(−2.5467)**		
(1,100)	8	2	0.0367	−0.0211	0.0579	0.0163	0.0300
			(2.4448)**	(−1.5981)	(2.6050)***		
(1,150)	6	4	0.0360	0.0071	0.0289	0.0178	0.0370
			(2.0896)**	(−0.2728)	(1.5951)		
(1,200)	4	0	0.0438	Nil	Nil	0.0141	Nil
			(2.2668)**	Nil	Nil		
Average	7	2	0.0336	0.0262	0.0040	0.0213	0.0335
Annual			319023.2786	53708.2186			
One percent band							
(1,50)	1	1	0.0112	−0.0499	0.0611	Nil	Nil
			(0.0055)	(−2.1528)**	(1.5372)		
(1,100)	3	1	0.0293	−0.0423	0.0717	0.0183	Nil
			(1.1037)	(−1.8873)*	(2.2100)**		
(1,150)	1	1	0.0102	−0.0423	0.0525	Nil	Nil
			(−0.0316)	(−1.8873)*	(1.3217)		
(1,200)	0	0	Nil	Nil	Nil	Nil	Nil
			Nil	Nil	Nil		
Average	1	1	0.0169	−0.0449	0.0618	0.0183	Nil
Annual			5685.2880	−99.9979			

Notes: *Nb* is the number of buy signals.
Ns is the number of sell signals.
Buy–Sell is the difference between the mean buy period returns and the mean sell period returns.
* denotes 10% level of significance.
** denotes 5% level of significance.
*** denotes 1% level of significance.

Appendix B

B.1. *Summary tables*

Table B.1.

	BUY	SELL	BUY–SELL
VMA without band			
Sub-Sample I			
+	6(2)	0(0)	6(4)
−	0(0)	6(3)	0(0)
Average	0.0019	−0.0021	0.0040
Sub-Sample II			
+	6(1)	2(0)	5(3)
−	0(0)	4(2)	1(0)
Average	0.0023	−0.0008	0.0031
Sub-Sample III			
+	6(2)	2(0)	5(3)
−	0(0)	4(1)	1(0)
Average	0.0016	−0.0010	0.0026
Sub-Sample IV			
+	6(4)	0(0)	6(5)
−	0(0)	6(2)	0(0)
Average	0.0018	−0.0023	0.0041
Sub-Sample V			
+	6(1)	1(0)	6(4)
−	0(0)	5(3)	0(0)
Average	0.0016	−0.0008	0.0024
With 1% BAND			
Sub-Sample I			
+	6(2)	0(0)	6(4)
−	0(0)	6(3)	0(0)
Average	0.0020	−0.0023	0.0043
Sub-Sample II			
+	6(2)	2(0)	5(4)
−	0(0)	4(3)	1(0)
Average	0.0024	−0.0018	0.0042
Sub-Sample III			
+	6(2)	2(0)	5(4)
−	0(0)	4(1)	1(0)
Average	0.0016	−0.0011	0.0028
Sub-Sample IV			
+	6(5)	0(0)	6(6)
−	0(0)	6(3)	0(0)
Average	0.0019	−0.0025	0.0044

Table B.1. (*Continued*)

	BUY	SELL	BUY–SELL
Sub-Sample V			
+	6(1)	2(0)	6(4)
−	0(0)	4(4)	0(0)
Average	0.0017	−0.0011	0.0028

Notes: +/− sign shows number of variants with positive/negative mean returns of buy, sell and buy–sell.
Number in parenthesis indicates positive/negative mean buy, mean sell and mean buy–sell returns at 1%,5% and 10% significance level.

Table B.2.

	BUY	SELL	BUY–SELL
FMA without band			
Sub-Sample I			
+	4(0)	1(0)	4(0)
−	2(0)	5(0)	2(0)
Average	0.0078	−0.0081	0.0159
Sub-Sample II			
+	4(0)	5(0)	1(1)
−	0(0)	1(0)	3(0)
Average	0.0161	0.0328	−0.0046
Sub-Sample III			
+	6(0)	3(0)	6(1)
−	0(0)	3(0)	0(0)
Average	0.0345	−0.0039	0.0384
Sub-Sample IV			
+	4(0)	5(0)	3(0)
−	2(0)	1(0)	3(0)
Average	0.0196	0.0095	0.0101
Sub-Sample V			
+	2(0)	2(0)	4(0)
−	4(0)	4(0)	2(0)
Average	−0.0032	−0.0059	0.0026
FMA with 1% band			
Sub-Sample I			
+	5(0)	1(0)	5(0)
−	1(0)	5(0)	1(0)
Average	−0.0020	−0.0181	0.0161
Sub-Sample II			
+	3(1)	5(0)	1(0)
−	1(0)	0(0)	2(0)
Average	0.0173	0.0406	0.0054

Table B.2. (*Continued*)

	BUY	SELL	BUY–SELL
Sub-Sample III			
+	2(0)	0(0)	2(0)
−	1(0)	6(1)	1(0)
Average	0.0025	−0.0304	0.0135
Sub-Sample IV			
+	3(0)	3(0)	3(0)
−	1(0)	2(0)	1(0)
Average	0.0185	0.0212	−0.0055
Sub-Sample V			
+	2(0)	2(1)	3(0)
−	2(2)	2(2)	1(1)
Average	−0.0136	−0.0029	−0.0106

Notes: +/− sign shows number of variants with positive/negative mean returns of buy, sell and buy–sell. Number in parenthesis indicates positive/negative mean buy, mean sell and mean buy–sell returns at 1%,5% and 10% significance level. significance level.

Table B.3.

	BUY	SELL	BUY–SELL
TRB without band			
Sub-Sample I			
+	3(1)	0(0)	4(2)
−	1(0)	4(3)	0(0)
Average	0.0237	−0.1064	0.1301
Sub-Sample II			
+	4(0)	2(0)	2(1)
−	0(0)	1(1)	1(0)
Average	0.0213	−0.0319	0.0522
Sub-Sample III			
+	4(0)	1(0)	0(0)
−	0(0)	0(0)	1(0)
Average	0.0207	0.0484	−0.0398
Sub-Sample IV			
+	2(0)	0(0)	4(3)
−	2(0)	4(3)	0(0)
Average	0.0006	−0.1835	0.1842
Sub-Sample V			
+	4(3)	2(1)	2(1)
−	0(0)	1(0)	1(1)
Average	0.0336	0.0262	0.0040

Table B.3. (*Continued*)

	BUY	SELL	BUY–SELL
TRB with 1% band			
Sub-Sample I			
+	3(0)	0(0)	2(1)
−	1(0)	2(1)	0(0)
Average	0.0321	−0.0837	0.1058
Sub-Sample II			
+	2(0)	1(0)	1(1)
−	2(0)	2(1)	2(0)
Average	0.0147	−0.0260	0.0376
Sub-Sample III			
+	2(0)	1(0)	0(0)
−	2(0)	0(0)	1(0)
Average	0.0087	0.0537	−0.0811
Sub-Sample IV			
+	0(0)	0(0)	3(2)
−	3(0)	4(3)	0(0)
Average	−0.0519	−0.2082	0.1991
Sub-Sample V			
+	3(0)	0(0)	3(1)
−	0(0)	3(3)	0(0)
Average	0.0169	−0.0449	0.0618

Notes: +/− sign shows number of variants with positive/negative mean returns of buy, sell and buy–sell. Number in parenthesis indicates positive/negative mean buy, mean sell and mean buy–sell returns at 1%,5% and 10% significance level.

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