Candlestick Charting and Trading Volume: Evidence from Bursa Malaysia

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ABSTRACT

Technical analysis is deemed to be a futile practice among academicians who propose efficient market hypothesis, typically the weak form market efficiency which strongly protests the application of past prices and trading volume data for prediction of future market movement. As candlestick charting is one of the oldest technical indicators for short term investment, therefore this study examines the predictability of candlestick charting with combination to trading volume for Malaysian stock market within the period of 2000-2014. Skewness adjusted t-test is employed to test the statistical significance of candlestick returns. After taking into account the transaction costs and also out-of-sample test as robustness checking, the findings show that only bullish reversal patterns prior to trend are profitable for investors while most of the bearish reversal patterns have shown significant predictive power both before and after trend. The effective holding period for candlestick reversal patterns tend to accumulate around 10-15 day holding period.

Keywords: Efficient Market Hypothesis, Technical Analysis, Candlestick Charting, Reversal Patterns
JEL Classifications: G11, G12, G14

1. INTRODUCTION

The controversy between efficient market hypothesis and technical analysis still exists in today's finance world. All three forms of market efficiency signify the impossibility to obtain abnormal returns in an efficient market as all sorts of readily available information including the public and private information have been fully incorporated into the prices of financial assets (Fama, 1970). In particular, technical analysis is rejected by the weak form market efficiency which asserts the uselessness of historical information to forecast future market movement.

Technical analysis is believed to be originated from Dow theory since 1884. Technical analysis aims to trace market movement through numerical and charting analysis from past prices and trading volume data. The trading signals forecasted by technical indicators reflect investor sentiment that assist traders in market timing (Murphy, 1999). If prices is the primary element in the securities market, then trading volume would be the secondary element to be considered. Trading volume reflects the liquidity of stock from daily transaction of shares in the market besides functioning as a basic fuel to control the movement of market prices. The combination of trading volume and stock prices could thus detect the true commitment of price movement easily (Dormeier, 2011). Brock et al. (1992), Lo et al. (2000), Shen (2003), and Neely et al. (2011) have even provide positive evidences which prove the effectiveness of technical analysis while recent findings from behavioral finance which validates the irrationality of investors in decision making has added value to the practice of technical analysis method (Marshall et al., 2006).

The Japanese candlestick charting which is time-tested since 1700s is one of the oldest trading rules among other technical indicators. In fact, candlestick charting technique acts as a leading indicator which

is capable to provide earlier trading signals (Nison, 1991). Most of the prior studies which center around Taiwan stock market prove the predictive power of candlestick charting as shown by Shiu and Lu (2011), Lu and Shiu (2012), Lu et al. (2012), Lu et al. (2014), and Lu (2014) while Zhu et al. (2016) provide evidence for China stock market recently and also for European stocks by Caginalp and Laurent (1998) and Lu and Chen (2013). However, negative evidences are attained by Marshall et al. (2006), Marshall et al. (2008), Horton (2009), and Prado et al. (2013) which indicate the ineffectiveness of candlestick.

A research issue arises when candlestick technical trading strategy contradicts with the weak form market efficiency. Moreover, trading volume is considered as another crucial element in securities market apart from prices. As candlestick charting is deemed to be very suitable in Malaysian stock market with exhibition of short term rallies followed by short term corrections and trading cycle ranges from 3 to 15 days (Tam, 2001), this paper thus examines the profitability of candlestick reversal patterns with combination to trading volume factor for Bursa Malaysia from 1 to 15 holding days.

2. CANDLESTICK CHARTING

A normal single line candlestick is formed by the open, high, low, and close price from daily, weekly, or monthly data. A white candle with higher closing price than the opening price typically indicates a bullish signal while a black candle with opening price greater than the closing price usually implies a bearish signal. The vertical lines drawn above and below the real body are known as the upper and lower shadows respectively (Figure 1).

Reversal patterns which are constructed from a sequence of candlestick lines indicate a high probability of trend changes. Trend reversal signals in the opposite direction are powerful in assisting traders to buy low and sell high for profit maximization in stock trading. The common reversal patterns in the market are identified from practitioner books by Nison (1991) and Morris (1995) which are then documented accordingly in Figure 2.

3. DATA AND METHODOLOGY

The sample data for the present study comprises of the daily opening, high, low, and closing prices for public listed companies at Bursa Malaysia within the 15 years sample period from 2000 until 2014 with the most recent 3 years reserved for out-of-

sample test. Initially, we observe the crisis effect by dividing the original sample of 420 stocks from 2000 to 2011 into crisis and non-crisis categories. Crisis covers the period from 2008 to 2009 while non-crisis includes period of 2000-2007 and 2010-2011. After taking into consideration the factor of trading volume, the initial sample is filtered and only companies with average trading volume that exceed 1 million unit shares are selected for further analysis. As a result, a total of 59 companies are included as the in-sample data whereas the out-of-sample data consists of a total of 131 firms.

Following Lu (2014), the whole study is conducted based on three steps research design. Firstly, all possible candlestick patterns that occur within the sample period is scanned and recognized with Candle Scanner software. Secondly, a 3-day simple moving average over six inequalities is employed to identify trends prior to the occurrence of patterns computed as:

$$MA_3(t) = \frac{P(t-2) + P(t-1) + P(t)}{3} \qquad (1)$$

A set of inequalities is defined to help identifying market trends with acceptance of at most one violation of the inequalities. A downtrend is detected on day t when:

$$MA_3(t-6) > MA_3(t-5) > \ldots > MA_3(t-1) > MA_3(t) \qquad (2)$$

Whereas an uptrend on day t is defined as:

$$MA_3(t-6) < MA_3(t-5) < \ldots < MA_3(t-1) < MA_3(t) \qquad (3)$$

Thirdly, the stock returns is measured as the natural logarithm of the closing price on day t+n divided by the opening price on the day following a candlestick pattern computed as follows:

$$Returns = \ln \frac{C_{t+n}}{O_{t+1}} \qquad (4)$$

Where, n = Number of holding period.

Raw returns is examined in this study instead of the abnormal ones as candlestick trading rule is more suitable for short term investment. The stock returns is computed based on a buy-and-hold investment strategy and it is assumed that a trade is simulated at the opening price on the day following a reversal pattern and then sold

**Figure 1:** Single line candlesticks
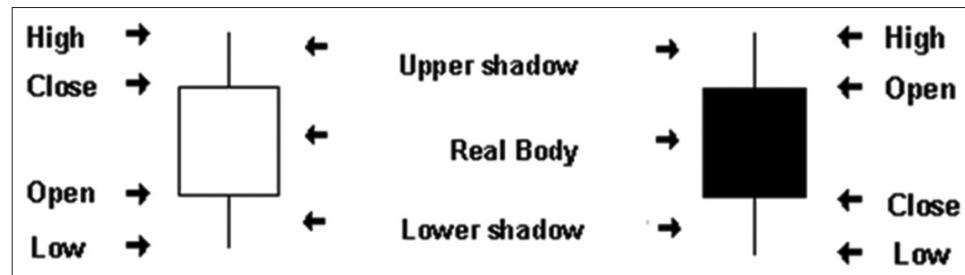
Figure 2: Reversal patterns

Reversal pattern	Prior trend	Characteristics	Signal
Bullish Engulfing	Downtrend	The first day is a small black body. The second day is a long white candlestick which engulfs the prior day's real body completely - emotion	Bullish
Bearish Engulfing	Uptrend	The first day is a small white body. The second day is a long black candlestick which engulfs the prior day's real body completely	Bearish
Bullish Harami	Downtrend	The first day is an unusually large black candlestick. The second day is a small white body which is completely engulfed by the prior day's real body	Bullish
Bearish Harami	Uptrend	The first day is an unusually large white candlestick. The second day is a small black body which is completely engulfed by the prior day's real body	Bearish
Bullish Harami Cross	Downtrend	The first day is a black candlestick. The second day is a doji which is completely engulfed by the prior day's black body. It is typically more bullish than a regular Bullish Harami	Bullish
Bearish Harami Cross	Uptrend	The first day is a white candlestick. The second day is a doji which is completely engulfed by the prior day's white body. It is typically more bearish than a regular Bearish Harami	Bearish
Homing Pigeon	Downtrend	The first day is a long black candle. The second day's black candle is completely engulfed by the first day's black body	Bullish
Descending Hawk	Uptrend	The first day is a long white candle. The second day's white candle is completely engulfed by the first day's white body	Bearish
Piercing Line	Downtrend	The first day is a black candlestick. The second day is a white candlestick which opens with a gap down below the prior candlestick's low. It then closes above the midpoint of the prior day's black body but still within the prior day's real body	Bullish
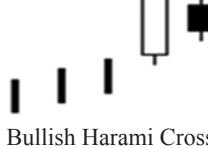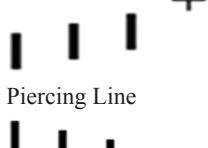
Dark Cloud Cover	Uptrend	The first day is a white candlestick. The second day is a black candlestick which opens above the prior candlestick's high. It then closes below the midpoint of the prior day's white body but still within the prior day's real body	Bearish
Bullish Meeting Lines	Downtrend	The first day is a long black candlestick. The second day is a long white candlestick with the same close as the previous day's candlestick	Bullish
Bearish Meeting Lines	Uptrend	The first day is a long white candlestick. The second day is a long black candlestick with the same close as the previous day's candlestick	Bearish
Three Inside Up	Downtrend	Bullish Harami pattern is followed by a white candlestick on the third day which closes at a higher price for the 3 days	Bullish
Three Inside Down	Uptrend	Bearish Harami pattern is followed by a black candlestick on the third day which closes at a lower price for the 3 days	Bearish
Three Outside Up	Downtrend	Bullish Engulfing pattern is followed by a white candlestick on the third day which closes at a higher price for the 3 days	Bullish
Three Outside Down	Uptrend	Bearish Engulfing pattern is followed by a black candlestick on the third day which closes at a lower price for the 3 days	Bearish
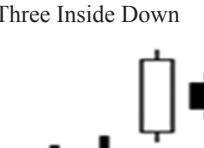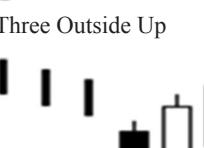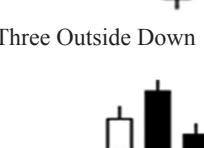
at the end of the closing price after holding for a specific holding period. The profitability of candlestick patterns is measured from 1-day until 15-day holding period to determine the effective holding period. The null hypothesis of:

H0: $\mu = 0$ is tested with skewness adjusted t-test computed as follows:

$$t_{sa} = \sqrt{n}\left(s + \frac{1}{3}\gamma s^2 + \frac{1}{6n}\gamma\right)$$

(5)

Where, s = standard mean of returns and γ = estimated skewness of returns.

As stated under Bursa Malaysia, the client is liable to pay for the brokerage fees, stamp duty, and clearing fees apart from the initial cost of buying and selling shares in the securities market. Therefore, this study assumed a transaction cost of 1%. Bearish patterns typically show negative returns rate while bullish patterns display positive returns rate with the application of candlestick charting method. Besides, a prevailing uptrend and downtrend is required to confirm the predictive power of bearish and bullish reversal patterns respectively.

4. EMPIRICAL RESULTS

4.1. Summary Statistics

Table 1 presents the summary statistics between the open, high, low, and close series for 420 stocks within the sample period of 3 January 2000 to 30 December 2011 before dividing the stocks according to trading volume. N represents the total number of daily returns which are measured as the natural logarithm difference. A total of 1,278,921 daily returns are obtained within the 12 years sample period. The close series have the highest average returns of 0.0323% but the highest standard deviation is shown from the open series at 7.32%. The open, high, and close series are right-skewed while only the low series indicate a negative skewness of approximately −0.24. The kurtosis results show that all four series are highly peaked and leptokurtic. Statistical significance results for both skewness and kurtosis imply that the stock returns are not normally distributed.

4.2. Crisis Impact

Generally, the average returns for reversal patterns during crisis period are noted to be significantly lower as compared to non-crisis period which thus denoting the deteriorating impact of crisis on stock returns. Prior to trend identification, Table 2 shows that the average returns for Bearish Engulfing, Bearish Harami, and Three Inside Down patterns are recorded at −1.77%, −1.20%, and −1.69% respectively during non-crisis period but then reduce to −2.17%, −1.46%, and −1.89%

correspondingly at crisis period. After a prevailing uptrend, Table 3 shows that the average returns for Descending Hawk during crisis period has dropped to −4.06% comparing to a −3.12% returns rate before trend while the average returns for Three Inside Down has also reduced to −2.41% after trend which thus implying stronger selling signals on 10-day holding period after a correct trend.

4.3. In-sample Results

The results from Tables 3 and 4 show that Dark Cloud Cover, Bearish Engulfing, Bearish Harami, Bearish Harami cross, Bullish Harami cross, Homing Pigeon, Three Inside Down, Three Inside Up, and Three Outside Down patterns have revealed significant returns rate both before and after trend. Prior to trend, the magnitude of returns rate for Dark Cloud Cover and bearish Harami cross patterns are greater than other reversal patterns which thus implying stronger bearish signals. Negative returns rate as high as −5.94% on 11th holding period and −3.79% on 13 holding days are recorded respectively. However, Bullish Meeting Lines only reveal significant returns rate of 1.10% for the first holding day prior to trend identification.

Meanwhile, Descending Hawk only shows negative returns rate after a prevailing uptrend while positive returns rate is only recorded by Bullish Harami after a prevailing downtrend on the 12 and 13 holding days. The magnitude of returns rate is generally larger after a prevailing trend. Follow by a prevailing uptrend, Dark Cloud Cover has revealed stronger bearish signals than other bearish reversal patterns with a −8.97% returns on the 15-day holding period. For a 10-day holding period, the strength of bearishness signified by Bearish Harami cross is typically greater than Bearish Engulfing with a −4.75% and −3.57% returns rate noted respectively. After a prevailing downtrend, both Bullish Harami cross and Homing Pigeon patterns have resulted with largest returns rate on the 15-day holding period at 3.77% and 2.26% respectively while Three Outside Up reveals bullish signals more significantly on the 7-day holding period at 1.32% returns rate.

Table 1: Summary statistics

Statistics	Open	High	Low	Close
N	1278921	1278921	1278921	1278921
Mean	3.12×10^{-4}	3.22×10^{-4}	3.12×10^{-4}	3.23×10^{-4}
Standard deviation	0.0732	0.0702	0.0527	0.0551
Skewness	0.0945***	0.5096***	−0.2407***	0.6533***
Kurtosis	171.1478***	191.1190***	440.8630***	324.2433***

***Indicates statistical significance at 1% level

Table 2: Crisis effect on average returns of reversal patterns before and after trend

Reversal patterns	10-day returns (%)			
	Before trend		After trend	
	Crisis	Non-crisis	Crisis	Non-crisis
Dark Cloud Cover	3.15 (0.02)**	−3.05 (0.00)***	2.30 (0.21)	−3.64 (0.00)***
Piercing	−0.84 (0.24)	−0.15 (0.67)	−0.89 (0.37)	−0.21 (0.65)
Descending Hawk	−3.12 (0.00)***	−0.54 (0.27)	−4.06 (0.00)***	−1.63 (0.02)**
Homing Pigeon	−1.84 (0.07)*	−1.35 (0.00)***	−2.05 (0.11)	−1.29 (0.00)***
Engulfing−	−2.17 (0.00)***	−1.77 (0.00)***	−0.75 (0.20)	−2.41 (0.00)***
Engulfing+	−2.71 (0.00)***	−0.21 (0.07)*	−2.81 (0.00)***	−0.18 (0.30)
Harami−	−1.46 (0.00)***	−1.20 (0.00)***	−1.09 (0.15)	−1.89 (0.00)***
Harami+	0.18 (0.85)	−0.61 (0.00)***	−2.47 (0.02)**	−0.40 (0.05)**
Harami cross−	0.98 (0.45)	−1.20 (0.05)**	0.63 (0.74)	−1.23 (0.23)
Harami cross+	−2.80 (0.00)***	−0.48 (0.30)	−2.29 (0.02)**	−0.22 (0.71)
Meeting lines−	0.88 (0.43)	−0.69 (0.34)	0.61 (0.70)	−1.03 (0.20)
Meeting lines+	−2.47 (0.46)	0.11 (0.81)	−1.08 (0.81)	−0.47 (0.49)
Three Inside Down	−1.89 (0.00)***	−1.69 (0.00)***	−2.41 (0.00)***	−2.25 (0.00)***
Three Inside Up	−0.38 (0.51)	0.25 (0.38)	−0.19 (0.83)	0.35 (0.34)
Three Outside Down	−1.27 (0.09)*	−2.21 (0.00)***	−1.20 (0.18)	−2.62 (0.00)***
Three Outside Up	−2.23 (0.49)	0.39 (0.10)	−4.93 (0.02)**	0.44 (0.20)

The values in parentheses represent P values of skewness adjusted t-test. *Indicates statistical significance at 10% level, **at 5% level and ***at 1% level

Table 3: Average returns of reversal patterns before trend for in-sample (2000–2007)

Reversal patterns	No.	Returns (%)														
		1 day	2 day	3 day	4 day	5 day	6 day	7 day	8 day	9 day	10 day	11 day	12 day	13 day	14 day	15 day
Dark Cloud Cover	76	−0.50 (0.23)	−2.23 (0.00)***	−1.88 (0.01)***	−2.34 (0.02)**	−2.00 (0.04)**	−1.99 (0.04)**	−1.60 (0.16)	−1.49 (0.17)	−4.28 (0.05)**	−5.21 (0.02)**	−5.53 (0.01)***	−5.94 (0.01)***	−4.89 (0.04)**	−4.80 (0.04)**	−5.14 (0.03)**
Descending Hawk	48	0.07 (0.96)	−0.50 (0.49)	−1.07 (0.25)	−1.28 (0.24)	−1.26 (0.26)	−0.40 (0.75)	−0.24 (0.84)	0.55 (0.80)	0.66 (0.76)	0.72 (0.74)	0.62 (0.78)	−0.65 (0.71)	−1.01 (0.58)	−1.48 (0.41)	−1.83 (0.30)
Engulfing−	905	−0.08 (0.53)	−0.24 (0.20)	−0.59 (0.25)	−1.33 (0.33)	−1.36 (0.36)	−1.21 (0.21)	−1.47 (0.27)	−1.45 (0.22)	−1.42 (0.18)	−1.73 (0.12)	−1.81 (0.14)	−2.20 (0.10)*	−2.18 (0.11)	−2.33 (0.08)*	−2.08 (0.04)
Engulfing+	1264	0.05 (0.63)	−0.05 (0.20)	0.22 (0.01)***	−0.15 (0.00)***	−0.01 (0.00)***	−0.20 (0.00)***	−0.21 (0.00)***	−0.12 (0.00)***	−0.15 (0.00)***	0.04 (0.00)***	0.10 (0.00)***	−0.06 (0.00)***	−0.14 (0.00)***	−0.36 (0.00)***	−0.20 (0.00)***
Harami−	597	−0.13 (0.30)	0.10 (0.75)	−0.17 (0.35)	−0.65 (0.46)	−0.81 (0.95)	−0.93 (0.41)	−1.06 (0.39)	−1.15 (0.65)	−1.55 (0.59)	−1.58 (0.91)	−1.82 (0.75)	−2.29 (0.84)	−2.25 (0.67)	−2.28 (0.29)	−2.17 (0.57)
Harami+	1063	−0.30 (0.00)***	−0.42 (0.00)***	−0.21 (0.52)	−0.50 (0.05)**	−0.47 (0.04)**	−0.60 (0.03)**	−0.76 (0.02)**	−0.53 (0.02)**	−0.82 (0.00)***	−0.37 (0.00)***	−0.14 (0.00)***	0.06 (0.00)***	0.25 (0.00)***	0.19 (0.00)***	0.04 (0.00)***
Harami Cross−	46	−0.21 (0.54)	−0.75 (0.19)	0.57 (0.08)*	0.93 (0.03)**	1.24 (0.02)**	1.42 (0.03)**	1.25 (0.02)**	2.44 (0.01)***	1.69 (0.01)***	1.56 (0.01)***	2.08 (0.02)**	1.88 (0.02)**	2.14 (0.02)**	2.31 (0.03)**	2.41 (0.04)**
Harami Cross+	142	−0.18 (0.56)	−0.24 (0.61)	−0.81 (0.26)	−0.70 (0.10)*	0.11 (0.11)	−0.10 (0.12)	−0.24 (0.27)	−0.39 (0.24)	−0.37 (0.24)	−0.46 (0.35)	−0.08 (0.40)	0.71 (0.07)*	1.61 (0.04)**	1.76 (0.08)*	2.64 (0.02)**
Homing Pigeon	137	−0.12 (0.73)	−0.77 (0.14)	2.15 (0.13)	2.30 (0.29)	4.90 (0.86)	5.54 (0.89)	4.00 (0.73)	4.65 (0.58)	4.87 (0.64)	3.89 (0.57)	3.61 (0.93)	3.79 (0.49)	3.93 (0.10)*	2.93 (0.08)*	2.75 (0.01)***
Meeting Lines−	15	0.82 (0.46)	2.16 (0.23)	0.88 (0.30)	0.59 (0.38)	0.59 (0.15)	0.50 (0.57)	0.79 (0.53)	0.56 (0.67)	0.82 (0.64)	1.21 (0.56)	2.39 (0.40)	1.94 (0.49)	1.37 (0.61)	1.58 (0.61)	1.20 (0.68)
Meeting Lines+	28	1.10 (0.03)**	0.47 (0.51)	−0.03 (0.19)	−0.69 (0.46)	−0.17 (0.44)	0.09 (0.57)	−0.14 (0.85)	−0.29 (0.70)	−1.10 (0.23)	−0.52 (0.58)	−0.02 (0.98)	−0.75 (0.47)	−0.60 (0.58)	−0.96 (0.41)	−1.08 (0.36)
Piercing	111	−0.14 (0.73)	0.02 (0.96)	−0.18 (0.96)	−0.34 (0.20)	−0.15 (0.80)	−0.85 (0.89)	−0.85 (0.19)	−0.92 (0.43)	−1.17 (0.22)	−1.57 (0.17)	−1.93 (0.20)	−1.80 (0.11)	−1.38 (0.03)**	−1.52 (0.05)**	−1.37 (0.09)*
Three Inside Down	297	0.07 (0.73)	−0.15 (0.62)	−0.26 (0.42)	−0.07 (0.85)	0.14 (0.72)	0.21 (0.64)	0.19 (0.73)	0.39 (0.58)	0.63 (0.64)	0.84 (0.24)	0.81 (0.68)	1.05 (0.49)	0.62 (0.61)	0.60 (0.40)	0.65 (0.38)
Three Inside Up	336	−0.20 (0.35)	−0.05 (0.85)	−1.31 (0.30)	−1.14 (0.46)	−1.11 (0.26)	−0.78 (0.11)	−0.50 (0.27)	−0.50 (0.34)	−0.79 (0.18)	−0.97 (0.12)	−1.39 (0.02)**	−1.31 (0.05)**	−1.54 (0.03)**	−1.37 (0.05)**	−1.17 (0.12)
Three Outside Down	404	−0.24 (0.23)	−0.36 (0.22)	−1.31 (0.08)*	−1.14 (0.03)**	−1.11 (0.02)**	−0.85 (0.03)**	−0.50 (0.02)**	−0.50 (0.06)*	−0.79 (0.01)***	−0.97 (0.00)***	−1.39 (0.00)***	−1.31 (0.00)***	−1.54 (0.00)***	−1.37 (0.00)***	−1.17 (0.01)***
Three Outside Up	360	0.38 (0.06)*	1.03 (0.00)***	0.51 (0.08)*	0.73 (0.03)**	0.45 (0.22)	0.53 (0.16)	0.87 (0.03)**	0.70 (0.09)*	1.05 (0.02)**	1.26 (0.01)***	1.27 (0.01)***	1.14 (0.02)**	0.74 (0.14)	0.88 (0.10)	0.55 (0.32)

The P values of skewness adjusted t-test are provided in parentheses. *Indicates statistical significance at 10% level, ** at 5% level, and *** at 1% level

Table 4: Average returns of reversal patterns after trend for in-sample (2000-2007)

Reversal patterns	No.	Returns (%)														
		1 day	2 day	3 day	4 day	5 day	6 day	7 day	8 day	9 day	10 day	11 day	12 day	13 day	14 day	15 day
Uptrend																
Dark Cloud Cover	32	−1.32 (0.06)*	−2.69 (0.02)**	−2.50 (0.08)*	−2.60 (0.09)*	−1.97 (0.19)	−0.67 (0.64)	−0.34 (0.84)	−0.15 (0.93)	−7.51 (0.15)	−8.06 (0.12)	−8.46 (0.11)	−8.84 (0.11)	−7.62 (0.16)	−7.95 (0.13)	−8.97 (0.10)*
Descending Hawk	27	0.18	−1.15	−2.36	−2.46	−2.89	−2.47	−1.91	−1.68	−2.24	−2.26	−3.18	−4.35	−4.96	−5.00	−5.39
Engulfing−	455	−0.01 (0.98)	−0.46 (0.32)	−0.92 (0.11)	−2.20 (0.16)	−2.49 (0.04)**	−2.22 (0.09)*	−3.03 (0.28)	−2.94 (0.45)	−2.94 (0.35)	−3.57 (0.32)	−3.76 (0.13)	−3.95 (0.03)**	−3.69 (0.02)**	−3.83 (0.02)**	−3.59 (0.01)***
Harami−	277	−0.36 (0.07)*	0.08 (0.10)*	−0.22 (0.01)***	−0.92 (0.00)***	−1.42 (0.00)***	−1.59 (0.00)***	−1.81 (0.00)***	−1.81 (0.00)***	−1.97 (0.00)***	−1.94 (0.00)***	−2.18 (0.00)***	−2.50 (0.00)***	−2.52 (0.00)***	−2.56 (0.00)***	−2.54 (0.00)***
Harami Cross−	24	−0.37 (0.35)	−0.12 (0.80)	−0.02 (0.60)	−3.60 (0.15)	−3.79 (0.14)	−4.10 (0.12)	−3.66 (0.12)	−4.30 (0.07)*	−4.44 (0.07)*	−4.75 (0.06)*	−4.75 (0.07)*	−5.00 (0.05)**	−4.48 (0.10)	−3.78 (0.16)	−3.40 (0.25)
Meeting Lines−	8	0.65	0.80	0.97	−0.03	−0.26	−0.53	−3.41	−2.71	−2.13	−3.23	−3.71	−3.63	−2.55	−4.71	−3.31
Three Inside Down	139	0.14 (0.58)	−0.33 (0.57)	−0.15 (0.57)	−1.14 (0.95)	−0.76 (0.88)	−2.38 (0.85)	−2.20 (0.22)	−2.35 (0.42)	−2.47 (0.62)	−2.83 (0.48)	−3.27 (0.55)	−3.39 (0.53)	−2.85 (0.61)	−3.13 (0.47)	−2.95 (0.62)
Three Outside Down	218	−0.35 (0.28)	−0.85 (0.06)*	−2.42 (0.00)***	−2.28 (0.00)***	−1.99 (0.00)***	−1.97 (0.01)***	−1.51 (0.04)**	−1.61 (0.02)**	−2.37 (0.00)***	−2.68 (0.00)***	−3.10 (0.00)***	−2.67 (0.01)***	−2.69 (0.00)***	−2.53 (0.01)***	−2.24 (0.03)**
Downtrend																
Engulfing+	630	−0.01 (0.95)	0.13 (0.46)	0.41 (0.06)*	−0.01 (0.98)	0.16 (0.57)	0.00 (0.10)	−0.06 (0.86)	0.12 (0.72)	0.10 (0.77)	0.43 (0.24)	0.49 (0.21)	0.36 (0.36)	0.38 (0.36)	−0.03 (0.94)	0.26 (0.57)
Harami+	577	−0.16	−0.07	0.15	−0.24	−0.25	−0.29	−0.37	−0.06	−0.27	0.34	0.72	1.00	1.14	0.94	0.74
Harami Cross+	69	−0.58 (0.26)	−1.06 (0.72)	−0.15 (0.62)	0.62 (0.42)	0.75 (0.44)	1.20 (0.45)	1.06 (0.38)	2.23 (0.89)	1.51 (0.56)	1.39 (0.47)	2.40 (0.13)	2.28 (0.04)**	3.00 (0.02)**	3.26 (0.07)*	3.77 (0.16)
Homing Pigeon	70	−0.26	−1.33	−1.78	−2.18	−0.40	−0.43	−0.31	−0.07	0.07	0.06	0.48	0.54	1.26	1.47	2.26
Meeting Lines+	17	0.67 (0.52)	0.55 (0.60)	1.01 (0.15)	1.16 (0.13)	0.95 (0.66)	0.58 (0.69)	0.73 (0.76)	0.91 (0.93)	−0.33 (0.96)	0.12 (0.96)	−0.14 (0.74)	0.46 (0.69)	0.62 (0.32)	−0.14 (0.26)	0.02 (0.09)*
Piercing	67	0.08 (0.22)	0.72 (0.60)	0.56 (0.15)	−0.08 (0.13)	0.53 (0.31)	1.21 (0.63)	0.97 (0.68)	0.51 (0.64)	−0.33 (0.89)	−0.37 (0.95)	0.91 (0.96)	−0.15 (0.86)	0.44 (0.84)	0.09 (0.96)	−0.30 (0.98)
Three Inside Up	201	−0.09 (0.89)	−0.06 (0.86)	−0.27 (0.43)	−0.13 (0.91)	0.17 (0.55)	0.36 (0.20)	0.61 (0.33)	0.77 (0.65)	0.78 (0.77)	0.95 (0.75)	0.92 (0.53)	1.27 (0.90)	0.78 (0.78)	0.71 (0.97)	0.84 (0.84)
Three Outside Up	192	0.48* (0.06)*	1.17 (0.00)***	0.63 (0.09)*	0.82 (0.07)*	0.92 (0.07)*	0.84 (0.11)	1.32 (0.02)**	0.98 (0.09)*	1.24 (0.03)**	1.16 (0.04)**	1.07 (0.08)*	0.98 (0.12)	0.48 (0.47)	0.66 (0.34)	0.15 (0.83)

The P values of skewness adjusted t-test are provided in parentheses. *Indicates statistical significance at 10% level **, at 5% level, and *** at 1% level

Table 5: Average returns of reversal patterns before trend for out-of-sample test (2012-2014)

Reversal patterns	No.	Returns (%)														
		1 day	2 day	3 day	4 day	5 day	6 day	7 day	8 day	9 day	10 day	11 day	12 day	13 day	14 day	15 day
Dark Cloud Cover	28	−1.13 (0.03)**	−0.47 (0.54)	−0.60 (0.56)	−0.23 (0.85)	0.67 (0.64)	−0.77 (0.60)	−0.50 (0.79)	0.52 (0.79)	0.22 (0.90)	1.18 (0.62)	1.10 (0.63)	1.42 (0.58)	0.67 (0.78)	0.11 (0.94)	0.68 (0.76)
Descending Hawk	24	0.41 (0.17)	0.56 (0.24)	1.09 (0.04)**	0.92 (0.12)	0.63 (0.22)	0.95 (0.19)	2.11 (0.53)	1.88 (0.14)	1.98 (0.08)*	1.93 (0.09)*	1.79 (0.24)	1.79 (0.25)	1.91 (0.25)	2.25 (0.23)	3.09 (0.76)
Engulfing−	390	−0.01 (0.96)	−0.12 (0.77)	−0.21 (0.58)	3.32 (0.20)	−0.36 (0.48)	−0.42 (0.45)	0.59 (0.02)**	−0.67 (0.26)	−0.71 (0.22)	−0.67 (0.27)	−0.69 (0.27)	−0.72 (0.26)	−0.67 (0.31)	2.72 (0.27)	−0.65 (0.34)
Engulfing+	519	−0.06 (0.77)	−0.41 (0.08)*	1.73 (0.26)	−0.57 (0.06)*	−0.83 (0.01)***	4.78 (0.09)*	−0.76 (0.51)	−0.77 (0.03)**	−0.63 (0.11)	−0.77 (0.07)*	−0.67 (0.02)**	0.26 (0.69)	−0.45 (0.35)	−0.39 (0.27)	−0.53 (0.32)
Harami−	348	0.08 (0.68)	0.29 (0.24)	3.22 (0.18)	−0.12 (0.77)	−0.42 (0.38)	−0.36 (0.49)	−0.68 (0.02)**	−0.44 (0.44)	−0.57 (0.35)	−0.41 (0.06)*	−0.69 (0.14)	−0.73 (0.69)	−0.94 (0.35)	−0.85 (0.43)	2.56 (0.32)
Harami+	464	−0.22 (0.09)*	−0.46 (0.07)*	−0.62 (0.02)**	−0.48 (0.09)*	−0.52 (0.10)*	−0.40 (0.25)	0.28 (0.21)	−0.65 (0.11)	4.96 (0.09)*	−0.56 (0.53)	−0.64 (0.17)	0.66 (0.42)	−0.71 (0.16)	−0.54 (0.32)	−0.62 (0.27)
Harami Cross−	22	−0.30 (0.51)	−0.24 (0.78)	−0.44 (0.63)	−1.42 (0.20)	−0.66 (0.65)	−0.32 (0.83)	−1.60 (0.68)	−1.24 (0.45)	−2.08 (0.18)	−1.55 (0.20)	−1.59 (0.32)	−2.49 (0.16)	−3.35 (0.16)	−3.48 (0.08)*	−3.29 (0.17)
Harami Cross+	65	0.00 (0.98)	−1.00 (0.03)**	−2.00 (0.00)***	−2.72 (0.00)***	−3.23 (0.00)***	−3.36 (0.00)***	−3.38 (0.28)	−3.64 (0.02)**	−4.78 (0.45)	−4.44 (0.27)	−4.03 (0.32)	−4.02 (0.02)**	−4.43 (0.10)*	−3.72 (0.08)*	−4.24 (0.05)**
Homing Pigeon	52	−0.34 (0.34)	−1.16 (0.02)**	−1.01 (0.00)***	−0.60 (0.00)***	−1.03 (0.00)***	−0.30 (0.00)***	−0.57 (0.02)**	−0.67 (0.01)***	0.00 (0.00)***	0.80 (0.00)***	0.85 (0.00)***	1.18 (0.00)***	0.94 (0.00)***	1.25 (0.00)***	1.85 (0.00)***
Meeting Lines−	15	−0.47 (0.56)	−1.60 (0.02)**	−2.99 (0.00)***	−3.15 (0.00)***	−1.79 (0.19)	−1.73 (0.72)	−1.48 (0.53)	−1.85 (0.48)	−1.99 (0.99)	−3.64 (0.33)	−7.93 (0.34)	−6.34 (0.21)	−8.27 (0.34)	−8.67 (0.23)	−9.23 (0.10)*
Meeting Lines+	22	1.38 (0.02)**	2.00 (0.02)**	2.23 (0.04)**	2.95 (0.02)**	2.57 (0.03)**	3.09 (0.01)***	2.73 (0.43)	3.07 (0.02)**	3.89 (0.23)	3.05 (0.07)*	4.31 (0.02)**	4.59 (0.06)*	4.88 (0.02)**	4.42 (0.02)**	4.79 (0.02)**
Piercing	42	−0.07 (0.88)	−0.18 (0.72)	30.39 (0.14)	0.23 (0.02)**	0.72 (0.03)**	1.13 (0.21)	11.27 (0.04)**	1.43 (0.13)	2.12 (0.05)**	2.24 (0.04)**	2.99 (0.02)**	2.17 (0.04)**	2.01 (0.01)***	0.98 (0.05)**	1.03 (0.05)**
Three Inside Down	145	−0.15 (0.56)	−0.70 (0.03)**	−0.50 (0.24)	−0.78 (0.79)	−1.12 (0.36)	−1.52 (0.53)	−1.42 (0.07)*	−1.06 (0.50)	−1.17 (0.07)*	−1.55 (0.03)**	−1.41 (0.06)*	−1.42 (0.06)*	7.76 (0.11)	−1.86 (0.56)	−2.29 (0.53)
Three Inside Up	129	−0.16 (0.76)	−0.21 (0.62)	0.03 (0.93)	0.19 (0.68)	0.39 (0.48)	−0.43 (0.19)	−0.42 (0.58)	−0.31 (0.68)	−0.42 (0.57)	−0.45 (0.60)	−0.71 (0.42)	−0.94 (0.36)	−0.85 (0.43)	−0.79 (0.47)	−0.63 (0.57)
Three Outside Down	160	−0.10 (0.74)	−0.21 (0.65)	8.01 (0.20)	−1.32 (0.05)**	−1.74 (0.04)**	−1.22 (0.02)**	−1.03 (0.28)	−0.63 (0.54)	−1.08 (0.31)	−1.25 (0.25)	−1.53 (0.17)	−1.46 (0.21)	6.78 (0.25)	−2.33 (0.47)	−2.40 (0.51)
Three Outside Up	123	−0.52 (0.05)**	−0.93 (0.00)***	−0.69 (0.13)	−1.12 (0.02)**	22.03 (0.06)*	−1.33 (0.02)**	−0.82 (0.20)	−0.42 (0.54)	−0.57 (0.40)	−0.40 (0.59)	2.87 (0.22)	−0.32 (0.69)	−0.38 (0.65)	−0.68 (0.43)	−0.57 (0.51)

The P values of skewness adjusted t-test are provided in parentheses. *Indicates statistical significance at 10% level, ** at 5% level, and *** at 1% level

Table 6: Average returns of reversal patterns after trend for out-of-sample test (2012-2014)

Reversal patterns	No.	Returns (%)														
		1 day	2 day	3 day	4 day	5 day	6 day	7 day	8 day	9 day	10 day	11 day	12 day	13 day	14 day	15 day
Uptrend																
Dark Cloud Cover	13	−2.31 (0.01)***	−1.98 (0.09)*	−1.76 (0.30)	−1.51 (0.51)	−1.16 (0.59)	−2.65 (0.29)	−2.57 (0.37)	−0.34 (0.92)	0.63 (0.86)	1.27 (0.77)	2.37 (0.59)	2.28 (0.65)	1.63 (0.74)	0.56 (0.89)	1.11 (0.80)
Descending Hawk	12	0.59	0.55	1.55	1.19	0.76	1.22	2.26	2.45	2.57	2.42	2.69	2.56	2.18	2.32	3.99
Engulfing−	173	0.44 (0.28)	0.17 (0.52)	−0.18 (0.08)*	7.97 (0.24)	0.20 (0.36)	−0.02 (0.97)	0.06 (0.96)	−0.42 (0.67)	−0.28 (0.76)	−0.17 (0.86)	−0.08 (0.94)	−0.09 (0.93)	0.41 (0.69)	8.05 (0.14)	0.19 (0.86)
Harami−	162	−0.09 (0.31)	0.45 (0.73)	0.20 (0.81)	0.66 (0.17)	0.36 (0.79)	0.38 (0.97)	0.03 (0.96)	0.32 (0.67)	0.73 (0.41)	0.78 (0.42)	0.14 (0.90)	0.14 (0.90)	−0.02 (0.98)	0.17 (0.88)	7.20 (0.16)
Harami Cross−	9	−0.07 (0.79)	0.21 (0.23)	0.36 (0.67)	−0.45 (0.24)	−0.61 (0.61)	−0.09 (0.61)	−0.15 (0.95)	−0.64 (0.70)	−2.75 (0.04)**	−0.97 (0.66)	−0.60 (0.82)	−0.35 (0.89)	−1.12 (0.72)	−1.68 (0.62)	−0.59 (0.88)
Meeting Lines−	6	−1.54 (0.97)	−2.05 (0.80)	−3.46 (0.78)	−5.20 (0.81)	−3.80 (0.73)	−2.75 (0.98)	−2.75 (0.95)	−3.26 (0.61)	−2.88 (0.38)	−4.74 (0.66)	−4.72 (0.82)	−3.04 (0.89)	−3.40 (0.72)	−2.80 (0.62)	−3.30 (0.88)
Three Inside Down	75	0.04 (0.07)*	−0.10 (0.11)	−0.09 (0.00)***	−0.21 (0.02)**	−0.37 (0.06)*	−0.81 (0.12)	−0.47 (0.27)	0.34 (0.29)	−0.10 (0.38)	−0.50 (0.20)	−0.29 (0.14)	−0.24 (0.32)	−0.22 (0.34)	−0.54 (0.41)	−0.94 (1.00)
Three Outside Down	67	−0.21 (0.93)	−0.21 (0.77)	20.16 (0.18)	−1.37 (0.72)	−1.31 (0.37)	−0.69 (0.64)	−0.78 (0.62)	0.28 (0.83)	0.04 (0.98)	−0.11 (0.96)	−0.94 (0.62)	−0.38 (0.85)	20.12 (0.15)	−1.51 (0.48)	−1.44 (0.53)
Downtrend																
Engulfing+	260	−0.30 (0.24)	−0.44 (0.37)	−0.59 (0.05)**	−0.53 (0.24)	−0.76 (0.10)*	−0.67 (0.17)	−0.62 (0.23)	−0.22 (0.69)	0.15 (0.83)	−0.13 (0.83)	−0.01 (0.98)	−0.04 (0.96)	0.07 (0.93)	0.21 (0.80)	0.18 (0.83)
Harami+	245	−0.17 (0.34)	−0.35 (0.17)	−0.65 (0.09)*	−0.36 (0.38)	−0.40 (0.40)	−0.15 (0.17)	−0.42 (0.42)	−0.37 (0.69)	4.77 (0.83)	−0.19 (0.83)	−0.52 (0.98)	−0.25 (0.96)	−0.44 (0.93)	−0.29 (0.80)	−0.40 (0.83)
Harami Cross+	37	0.31 (0.54)	−0.84 (0.37)	−1.48 (0.06)*	−1.68 (0.05)**	−2.18 (0.01)***	−1.70 (0.03)**	−2.13 (0.04)**	−2.11 (0.03)**	−1.01 (0.26)	−0.22 (0.11)	−0.38 (0.04)**	−0.20 (0.06)*	−0.13 (0.06)*	−0.09 (0.09)*	0.36 (0.06)*
Homing Pigeon	26	−0.38 (0.42)	−1.11 (0.10)	−1.31 (0.15)	−1.08 (0.24)	−2.27 (0.05)**	−0.90 (0.08)*	−2.13 (0.37)	−2.11 (0.24)	−1.01 (0.25)	−0.22 (0.80)	−0.38 (0.72)	−0.20 (0.86)	−0.13 (0.95)	−0.09 (0.99)	0.36 (0.77)
Meeting Lines+	10	1.06 (0.10)*	1.57 (0.06)*	2.40 (0.18)	3.62 (0.00)***	2.71 (0.05)**	2.93 (0.08)*	1.71 (0.04)**	1.79 (0.03)**	2.77 (0.25)	2.87 (0.80)	3.26 (0.72)	3.21 (0.86)	4.00 (0.95)	2.92 (0.99)	3.61 (0.77)
Piercing	21	−0.20 (0.78)	−0.21 (0.31)	60.28 (0.16)	0.10 (0.98)	0.65 (0.56)	1.75 (0.07)*	21.28 (0.11)	2.56 (0.27)	3.03 (0.14)	2.93 (0.11)	3.07 (0.24)	2.71 (0.29)	2.98 (0.11)	1.65 (0.39)	2.48 (0.21)
Three Inside Up	62	−0.17 (0.93)	−0.46 (0.67)	0.00 (0.97)	−0.11 (0.90)	0.19 (0.80)	−0.90 (0.42)	−0.95 (0.49)	−0.54 (0.68)	−0.67 (0.56)	−1.08 (0.00)***	−1.19 (0.00)***	−1.18 (0.03)**	−1.10 (0.08)*	−0.98 (0.61)	−1.00 (0.57)
Three Outside Up	65	−0.43 (0.27)	−0.64 (0.51)	0.05 (0.89)	−0.71 (0.33)	−0.56 (0.48)	−0.78 (0.35)	0.05 (0.95)	0.77 (0.40)	0.74 (0.39)	0.56 (0.53)	0.86 (0.39)	0.94 (0.37)	0.82 (0.48)	0.41 (0.74)	0.38 (0.76)

The P values of skewness adjusted t-test are provided in parentheses. *Indicates statistical significance at 10% level, ** at 5% level, and *** at 1% level

Table 7: Effective holding period for bearish reversal patterns

Bearish reversal patterns	Before trend				After uptrend			
	In-sample (2000-2007)		Out-of-sample (2012-2014)		In-sample (2000-2007)		Out-of-sample (2012-2014)	
Dark Cloud Cover	2 day	−2.23 (0.00)***	1 day	−1.13 (0.03)**	1 day	−1.32 (0.06)*	1 day	−2.31 (0.00)***
	3 day	−1.88 (0.01)***			2 day	−2.69 (0.02)**	2 day	−1.98 (0.10)*
	4 day	−2.34 (0.02)**			3 day	−2.50 (0.08)*		
	5 day	−2.00 (0.04)**			4 day	−2.60 (0.09)*		
	6 day	−1.99 (0.04)**			15 day	−8.97 (0.10)*		
	9 day	−4.28 (0.05)**						
	10 day	−5.21 (0.02)**						
	11 day	−5.53 (0.01)***						
	12 day	−5.94 (0.01)***						
	13 day	−4.89 (0.04)**						
	14 day	−4.80 (0.04)**						
	15 day	−5.14 (0.03)**						
Descending Hawk					5 day	−2.89 (0.04)**		
					6 day	−2.47 (0.09)*		
					12 day	−4.35 (0.03)**		
					13 day	−4.96 (0.01)**		
					14 day	−5.00 (0.01)**		
					15 day	−5.39 (0.01)***		
Engulfing−	4 day	−1.33 (0.00)***			4 day	−2.20 (0.00)***		
	5 day	−1.36 (0.00)***			5 day	−2.49 (0.00)***		
	6 day	−1.21 (0.00)***			6 day	−2.22 (0.00)***		
	7 day	−1.47 (0.00)***			7 day	−3.03 (0.00)***		
	8 day	−1.45 (0.00)***			8 day	−2.94 (0.00)***		
	9 day	−1.42 (0.00)***			9 day	−2.94 (0.00)***		
	10 day	−1.73 (0.00)***			10 day	−3.57 (0.00)***		
	11 day	−1.81 (0.00)***			11 day	−3.76 (0.00)***		
	12 day	−2.20 (0.00)***			12 day	−3.95 (0.00)***		
	13 day	−2.18 (0.00)***			13 day	−3.69 (0.00)***		
	14 day	−2.33 (0.00)***			14 day	−3.83 (0.00)***		
	15 day	−2.08 (0.00)***			15 day	−3.59 (0.00)***		
Harami−	7 day	−1.06 (0.02)**			5 day	−1.42 (0.03)**		
	8 day	−1.15 (0.02)**			6 day	−1.59 (0.03)**		
	9 day	−1.55 (0.00)***			7 day	−1.81 (0.02)**		
	10 day	−1.58 (0.00)***			8 day	−1.81 (0.03)**		
	11 day	−1.82 (0.00)***			9 day	−1.97 (0.01)**		
	12 day	−2.29 (0.00)***			10 day	−1.94 (0.01)**		
	13 day	−2.25 (0.00)***			11 day	−2.18 (0.01)***		
	14 day	−2.28 (0.00)***			12 day	−2.50 (0.00)***		
	15 day	−2.17 (0.00)***			13 day	−2.52 (0.00)***		
					14 day	−2.56 (0.00)***		
					15 day	−2.54 (0.00)***		
Harami Cross−	3 day	−1.19 (0.08)*	13 day	−3.35 (0.10)*	8 day	−4.30 (0.07)*	9 day	−2.75 (0.04)**
	4 day	−2.89 (0.03)**	14 day	−3.48 (0.10)*	9 day	−4.44 (0.07)*		
	5 day	−3.05 (0.02)**			10 day	−4.75 (0.06)*		
	6 day	−3.02 (0.03)**			11 day	−4.75 (0.07)*		
	7 day	−3.32 (0.01)**			12 day	−5.00 (0.05)**		
	8 day	−3.62 (0.01)***						
	9 day	−3.66 (0.01)***						
	10 day	−3.56 (0.01)***						
	11 day	−3.55 (0.01)**						
	12 day	−3.50 (0.01)**						
	13 day	−3.79 (0.01)**						
	14 day	−3.22 (0.03)**						
	15 day	−3.28 (0.04)**						

(Contd...)

Table 7: *(Continued)*

Bearish reversal patterns	Before trend				After uptrend			
	In-sample (2000-2007)		Out-of-sample (2012-2014)		In-sample (2000-2007)		Out-of-sample (2012-2014)	
Meeting Lines			2 day	−1.60 (0.02)**			1 day	−1.54 (0.07)*
			3 day	−2.99 (0.00)***			3 day	−3.46 (0.00)***
			4 day	−3.15 (0.04)**			4 day	−5.20 (0.02)**
			10 day	−3.64 (0.07)*			5 day	−3.80 (0.06)*
			11 day	−7.93 (0.02)**				
			12 day	−6.34 (0.06)*				
			13 day	−8.27 (0.02)**				
			14 day	−8.67 (0.02)**				
			15 day	−9.23 (0.02)**				
Three Inside Down	10 day	−1.57 (0.04)**	5 day	−1.12 (0.03)**	6 day	−2.38 (0.05)*		
	11 day	−1.93 (0.01)**	6 day	−1.52 (0.01)***	8 day	−2.35 (0.06)*		
	12 day	−1.80 (0.03)**	7 day	−1.42 (0.02)**	9 day	−2.47 (0.05)**		
	14 day	−1.52 (0.08)*	9 day	−1.17 (0.08)*	10 day	−2.83 (0.03)**		
			10 day	−1.55 (0.04)**	11 day	−3.27 (0.01)**		
			11 day	−1.41 (0.06)*	12 day	−3.39 (0.01)**		
			12 day	−1.42 (0.06)*	13 day	−2.85 (0.04)**		
			14 day	−1.86 (0.03)**	14 day	−3.13 (0.03)**		
			15 day	−2.29 (0.01)***	15 day	−2.95 (0.06)*		
Three Outside Down	3 day	−1.31 (0.00)***	4 day	−1.32 (0.04)**	3 day	−2.42 (0.00)***		
	4 day	−1.14 (0.01)***	5 day	−1.74 (0.04)**	4 day	−2.28 (0.00)***		
	5 day	−1.11 (0.02)**	14 day	−2.33 (0.06)*	5 day	−1.99 (0.00)***		
	11 day	−1.39 (0.02)**	15 day	−2.40 (0.06)*	6 day	−1.97 (0.01)***		
	12 day	−1.31 (0.05)**			7 day	−1.51 (0.04)**		
	13 day	−1.54 (0.02)**			8 day	−1.61 (0.02)**		
	14 day	−1.37 (0.05)**			9 day	−2.37 (0.00)***		
					10 day	−2.68 (0.00)***		
					11 day	−3.10 (0.00)***		
					12 day	−2.67 (0.01)***		
					13 day	−2.69 (0.00)***		
					14 day	−2.53 (0.01)***		
					15 day	−2.24 (0.03)**		

The average returns rate (%) for each candlestick are presented before the P values of skewness adjusted t-test which are provided in parentheses. *Indicates statistical significance at 10% level, ** at 5% level, and *** at 1% level

4.4. Robustness Checking

The out-of-sample test acts as a robustness checking for the effectiveness of candlestick charting. Thus, the predictive power of candlesticks is confirmed when the results for out-of-sample test are consistent with the in-sample test.

4.5. Out-of-sample Test

Table 5 and 6 show that prior to trend, bearish signal is shown by Three Inside Down and Three Outside Down patterns but not for after trend while Dark Cloud Cover, Bearish Harami cross, and Bearish Meeting Lines have indicated bearishness both before and after trend. After a prevailing uptrend, negative returns are achieved significantly for short holding period of <10 days. When comparing between different holding period, it is found that the strength of bearishness for Bearish Meeting Lines and Three Inside Down patterns before trend are comparatively stronger during the 15-day holding period at −9.23% and −2.29% respectively.

Prior to trend identification, Bullish Meeting Lines pattern is deemed to be more effective in reflecting bullish signals as significant positive returns are achieved throughout the first day until the 15th day holding period with the highest returns recorded on the 13-day holding period at 4.88%. Meanwhile, Bullish Meeting Lines only shows bullish signals for short holding period after a prevailing downtrend. Homing Pigeon and Three Outside Up only show bullishness prior to trend with the highest average returns recorded at 1.85% on 15-day holding period and at 22.03% on 5-day holding period correspondingly. The magnitude of returns rate is typically higher after trend. For Piercing pattern, the largest positive returns are obtained during the 11-day holding period both before and after trend at 2.99% and 3.07% respectively.

4.6. Comparing Bearish Reversal Patterns

Dark Cloud Cover and Bearish Harami cross are the only bearish reversal patterns which show significant bearish signals consistently both before and after trend. The effective holding period for Dark Cloud Cover focuses on the first and second holding day. Bearish Harami cross is more effective in reflecting bearish signals on 9-day holding period after a prevailing uptrend while significant negative returns are shown effectively during the 13-day and 14-day holding period before trend. Prior to trend, both Three Inside Down and Three Outside Down patterns show an effective holding period of 14-day (Table 7).

4.7. Comparing Bullish Reversal Patterns

The predictive power for bullish reversal patterns are only proven before trend identification. None of the results from the in-sample test are consistent with the out-of-sample test for bullish reversal patterns following a prevailing downtrend. Homing Pigeon, Bullish Meeting Lines, and Three Outside Up are found to be more effective in portraying bullish signals prior to trend. Homing Pigeon is more effective in revealing bullish signals on 15-day holding period while the effective holding period for Bullish Meeting Lines lie on 1-day holding period (Table 8).

5. CONCLUSION

This study examines the effectiveness of candlestick reversal patterns in combination with the trading volume factor in Malaysian stock market. The results from this study indicate that the technical indicator of candlestick charting is effective in portraying accurate signals for investors. In conclusion, the predictive power of bearish reversal patterns which include Dark Cloud Cover, Bearish Harami cross, Three Inside Down, and Three Outside Down are proven to exist. Meanwhile, only the bullish reversal patterns of Homing Pigeon, Meeting lines, and

Table 8: Effective holding period for bullish reversal patterns

Bullish reversal patterns	Before trend				After downtrend			
	In-sample (2000-2007)		Out-of-sample (2012-2014)		In-sample (2000-2007)		Out-of-sample (2012-2014)	
Harami+					12 day	1.00 (0.04)**		
					13 day	1.14 (0.02)**		
Harami Cross+	5 day	1.24 (0.04)**			11 day	2.40 (0.06)*		
	6 day	1.42 (0.03)**			12 day	2.28 (0.06)*		
	8 day	2.44 (0.01)***			13 day	3.00 (0.03)**		
	9 day	1.69 (0.06)*			14 day	3.26 (0.03)**		
	11 day	2.08 (0.03)**			15 day	3.77 (0.01)**		
	12 day	1.88 (0.07)*						
	13 day	2.14 (0.04)**						
	14 day	2.31 (0.03)**						
	15 day	2.41 (0.02)**						
Homing Pigeon	13 day	1.61 (0.10)*	15 day	1.85 (0.10)*	15 day	2.26 (0.09)*		
	14 day	1.76 (0.08)*						
	15 day	2.64 (0.01)***						
Meeting Lines+	1 day	1.10 (0.03)**	1 day	1.38 (0.01)**			1 day	1.06 (0.10)*
			2 day	2.00 (0.02)**			4 day	3.62 (0.00)***
			3 day	2.23 (0.03)**			5 day	2.71 (0.01)***
			4 day	2.95 (0.02)**			6 day	2.93 (0.04)**
			5 day	2.57 (0.03)**				
			6 day	3.09 (0.01)***				
			7 day	2.73 (0.04)**				
			8 day	3.07 (0.02)**				
			9 day	3.89 (0.00)***				
			10 day	3.05 (0.03)**				
			11 day	4.31 (0.02)**				
			12 day	4.59 (0.02)**				
			13 day	4.88 (0.01)***				
			14 day	4.42 (0.05)**				
			15 day	4.79 (0.02)**				
Piercing			7 day	11.27 (0.07)*			6 day	1.75 (0.07)*
			9 day	2.12 (0.04)**			8 day	2.56 (0.02)**
			10 day	2.24 (0.03)**			9 day	3.03 (0.00)***
			11 day	2.99 (0.00)***			10 day	2.93 (0.00)***
			12 day	2.17 (0.04)**			11 day	3.07 (0.00)***
							12 day	2.71 (0.03)**
							13 day	2.98 (0.08)*
Three Outside Up	2 day	1.03 (0.00)***	5 day	22.03 (0.06)*	2 day	1.17 (0.00)***		
	9 day	1.05 (0.02)**			7 day	1.32 (0.02)**		
	10 day	1.26 (0.01)***			9 day	1.24 (0.03)**		
	11 day	1.27 (0.01)***			10 day	1.16 (0.04)**		
	12 day	1.14 (0.02)**			11 day	1.07 (0.08)*		

The average returns rate (%) for each candlestick are presented before the P values of skewness adjusted t-test which are provided in parentheses. *Indicates statistical significance at 10% level, ** at 5% level, and *** at 1% level

Three Outside Up have shown profitable signals consistently. The effective holding period for candlestick charting is found to accumulate around 10-15 holding days.

The evidence on effectiveness of candlestick trading strategy from this study contributes to the usefulness of technical analysis which thus violates the efficient market hypothesis. However, it is suggested that the size of real body and length of upper and lower shadows of candlesticks can be considered for future research framework.

6. ACKNOWLEDGMENTS

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