Double bottom pattern recognition for trading strategy

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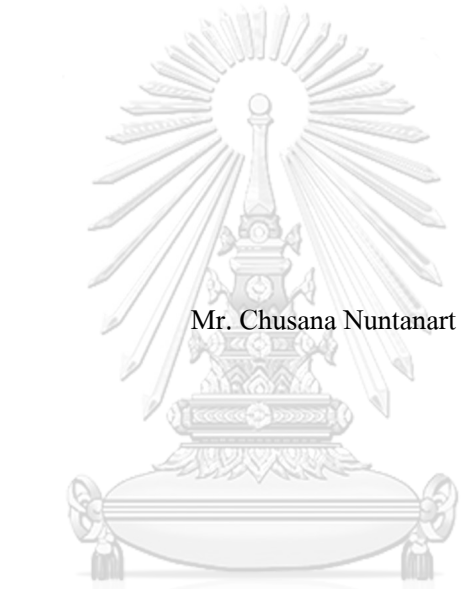

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We utilize the Double bottom pattern, which is a common and the most easily recognized reversal pattern in the technical analysis approach, to seek the existence of abnormal returns from 1 Jan 2009 to 31 Dec 2019. The general event study methodology was used to statistically test for the existence of abnormal returns from 611 stocks in SET. We concluded that there was an existence of abnormal return from trading with the Double bottom pattern strategy. This led to the conclusion that the Thai stock market might be not as informationally efficient as academics have conjectured.

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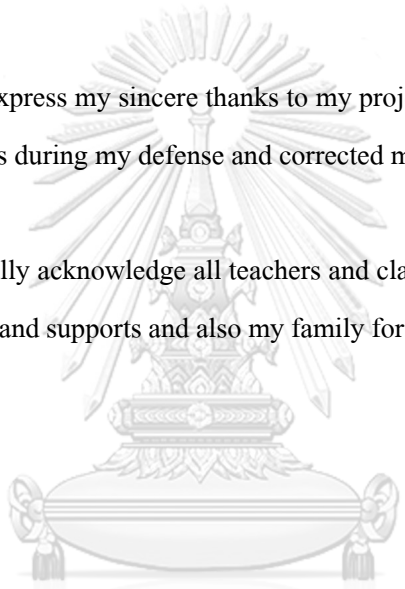

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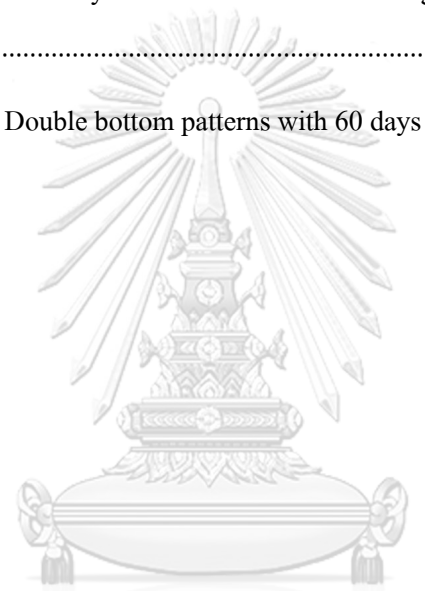


Chapter 1: Introduction

1.1 Background and Motivation

For many decades, technical analysis has been considered as an approach for some investors to invest in stocks. It involves using historical price and volume data to predict market movements. Therefore, technical analysis has been considered as an approach for some investors to invest in stocks technical analysis is often used to generate short-term trading signals for investors. Murphy (1999) considered as the father of inter-market technical analysis, indicates three essential principles for the technical approach. The first principle is "Market action discounts everything", i.e. anything from a company's fundamentals to market psychology are already priced into the stock. Therefore, a technical analyst does not have to investigate any fundamental factors. The second principle is "Prices move in trends", i.e. the stock price movement will continue in the same direction until it reverses. The last principle is "History repeats itself", i.e. the nature of price movement is attributed to market psychology, which tends not to change. These three principles can be concluded that, if some patterns occur in the past, it is likely to repeat itself in the future.

Therefore, technical pattern analysis is regarded as one of the most important technical analysis approaches. Murphy (1999) classifies price patterns into two types. The first type is continuation patterns, which suggest that the market is going to keep its current movement trend. The second type is reversal patterns, which indicate that an important reversal in trend is taking place. In this study, we focus on the Double bottom pattern, which is common and the most easily recognized reversal pattern (Murphy, 1999). It is a well-known pattern and has been used until now. After we can recognize this Double bottom pattern, we can identify a confirmation line. A trade will be placed, if the price is beyond the confirmation line. Bulkowski (2011) shows that on average there are 35% rise in bull market and 24% rise in bear market after the confirmation line.

However, technical analysis is not consistent with the efficient market hypothesis, which is firstly introduced by Fama (1960). This hypothesis states that stock prices reflect all information, and it is impossible for investors to purchase undervalued stocks or sell stocks for inflated prices. Therefore, trading with the Double bottom pattern is expected to perform well in the market, which is not informationally efficient, e.g. emerging market. Hence, the Thai

stock market was chosen to be tested for the existence of abnormal return (Islam, Watanapalachaikul, & Clark, 2007). Unfortunately, recognizing the pattern for all stocks in the market will be a difficult task for humans.

Thus, this study presents a rule-based algorithm to recognize the Double bottom pattern. The first advantage of this algorithm is that it is a faster way than utilizing human effort. The second advantage is that it can be adjusted according to the different official descriptions of the Double bottom pattern. After we develop this algorithm, we can seek the existence of abnormal returns of the Thai stock market.

In this study, we develop an algorithm to recognize the technical pattern called Double bottom. We utilize our algorithm to all stocks in the Thai stock market to provide the answer to the following question; "Does the Double bottom pattern significantly generates abnormal returns in the Thai stock market?". By answering this question, we investigate a part of a bigger question for academics: whether the Thai Stock market is informationally efficient or not. If the Thai stock market is truly efficient, any technical pattern including the Double bottom pattern should not be able to generate any abnormal returns.

1.2 Research Hypothesis

Based on the past evidence from Islam et al. (2007) which studied the Thai stock market, we hypothesize that the Double bottom pattern can also generate an abnormal return in the Thai stock market. Although the abnormal return of the portfolio using the Double bottom trading strategy may depend on the individual choice of parameters, this study uses the benchmark parameters as Kirkpatrick II and Dahlquist (2010) to create the Double bottom characteristics similar to their study whose result found to be significant. Furthermore, this study plans to explore various other choices of parameters that could be more suitable for the Thai stock market to confirm the robustness of our result.

The research hypothesis: The portfolio with Double bottom pattern as trading strategy could generate statistically significant abnormal return in Thai stock market.

After the hypothesis is tested, depending on the result that comes out, we could understand more whether the Thai stock market is currently informationally efficient, at least from the one specific rule-based strategy. While a positive result confirms the general belief that the Thai

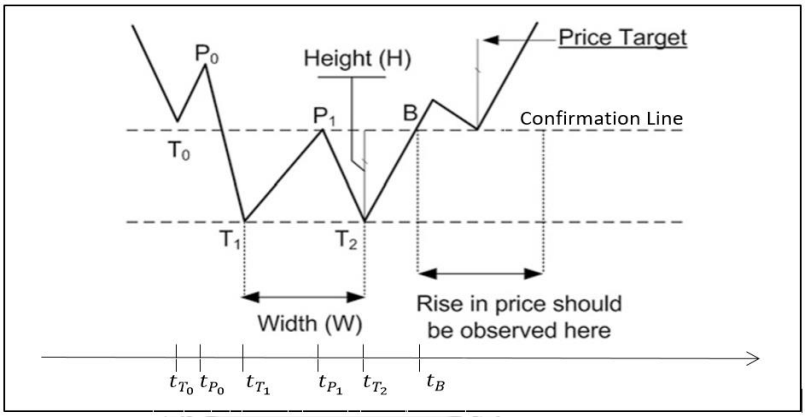
market is still not as efficient as academics have conjectured, the negative result, however, does not lead to the opposite conclusion. Nevertheless, we believe that our study is still useful for the initiative for the future study on the trading pattern analysis in the Thai stock market.

Chapter 2: Literature Review

2.1 Double bottom pattern recognition

There are some researchers who studied stock pattern recognition in the past. Tsinaslanidis and Zapranis (2016) explained characteristic components of the Double bottom pattern. However, they did not clearly show an algorithm to extract the corner of the pattern from a given time series data.

Figure 1: Simplified illustration of the Double bottom pattern



The four conditions for identifying the Double bottom pattern are the following:

- Condition 1. Trend Preexistence: The pattern is preceded by a generally negative trend. the formula can be written as,

$$P_1 < P_0 \text{ and } T_1 < T_0 . \quad (1)$$

- Condition 2. Balance: Price variation between two peaks should be less than 4%. the formula can be written as,

$$|T_1 - T_2|/\min(T_1, T_2) \leq 0.04 . \quad (2)$$

- Condition 3. Depth: There should be at least a 10 % rise between the two bottoms. the formula can be written as,

$$(P_1 - T_1)/T_1 \geq 0.1 . \quad (3)$$

- Condition 4. Penetration: let t_B denote the time at which the price rises above resistance level indicated by point P_1. This must not happen too long after the formation of the right peak. the formula can be written as,

$$t_B < t_{T_2} + \left(t_{T_2} - t_{T_1}\right). \quad (4)$$

Bulkowski (2011) suggested that the price variation between the two bottoms should be small. The best performance was between 2% and 5% variation. Furthermore, there should be at least 10% rise between the lowest valley to the peak between the two bottoms. Taller patterns perform better.

Wan and Si (2017) classified 53 chart patterns into five categories. The Double bottom was categorized as fixed fluctuation patterns which have a certain number of highs and lows. They used PIP method to extract a specified number of PIPs (salient points) and then made the rule-based algorithm to identify the pattern. However, they had to make common rules for all 53 chart patterns. Therefore, some conditions which are used to identify the Double bottom pattern could be relaxed, such as,

$$|T_1 - T_2| \leq 0.1 \times |max(S) - min(S)|, \quad (5)$$

$$|P_1 - \min(T_1, T_2)| > 0.1 \times |\max(S) - \min(S)|, \quad (6)$$

where S is a sequence of prices. Several traders might adjust their conditions according to their preferences. This study will develop an algorithm, which is tailor-made for the Double bottom pattern.

2.2 Efficiency of Thai stock market

The existence of abnormal return from the Double bottom pattern should be found in emerging markets which may be not informationally efficient. Therefore, the Thai stock market is selected as it is believed to be informationally efficient. There are some researchers, who studied the Thai stock market.

Sukpitak and Hengpunya (2016) examined market efficiency by utilizing the detrended fluctuation analysis. The Stock Exchange of Thailand (SET) and MAI tend to be more efficient form November 2006 to March 2015; Furthermore, SET is more efficient than MAI. Although they concluded that the Thai stock market tends to be more efficient, we still need to investigate more to support the evidence of the efficient market hypothesis.

Islam et al. (2007) did the Geary test and autocorrelation function test to investigate the efficient market hypothesis of the Thai stock market. Their data consists of the pre-crisis period from 1992 to 1996 and the post-crisis period from 1997 to 2001. They found an autocorrelation

on the Thai stock market returns especially during the post-crisis period. Therefore, at least in the past, Thai stock was not informationally efficient.

Chapter 3: Data

3.1 Stock price data

We will use the daily adjusted closing price which is already accounted for the corporate actions. The data consists of 611 stocks in SET from 1 Jan 2009 to 31 Dec 2019. The historical data will be obtained from Yahoo finance.

Chapter 4: Methodology

4.1 Double bottom characteristics

The Double bottom pattern seems to be a W-shape. This pattern is the most frequently seen and easily recognized (Murphy, 1999). After we recognize the pattern, we can identify a confirmation line. As shown in Figure 1, a trade will be placed, if the price is beyond the confirmation line.

The main characteristics which was identified by Bulkowski (2011) can be written as:

1. *Downward price trend*: Price trends downward leading to the Double bottom and should not drift below the left bottom.
2. *Rise between bottoms*: At least 10% difference between T_1 and P_1. More different patterns perform better.
3. *Bottom low prices*: Price variation between T_1 and T_2 should be small. Best performance is between 2% and 5% variation.
4. *Bottom separation*: Bottoms should be at least a few weeks apart. Best performance is 3–6 weeks apart.

However, some traders may adjust their rule or define more rules to this pattern depending on their experience and knowledge, for example, the difference between T_1 and P_1 should be between 10% and 20%. Thus, we build the algorithm, which can be adjusted its parameters, according to trader preference. Therefore, we revise the key characteristics of the Double bottom pattern. They can be written as:

1. *Downward price trend*: Price trends downward leading to the Double bottom and should not drift below the left bottom.
2. *Rise between bottoms*: The ratio between P_1 and T_1 should be between c_1 and c_2, where c_1 and c_2 are greater than one, and $c_1 < c_2$.
3. *Bottom low prices*: The ratio between T_2 and T_1 should be less than c_3, where c_3 is greater than one.
4. *Bottom separation*: $t_{T_2} - t_{T_1} \in [c_4, c_5]$, where c_4, c_5 are positive integers, and $c_4 < c_5$.

For example, if we want to set c_1, c_2 and c_3, according to characteristics from Bulkowski (2011), we can set $c_1 = 1.1, c_2 = G$, $c_3 \in [1.02,1.05], c_4 = 15$ and $c_5 = 30$, where G is a big positive number.

Several traders and studies suggest the different parameters to be used for recognizing the Double bottom pattern. In this study, we use the suggested parameters from Bulkowski (2011) and Kirkpatrick II and Dahlquist (2010). We summarize them in the Table 1.

Table 1: A summary of parameters to be used in this study

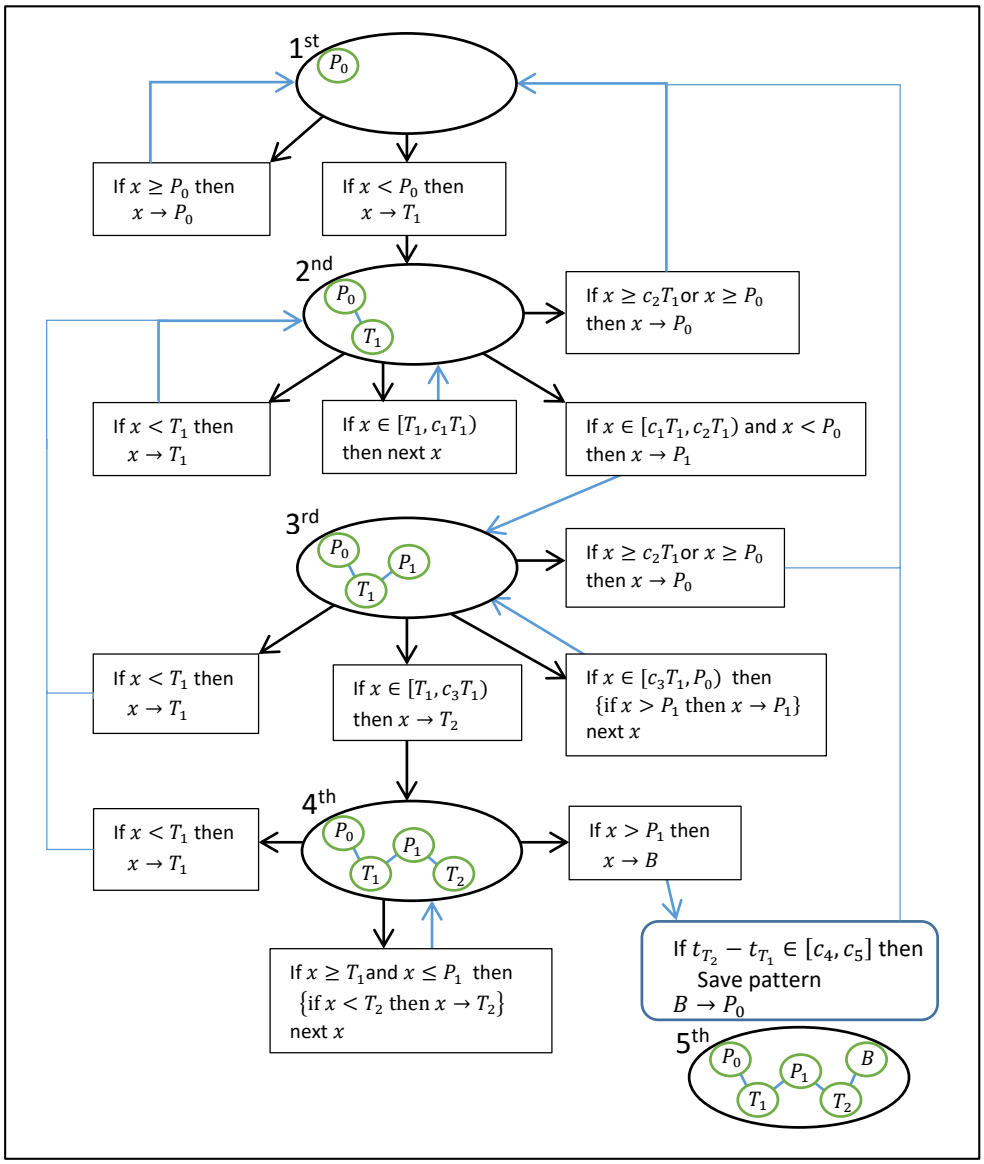
Authors (Year)	c_1	c_2	c_3	c_4	c_5
Bulkowski (2011)	1.1	G	1.02	15	30
Bulkowski (2011)	1.1	G	1.04	15	30
Bulkowski (2011)	1.1	G	1.05	15	30
Kirkpatrick and Dahlquist (2010)	1.1	G	1.05	10	35

4.2 Double bottom pattern recognition

As shown in Figure 1, the Double bottom pattern consists of five vertices which are P_0, T_1, P_1, T_2 and B respectively. We can build an algorithm for searching the vertices as shown in Figure 2. The algorithm will start searching from the leftmost vertex to the rightmost vertex. The diagram contains five states, which are the oval shapes. The label of each of the states are at the top left of the oval shapes. In the state diagram, we indicate P_0, T_1, P_1, T_2 and B as the vertex that we want to extract. The x denotes the current vertex, and "next x" means that we move the current vertex to the right vertex. The conditions for moving to the next state are given in the rectangle shapes. After the fifth state is found, we can save the position of each of the vertices, then we set the fifth vertex B as the first vertex P_0, and start the next iteration in order to find the next Double bottom pattern.

For example, if we are in the first state, there are two possible transitions, which move to the first and second states. The condition of the transition moving to the second state, is that the next vertex must be lower than the first vertex P_0. For another example, if we are in the third state, there are four possible transitions, which move to the first, third and fourth states. The condition of the transition moving to the third state, is that the value of current vertex x is between T_1 and $c_3 T_1$. However, before moving back to the third state, the algorithm will check that if the value of current vertex x is greater than the third vertex P_1, then the current vertex x will be assigned to the third vertex P_1, then we move the current vertex to the right vertex.

Figure 2: The state diagram showing how to find the Double bottom pattern

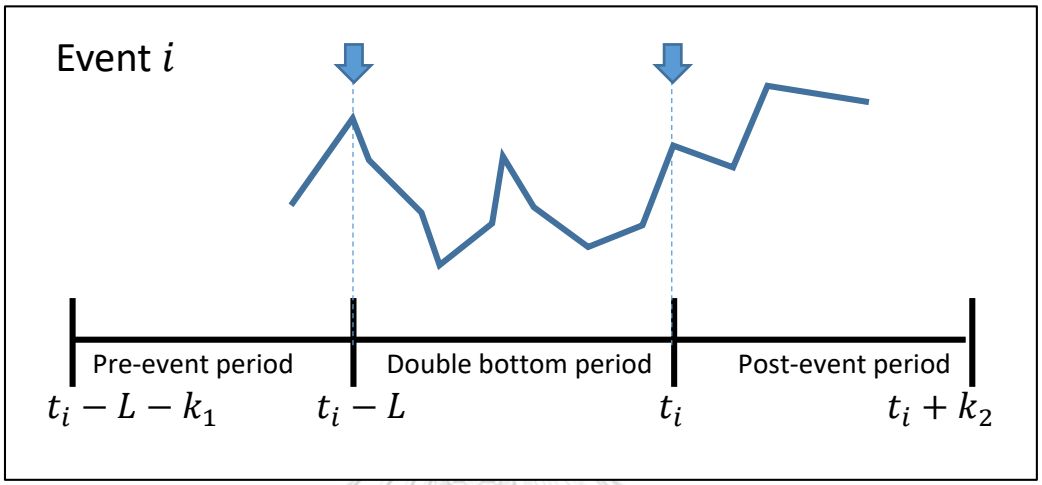


4.3 Abnormal return event study

After we build the algorithm to recognize the Double bottom pattern, we would like to investigate that the trading strategy from this pattern can generate abnormal profits in the Thai stock market. In this study, we use the general event study methodology, which is explained by MacKinlay (1997). As shown in Figure 3, the Double bottom pattern is completely formed at time t_i. Let L denote the length of time which the Double bottom pattern takes to form its pattern, k_1 denote the number of days before the event, and k_2 denote the number of days after the event. We can divide the event period into three parts. The first part is pre-event period,

which covers from time $t_i - L - k_1$ to time $t_i - L$. The second part is the Double bottom period, which covers from time $t_i - L$ to time t_i. The last part is post-event period, which covers from time t_i to time $t_i + k_2$.

Figure 3: Event study period with pre-event and post-event period



In order to test the hypothesis, we first construct the market model for each stock. We assume that the return of event i at time t can be written as:

$$r_{i,t} = \alpha_i + \beta_i r_{m,t} + \varepsilon_{i,t} \,, \tag{7}$$

where $r_{i,t}$ is the return of event i at time t, α_i is an alpha of event i, β_i is a beta of event i, $r_{m,t}$ is the return of market at time t, and $\varepsilon_{i,t}$ is an error term for the return of event i and time t. We will estimate $\hat{\alpha}_i$ and $\hat{\beta}_i$ by using returns of event i during the pre-event period. In this study, we set the number of days before the event k_1 as 30. The expected return of event i at time t can written as:

$$\hat{r}_{i,t} = \hat{\alpha}_i + \hat{\beta}_i r_{m,t} \,, \tag{8}$$

where $\hat{r}_{i,t}$ is the expected return of event i at time t, $\hat{\alpha}_i$ is an estimated alpha of event i, and $\hat{\beta}_i$ is an estimated beta of event i. Among various models of expected return, the equation (8) or the market model has been used with an event study for a long time (Agrawal & Kamakura, 1995; Corhay & Rad, 1996; Tripathi & Mukhopadhyay, 2020). However, our work has some limitations as same as the previous studies. We did not consider a risk-free rate as the traditional capital asset pricing model (CAPM) used it for computing the expected return. We can use this model to compute the abnormal return in the post-event period of event i at time t, which is given by,

$$AR_{i,t} = r_{i,t} - \hat{r}_{i,t} \quad , \tag{9}$$

where $AR_{i,t}$ is an abnormal return of event i at time t. Finally, we can compute the cumulative abnormal return (CAR_i) for each event i though post-event period by the following formula:

$$CAR_i = \sum_{t=t_i+1}^{t_i+k_2} AR_{i,t} \,, \tag{10}$$

where CAR_i is a cumulative abnormal return of event i within the post-event period, t_i is the time at the end of event i. In this study, we will set the number of days after the event $k_2 = 1,2, \ldots ,60$. We will compute all cumulative abnormal return CAR_i for all event, then we can find its average by the following formula:

$$\overline{CAR} = \frac{\sum_{i=1}^{M} CAR_i}{M} \,, \tag{11}$$

where $\overline{CAR}$ is the average cumulative abnormal return for all events, and M is a number of observed the Double pattern events. After we compute the average cumulative abnormal return $\overline{CAR}$, we can test our hypothesis. The null and alternative hypothesis are given below:

$$H_0 : \overline{CAR} \leq 0 \,, \tag{12}$$
$$H_a : \overline{CAR} > 0 \,. \tag{13}$$

In this study, we would like to test if the Double bottom pattern event can significantly generate an abnormal return. We will conduct t-test statistic with 95% confidence level and $M - 1$ degrees of freedom. If we can reject the null hypothesis H_0, we will conclude that there is an existence of abnormal profit by using the Double bottom pattern. Therefore, the Thai stock market is not currently informationally efficient. However, if we cannot reject the null hypothesis, this study will be a support evidence of the efficient market hypothesis in the Thai stock market.

Chapter 5: Result and Discussion

5.1 Double bottom pattern recognition

As we mentioned in the section 3.1, the data entailed in our study were obtained from Yahoo! Finance. We collected the daily adjusted close prices on 611 stocks in SET, from 1 Jan 2009 to 31 Dec 2019. We have 2,651 price information in the past 10 years. These 611 stocks were divided into large and small market capitalization groups. According to the obtained data, there were 153 stocks which have a market capitalization of more than ten billion baht. The list of stocks is shown in the appendix.

According to table 1, we have four sets of parameters to be used for recognizing the Double bottom pattern. These four sets will be called Bulkowski_1, Bulkowski_2, Bulkowski_3 and Kirkpatrick_Dahlquist respectively. The results after applying the Double bottom pattern recognition algorithm with these four sets of parameters are shown in the Table 2.

Table 2: Number of recognized patterns from the four set of parameters

Set of parameters	# Double bottom patterns	# Large market capitalization patterns	# Small market capitalization patterns
Bulkowski_1	203	42	161
Bulkowski_2	383	101	282
Bulkowski_3	524	142	382
Kirkpatrick_Dahlquist	864	227	637

5.2 Abnormal return event study on the real data

As we mentioned in the section 4.3, we set the number of days after the event $k_2 = 1,2,\dots,60$. We computed the cumulative returns for all events, and the Table 3 presents the cumulative returns for the four sets of parameters. In order to compare the cumulative returns from SET index and stocks, the t-test statistic is used. After Double bottom pattern was formed, the cumulative returns at 60 trading days are 0.9%, 2.0%, 3.6% and 2.4% respectively, and they are not more than the cumulative returns from SET index.

Table 3: Comparison of cumulative returns from SET index and the four sets of parameters after the event

Day	***Bulkowski_1***			***Bulkowski_2***			***Bulkowski_3***			***Kirkpatrick_Dahlquist***		
	SET	*Stocks*	*T Test*	*SET*	*Stocks*	*T Test*	*SET*	*Stocks*	*T Test*	*SET*	*Stocks*	*T Test*
1	-0.1%	-3.0%	-4.77	0.0%	-2.0%	-5.47	0.0%	-1.6%	-5.69	0.1%	-1.4%	-6.77
2	-0.1%	-3.7%	-5.57	0.0%	-2.3%	-5.46	0.0%	-1.9%	-5.66	0.1%	-1.6%	-6.63
3	-0.1%	-3.8%	-5.56	0.0%	-2.3%	-5.58	0.0%	-1.8%	-5.62	0.1%	-1.3%	-5.34
4	0.0%	-4.5%	-6.06	0.1%	-2.6%	-5.76	0.2%	-2.1%	-6.11	0.2%	-1.5%	-5.26
5	0.0%	-2.9%	-3.12	0.1%	-1.8%	-3.30	0.2%	-1.4%	-3.66	0.2%	-1.1%	-3.82
6	0.1%	-2.9%	-3.33	0.2%	-1.7%	-3.44	0.3%	-1.3%	-3.80	0.3%	-0.9%	-3.28
7	0.2%	-3.6%	-4.29	0.2%	-2.3%	-4.60	0.4%	-1.6%	-4.54	0.3%	-1.0%	-3.49
8	0.2%	-3.2%	-3.76	0.3%	-2.0%	-4.02	0.4%	-1.5%	-4.21	0.3%	-0.9%	-3.20
9	0.3%	-3.2%	-3.83	0.4%	-1.9%	-4.09	0.5%	-1.4%	-4.15	0.4%	-0.8%	-3.00
10	0.4%	-2.9%	-3.56	0.4%	-1.8%	-3.75	0.5%	-1.3%	-3.80	0.5%	-0.7%	-2.78
11	0.4%	-2.9%	-3.34	0.4%	-1.8%	-3.67	0.5%	-1.3%	-3.52	0.5%	-0.7%	-2.82
12	0.3%	-3.0%	-3.34	0.3%	-2.0%	-3.75	0.4%	-1.3%	-3.48	0.5%	-0.8%	-2.98
13	0.3%	-2.7%	-3.01	0.4%	-1.7%	-3.16	0.4%	-1.2%	-3.01	0.5%	-0.8%	-2.98
14	0.4%	-3.2%	-3.35	0.5%	-2.0%	-3.69	0.5%	-1.3%	-3.33	0.6%	-0.9%	-3.25
15	0.4%	-3.3%	-3.51	0.5%	-2.1%	-4.04	0.6%	-1.2%	-3.10	0.6%	-0.8%	-3.01
20	0.7%	-2.2%	-2.56	0.8%	-1.2%	-2.73	0.8%	-0.3%	-1.67	0.8%	0.0%	-1.62
25	0.8%	-1.6%	-1.85	0.9%	-1.2%	-2.58	0.8%	0.0%	-1.17	0.7%	-0.1%	-1.36
30	0.9%	-0.4%	-0.87	1.0%	-0.3%	-1.46	1.0%	1.1%	0.08	0.7%	0.4%	-0.45
35	1.3%	0.4%	-0.54	1.3%	0.7%	-0.65	1.3%	2.2%	0.79	0.8%	0.9%	0.12
40	1.8%	0.7%	-0.67	1.6%	0.8%	-0.72	1.5%	2.3%	0.69	1.0%	1.0%	0.06
45	2.2%	0.7%	-0.78	2.0%	1.7%	-0.28	1.8%	3.2%	1.12	1.3%	1.8%	0.52
50	2.3%	0.2%	-1.10	2.2%	1.5%	-0.58	2.0%	3.3%	1.04	1.5%	1.8%	0.39
55	2.6%	0.2%	-1.26	2.5%	1.4%	-0.91	2.3%	3.1%	0.68	1.8%	1.9%	0.12
60	3.0%	0.9%	-1.11	2.9%	2.0%	-0.71	2.5%	3.6%	0.90	2.1%	2.4%	0.31

Notes:

The t-test statistic is used to confirm that cumulative return from trading stocks is higher than SET index. In order to assure higher robustness of results, different t test criteria are considered: 1.65, 2.34 and 3.09 corresponding to 95%, 99% and 99.9% confident level respectively for Bulkowski_1 which has the lowest number of events. The t test criteria of Kirkpatrick_Dahlquist which has the highest number of events is 1.65, 2.33 and 3.11 corresponding to 95%, 99% and 99.9% confident level respectively.

Furthermore, we calculate cumulative returns from the large market capitalization stocks. The result is shown in Table 4. We can reject null hypothesis at 4, 13, 12, 11 days with 95% confident level. The result from small market capitalization stocks, which is not better than the market, are in the appendix.

Table 4: Comparison of cumulative returns from the large market capitalization stocks in SET index and the four sets of parameters after the event

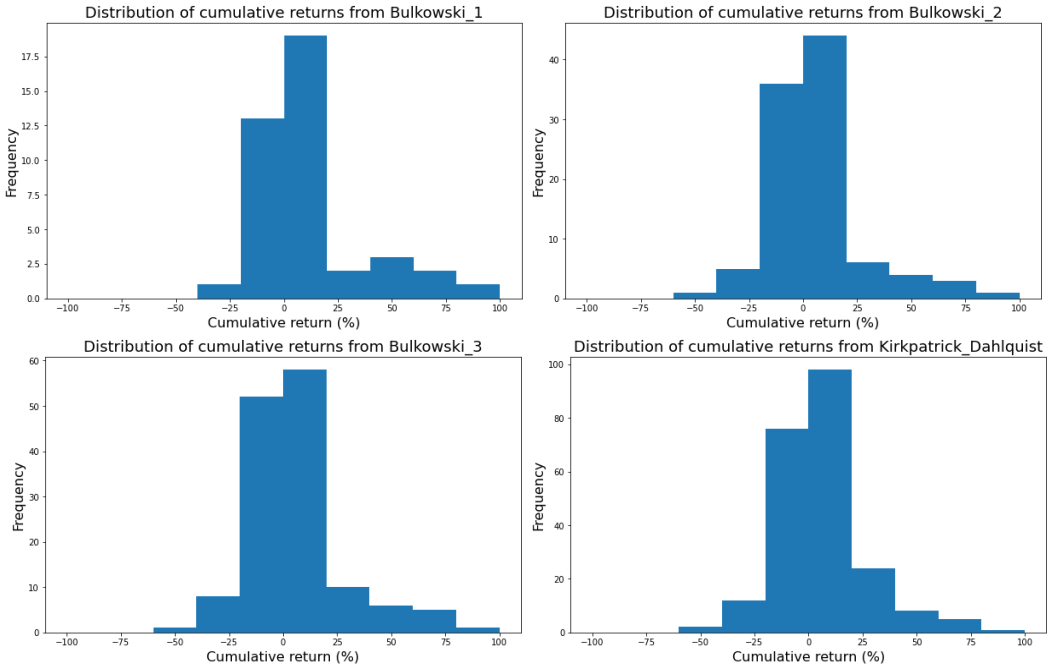
Day	***Bulkowski_1***			***Bulkowski_2***			***Bulkowski_3***			***Kirkpatrick_Dahlquist***		
	SET	*Stocks*	*T Test*	*SET*	*Stocks*	*T Test*	*SET*	*Stocks*	*T Test*	*SET*	*Stocks*	*T Test*
1	0.0%	0.5%	1.22	0.1%	0.0%	-0.41	0.1%	0.2%	0.35	0.1%	0.1%	-0.03
2	-0.2%	0.3%	0.59	0.1%	-0.3%	-0.86	0.1%	0.0%	-0.26	0.1%	0.0%	-0.47
3	-0.1%	1.4%	1.58	0.1%	0.3%	0.39	0.2%	0.7%	1.16	0.2%	0.5%	0.84
4	-0.1%	1.9%	1.99	0.2%	0.6%	0.84	0.3%	0.9%	1.46	0.2%	0.5%	0.91
5	0.0%	2.7%	2.22	0.2%	1.0%	1.27	0.3%	1.2%	1.69	0.3%	0.9%	1.61
6	0.0%	2.5%	2.12	0.2%	0.9%	1.12	0.4%	1.2%	1.42	0.3%	0.9%	1.47
7	0.0%	1.9%	1.88	0.3%	0.8%	0.80	0.5%	1.0%	0.84	0.3%	0.6%	0.74
8	0.1%	1.9%	1.88	0.4%	0.9%	0.86	0.6%	1.1%	0.88	0.3%	0.7%	0.92
9	0.2%	2.2%	1.97	0.6%	1.2%	0.99	0.7%	1.3%	1.06	0.4%	0.9%	1.08
10	0.2%	2.1%	1.95	0.7%	1.1%	0.70	0.8%	1.4%	1.06	0.5%	1.1%	1.36
11	0.1%	2.8%	2.26	0.6%	1.3%	0.88	0.8%	1.7%	1.49	0.5%	1.3%	1.66
12	-0.1%	2.8%	2.48	0.6%	1.2%	0.97	0.6%	1.7%	1.65	0.4%	1.3%	1.85
13	0.0%	3.7%	2.98	0.5%	1.8%	1.67	0.6%	2.1%	2.08	0.4%	1.5%	2.07
14	0.0%	4.7%	3.38	0.5%	2.0%	1.73	0.7%	2.3%	2.11	0.4%	1.6%	2.11
15	0.2%	4.8%	3.21	0.7%	2.1%	1.52	0.8%	2.2%	1.83	0.5%	1.7%	2.03
20	0.4%	6.4%	3.34	1.0%	3.2%	2.07	1.1%	3.2%	2.22	0.7%	2.2%	2.27
25	0.3%	9.3%	3.54	0.9%	4.2%	2.43	0.9%	3.4%	2.24	0.5%	2.2%	2.23
30	0.5%	10.5%	3.43	1.1%	5.1%	2.55	1.3%	4.3%	2.38	0.7%	2.9%	2.39
35	0.5%	13.5%	3.37	1.1%	6.1%	2.60	1.3%	5.0%	2.49	0.9%	3.6%	2.68
40	1.2%	14.2%	3.21	1.4%	6.8%	2.62	1.5%	5.7%	2.56	1.2%	4.4%	2.89
45	1.7%	17.2%	2.67	2.0%	8.7%	2.41	2.0%	7.2%	2.44	1.6%	5.4%	2.67
50	1.5%	17.8%	3.12	1.9%	9.3%	2.90	2.1%	8.0%	2.90	1.7%	6.2%	3.35
55	1.8%	17.6%	3.34	2.0%	8.3%	2.59	2.4%	7.5%	2.65	2.1%	6.6%	3.42
60	2.2%	16.5%	2.97	2.3%	7.7%	2.19	2.6%	7.3%	2.41	2.3%	6.4%	3.03

Notes:

The t-test statistic is used to confirm that cumulative return from trading stocks is higher than SET index. In order to assure higher robustness of results, different t test criteria are considered: 1.65, 2.34 and 3.09 corresponding to 95%, 99% and 99.9% confident level respectively for Bulkowski_1 which has the lowest number of events. The t test criteria of Kirkpatrick_Dahlquist which has the highest number of events is 1.65, 2.33 and 3.11 corresponding to 95%, 99% and 99.9% confident level respectively.

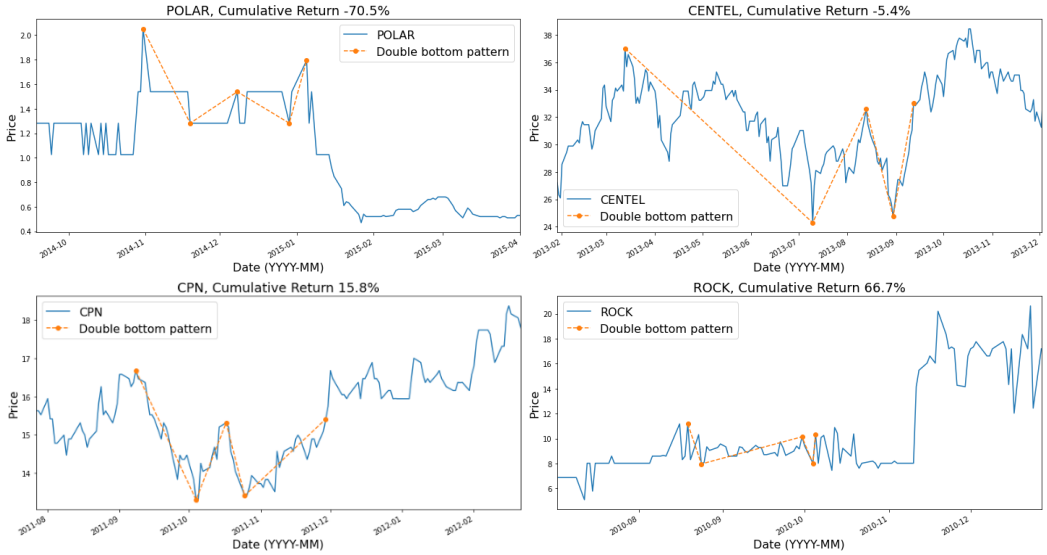
Therefore, trading with this strategy by simply buying stocks after the pattern is completely formed can beat the market index for large capitalization stocks but not for small capitalization stocks. However, this does not rule out the possibility that we can make money from small capitalization stocks, if we use a better strategy and that will be tested using the event study method. We also plotted the histograms of the cumulative returns for all parameter sets at 60 days after the pattern is completed, as shown in Figure 4.

Figure 4: The histograms of 60-day cumulative returns from large market capitalization stocks with all parameter sets.



We also plotted some examples of Double bottom patterns in Figure 5. It depicted some price paths which are starting from the time that pattern started until 60 days after the pattern is completed.

Figure 5: Examples of the Double bottom patterns with 60 days after the pattern is completed.



Before estimating alpha and beta, we compute abnormal return by assuming that the alpha is zero and the beta is one, then we compute abnormal return of event i at time t $\left(\mathrm{AR}_{i,t}\right)$. The Table 4 presents the average abnormal return for all events (AAR) and the average cumulative

abnormal return for all events $\overline{CAR}$ with their t-test statistics from Bulkowski_1, Bulkowski_2, Bulkowski_3 and Kirkpatrick_Dahlquist respectively.

Table 5: Average cumulative abnormal return ($\overline{CAR}$) and T Test statistic from assuming that alpha is zero and beta is one

Day	***Bulkowski_1***		***Bulkowski_2***		***Bulkowski_3***		***Kirkpatrick_Dahlquist***	
	AAR	*T Test*	*AAR*	*T Test*	*AAR*	*T Test*	*AAR*	*T Test*
-1	1.43%	0.22	1.54%	0.27	1.50%	0.29	1.69%	0.33
0	2.27%	0.32	2.24%	0.35	2.19%	0.35	2.23%	0.35
1	-2.05%	-0.33	-1.20%	-0.28	-0.85%	-0.25	-0.72%	-0.23
2	0.30%	-0.10	0.55%	-0.05	0.55%	-0.05	0.64%	-0.04
3	1.12%	0.03	0.90%	0.02	0.86%	0.02	1.05%	0.07
4	0.20%	-0.15	0.47%	-0.10	0.44%	-0.10	0.61%	-0.06
5	2.59%	0.17	1.76%	0.13	1.55%	0.11	1.30%	0.09
10	1.19%	0.04	0.97%	0.03	0.90%	0.03	0.91%	0.04
15	0.30%	0.01	0.37%	-0.03	0.62%	0.01	0.71%	0.02
20	1.09%	0.06	0.90%	0.04	0.99%	0.05	1.01%	0.05
25	0.70%	0.04	0.58%	-0.01	0.68%	0.02	0.62%	-0.02
30	1.14%	0.08	0.74%	0.01	0.82%	0.03	0.77%	0.00
35	1.18%	0.06	0.96%	0.03	1.03%	0.06	0.89%	0.04
40	0.85%	-0.01	0.76%	-0.02	0.69%	-0.03	0.84%	0.01
45	1.05%	0.10	0.99%	0.09	1.00%	0.08	1.00%	0.06
50	-0.14%	-0.18	0.32%	-0.12	0.48%	-0.07	0.63%	-0.03
55	0.64%	-0.01	0.51%	-0.03	0.51%	-0.04	0.60%	-0.03
60	0.40%	-0.07	0.74%	-0.01	0.76%	0.00	0.84%	0.01
Window	$\overline{CAR}$	*T Test*	$\overline{CAR}$	*T Test*	$\overline{CAR}$	*T Test*	$\overline{CAR}$	*T Test*
[-29,0]	21.25%	11.38	20.06%	16.51	20.07%	11.59	20.70%	17.27
[0,10]	-2.28%	6.43	-1.58%	10.39	-1.36%	13.17	-0.75%	17.76
[0,30]	1.62%	1.02	0.34%	0.35	1.03%	1.20	1.11%	1.65
[0,60]	4.12%	24.08	2.39%	35.39	3.11%	41.27	3.10%	48.35

Notes:

In order to assure higher robustness of results, different t test criteria are considered: 1.65, 2.34 and 3.09 corresponding to 95%, 99% and 99.9% confident level respectively for Bulkowski_1 which has the lowest number of events. The t test criteria of Kirkpatrick_Dahlquist which has the highest number of events is 1.65, 2.33 and 3.11 corresponding to 95%, 99% and 99.9% confident level respectively. The average abnormal returns and cumulative abnormal returns are reported respectively for a [−1,+60] and [−29,60] window period respectively.

We estimate the alpha and beta by using pre-event period information. We can compute the average cumulative abnormal return ($\overline{CAR}$) and t-test statistics. The results from all sets of parameters are shown in the Table 6.

Table 6: Average cumulative abnormal return ($\overline{CAR}$) and T Test statistic from estimated alpha and beta

Day	***Bulkowski_1***		***Bulkowski_2***		***Bulkowski_3***		***Kirkpatrick_Dahlquist***	
	AAR	*T Test*	*AAR*	*T Test*	*AAR*	*T Test*	*AAR*	*T Test*
-1	0.53%	0.09	0.76%	0.14	0.73%	0.14	0.90%	0.18
0	1.50%	0.22	1.57%	0.26	1.49%	0.24	1.50%	0.24
1	-2.05%	-0.23	-1.20%	-0.17	-0.85%	-0.13	-0.72%	-0.11
2	0.30%	0.05	0.55%	0.12	0.55%	0.13	0.64%	0.15
3	1.12%	0.21	0.90%	0.20	0.86%	0.21	1.05%	0.25
4	0.20%	0.04	0.47%	0.11	0.44%	0.11	0.61%	0.14
5	2.59%	0.24	1.76%	0.22	1.55%	0.22	1.30%	0.21
10	1.19%	0.19	0.97%	0.19	0.90%	0.20	0.91%	0.20
15	0.30%	0.05	0.37%	0.08	0.62%	0.10	0.71%	0.13
20	1.09%	0.18	0.90%	0.18	0.99%	0.20	1.01%	0.18
25	0.70%	0.19	0.58%	0.18	0.68%	0.19	0.62%	0.16
30	1.14%	0.18	0.74%	0.15	0.82%	0.18	0.77%	0.17
35	1.18%	0.17	0.96%	0.18	1.03%	0.22	0.89%	0.19
40	0.85%	0.11	0.76%	0.12	0.69%	0.12	0.84%	0.14
45	1.05%	0.18	0.99%	0.21	1.00%	0.22	1.00%	0.21
50	-0.14%	-0.03	0.32%	0.08	0.48%	0.12	0.63%	0.16
55	0.64%	0.10	0.51%	0.10	0.51%	0.11	0.60%	0.14
60	0.40%	0.07	0.74%	0.16	0.76%	0.18	0.84%	0.23
Window	$\overline{CAR}$	T Test	$\overline{CAR}$	T Test	$\overline{CAR}$	T Test	$\overline{CAR}$	T Test
[-29,0]	0.00%	-0.75	0.00%	-0.99	0.00%	-1.45	0.00%	-1.24
[0,10]	6.45%	5.22	6.37%	8.29	6.44%	8.59	7.04%	12.50
[0,30]	25.30%	9.77	22.99%	14.01	23.40%	12.08	23.54%	17.34
[0,60]	50.73%	11.23	47.42%	15.99	47.78%	13.06	48.27%	18.78

Notes:

In order to assure higher robustness of results, different t test criteria are considered: 1.65, 2.34 and 3.09 corresponding to 95%, 99% and 99.9% confident level respectively for Bulkowski_1 which has the lowest number of events. The t test criteria of Kirkpatrick_Dahlquist which has the highest number of events is 1.65, 2.33 and 3.11 corresponding to 95%, 99% and 99.9% confident level respectively. The average abnormal returns and cumulative abnormal returns are reported respectively for a [−1,+60] and [−29,60] window period respectively.

From Table 6, we could reject null hypothesis for 10, 30 and 60 days after the event k_2 for all four parameters sets. The number of $\overline{CAR}$ seem to be large, because we do the summation of daily abnormal returns, and for small capitalization stocks, the abnormal returns can be extreme.

As shown in the Table 2, Kirkpatrick_Dahlquist has the most recognized patterns, so we will do further analysis with this set of parameters. The recognized patterns by using

Kirkpatrick_Dahlquist set of parameters are shown in the appendix. After we divide the stocks into large and small market capitalization groups, we can calculate the average cumulative abnormal return for all events ($\overline{CAR}$) for each parameter sets. The results are shown in the Table 7.

Table 7: Average cumulative abnormal return ($\overline{CAR}$) and T Test statistic for each of large and small market capitalization groups

Day	***Large market capitalization***		***Small market capitalization***	
	AAR	*T Test*	*AAR*	*T Test*
-1	0.63%	0.27	1.00%	0.17
0	0.95%	0.29	1.70%	0.25
1	0.47%	0.14	-1.14%	-0.16
2	0.49%	0.22	0.70%	0.14
3	0.92%	0.33	1.10%	0.24
4	0.67%	0.32	0.59%	0.12
5	0.89%	0.38	1.44%	0.20
10	0.72%	0.33	0.97%	0.19
15	0.47%	0.23	0.80%	0.13
20	0.37%	0.13	1.24%	0.19
25	0.37%	0.19	0.71%	0.16
30	0.69%	0.34	0.81%	0.15
35	0.69%	0.29	0.97%	0.18
40	0.79%	0.24	0.85%	0.13
45	0.61%	0.27	1.14%	0.22
50	0.73%	0.28	0.60%	0.13
55	0.51%	0.21	0.63%	0.14
60	0.51%	0.19	0.96%	0.25
Window	$\overline{CAR}$	T Test	$\overline{CAR}$	T Test
[-29,0]	0.00%	-2.07	0.00%	-0.65
[0,10]	6.22%	10.12	7.34%	10.03
[0,30]	18.14%	12.18	25.46%	14.49
[0,60]	36.05%	13.78	52.62%	15.74

Notes:

In order to assure higher robustness of results, different t test criteria are considered: 1.65, 2.33 and 3.11 corresponding to 95%, 99% and 99.9% confident level respectively. The average abnormal returns and cumulative abnormal returns are reported respectively for a [−1,+60] and [−29,60] window period respectively.

From Table 7, we could reject null hypothesis from both large and small market capitalization groups for 10, 30 and 60 days after the event k_2. Furthermore, from the results,

we concluded that there was a significant abnormal return in Thai stock market from the Double bottom patterns with specific recognizing parameters from 1 Jan 2009 to 31 Dec 2019. This result clung to the assumptions that we traded the stocks in the large or small market capitalization groups after the Double bottom pattern was completely formed and hold these stocks for a sufficient length of time. Given that our findings are based on a limited number of sets of recognizing parameters, some set of recognizing parameters might not significantly generate any profits with the Double bottom pattern.

Chapter 6: Conclusion

The evidence from this study suggested that we could generate a statistically significant abnormal return in the Thai stock market with the Double bottom pattern as a trading strategy. We should invest a stock after the Double bottom pattern was completely formed and hold this stock for a sufficient length of time. Interestingly, we could utilize this strategy with a stock, which has a market capitalization above ten billion baht, and we could also significantly generate an abnormal return in the market.

Our results shared a number of similarities with Islam et al. (2007), who investigated the efficient market hypothesis of Thai stock market and concluded that the market was not informationally efficient in the past. Although Sukpitak and Hengpunya (2016) examined the Thai stock market efficiency and concluded that the market tends to be a more efficient form November 2006 to March 2015, we have obtained results showing the existence of abnormal returns in the market with the Double bottom pattern as trading strategy from 2009 to 2019. These findings are consistent with the general belief that the Thai market is still not as efficient as academics have conjectured.

Therefore, to the best of our knowledge, the Thai stock market might not be informationally efficient from 2009 to 2019. However, our work clearly has some limitations as same as the previous studies. We might not know the efficiency of the Thai stock market in the future; consequently, we have to investigate the efficient market hypothesis again in the future.

Appendix

Table 7: The information of all stock, which has been used in the research.

No.	Name	Market capitalization	Group of market capitalization
1	7UP	1120.78	Small
2	A	4900.00	Small
3	AAV	9797.00	Small
4	ABPIF	2148.00	Small
5	ACC	819.26	Small
6	ACE	32156.16	Large
7	ACG	738.00	Small
8	ADVANC	545647.22	Large
9	AEC	428.49	Small
10	AEONTS	26375.00	Large
11	AFC	284.84	Small
12	AH	2951.64	Small
13	AHC	1918.84	Small
14	AI	4871.99	Small
15	AIMCG	1828.80	Small
16	AIMIRT	5711.75	Small
17	AIT	3569.35	Small
18	AJ	6510.86	Small
19	AJA	551.24	Small
20	AKR	644.78	Small
21	ALLA	720.00	Small
22	ALT	3566.51	Small
23	ALUCON	6566.40	Small
24	AMANAH	2661.83	Small
25	AMARIN	3414.12	Small
26	AMATA	14191.10	Large
27	AMATAR	3686.27	Small
28	AMATAV	4618.90	Small
29	AMC	758.55	Small
30	ANAN	4766.19	Small
31	AOT	832142.02	Large
32	AP	19661.87	Large
33	APCO	2160.00	Small
34	APCS	3630.00	Small
35	APEX	359.98	Small
36	APURE	1878.20	Small
37	AQ	1706.50	Small
38	AQUA	1745.34	Small
39	AS	1737.88	Small
40	ASAP	1727.88	Small
41	ASEFA	1716.00	Small
42	ASIA	1472.00	Small
43	ASIAN	5698.64	Small
44	ASIMAR	353.86	Small
45	ASK	6545.26	Small
46	ASP	3621.73	Small
47	AWC	127360.00	Large
48	AYUD	13137.76	Large
49	B	398.83	Small
50	B52	323.53	Small
51	BA	11760.00	Large
52	BAFS	13833.67	Large
53	BAM	71428.13	Large
54	BANPU	29681.07	Large
55	BAT-3K	4500.00	Small

Table 7: The information of all stock, which has been used in the research (cont.).

No.	Name	Market capitalization	Group of market capitalization
56	BAY	156677.73	Large
57	BBL	199474.08	Large
58	BCH	37655.59	Large
59	BCP	23820.77	Large
60	BCPG	25986.68	Large
61	BCT	12075.00	Large
62	BDMS	330553.64	Large
63	BEAUTY	4119.41	Small
64	BEC	9320.00	Small
65	BEM	138329.25	Large
66	BFIT	15572.73	Large
67	BGC	8194.44	Small
68	BGRIM	117962.22	Large
69	BH	87801.71	Large
70	BIG	1764.44	Small
71	BJC	152293.40	Large
72	BJCHI	2687.48	Small
73	BKD	2120.13	Small
74	BKER	4982.37	Small
75	BKI	30131.01	Large
76	BKKCP	1200.00	Small
77	BLA	26808.79	Large
78	BLAND	17548.15	Large
79	BLISS		Small
80	BOFFICE	9002.04	Small
81	BPP	43629.61	Large
82	BR	1689.88	Small
83	BROCK	1547.75	Small
84	BRR	2225.15	Small
85	BRRGIF	2275	Small
86	BSBM	985.28	Small
87	BTNC	136.8	Small
88	BTS	136874.28	Large
89	BTSGIF	35885.6	Large
90	BUI	268.5	Small
91	BWG	2241.6	Small
92	B-WORK	4388.72	Small
93	CBG	124000	Large
94	CCET	8061.72	Small
95	CCP	1328.65	Small
96	CEN	514.15	Small
97	CENTEL	34087.5	Large
98	CFRESH	1613.15	Small
99	CGD	5290.32	Small
100	CGH	2949.11	Small
101	CHARAN	272.4	Small
102	CHG	28380	Large
103	CHOTI	496.88	Small
104	CI	735.95	Small
105	CIMBT	20196.91	Large
106	CITY	537	Small
107	CK	33030.99	Large
108	CKP	48369.83	Large
109	CM	1051.96	Small
110	CMAN	1142.4	Small

Table 7: The information of all stock, which has been used in the research (cont.).

No.	Name	Market capitalization	Group of market capitalization
111	CMR	7483.01	Small
112	CNT	1449.34	Small
113	COL	9600	Small
114	COM7	50100	Large
115	COTTO	6916.64	Small
116	CPALL	572672.71	Large
117	CPF	273406.95	Large
118	CPH	123.2	Small
119	CPI	790.94	Small
120	CPL	664.16	Small
121	CPN	208692	Large
122	CPNCG	4394.38	Small
123	CPNREIT	55090.67	Large
124	CPT	765	Small
125	CPTGF	9863.4	Small
126	CPW	1002	Small
127	CRANE	1410.23	Small
128	CSC	2756.04	Small
129	CSP	277.85	Small
130	CSR	1424.75	Small
131	CSS	1669.55	Small
132	CTARAF	1616	Small
133	CTW	2009.43	Small
134	CWT	1600.46	Small
135	DCC	21645.21	Large
136	DCON	1885.22	Small
137	DDD	5531.25	Small
138	DELTA	149062.1	Large
139	DEMCO	2103.39	Small
140	DIF	157348.48	Large
141	DOHOME	29667.6	Large
142	DREIT	2703.7	Small
143	DRT	6398.74	Small
144	DTAC	84649.24	Large
145	DTC	5950	Small
146	DTCI	295	Small
147	EA	155727.5	Large
148	EASON	691.45	Small
149	EASTW	16221.32	Large
150	ECL	887.09	Small
151	EE	1807	Small
152	EGATIF	25234.55	Large
153	EGCO	114242.9	Large
154	EKH	2580	Small
155	EMC	1265.06	Small
156	EP	3409.82	Small
157	EPG	13608	Large
158	ERW	8458.91	Small
159	ERWPF	739.62	Small
160	ESSO	22841.66	Large
161	ESTAR	1757.79	Small
162	EVER	893.5	Small
163	F&D	317.24	Small
164	FANCY	350.55	Small
165	FE	1613.35	Small

Table 7: The information of all stock, which has been used in the research (cont.).

No.	Name	Market capitalization	Group of market capitalization
166	FMT	897.6	Small
167	FN	1150	Small
168	FNS	1002.98	Small
169	FORTH	5568	Small
170	FPT	24816.27	Large
171	FSS	813.96	Small
172	FTE	936	Small
173	FTREIT	41771.33	Large
174	FUTUREPF	10114.71	Large
175	GAHREIT	1404	Small
176	GBX	479.19	Small
177	GC	1070	Small
178	GEL	1025.6	Small
179	GENCO	572.37	Small
180	GFPT	15923.53	Large
181	GGC	9366.55	Small
182	GIFT	796.73	Small
183	GJS	2293.84	Small
184	GL	5308.87	Small
185	GLAND	14039.63	Large
186	GLOBAL	88472.36	Large
187	GLOCON	2031.98	Small
188	GOLDPF	1194.8	Small
189	GPI	852	Small
190	GPSC	179052.81	Large
191	GRAMMY	8281.49	Small
192	GRAND	1880.28	Small
193	GREEN	818.02	Small
194	GSTEEL		Small
195	GULF	338661.38	Large
196	GUNKUL	22383.98	Large
197	GVREIT	10510.92	Large
198	GYT	1576.2	Small
199	HANA	33201.25	Large
200	HFT	2409.87	Small
201	HMPRO	195952.85	Large
202	HPF	2227.8	Small
203	HREIT	5656.2	Small
204	HTC	5425.93	Small
205	HTECH	876	Small
206	HUMAN	5984	Small
207	ICC	8719.01	Small
208	ICHI	14430	Large
209	IFS	1184.4	Small
210	IHL	1588.72	Small
211	III	2729.7	Small
212	ILINK	2745.34	Small
213	ILM	6110.5	Small
214	IMPACT	26981.5	Large
215	INET	1490.12	Small
216	INGRS	680.06	Small
217	INOX	4287.64	Small
218	INSURE	310	Small
219	INTUCH	175556.39	Large
220	IRC	2440	Small

Table 7: The information of all stock, which has been used in the research (cont.).

No.	Name	Market capitalization	Group of market capitalization
221	IRPC	46181.79	Large
222	IT	981.95	Small
223	ITD	5491.06	Small
224	IVL	130819.06	Large
225	J	960.51	Small
226	JAS	24059.88	Large
227	JASIF	77600	Large
228	JCK	3778.78	Small
229	JCT	1093.5	Small
230	JMART	14777.72	Large
231	JMT	29865.54	Large
232	JTS	1921.56	Small
233	JUTHA	64.98	Small
234	JWD	7752	Small
235	KAMART	2481.59	Small
236	KBANK	196845.65	Large
237	KBS	1884	Small
238	KC		Small
239	KCAR	1887.5	Small
240	KCE	34890.61	Large
241	KDH	1667.04	Small
242	KGI	6612.65	Small
243	KKC	795	Small
244	KKP	33446.67	Large
245	KPNPF	1206	Small
246	KSL	9085.08	Small
247	KTB	133471.38	Large
248	KTC	79928.36	Large
249	KTIS	9958.8	Small
250	KWC	1740	Small
251	KWG	948.28	Small
252	KYE	6197.4	Small
253	L&E	836.47	Small
254	LALIN	4902.5	Small
255	LANNA	3281.25	Small
256	LEE	2084.13	Small
257	LH	88427.88	Large
258	LHFG	19065.29	Large
259	LHHOTEL	5432.99	Small
260	LHK	857.92	Small
261	LHPF	1749	Small
262	LHSC	5954.39	Small
263	LOXLEY	3306.83	Small
264	LPH	3255	Small
265	LPN	7201.41	Small
266	LRH	5292.18	Small
267	LST	3591.6	Small
268	LUXF	1346.02	Small
269	M	48115.88	Large
270	MACO	3517.79	Small
271	MAJOR	15746.15	Large
272	MAKRO	214800	Large
273	MALEE	1904	Small
274	MANRIN	608.07	Small
275	MATCH	1250.61	Small

Table 7: The information of all stock, which has been used in the research (cont.).

No.	Name	Market capitalization	Group of market capitalization
276	MATI	741.4	Small
277	MAX	856.69	Small
278	MBK	22542.48	Large
279	MBKET	4252.57	Small
280	MC	7640	Small
281	M-CHAI	2960	Small
282	MCOT	3146.91	Small
283	MCS	6850	Small
284	MDX	1236.54	Small
285	MEGA	31387.3	Large
286	METCO	2821.24	Small
287	MFC	1708.37	Small
288	MFEC	2127.81	Small
289	MIDA	851.39	Small
290	M-II	1238.4	Small
291	MILL	3167.7	Small
292	MINT	117119.94	Large
293	MIPF	2907	Small
294	MIT	310.05	Small
295	MJD	1290.62	Small
296	MJLF	2277	Small
297	MK	3186.32	Small
298	ML	883.78	Small
299	MNIT	197.34	Small
300	MNIT2	403.89	Small
301	MNRF	292.4	Small
302	MODERN	1800	Small
303	MONO	8399.95	Small
304	MPIC	1768.16	Small
305	MSC	2016	Small
306	M-STOR	364.8	Small
307	MTC	104410	Large
308	MTI	5074	Small
309	NC	138.3	Small
310	NCH	1095.85	Small
311	NEP	534.84	Small
312	NER	5328.4	Small
313	NEW	480	Small
314	NEX	8037.37	Small
315	NFC	1838.44	Small
316	NKI	1697.5	Small
317	NMG		Small
318	NNCL	3850.72	Small
319	NOBLE	6299.3	Small
320	NOK	2647.72	Small
321	NSI	1084.2	Small
322	NTV	6720	Small
323	NUSA	2368.74	Small
324	NVD	1684.33	Small
325	NWR	1266.89	Small
326	NYT	3868.8	Small
327	OCC	534	Small
328	OGC	450.08	Small
329	OHTL	4876.59	Small
330	OISHI	15000	Large

Table 7: The information of all stock, which has been used in the research (cont.).

No.	Name	Market capitalization	Group of market capitalization
331	ORI	17170.03	Large
332	OSP	117146.25	Large
333	PACE		Small
334	PAE		Small
335	PAF	302.4	Small
336	PAP	1689.6	Small
337	PATO	1388.13	Small
338	PB	31725	Large
339	PCSGH	6801.5	Small
340	PDI	1559.4	Small
341	PDJ	776.03	Small
342	PE		Small
343	PERM	562.5	Small
344	PF	3527.8	Small
345	PG	451.2	Small
346	PK	605.33	Small
347	PL	1204.95	Small
348	PLANB	22324.77	Large
349	PLAT	7168	Small
350	PLE	1062.22	Small
351	PM	4427.02	Small
352	PMTA	865.26	Small
353	POLAR		Small
354	POMPUI		Small
355	POPF	5009.04	Small
356	PORT	1250.83	Small
357	POST	600	Small
358	PPF	2536.96	Small
359	PPP	600	Small
360	PPPM	240.82	Small
361	PR9	5268.21	Small
362	PRAKIT	450.35	Small
363	PREB	1990.96	Small
364	PRECHA	302.4	Small
365	PRG	6660	Small
366	PRIME	9530.05	Small
367	PRIN	1952.02	Small
368	PRINC	9833.04	Small
369	PRM	22625	Large
370	PRO		Small
371	PSH	25167.81	Large
372	PSL	7266.3	Small
373	PT	1561.39	Small
374	PTG	31396	Large
375	PTL	22230	Large
376	PTT	1028267.86	Large
377	PTTEP	349358.72	Large
378	PTTGC	204025.42	Large
379	PYLON	3179.46	Small
380	Q-CON	1896	Small
381	QH	24000.21	Large
382	QHHR	1948.8	Small
383	QHOP	424.69	Small
384	QHPF	7810.6	Small
385	RAM	33360	Large

Table 7: The information of all stock, which has been used in the research (cont.).

No.	Name	Market capitalization	Group of market capitalization
386	RATCH	80475	Large
387	RBF	20200	Large
388	RCI	2343.99	Small
389	RCL	2801.18	Small
390	RICHY	835.96	Small
391	RJH	6600	Small
392	RML	2712.11	Small
393	ROCK	206	Small
394	ROH	3468.75	Small
395	ROJNA	8647.58	Small
396	RPC	626.24	Small
397	RPH	2839.2	Small
398	RS	19158.19	Large
399	RSP	1255.1	Small
400	S	9732.28	Small
401	S11	4076.45	Small
402	SABINA	6567.75	Small
403	SAFARI		Small
404	SAM	480.76	Small
405	SAMART	4891.61	Small
406	SAMCO	763.74	Small
407	SAMTEL	3120.9	Small
408	SAPPE	6178.88	Small
409	SAT	5697.6	Small
410	SAUCE	9000	Small
411	SAWAD	61791.86	Large
412	SAWANG	304.8	Small
413	SBPF	202.03	Small
414	SC	9445.95	Small
415	SCB	241086.92	Large
416	SCC	442800	Large
417	SCCC	41869	Large
418	SCG	3266.1	Small
419	SCI	1102.5	Small
420	SCN	2136	Small
421	SCP	1845	Small
422	SDC	1698.66	Small
423	SEAFCO	4105.38	Small
424	SE-ED	556.56	Small
425	SEG	17899.93	Large
426	SENA	4014.91	Small
427	SF	9508.37	Small
428	SFLEX	4592	Small
429	SFP	2730	Small
430	SGP	16265.09	Large
431	SHANG	7280	Small
432	SHR	7187.28	Small
433	SHREIT	1284.33	Small
434	SIAM	836.31	Small
435	SINGER	5874.92	Small
436	SIRI	10552.54	Large
437	SIRIP	1428	Small
438	SIS	5007.84	Small
439	SISB	7802	Small
440	SITHAI	1571.74	Small

Table 7: The information of all stock, which has been used in the research (cont.).

No.	Name	Market capitalization	Group of market capitalization
441	SKE	688.2	Small
442	SKN	2016	Small
443	SKR	11995.97	Large
444	SLP	480	Small
445	SMIT	1833.8	Small
446	SMK	7350	Small
447	SMPC	6426.08	Small
448	SMT	2124.66	Small
449	SNC	2877.77	Small
450	SNP	5002.17	Small
451	SOLAR	527.8	Small
452	SORKON	1665.51	Small
453	SPACK	768	Small
454	SPALI	36218.04	Large
455	SPC	21945	Large
456	SPCG	17531.82	Large
457	SPF	12445	Large
458	SPG	4347	Small
459	SPI	34599.39	Large
460	SPRC	28183.36	Large
461	SPRIME	4199.45	Small
462	SQ	1837.67	Small
463	SRICHA	2912.86	Small
464	SRIPANWA	2232.51	Small
465	SSC	8974.14	Small
466	SSF	1741.49	Small
467	SSP	6776.7	Small
468	SSPF	1603.2	Small
469	SSSC	1248	Small
470	SST	1323.66	Small
471	SSTRT	820.31	Small
472	STA	41856	Large
473	STANLY	11493.75	Large
474	STARK	49530.64	Large
475	STEC	19063.83	Large
476	STHAI		Small
477	STPI	6304.35	Small
478	SUC	9975	Small
479	SUPER	22426.56	Large
480	SUSCO	3124.02	Small
481	SUTHA	918	Small
482	SVH	42000	Large
483	SVI	7888.29	Small
484	SVOA	805.98	Small
485	SYMC	2107.56	Small
486	SYNEX	11524.11	Large
487	SYNTEC	2368	Small
488	TAE	2360	Small
489	TASCO	39459.04	Large
490	TBSP	2654.86	Small
491	TC	1260.6	Small
492	TCAP	36992.45	Large
493	TCC	243.09	Small
494	TCCC	13331.48	Large
495	TCJ	346.36	Small

Table 7: The information of all stock, which has been used in the research (cont.).

No.	Name	Market capitalization	Group of market capitalization
496	TCMC	831.89	Small
497	TCOAT	231	Small
498	TEAM	528.76	Small
499	TEAMG	1618.4	Small
500	TFFIF	46614	Large
501	TFG	25570.53	Large
502	TFI	286.65	Small
503	TFMAMA	65281.39	Large
504	TGPRO	377.56	Small
505	TH	472.87	Small
506	THAI	7072.18	Small
507	THANI	14648.37	Large
508	THCOM	6795.83	Small
509	THE	1465.74	Small
510	THG	16387.24	Large
511	THIP	1968	Small
512	THL		Small
513	THRE	3877.79	Small
514	THREL	1356	Small
515	TIF1	765	Small
516	TIP	16200	Large
517	TIPCO	3643.48	Small
518	TISCO	53242.93	Large
519	TIW	1167	Small
520	TK	3475	Small
521	TKN	14628	Large
522	TKS	2496.02	Small
523	TKT	211.86	Small
524	TLGF	40668.72	Large
525	TLHPF	1625.4	Small
526	TMB	89614.2	Large
527	TMD	3300	Small
528	TMT	4162.22	Small
529	TNITY	740.98	Small
530	TNL	2484	Small
531	TNPC	233.25	Small
532	TNPF	298.73	Small
533	TNR	3000	Small
534	TOA	77609.25	Large
535	TOG	1612.68	Small
536	TOP	80071.09	Large
537	TOPP	1158	Small
538	TPA	613.58	Small
539	TPBI	1959.34	Small
540	TPCORP	1004.4	Small
541	TPIPL	25126.46	Large
542	TPIPP	35616	Large
543	TPOLY	1145.52	Small
544	TPP	547.5	Small
545	TPRIME	7391.25	Small
546	TQM	37200	Large
547	TR	4435.2	Small
548	TRC	1150.46	Small
549	TRITN	3082.75	Small
550	TRU	1997.06	Small

Table 7: The information of all stock, which has been used in the research (cont.).

No.	Name	Market capitalization	Group of market capitalization
551	TRUBB	1267.55	Small
552	TRUE	110115.04	Large
553	TSC	2429.13	Small
554	TSE	5802.54	Small
555	TSI	551.84	Small
556	TSR	1473.15	Small
557	TSTE	2644.96	Small
558	TSTH	3200.19	Small
559	TTA	5175.8	Small
560	TTCL	2119.04	Small
561	TTI	925	Small
562	TTLPF	3996	Small
563	TTT	3152.28	Small
564	TTW	52269	Large
565	TU	67282.6	Large
566	TVI	1036.26	Small
567	TVO	21630.34	Large
568	TWP	556.2	Small
569	TWPC	3063.86	Small
570	TWZ	594.4	Small
571	TYCN	1103.99	Small
572	U	7578.52	Small
573	UAC	2470.14	Small
574	UMI	543.73	Small
575	UNIQ	5296.98	Small
576	UOBKH	1537.49	Small
577	UP	347.5	Small
578	UPF	435	Small
579	UPOIC	1088.81	Small
580	URBNPF	213.12	Small
581	UT	675	Small
582	UTP	9425	Small
583	UV	5353.39	Small
584	UVAN	4230	Small
585	VARO	349.66	Small
586	VGI	61139.28	Large
587	VI		Small
588	VIBHA	20499.56	Large
589	VIH	3937.59	Small
590	VNG	5830.4	Small
591	VNT	27733.53	Large
592	VPO	347.8	Small
593	VRANDA	1886.12	Small
594	WACOAL	5400	Small
595	WAVE	407.12	Small
596	WG	3302.25	Small
597	WHA	45438.38	Large
598	WHABT	1706.9	Small
599	WHART	37553.05	Large
600	WHAUP	15223.5	Large
601	WICE	3207.35	Small
602	WIIK	953.59	Small
603	WIN	207.62	Small
604	WORK	4592.23	Small
605	WORLD		Small

Table 7: The information of all stock, which has been used in the research (cont.).

No.	Name	Market capitalization	Group of market capitalization
606	WP	2457.69	Small
607	WPH	948	Small
608	WR		Small
609	YCI		Small
610	ZEN	2745	Small
611	ZMICO	1025.32	Small

Table 8: The recognized patterns by using Kirkpatrick_Dahlquist set of parameters.

No.	Name	Event start date	Event end date
1	7UP	27-Feb-12	23-May-12
2	7UP	27-May-13	02-Oct-15
3	7UP	09-Nov-15	16-May-19
4	AAV	18-Mar-13	03-Jan-14
5	AAV	21-Jul-14	12-Nov-14
6	ACC	27-Mar-13	04-Sep-13
7	AEC	03-Jun-13	11-Dec-15
8	AEC	01-Feb-17	26-Dec-18
9	AEONTS	20-Jun-17	08-Aug-17
10	AFC	15-Oct-10	19-Nov-10
11	AFC	19-May-11	13-Jun-11
12	AFC	26-Aug-11	03-Oct-11
13	AH	13-Jul-17	31-Jul-17
14	AHC	25-Jun-14	23-Jul-14
15	AIT	05-Oct-12	31-Oct-12
16	AIT	07-May-13	10-Jul-13
17	AJA	09-Apr-15	15-Jun-15
18	AKR	23-Aug-10	27-Sep-10
19	AKR	19-Nov-10	26-Sep-11
20	AKR	30-Mar-12	11-Apr-12
21	AKR	29-Sep-14	07-Oct-14
22	AKR	21-Jan-15	12-May-15
23	AKR	14-Jul-15	14-Dec-15
24	ALLA	23-Jan-17	13-Mar-17
25	ALLA	20-Jul-17	14-Jan-19
26	ALT	15-Dec-16	22-Dec-16
27	ALUCON	04-Mar-10	09-Mar-10
28	AMANAH	10-Feb-12	23-May-12
29	AMATA	24-Mar-10	19-Apr-10
30	AMATA	24-Sep-10	08-Dec-10
31	AMATA	14-Jan-11	25-Jan-11
32	AMATA	13-Mar-13	25-Jun-13
33	AMATA	19-Sep-13	03-Jan-14
34	AMATA	22-Jul-14	21-Oct-14
35	AMC	15-Mar-13	22-Mar-13
36	ANAN	23-Nov-17	03-Jan-19
37	ANAN	18-Apr-19	10-May-19
38	AOT	23-Feb-10	19-Apr-10
39	AOT	25-Jul-11	09-Aug-11
40	AOT	07-Mar-16	12-Oct-16
41	AP	27-Feb-13	06-Jan-14
42	APCS	23-Nov-11	15-Dec-11
43	APCS	06-Feb-15	23-Feb-15
44	APURE	14-Jun-17	13-Jul-17
45	AQ	11-May-12	02-Jan-14

Table 8: The recognized patterns by using Kirkpatrick_Dahlquist set of parameters (cont.).

No.	Name	Event start date	Event end date
46	AQ	21-Jul-14	31-Jul-14
47	AQ	23-Sep-14	13-May-15
48	AQUA	23-Jul-14	10-Apr-18
49	ASAP	26-Feb-18	25-Dec-18
50	ASEFA	21-Sep-15	01-Oct-15
51	ASEFA	31-Aug-16	12-Sep-16
52	ASK	07-Mar-13	22-Mar-13
53	ASP	24-Mar-10	16-Apr-10
54	AYUD	23-Nov-17	27-Dec-17
55	B	09-Aug-10	26-Sep-11
56	B	05-Jun-12	15-Jun-12
57	B	04-Oct-12	15-Nov-12
58	B	11-Nov-14	01-Jun-16
59	B	14-Jul-16	08-Sep-16
60	B	10-Nov-16	06-Dec-16
61	B	09-Oct-17	16-Oct-17
62	B52	28-Aug-14	22-Dec-15
63	BA	24-Apr-18	29-Jun-18
64	BANPU	14-Jan-11	10-Feb-11
65	BANPU	18-Apr-11	25-Aug-11
66	BANPU	05-Sep-14	16-Dec-14
67	BANPU	07-Apr-15	24-Aug-15
68	BANPU	16-Oct-15	18-Jan-16
69	BANPU	09-Mar-16	26-Apr-16
70	BBL	20-Apr-11	04-Oct-11
71	BBL	08-May-13	24-Jun-13
72	BCH	24-Sep-10	21-Oct-10
73	BCH	09-Sep-11	01-Nov-11
74	BCH	11-Mar-13	22-Mar-13
75	BCT	15-Jul-10	08-Sep-10
76	BCT	08-Aug-18	29-Mar-19
77	BEAUTY	07-Nov-13	21-Feb-14
78	BEC	21-Mar-12	17-Apr-12
79	BEC	07-Feb-13	03-Jan-14
80	BEC	02-Dec-14	20-Jan-16
81	BEC	01-Mar-16	24-May-16
82	BEM	21-Jul-14	31-Jul-14
83	BFIT	20-Apr-10	25-May-10
84	BFIT	25-Aug-16	13-Oct-16
85	BFIT	24-Oct-17	12-Dec-17
86	BFIT	05-Mar-18	28-Dec-18
87	BH	27-Oct-17	29-Jun-18
88	BIG	03-Mar-15	26-Mar-15
89	BIG	31-Jul-18	21-May-19
90	BJCHI	25-Sep-14	30-Nov-17
91	BKKCP	30-Apr-10	04-May-10
92	BKKCP	29-Apr-11	03-Oct-11
93	BKKCP	26-Dec-11	27-Dec-11
94	BKKCP	28-Feb-12	09-Mar-12
95	BKKCP	16-Nov-12	27-Nov-12
96	BKKCP	22-Jan-13	23-Jan-13
97	BKKCP	29-Apr-13	13-Jun-13
98	BKKCP	06-Aug-13	28-Aug-13
99	BKKCP	18-Feb-14	25-Feb-14
100	BKKCP	26-May-14	01-Oct-14
101	BLA	31-Aug-10	18-Nov-10
102	BLA	10-Aug-11	04-Oct-11

Table 8: The recognized patterns by using Kirkpatrick_Dahlquist set of parameters (cont.).

No.	Name	Event start date	Event end date
103	BLA	29-Aug-16	08-Sep-16
104	BLAND	19-Mar-10	19-Apr-10
105	BLAND	11-Mar-13	24-Jun-13
106	BLAND	16-Oct-13	06-Jan-14
107	BROCK	15-Mar-13	22-Mar-13
108	BROCK	27-Apr-15	13-Oct-16
109	BRR	12-Jan-17	15-Mar-17
110	BSBM	27-Oct-14	22-Dec-15
111	BTNC	25-Feb-15	31-Jan-17
112	BTS	09-Jul-10	24-Feb-11
113	BWG	20-Apr-11	05-Oct-11
114	BWG	16-Jun-14	31-Jul-14
115	CCP	17-Feb-10	11-Mar-10
116	CCP	03-Sep-10	07-Sep-10
117	CCP	01-Oct-14	13-May-15
118	CCP	15-Jul-15	22-Dec-15
119	CEN	23-Aug-10	06-Sep-10
120	CEN	13-Mar-13	22-Mar-13
121	CENTEL	13-Mar-13	10-Jul-13
122	CENTEL	03-Jan-18	24-Aug-18
123	CFRESH	19-Sep-16	28-Aug-19
124	CGD	19-Nov-10	03-Oct-11
125	CGH	14-Nov-14	07-Dec-18
126	CHARAN	28-May-13	06-Sep-13
127	CHARAN	22-Sep-14	19-Dec-14
128	CHARAN	30-Mar-15	28-Jul-15
129	CHARAN	02-Nov-17	14-May-19
130	CHG	20-Jul-16	12-Sep-16
131	CHG	28-Sep-18	21-Jan-19
132	CI	02-May-13	13-Jun-13
133	CI	24-Jul-13	04-Feb-14
134	CI	21-Jul-14	01-Aug-14
135	CK	30-Sep-10	26-Sep-11
136	CK	20-May-13	03-Jan-14
137	CK	30-Sep-14	21-Oct-14
138	CK	27-Jan-15	26-Mar-15
139	CK	24-Jun-15	18-Aug-15
140	CKP	07-Nov-14	24-Aug-15
141	CKP	22-Oct-15	08-Jan-16
142	CM	21-Feb-13	13-Aug-15
143	CM	25-Jan-17	22-Feb-17
144	CNT	04-Mar-10	09-Mar-10
145	CNT	07-Mar-13	22-Mar-13
146	COL	08-Apr-15	01-Oct-15
147	COM7	20-Nov-17	13-Dec-17
148	COM7	11-May-18	28-Jun-18
149	CPALL	01-Sep-11	04-Oct-11
150	CPALL	02-Sep-15	04-Jan-16
151	CPF	27-Dec-13	08-May-14
152	CPF	15-Oct-14	17-Mar-15
153	CPF	21-May-15	24-Aug-15
154	CPF	24-Sep-15	22-Dec-15
155	CPF	25-Aug-16	22-Feb-18
156	CPH	02-Aug-10	02-Mar-11
157	CPH	09-Jul-12	16-Jul-12
158	CPH	10-Nov-15	18-Dec-15
159	CPH	07-Mar-16	12-Nov-18

Table 8: The recognized patterns by using Kirkpatrick_Dahlquist set of parameters (cont.).

No.	Name	Event start date	Event end date
160	CPL	05-Feb-18	02-Jul-18
161	CPL	12-Sep-18	30-Oct-19
162	CPN	08-Sep-11	04-Oct-11
163	CPN	13-Jul-15	24-Aug-15
164	CPN	01-Sep-16	12-Oct-16
165	CRANE	29-Mar-13	24-Apr-19
166	CSC	15-Aug-11	04-Oct-11
167	CSC	21-May-13	25-Jun-13
168	CSC	14-Aug-13	14-Jan-14
169	CSS	19-Feb-15	29-Jul-15
170	CTARAF	26-Feb-10	03-Mar-10
171	CTARAF	30-Apr-10	10-Jun-10
172	CTARAF	30-Jul-10	15-Sep-10
173	CTARAF	29-Oct-10	23-Nov-10
174	CTARAF	28-Feb-11	29-Mar-11
175	CTW	09-Dec-10	05-Oct-11
176	CWT	04-Dec-12	22-Mar-13
177	CWT	26-Feb-15	28-Jul-15
178	DCC	08-May-12	12-Jun-12
179	DELTA	10-Aug-10	10-Sep-10
180	DELTA	16-May-17	03-Sep-19
181	DELTA	15-Oct-19	29-Oct-19
182	DEMCO	06-Sep-12	11-Oct-12
183	DEMCO	24-Nov-14	15-Dec-14
184	DEMCO	02-Feb-15	24-Jun-16
185	DEMCO	08-Nov-16	18-Nov-16
186	DRT	11-Mar-13	22-Mar-13
187	DTAC	08-May-13	03-Jan-14
188	DTAC	02-Feb-16	05-Feb-16
189	DTAC	11-Aug-16	12-Sep-16
190	DTCI	14-Mar-12	09-Jul-12
191	DTCI	27-Jan-17	31-Jan-17
192	EA	24-Nov-14	24-Dec-14
193	EA	02-Mar-15	21-Jul-15
194	EA	20-Nov-15	07-Jan-16
195	EASON	09-May-13	24-Aug-15
196	EASON	22-Oct-15	04-Jan-16
197	ECL	26-Jan-15	29-Jul-15
198	ECL	18-Apr-17	24-Apr-17
199	EE	18-Jun-10	16-Nov-10
200	EE	15-Mar-13	22-Mar-13
201	EE	26-Apr-13	13-Jun-13
202	EE	23-May-14	09-Jun-14
203	EMC	28-Dec-10	09-Apr-14
204	EMC	14-Oct-14	15-Dec-14
205	EPG	18-Jan-16	08-Mar-18
206	ERW	07-Mar-13	02-Jan-14
207	ERW	24-Sep-18	13-Aug-19
208	ESSO	23-Mar-10	19-Apr-10
209	ESSO	20-May-11	27-Jun-11
210	ESSO	30-Jan-18	13-Mar-18
211	ESSO	11-Apr-19	25-Oct-19
212	EVER	15-Feb-10	09-Mar-10
213	EVER	13-Oct-11	29-Dec-11
214	EVER	07-Nov-18	21-Nov-18
215	F&D	02-Jun-10	03-Jun-10
216	F&D	23-Jul-10	15-Nov-10

Table 8: The recognized patterns by using Kirkpatrick_Dahlquist set of parameters (cont.).

No.	Name	Event start date	Event end date
217	F&D	28-Dec-12	06-Jan-15
218	F&D	13-May-15	13-Oct-16
219	FANCY	09-Sep-14	15-Dec-14
220	FANCY	12-Mar-15	24-Nov-15
221	FANCY	10-Feb-16	13-Oct-16
222	FANCY	15-Dec-16	22-Nov-18
223	FE	11-Apr-13	29-Apr-13
224	FMT	21-Aug-13	06-Jan-14
225	FMT	01-Oct-14	01-Dec-14
226	FORTH	18-Mar-13	22-Mar-13
227	FORTH	20-Aug-15	11-Jan-16
228	FSS	24-Mar-10	25-May-10
229	FUTUREPF	25-May-11	31-May-11
230	FUTUREPF	18-Jun-12	19-Jun-12
231	GC	24-Mar-15	29-Jul-15
232	GEL	25-Nov-10	21-Feb-11
233	GENCO	27-Jan-15	14-Dec-15
234	GENCO	21-Nov-17	07-Mar-18
235	GIFT	03-Aug-11	03-Oct-11
236	GIFT	20-Feb-13	04-Sep-13
237	GIFT	13-Nov-14	15-Dec-14
238	GIFT	31-Mar-17	15-Nov-17
239	GIFT	31-Jan-18	02-Jul-18
240	GIFT	03-Sep-18	07-Oct-19
241	GJS	11-May-10	24-May-10
242	GJS	27-Aug-10	01-Sep-10
243	GJS	22-Nov-10	13-Jun-11
244	GJS	03-Aug-11	26-Aug-13
245	GL	05-Jul-10	20-Sep-10
246	GL	20-Nov-12	08-Jan-13
247	GL	08-Jul-14	18-Dec-14
248	GL	26-Jul-16	12-Sep-16
249	GLAND	20-May-13	28-Aug-13
250	GLOBAL	27-Aug-10	14-Sep-10
251	GLOBAL	28-May-13	30-Jan-14
252	GPSC	22-Jan-18	07-Mar-18
253	GPSC	07-May-18	22-Nov-18
254	GRAND	30-Mar-10	19-Apr-10
255	GRAND	27-Dec-10	11-Dec-15
256	GULF	24-Jan-18	29-Jun-18
257	GUNKUL	05-Aug-11	04-Oct-11
258	GYT	02-May-13	03-Jan-14
259	HANA	27-Jul-10	30-Nov-10
260	HANA	12-Jun-17	31-Jul-17
261	HMPRO	30-May-13	06-Jan-14
262	HMPRO	08-Aug-16	12-Sep-16
263	HTECH	27-Sep-12	15-Nov-12
264	HUMAN	16-Feb-18	23-Mar-18
265	HUMAN	07-May-18	09-Jul-18
266	ICHI	21-Jul-14	13-Oct-16
267	IFS	13-Feb-15	12-May-15
268	IHL	29-Oct-10	15-Feb-11
269	ILINK	05-Jun-13	29-Aug-13
270	INET	23-Feb-10	10-Mar-10
271	INGRS	26-Sep-17	15-Dec-17
272	INGRS	23-Jan-18	14-Dec-18
273	INOX	24-Apr-12	22-Jun-12

Table 8: The recognized patterns by using Kirkpatrick_Dahlquist set of parameters (cont.).

No.	Name	Event start date	Event end date
274	INSURE	10-Oct-12	04-Dec-12
275	INSURE	25-Apr-16	23-Jan-17
276	INTUCH	17-May-13	21-Jun-13
277	IRPC	26-Apr-11	24-Jun-13
278	IRPC	28-Feb-18	28-Oct-19
279	ITD	18-Mar-13	06-Jan-14
280	ITD	19-Oct-15	28-Jun-18
281	IVL	24-Oct-13	03-Jan-14
282	IVL	28-Jul-14	15-Dec-14
283	IVL	02-May-18	05-Jul-18
284	JAS	26-Feb-10	08-Mar-10
285	JAS	24-Aug-10	01-Sep-10
286	JAS	29-Apr-11	05-Oct-11
287	JAS	09-May-12	23-May-12
288	JAS	22-May-13	24-Jun-13
289	JAS	29-Oct-13	07-Jan-16
290	JAS	07-Nov-16	17-Nov-16
291	JASIF	23-Sep-15	12-Feb-16
292	JCK	04-Aug-11	11-Aug-11
293	JCK	23-Feb-12	02-Mar-12
294	JCK	04-May-12	05-Jun-12
295	JCK	04-Jul-14	07-Aug-14
296	JCT	14-May-10	14-Jun-10
297	JMART	08-Sep-11	03-Oct-11
298	JMART	11-Mar-13	22-Mar-13
299	JMART	14-Sep-17	28-Sep-17
300	JMT	13-Mar-15	27-Mar-15
301	JUTHA	08-Apr-10	03-Oct-11
302	JUTHA	07-Nov-13	06-Jan-14
303	KAMART	12-Sep-12	30-Oct-12
304	KAMART	23-Sep-14	07-Oct-14
305	KAMART	13-Mar-15	08-Jul-15
306	KAMART	28-Oct-16	18-Nov-16
307	KBANK	22-Jul-11	04-Oct-11
308	KBANK	21-Nov-14	24-Aug-15
309	KBS	23-Jul-14	31-Oct-19
310	KCAR	05-Mar-10	08-Mar-10
311	KCAR	04-May-17	15-May-17
312	KCE	06-Aug-10	26-Nov-10
313	KCE	10-Jan-11	24-Jan-11
314	KCE	26-Apr-13	13-Jun-13
315	KCE	30-Jun-15	17-Jul-15
316	KCE	08-Dec-16	04-Jan-19
317	KDH	12-Jul-10	12-Nov-10
318	KDH	19-Apr-16	13-Oct-16
319	KGI	24-Mar-10	19-Apr-10
320	KGI	06-Oct-10	23-Nov-10
321	KKC	14-Jan-11	13-Jun-11
322	KKP	21-Oct-10	04-Oct-11
323	KSL	09-Mar-10	19-Apr-10
324	KSL	23-Nov-17	24-Oct-19
325	KTB	19-Jan-11	01-Feb-11
326	KTB	01-Aug-11	04-Oct-11
327	KTC	02-Mar-10	19-Apr-10
328	KTC	04-Apr-11	04-Oct-11
329	KTC	24-Apr-15	28-Jul-15
330	KTC	18-Nov-15	11-Dec-15

Table 8: The recognized patterns by using Kirkpatrick_Dahlquist set of parameters (cont.).

No.	Name	Event start date	Event end date
331	KTIS	27-Aug-14	06-Dec-18
332	KWC	10-Feb-14	11-Nov-14
333	KWG	19-Jul-10	05-Jun-12
334	KWG	29-Jan-13	22-Mar-13
335	KWG	13-Jun-16	12-Oct-16
336	L&E	28-Jul-10	10-Sep-10
337	LANNA	07-Apr-10	19-Apr-10
338	LHFG	28-Apr-14	20-May-14
339	LHK	24-Sep-12	20-Nov-12
340	LHK	22-Feb-13	22-Mar-13
341	LOXLEY	19-Feb-10	19-Apr-10
342	LOXLEY	30-Aug-10	15-Sep-10
343	LOXLEY	15-Nov-10	22-Nov-10
344	LOXLEY	18-Jan-11	25-Jan-11
345	LOXLEY	15-May-13	25-Aug-15
346	LPH	15-Jul-16	12-Sep-16
347	LPN	28-Oct-10	14-Jan-11
348	LPN	08-Mar-13	05-Apr-13
349	LRH	28-Apr-11	15-Nov-12
350	LST	03-Feb-17	13-Mar-17
351	LST	24-May-17	05-Jul-17
352	M	24-Jul-14	20-Jun-16
353	MACO	10-May-13	25-Jun-13
354	MACO	11-Jun-14	04-Jul-14
355	MACO	01-Oct-14	16-Dec-14
356	MACO	24-Aug-16	12-Oct-16
357	MACO	31-Oct-17	11-Mar-19
358	MAJOR	26-May-15	27-Jul-15
359	MAJOR	26-Jul-16	12-Sep-16
360	MAKRO	24-Aug-11	04-Oct-11
361	MALEE	15-May-12	05-Jun-12
362	MANRIN	22-Aug-12	13-Sep-12
363	MATCH	30-May-12	11-Jul-12
364	MATI	20-Mar-12	27-Mar-12
365	MATI	29-Sep-16	12-Oct-16
366	MATI	20-Jul-17	21-Aug-17
367	MATI	02-Oct-17	25-Feb-19
368	MAX	24-Apr-14	09-May-14
369	MAX	24-Jul-14	06-Aug-14
370	MAX	22-Apr-15	28-Jul-15
371	MAX	29-Sep-15	30-May-16
372	MBKET	24-Mar-10	19-Apr-10
373	MBKET	15-Mar-13	22-Mar-13
374	MC	14-Aug-14	15-Dec-14
375	MC	13-Jul-16	08-Sep-16
376	MC	16-Mar-17	12-May-17
377	MC	12-Jun-17	18-Aug-17
378	M-CHAI	23-Sep-10	24-Sep-10
379	M-CHAI	05-Nov-10	15-Nov-10
380	M-CHAI	30-Jan-12	27-Mar-12
381	M-CHAI	24-Aug-12	20-Dec-12
382	MCOT	03-Aug-11	07-Oct-11
383	MCS	20-Jan-11	24-Jan-11
384	MCS	19-Aug-15	24-Aug-15
385	MCS	24-Aug-16	12-Sep-16
386	MDX	25-Nov-10	04-Oct-11
387	MDX	10-Sep-14	15-Dec-14

Table 8: The recognized patterns by using Kirkpatrick_Dahlquist set of parameters (cont.).

No.	Name	Event start date	Event end date
388	MDX	19-Feb-15	07-Jan-16
389	MEGA	26-Aug-16	12-Sep-16
390	MEGA	31-Jan-17	22-Feb-17
391	METCO	14-May-14	23-May-14
392	MFEC	18-Mar-13	22-Mar-13
393	MFEC	23-May-13	24-Aug-15
394	MFEC	27-Oct-15	18-Dec-15
395	M-II	24-Dec-18	21-Feb-19
396	MILL	26-Dec-14	23-Dec-15
397	MILL	04-Feb-16	17-Feb-16
398	MILL	31-Aug-16	12-Oct-16
399	MINT	01-Oct-10	11-Feb-11
400	MINT	02-Aug-11	04-Oct-11
401	MINT	17-May-13	10-Jul-13
402	MINT	06-Nov-17	01-Jun-18
403	MIT	30-Mar-16	04-Dec-18
404	MJLF	30-Apr-10	04-May-10
405	MJLF	30-Jul-10	24-Aug-10
406	MJLF	29-Oct-10	01-Nov-10
407	MK	13-Jul-16	12-Sep-16
408	ML	20-Aug-10	27-Sep-10
409	ML	11-Mar-13	22-Mar-13
410	ML	26-Apr-13	24-Jun-13
411	ML	10-Nov-14	15-Dec-14
412	MNIT	30-Jul-10	05-Nov-10
413	MNIT	31-Jan-11	14-Feb-11
414	MNIT	31-Mar-11	01-Apr-11
415	MNIT	31-Jan-12	06-Sep-12
416	MNIT	11-Mar-19	22-May-19
417	MNIT	10-Jul-19	28-Aug-19
418	MODERN	30-Sep-14	17-May-17
419	MPIC	10-Jan-11	25-Jan-11
420	MPIC	09-May-12	16-Aug-12
421	MPIC	02-Apr-13	24-Nov-16
422	MPIC	30-Mar-18	28-Nov-18
423	MPIC	27-Dec-18	17-Sep-19
424	MSC	28-Jul-10	03-Sep-10
425	MSC	07-Oct-10	08-Oct-10
426	MSC	10-Jun-15	24-Aug-15
427	MTC	02-Nov-18	18-Jan-19
428	NC	07-Dec-11	16-Dec-11
429	NC	12-Mar-15	16-Dec-15
430	NC	07-Mar-16	29-Jun-16
431	NC	03-Mar-17	18-May-17
432	NEP	24-Feb-12	16-May-12
433	NEP	28-Dec-18	04-Mar-19
434	NEW	04-Aug-11	20-Sep-11
435	NEW	25-Sep-13	12-Dec-13
436	NEX	24-Feb-17	19-Apr-17
437	NKI	31-Mar-10	05-Apr-10
438	NKI	07-Oct-10	05-Nov-10
439	NMG	31-Mar-10	22-Apr-10
440	NMG	10-Feb-12	22-Mar-12
441	NMG	13-Mar-13	10-Jan-14
442	NMG	11-Mar-15	14-Dec-15
443	NOBLE	20-May-13	03-Jul-13
444	NOBLE	27-Jul-16	12-Sep-16

Table 8: The recognized patterns by using Kirkpatrick_Dahlquist set of parameters (cont.).

No.	Name	Event start date	Event end date
445	NOK	15-Oct-13	03-Jan-14
446	NOK	17-Mar-14	17-Nov-14
447	NSI	26-Feb-16	12-Sep-16
448	NTV	20-Apr-16	18-May-16
449	NWR	14-Mar-13	21-Jan-16
450	OCC	30-May-11	17-Jun-11
451	OCC	14-May-12	15-May-12
452	OCC	28-Aug-14	30-Oct-14
453	OHTL	07-Jan-14	30-Jan-14
454	OISHI	09-Dec-10	13-Dec-10
455	OISHI	20-May-11	30-Nov-11
456	ORI	29-Jan-18	16-Nov-18
457	PAE	09-Apr-10	25-May-10
458	PAF	15-Aug-11	26-Sep-11
459	PAF	14-Nov-11	15-Nov-12
460	PAF	08-Jan-15	23-May-16
461	PATO	19-Mar-10	12-Apr-10
462	PE	12-Jan-15	26-Nov-18
463	PERM	11-Sep-14	15-Dec-14
464	PERM	03-Feb-15	02-Dec-15
465	PERM	30-Aug-16	12-Sep-16
466	PF	22-Jul-10	31-Jan-11
467	PF	26-Jul-11	04-Oct-11
468	PF	27-Mar-12	21-May-12
469	PF	15-Mar-13	25-Jun-13
470	PG	30-Apr-10	26-May-10
471	PG	02-Aug-10	09-Dec-10
472	PG	28-Feb-11	05-Oct-11
473	PK	17-Feb-10	19-Apr-10
474	PK	11-Aug-15	22-Dec-15
475	PK	01-Jun-17	22-Aug-17
476	PLE	11-May-11	13-Jun-11
477	POLAR	23-May-13	22-Aug-13
478	POLAR	02-Oct-13	21-Jan-14
479	POLAR	12-Mar-14	21-Mar-14
480	POLAR	26-Aug-14	24-Sep-14
481	POLAR	31-Oct-14	19-Nov-14
482	PORT	15-Jan-18	23-Jan-18
483	PORT	16-Feb-18	11-Apr-19
484	POST	11-Apr-13	11-Nov-15
485	POST	20-Apr-16	23-Aug-18
486	POST	24-Sep-18	30-Oct-18
487	POST	03-Jan-19	02-Sep-19
488	POST	04-Nov-19	11-Nov-19
489	PPP	29-Mar-13	09-Apr-13
490	PPP	04-Jan-17	10-Mar-17
491	PRAKIT	03-Nov-15	14-Dec-15
492	PREB	21-Feb-13	22-Mar-13
493	PREB	21-Apr-15	20-Jul-15
494	PRECHA	01-Oct-14	21-Oct-14
495	PRECHA	02-Feb-15	05-Mar-15
496	PRECHA	21-Apr-15	12-May-15
497	PRG	13-Jul-15	15-Dec-15
498	PRIME	11-Nov-14	02-Mar-16
499	PRINC	26-Apr-11	28-Jun-11
500	PRINC	23-Aug-11	04-Oct-11
501	PRINC	15-Jan-13	22-Mar-13

Table 8: The recognized patterns by using Kirkpatrick_Dahlquist set of parameters (cont.).

No.	Name	Event start date	Event end date
502	PRINC	25-Apr-13	13-Sep-13
503	PRINC	01-Oct-14	17-Oct-14
504	PRM	01-Nov-17	25-Dec-18
505	PRO	17-Feb-10	03-Mar-11
506	PSL	24-Mar-14	06-Jan-15
507	PT	08-Sep-11	26-Sep-11
508	PT	09-Nov-17	27-Nov-17
509	PTG	24-Nov-14	16-Dec-14
510	PTL	11-May-11	17-Sep-15
511	PTL	27-Oct-15	07-Jan-16
512	PTL	03-Oct-18	27-Dec-18
513	PTT	03-May-12	05-Jun-12
514	PTT	20-Sep-13	06-Jan-14
515	PTT	25-Nov-14	16-Dec-14
516	PTTEP	13-Aug-14	16-Dec-14
517	PTTEP	22-May-18	19-Jun-18
518	PTTGC	01-Mar-12	01-Jun-12
519	PTTGC	23-Dec-13	16-Dec-14
520	PYLON	29-Jan-15	27-Mar-15
521	PYLON	14-Jul-17	16-Aug-17
522	PYLON	12-Jan-18	29-Jun-18
523	QH	19-Mar-10	19-Apr-10
524	QH	22-Apr-11	21-Jun-11
525	QHOP	30-Apr-10	04-May-10
526	QHOP	29-Oct-10	10-Nov-10
527	QHOP	31-Jan-11	01-Feb-11
528	QHOP	30-Apr-12	02-May-12
529	QHPF	30-Apr-10	14-Jun-10
530	QHPF	28-Feb-11	30-Mar-11
531	QHPF	31-Jan-12	01-Feb-12
532	QHPF	30-Apr-12	16-May-12
533	RCI	09-Jul-10	07-Oct-11
534	RCI	07-Nov-12	16-Nov-12
535	RCI	28-Feb-13	22-Mar-13
536	RCI	19-Aug-13	27-Aug-13
537	RCI	17-Jul-15	12-Sep-16
538	RCL	16-Jul-10	05-Aug-10
539	RCL	23-Sep-10	04-Oct-11
540	RCL	19-Apr-12	05-Jun-12
541	RJH	14-Nov-17	29-Jun-18
542	RML	05-Apr-10	19-Apr-10
543	RML	09-Aug-10	12-Nov-10
544	ROCK	19-Aug-10	24-Aug-10
545	ROCK	02-Jun-17	27-Sep-17
546	ROH	26-May-10	07-Jun-10
547	ROH	20-Jan-11	06-Jan-12
548	ROH	12-Mar-12	13-Mar-12
549	ROH	18-May-12	08-Aug-12
550	ROH	14-Aug-13	29-Aug-13
551	ROH	20-Feb-19	02-May-19
552	ROJNA	12-Feb-13	02-Jan-14
553	ROJNA	23-Nov-17	06-Dec-17
554	RPC	28-Oct-14	16-Dec-14
555	RPC	19-Feb-15	21-Dec-15
556	RS	21-Jan-11	01-Feb-11
557	RS	25-Jul-11	28-Nov-11
558	RS	13-Feb-15	21-Jan-16

Table 8: The recognized patterns by using Kirkpatrick_Dahlquist set of parameters (cont.).

No.	Name	Event start date	Event end date
559	S	23-Aug-11	10-Oct-11
560	S	18-Jul-14	30-Jul-14
561	S	24-Apr-17	05-Jul-18
562	SAM	15-Oct-14	15-Dec-14
563	SAMART	29-May-13	02-Jan-14
564	SAMART	03-Feb-15	05-Mar-18
565	SAMCO	20-May-13	28-Aug-13
566	SAPPE	29-Oct-14	07-Jan-15
567	SAWAD	03-Nov-17	22-Feb-18
568	SAWAD	03-Dec-18	25-Dec-18
569	SAWANG	29-Mar-10	09-Apr-10
570	SAWANG	06-Sep-10	12-Nov-10
571	SAWANG	25-Feb-14	03-Mar-14
572	SAWANG	31-Oct-14	24-Dec-14
573	SAWANG	21-Apr-15	13-May-15
574	SAWANG	05-Oct-15	19-Oct-15
575	SAWANG	09-Nov-15	07-Jan-16
576	SC	27-Feb-13	21-Mar-13
577	SCB	01-Aug-11	04-Oct-11
578	SCB	01-Dec-14	24-Aug-15
579	SCC	02-Apr-19	25-Oct-19
580	SCI	06-Sep-17	04-Oct-17
581	SCN	17-Jun-15	11-Jan-16
582	SCP	07-Nov-12	09-Nov-12
583	SEAFCO	13-Mar-13	22-Mar-13
584	SEAFCO	30-Apr-13	10-Jul-13
585	SEAFCO	09-Dec-14	15-Dec-14
586	SEAFCO	12-Jul-17	24-Jul-17
587	SF	19-Jul-10	27-Jul-10
588	SF	26-Feb-13	22-Mar-13
589	SFP	05-Oct-12	23-Nov-12
590	SGP	18-Mar-14	20-Nov-14
591	SGP	24-Apr-15	07-Aug-15
592	SGP	12-Oct-15	29-Oct-15
593	SGP	08-Aug-16	09-Sep-16
594	SGP	01-Nov-17	03-Nov-17
595	SHANG	24-Jan-13	12-Feb-13
596	SINGER	03-May-12	22-May-12
597	SIRI	05-Apr-10	19-Apr-10
598	SITHAI	28-Jan-13	22-Mar-13
599	SKE	02-Feb-18	29-Jun-18
600	SKN	10-Nov-17	04-Jun-19
601	SKR	27-Feb-13	18-Mar-13
602	SLP	30-Aug-16	12-Sep-16
603	SLP	26-Oct-16	14-Nov-16
604	SMIT	12-Mar-13	22-Mar-13
605	SMPC	30-Apr-15	24-Jun-15
606	SMPC	09-Feb-16	18-Feb-16
607	SMT	11-Aug-10	07-Sep-10
608	SMT	17-Jan-11	10-Jan-18
609	SOLAR	19-Mar-10	04-Oct-11
610	SOLAR	09-Dec-14	15-Dec-14
611	SPACK	18-Mar-15	24-Aug-15
612	SPACK	19-Apr-17	27-Jul-17
613	SPALI	21-Jul-10	06-Sep-10
614	SPALI	01-Aug-16	12-Sep-16
615	SPALI	12-Jun-17	01-Nov-19

Table 8: The recognized patterns by using Kirkpatrick_Dahlquist set of parameters (cont.).

No.	Name	Event start date	Event end date
616	SPCG	16-Jun-14	22-Jul-14
617	SPCG	24-Nov-14	14-Dec-15
618	SPF	26-Feb-10	02-Mar-10
619	SPF	30-Jul-10	02-Aug-10
620	SPF	29-Oct-10	24-Jan-11
621	SPG	01-Sep-14	04-Aug-15
622	SPG	17-Nov-15	25-Dec-15
623	SPRC	18-Oct-16	14-Dec-16
624	SPRC	17-Oct-17	23-May-19
625	SPRIME	10-Jul-19	17-Jul-19
626	SQ	08-Nov-17	29-Jun-18
627	SQ	13-Sep-18	22-Jan-19
628	SQ	10-May-19	23-May-19
629	SSC	30-Nov-10	20-May-11
630	SSSC	13-May-13	08-Jul-13
631	SST	07-May-13	28-Aug-13
632	STA	05-Aug-10	07-Sep-10
633	STA	22-Apr-16	16-May-16
634	STANLY	22-May-13	11-Mar-16
635	STEC	02-Nov-10	16-Nov-10
636	STEC	14-Jan-11	25-Jan-11
637	STEC	24-Sep-14	15-Dec-14
638	STEC	30-Jan-15	24-Mar-15
639	STPI	19-Jul-10	09-Aug-11
640	STPI	31-Jan-12	24-May-12
641	SUSCO	03-Oct-14	16-Oct-14
642	SUSCO	24-Nov-14	06-Jan-15
643	SUSCO	25-Feb-15	21-Dec-15
644	SUSCO	23-Jun-16	12-Sep-16
645	SVI	11-Nov-14	26-Nov-14
646	SVI	28-Jan-16	09-Sep-16
647	SVOA	21-Jan-11	21-Mar-11
648	SVOA	16-Nov-17	13-Dec-17
649	SYMC	13-Dec-12	22-Mar-13
650	SYNEX	02-Aug-11	04-Oct-11
651	SYNEX	26-Oct-15	07-Jan-16
652	SYNEX	26-Jun-17	03-Jul-17
653	SYNEX	20-Nov-17	04-Dec-17
654	SYNEX	16-Oct-18	20-Nov-18
655	SYNTEC	24-Aug-16	12-Sep-16
656	TAE	26-Aug-14	16-Dec-14
657	TAE	24-Feb-15	27-Mar-15
658	TASCO	03-Sep-10	13-Sep-10
659	TASCO	21-May-13	10-Jul-13
660	TASCO	18-Oct-13	30-Jan-14
661	TASCO	17-Jul-14	15-Aug-14
662	TASCO	04-Nov-15	15-Feb-16
663	TASCO	20-Jun-16	13-Oct-16
664	TBSP	11-Mar-11	04-May-11
665	TBSP	18-Aug-16	28-Sep-16
666	TBSP	20-Apr-18	04-Dec-18
667	TC	27-Jul-10	26-Sep-11
668	TCAP	30-Mar-10	19-Apr-10
669	TCAP	01-Sep-11	26-Oct-11
670	TCC	11-Mar-15	12-Jul-17
671	TCCC	14-Jan-11	01-Mar-11
672	TCCC	15-Nov-13	08-Jan-14

Table 8: The recognized patterns by using Kirkpatrick_Dahlquist set of parameters (cont.).

No.	Name	Event start date	Event end date
673	TCJ	30-Aug-10	06-Sep-10
674	TCJ	25-Nov-10	16-Feb-11
675	TCMC	02-Jul-15	25-Aug-15
676	TCMC	06-Oct-16	27-Jul-17
677	TCOAT	05-Aug-10	17-Aug-10
678	TCOAT	20-Feb-13	22-Mar-13
679	TCOAT	23-May-13	24-Jun-13
680	TCOAT	22-Nov-13	15-Jan-14
681	TCOAT	13-Feb-15	25-Aug-15
682	TCOAT	25-Aug-16	12-Sep-16
683	TCOAT	16-Feb-17	06-Feb-18
684	TEAM	07-Jan-15	29-Jun-18
685	TFI	04-May-10	26-May-10
686	TGPRO	12-Mar-13	08-Jun-15
687	TH	23-Nov-10	24-Feb-11
688	THAI	09-Mar-11	23-Jun-11
689	THAI	22-Jul-11	04-Oct-11
690	THAI	03-Jun-13	06-Jan-14
691	THAI	31-Aug-16	20-Apr-17
692	THCOM	15-Jun-10	30-Jun-10
693	THCOM	30-Aug-10	26-Jan-11
694	THCOM	02-Jun-11	09-Jun-11
695	THCOM	03-Aug-11	05-Oct-11
696	THCOM	29-Mar-13	04-Apr-13
697	THCOM	16-May-13	09-Jul-13
698	THCOM	02-Apr-14	14-Dec-15
699	THCOM	05-Apr-16	23-Nov-17
700	THIP	02-Jul-10	27-Aug-10
701	THIP	27-Sep-10	28-Sep-10
702	THIP	03-Aug-11	20-Oct-11
703	THL	05-Apr-10	19-Apr-10
704	THRE	09-May-12	27-Jul-12
705	THRE	28-May-13	27-Feb-14
706	THREL	09-Feb-18	29-Jun-18
707	TIF1	30-Apr-10	17-May-10
708	TIF1	30-Jul-10	09-Sep-10
709	TIF1	29-Dec-11	06-Jan-12
710	TIF1	21-Mar-12	29-Mar-12
711	TIF1	09-May-12	01-Jun-12
712	TIF1	18-Jul-12	27-Jul-12
713	TIF1	03-Jan-13	13-Jun-13
714	TIF1	31-Jan-14	05-Feb-14
715	TIPCO	10-May-12	22-Nov-12
716	TISCO	10-Nov-10	05-Oct-11
717	TK	05-Feb-18	02-Jul-18
718	TKN	02-Mar-17	17-Jul-18
719	TKT	26-Jul-11	09-Mar-12
720	TKT	02-Oct-12	10-Jan-14
721	TKT	03-Apr-15	17-Jul-18
722	TKT	01-Oct-18	15-May-19
723	TMB	25-Mar-10	19-Apr-10
724	TMB	31-Aug-10	05-Oct-11
725	TMT	15-Mar-13	21-Mar-13
726	TNITY	13-Sep-10	22-Nov-10
727	TNL	07-Apr-10	19-May-10
728	TNL	01-Jun-12	11-Jun-12
729	TNL	29-Apr-13	30-Jan-14

Table 8: The recognized patterns by using Kirkpatrick_Dahlquist set of parameters (cont.).

No.	Name	Event start date	Event end date
730	TNPC	18-May-15	12-Sep-16
731	TNPF	30-Sep-11	07-Oct-11
732	TNPF	31-Oct-11	03-Nov-11
733	TNPF	23-Dec-11	27-Dec-11
734	TNR	07-Aug-17	06-Feb-18
735	TOG	03-Oct-16	13-Oct-16
736	TOP	04-May-10	22-Jul-10
737	TOPP	14-Jun-13	05-Sep-13
738	TPA	02-May-13	15-Dec-14
739	TPCORP	26-May-10	27-May-10
740	TPCORP	21-Jun-10	29-Jun-10
741	TPCORP	30-Sep-10	02-Dec-10
742	TPIPL	19-Mar-10	19-Apr-10
743	TPIPL	19-Jul-10	24-Aug-10
744	TPIPL	13-May-11	28-Jun-11
745	TPIPL	09-Feb-12	05-Jun-12
746	TPIPL	20-Oct-14	11-Nov-14
747	TPOLY	10-Jun-13	27-Mar-14
748	TPOLY	06-Feb-15	12-May-15
749	TPOLY	27-Oct-15	20-Jan-16
750	TPP	03-Mar-10	09-Mar-10
751	TPP	09-Nov-10	04-Oct-11
752	TPP	29-May-12	21-Jun-12
753	TPP	06-Mar-13	22-Mar-13
754	TRC	11-May-11	04-Oct-11
755	TRC	20-Mar-13	22-Mar-13
756	TRC	25-May-15	17-May-19
757	TRITN	24-Mar-10	29-Mar-10
758	TRITN	09-Aug-11	26-Oct-11
759	TRITN	09-May-12	16-May-12
760	TRITN	15-Mar-13	06-Jun-13
761	TRITN	16-Jul-13	06-Jan-14
762	TRITN	11-Mar-14	09-Apr-14
763	TRITN	11-Nov-14	15-Dec-14
764	TRITN	31-Jul-15	12-Oct-16
765	TRU	17-Feb-11	04-May-11
766	TRUBB	05-Aug-10	23-Nov-10
767	TRUBB	06-Jan-11	14-Dec-15
768	TRUBB	19-Jan-16	01-Mar-16
769	TRUBB	25-Apr-16	23-May-16
770	TRUBB	30-Jan-17	25-Oct-19
771	TRUE	07-Sep-10	05-Oct-11
772	TRUE	18-Sep-14	06-Oct-14
773	TRUE	26-Feb-15	25-Aug-15
774	TRUE	15-Oct-15	16-Jan-19
775	TSC	10-May-10	19-May-10
776	TSC	28-Feb-13	12-Nov-15
777	TSE	29-Aug-16	12-Sep-16
778	TSI	23-May-13	27-Aug-13
779	TSI	05-Sep-14	17-Dec-14
780	TSR	25-Nov-15	14-Dec-15
781	TSR	09-May-16	06-Mar-18
782	TSTE	08-Nov-10	29-Nov-10
783	TSTE	24-Oct-12	06-Mar-13
784	TSTH	18-Jan-13	16-Jul-13
785	TTA	23-Mar-10	01-Feb-11
786	TTA	19-Mar-13	22-Mar-13

Table 8: The recognized patterns by using Kirkpatrick_Dahlquist set of parameters (cont.).

No.	Name	Event start date	Event end date
787	TTA	28-Jun-13	10-Jul-13
788	TTA	18-Oct-13	28-Nov-13
789	TTCL	14-Jan-13	01-Feb-13
790	TTCL	28-Sep-18	17-Jan-19
791	TTW	15-Mar-13	13-Jun-13
792	TU	27-Aug-10	08-Sep-10
793	TU	08-Dec-14	10-Aug-15
794	TVO	11-Nov-10	18-Nov-10
795	TWP	29-Mar-10	08-Apr-10
796	TWP	17-Aug-10	24-Nov-10
797	TWP	21-May-13	24-Jun-13
798	TWP	10-Nov-14	22-Jan-16
799	TWPC	16-Aug-13	28-Aug-13
800	TWZ	02-Mar-10	03-Oct-11
801	TWZ	08-Jul-14	07-Aug-14
802	TWZ	04-Nov-14	22-Dec-15
803	TWZ	01-Aug-16	02-Jan-19
804	TWZ	05-Feb-19	15-Feb-19
805	TWZ	09-Apr-19	17-Apr-19
806	U	20-Aug-10	18-Jun-12
807	U	22-Jul-14	06-Aug-14
808	U	20-Apr-15	11-Nov-16
809	UAC	13-Feb-15	12-May-15
810	UMI	30-Oct-12	15-Nov-12
811	UMI	28-Feb-13	22-Mar-13
812	UMI	14-May-13	15-Dec-14
813	UMI	17-Jul-15	24-Aug-15
814	UMI	20-Oct-15	14-Dec-15
815	UNIQ	03-Oct-14	20-Oct-14
816	UNIQ	03-Feb-15	26-Mar-15
817	UP	26-Jan-12	17-Apr-12
818	UP	29-Mar-13	02-Dec-13
819	UP	25-Aug-14	24-Apr-19
820	UPF	21-Sep-10	17-Nov-10
821	UPF	19-Jan-18	25-Feb-19
822	UPOIC	10-May-12	16-May-12
823	URBNPF	26-Feb-10	26-Jan-11
824	UTP	18-Nov-10	08-Dec-10
825	UV	23-Feb-10	10-Mar-10
826	UV	07-Nov-17	12-Dec-17
827	UV	13-Feb-18	01-Nov-19
828	VARO	05-Jul-12	30-Jul-12
829	VARO	16-Jul-13	02-Aug-13
830	VARO	05-Aug-14	02-Oct-14
831	VGI	29-Apr-19	23-May-19
832	VIBHA	18-Jan-16	29-Jan-16
833	VIBHA	09-Aug-16	09-Sep-16
834	VIH	22-Sep-14	24-Aug-15
835	VIH	21-May-18	30-May-19
836	VNG	03-Sep-14	10-Sep-14
837	VNG	13-Nov-14	17-Dec-14
838	VNG	06-Feb-15	27-Mar-15
839	VNG	29-Jul-16	12-Sep-16
840	VNT	25-Jan-13	06-Jan-14
841	VNT	06-Mar-18	23-Apr-18
842	VNT	04-Jun-18	05-Jul-18
843	WACOAL	27-Apr-10	04-May-10

Table 8: The recognized patterns by using Kirkpatrick_Dahlquist set of parameters (cont.).

No.	Name	Event start date	Event end date
844	WACOAL	30-Jul-10	12-Nov-10
845	WAVE	19-Aug-10	01-Oct-10
846	WAVE	02-Nov-10	07-Dec-10
847	WAVE	11-May-11	05-Oct-11
848	WAVE	18-Aug-14	13-Nov-14
849	WAVE	24-Jun-15	02-Oct-15
850	WHA	18-Feb-13	22-Mar-13
851	WHA	04-Jun-13	24-Jun-13
852	WHA	23-Jul-13	01-Aug-13
853	WHAUP	20-Nov-17	29-Jun-18
854	WICE	29-Aug-16	12-Sep-16
855	WIIK	26-Feb-15	01-Oct-15
856	WIN	12-Mar-13	22-Mar-13
857	WIN	15-Oct-13	06-Jan-14
858	WORK	07-Sep-11	05-Oct-11
859	WORK	26-Feb-13	22-Mar-13
860	WP	01-Aug-18	03-Jan-19
861	YCI	18-Feb-10	09-Mar-10
862	YCI	23-Jan-13	06-Feb-13
863	ZMICO	01-Oct-10	29-Oct-10
864	ZMICO	11-Mar-13	22-Mar-13

Table 9: Comparison of cumulative returns from the large market capitalization stocks in SET index and the four sets of parameters after the event

Day	***Bulkowski_1***			***Bulkowski_2***			***Bulkowski_3***			***Kirkpatrick_Dahlquist***		
	SET	*Stocks*	*T Test*	*SET*	*Stocks*	*T Test*	*SET*	*Stocks*	*T Test*	*SET*	*Stocks*	*T Test*
1	-0.1%	-4.0%	-5.11	0.0%	-2.7%	-5.61	0.0%	-2.3%	-6.07	0.1%	-2.0%	-7.06
2	-0.1%	-4.8%	-6.03	0.0%	-3.0%	-5.49	0.0%	-2.5%	-5.89	0.1%	-2.2%	-6.80
3	-0.1%	-5.1%	-6.68	-0.1%	-3.3%	-6.19	0.0%	-2.8%	-6.64	0.1%	-2.0%	-5.94
4	0.0%	-6.1%	-7.31	0.0%	-3.8%	-6.48	0.1%	-3.3%	-7.17	0.2%	-2.2%	-5.77
5	0.0%	-4.4%	-3.97	0.1%	-2.7%	-3.90	0.1%	-2.4%	-4.50	0.2%	-1.7%	-4.51
6	0.2%	-4.3%	-4.19	0.2%	-2.6%	-4.01	0.3%	-2.3%	-4.56	0.3%	-1.6%	-3.85
7	0.2%	-5.1%	-5.01	0.2%	-3.3%	-5.10	0.3%	-2.6%	-5.17	0.3%	-1.6%	-3.87
8	0.3%	-4.5%	-4.37	0.2%	-3.0%	-4.48	0.3%	-2.5%	-4.85	0.3%	-1.5%	-3.63
9	0.3%	-4.6%	-4.49	0.3%	-3.0%	-4.61	0.4%	-2.5%	-4.81	0.4%	-1.4%	-3.42
10	0.5%	-4.3%	-4.17	0.4%	-2.8%	-4.13	0.4%	-2.3%	-4.43	0.4%	-1.3%	-3.30
11	0.5%	-4.4%	-4.10	0.4%	-2.9%	-4.16	0.4%	-2.4%	-4.33	0.5%	-1.4%	-3.49
12	0.4%	-4.5%	-4.17	0.3%	-3.1%	-4.26	0.3%	-2.4%	-4.36	0.5%	-1.5%	-3.78
13	0.4%	-4.4%	-4.02	0.3%	-2.9%	-4.00	0.3%	-2.4%	-4.11	0.5%	-1.6%	-3.92
14	0.5%	-5.2%	-4.62	0.4%	-3.4%	-4.68	0.5%	-2.6%	-4.56	0.6%	-1.8%	-4.24
15	0.4%	-5.4%	-4.86	0.5%	-3.6%	-5.05	0.5%	-2.5%	-4.10	0.7%	-1.6%	-3.94
20	0.8%	-4.5%	-4.06	0.8%	-2.8%	-3.89	0.7%	-1.5%	-2.76	0.9%	-0.8%	-2.59
25	1.0%	-4.4%	-3.75	0.9%	-3.2%	-4.12	0.8%	-1.3%	-2.27	0.8%	-0.9%	-2.32

Notes:

The t-test statistic is used to confirm that cumulative return from trading stocks is higher than SET index. In order to assure higher robustness of results, different t test criteria are considered: 1.65, 2.34 and 3.09 corresponding to 95%, 99% and 99.9% confident level respectively for Bulkowski_1 which has the lowest number of events. The t test criteria of Kirkpatrick_Dahlquist which has the highest number of events is 1.65, 2.33 and 3.11 corresponding to 95%, 99% and 99.9% confident level respectively.

Table 9: Comparison of cumulative returns from the large market capitalization stocks in SET index and the four sets of parameters after the event (cont.).

Day	Bulkowski_1			Bulkowski_2			Bulkowski_3			Kirkpatrick_Dahlquist		
	SET	Stocks	T Test	SET	Stocks	T Test	SET	Stocks	T Test	SET	Stocks	T Test
30	1.0%	-3.2%	-2.62	1.0%	-2.3%	-2.97	0.9%	-0.1%	-0.89	0.7%	-0.5%	-1.39
35	1.5%	-3.0%	-2.64	1.4%	-1.3%	-2.25	1.3%	1.1%	-0.11	0.8%	0.0%	-0.86
40	1.9%	-2.9%	-2.82	1.6%	-1.3%	-2.42	1.5%	1.0%	-0.36	0.9%	-0.2%	-1.10
45	2.3%	-3.6%	-3.47	2.0%	-0.8%	-2.06	1.7%	1.7%	-0.04	1.2%	0.5%	-0.73
50	2.5%	-4.4%	-3.81	2.4%	-1.3%	-2.60	2.0%	1.6%	-0.29	1.5%	0.3%	-1.14
55	2.8%	-4.3%	-3.96	2.7%	-1.1%	-2.68	2.2%	1.5%	-0.50	1.7%	0.3%	-1.40
60	3.2%	-3.2%	-3.43	3.1%	-0.1%	-2.09	2.4%	2.3%	-0.11	2.0%	1.0%	-0.98

Notes:

The t-test statistic is used to confirm that cumulative return from trading stocks is higher than SET index. In order to assure higher robustness of results, different t test criteria are considered: 1.65, 2.34 and 3.09 corresponding to 95%, 99% and 99.9% confident level respectively for Bulkowski_1 which has the lowest number of events. The t test criteria of Kirkpatrick_Dahlquist which has the highest number of events is 1.65, 2.33 and 3.11 corresponding to 95%, 99% and 99.9% confident level respectively.

REFERENCES

Agrawal, J., & Kamakura, W. A. (1995). The economic worth of celebrity endorsers: An event study analysis. *Journal of marketing, 59*(3), 56-62.

Bulkowski, T. N. (2011). *Encyclopedia of chart patterns* (Vol. 225): John Wiley & Sons.

Corhay, A., & Rad, A. T. (1996). Conditional heteroskedasticity adjusted market model and an event study. *The Quarterly Review of Economics and Finance, 36*(4), 529-538.

Fama, E. F. (1960). *Efficient market hypothesis.* Ph. D. dissertation, University of Chicago, Graduate School of Business.

Islam, S. M., Watanapalachaikul, S., & Clark, C. (2007). Some tests of the efficiency of the emerging financial markets: An analysis of the Thai stock market. *Journal of Emerging Market Finance, 6*(3), 291-302.

Kirkpatrick II, C. D., & Dahlquist, J. A. (2010). *Technical analysis: the complete resource for financial market technicians*: FT press.

MacKinlay, A. C. (1997). Event studies in economics and finance. *Journal of economic literature, 35*(1), 13-39.

Murphy, J. J. (1999). *Technical analysis of the financial markets: A comprehensive guide to trading methods and applications*: Penguin.

Sukpitak, J., & Hengpunya, V. (2016). Efficiency of Thai stock markets: Detrended fluctuation analysis. *Physica A: Statistical Mechanics and its Applications, 458*, 204-209.

Tripathi, M., & Mukhopadhyay, A. (2020). Financial Loss due to a Data Privacy Breach: An Empirical Analysis. *Journal of Organizational Computing and Electronic Commerce, 30*(4), 381-400.

Tsinaslanidis, P. E., & Zapranis, A. D. (2016). *Technical analysis for algorithmic pattern recognition*: Springer.

Wan, Y., & Si, Y.-W. (2017). A formal approach to chart patterns classification in financial time series. *Information Sciences, 411*, 151-175.

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