

Candlestick Accuracy and Investor Gain

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Technical analysis has been well-known by traders as one of the important tools of buying and selling when investors are investing in the capital market. This analysis has been established a long time ago since late 1869 which investors know as Random Walk and in early 1900 as Dow theory. Speculation has been a major goal of technical analysis invented, and most approaches try to capture the right moment to buy, hold or sell the stocks. At the same time, candlestick charts have also been developed in Japan by Munehisa Homma, a Japanese rice trader. Later on Steve Nisson brought this concept to the Western world. The problem arises with the question of which technical tools can be the most accurate. In this research, daily price of a certain stock in Indonesia are examined by the authors and evaluate its accuracy based on its candlestick pattern. 1-day and 2-day patterns of these candlesticks are compared by the authors and hopefully can bring insight about this sophisticated method. This result showed that there is no difference in the candlestick accuracy of 1-day pattern and 2-day pattern. While this research also suggests that an investor that uses technical analysis, especially the candlestick method, tends to be more cautious. It is true this candlestick pattern shows about 40% accuracy, but the authors prefer to be cautious about 60% unpredicted market behavior.

Keyword: Candlestick Analysis, Candlestick Pattern, Candlestick Accuracy, Technical Analysis, Stock Analysis, and Investment Decision

1. Introduction

Most investors in the capital market basically know that there are two types of analysis commonly used before they decide which stock will generate more capital gain in the future. First is fundamental analysis which analyzes all the firm's capabilities to generate sustainable profit based on a financial statement that has been published annually. The second is the technical analysis which analyzes trends and investor's irrational behavior based on historical pricing and a sophisticated mathematical approach. Before investors can understand fundamental analysis, investors basically need to understand the basic principle of accounting and some financial ratio. For technical analysis, investors need to understand some reversal and continuity pattern. Prings (2002) states that in the technical analysis, investors need to understand the market cycle and find the right moment to buy and sell. Basically, this pattern and cycle are believed to be created by investor reaction to every information provided by the market.

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In late 1869, the theory of random walk was established and stated that all stock prices follow a random pattern and cannot be predicted. Later, in early 1900, the Dow theory was also established based on the work of Charles Dow. At around that time a candlestick pattern was also established in Japan by Munehisa Homma, a Japanese rice trader. All the concepts of these tools talk about momentum and pattern. Prings (2002) also states that some indicator might be useful for mapping some trend in the future as investors can see in an approach such as the Moving Average (MA). There is also RSI (Relative Strength Index) for measuring stock overbought and oversold. Investors can also find Bollinger Bands and MACD indicator. All these indicators have only one goal: to know the right time to buy, sell or hold the stocks. Nisson (2001), in his book, introduced candlestick to the Western world. Candlestick approach is analyzed and examined by the authors as this research topic because it is really simple and interesting that investors can predict the future price just based on open, close, high and low stock price. This method simplifies stock price volatility and brought some information about reversal and continuity. Two firms are taken and compared by the authors in this research. The first one is Astra International with ticker code (ASII). ASII is one of the blue-chip stocks in Indonesia and has a good fundamental aspect. This firm already has 190 subsidiary firms with 6 different business segments. Based on a Jakarta Stock Exchange publication, by 2015, ASII's market capitalization had reached around 211,526,565 billion rupiahs. ASII is also the 5th firm that has a large market capitalization in Indonesia. The second firm is Kalbe Farma (KLBF). KLBF is one of the important firms in the consumer good sector. KLBF not only sells pharmaceutical products, but also some food and beverages as diversification of its business. By October 2013 the market capitalization of KLBF was the largest compared with other pharmacy firms (around 66.01 billion rupiahs). These two firms have their headquarters in Indonesia.

There are some previous researches that prove that candlestick pattern can be very helpful for an investor to decide the right time to buy, sell or hold. Detollenaere & Mazza (2013) find that candlestick pattern can help the trader or investor to choose between market timing and market impact cost. Lu, Shiu & Liu (2012) examine the profitability of candlestick's 2-day pattern based on 50 Taiwan tracker fund stocks and find that some patterns prove to be profitable. Later, Lu (2014) continued his research and found that some strategies might be useful. Lee & Gunaawan (2015) also examine the candlestick pattern on the firms that registered in Taiwan 50 Index. Their findings were that the accuracy of the result is not quite as high as they expected, but it could still generate high profits.

The goal of this research is to measure and compare the accuracy between 1-day pattern and 2-day pattern. Some examination will be applied by the authors from the daily stock price of ASII and KLBF and then t-test also will be applied to examine the difference between two patterns. This research tries to capture and examine the theoretical pattern based on Nisson (2001) and, after finding a certain pattern, its accuracy would be tested by the authors based on the theory. The authors are the first researchers who try to capture and examine candlestick pattern on very short-term investment time. The result should be different from previous researches that focus on long-term investment time.

The authors hope this result could contribute more information regarding the speculative investor. This research wants to provide speculator and trader with certain information about the candlestick pattern so they can be more cautious when using the candlestick pattern for their decision tools. The first part of this paper will consist of an introduction about the candlestick and purpose of this research. The second part of this paper is the literature review which contains some information about previous researches. The third part is the

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methodology which contains the method and the way the data are analyzed by the authors. The last part of this paper is the result and its conclusion.

2. Literature Review

Munehisa Homma developed a candlestick in early 1900. This concept was later brought by Steve Nisson to the Western world in his book “beyond candlestick”. The idea behind this concept is really simple. Investors could summarize stock price as its open, high, low and closing price and then each price summary pattern could reflect some investor behavior or tendency for the next day or next month transaction. Investors could see the force to sell or to buy each stock by its summary. For a long time, as the price summary is observed (candlestick), there are some patterns showing the same reaction; for example, if the hammer appears then the price tends to be reversed. Here is the basic pattern of the candlestick.

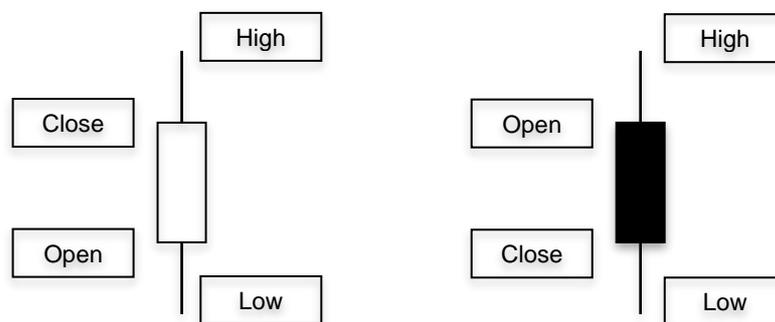


Figure 1: Basic Shape of the Candlestick

From the figure above, there is a minor difference in the body of the candle. The first candle has white color while the other has a dark color. The difference is in the position of the closing price. On the first candle, its closing price is higher than its opening price, as investors can say that the price today is increasing, while the dark candle shows the opposite position. Fariz (2009) conducted a research about technical analysis on ASII from September 2008 – June 2009. The result showed that the modified candlestick combined with the RSI indicator could help an investor to decide and generate profit with ROI around 23.60%. These simulations are based on a 7 times transaction, which consists of a 6 times profit and a 1 time loss. Muchlishin (2011) conducted a research about moving an average pattern and showed that a moving average can be used as a trend indicator and can be used as a signaling for the investor. Ameen conducted a research about 4 bullish and bearish candlestick patterns for 7 different currencies. The test showed that the candlestick reversal pattern showed strong evidence to generate profit. Marshall, Young and Cahan (2008) showed that candlestick is not profitable if the authors applied it to a large stock on the Japanese stock exchange for the period 1975 – 2004. Detollenaere & Mazza (2013) examined the idea that the candlestick pattern can help the trader or investor to choose between market timing and market impact cost. They found that, although market timing costs are lower after hammer and doji pattern, market impact costs are far lower and significant after the doji pattern happened. Lu, Shiu & Liu (2012) examine the profitability of the candlestick 2-day pattern based on a 50 Taiwan tracker fund stock from October 29th 2002 until December 31st 2008. They examine three bullish reversal patterns and three bearish reversal patterns and found that three bullish reversal patterns were more profitable in that sample. Lu (2014) continued his research about

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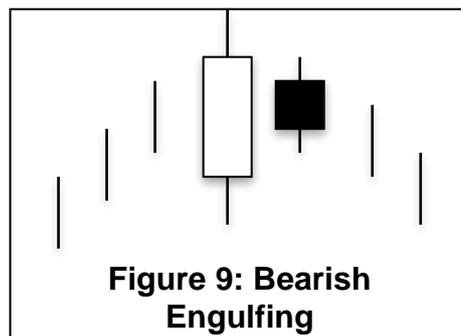
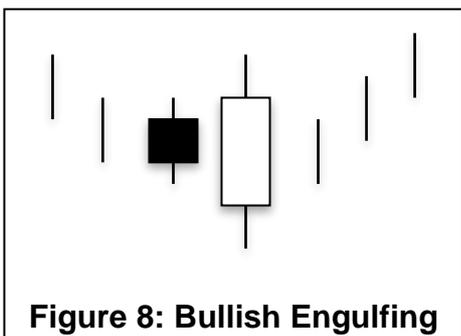
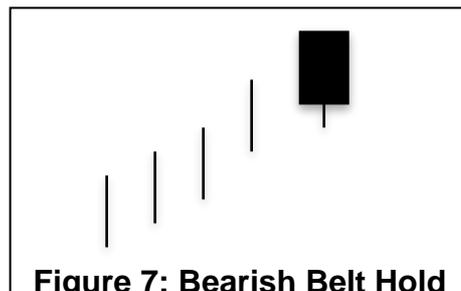
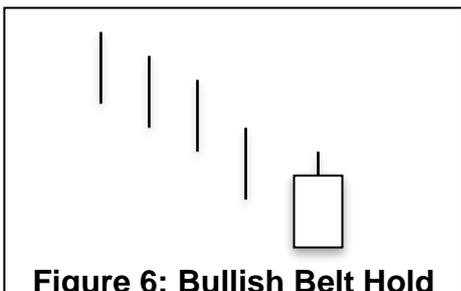
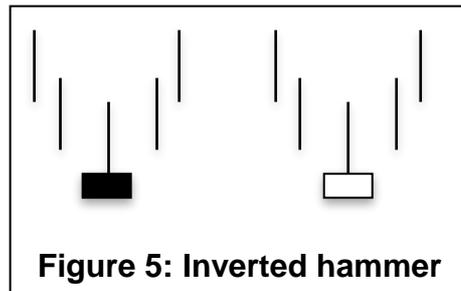
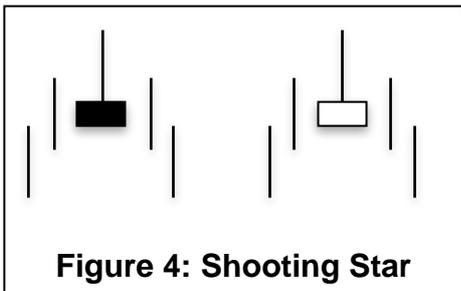
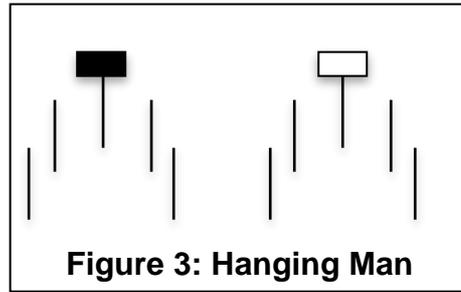
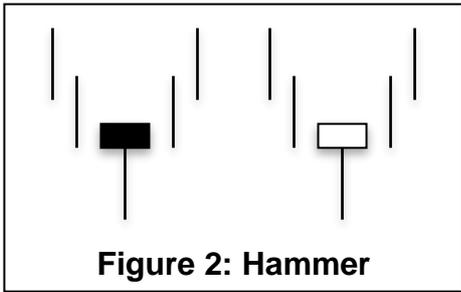
candlestick and examined the predictive power of those patterns from January 1992 to December 2009. The finding of this research was the four-price-level approach to categorizing the single-line patterns produced by the candlestick in a systematic way. Four patterns, it seems, were more profitable for Taiwan Stock after transaction cost. Lu, Chen & Hsu (2015) searched the optimum strategy for using the candlestick pattern. In this research they question whether the candlestick pattern can be used to decide future trends or buy and sell or holding strategy. They applied the candlestick trading strategy to DJIA data. The finding of this research was for any definition of trend; 8 reversal pattern on 3-day pattern with Caginalp-Laurent Holding Strategy was given the most profitable return which included 0.05% transaction cost. Prado, Ferneda, Morais, Luiz & Matsura (2013) conducted a research on the Brazil Stock Exchange. They used samples from 10 stocks from 2005 until 2009. Their findings were based on the statistical approach, and the predictive power of some patterns was proven significant. This research continues from an earlier one conducted by Greg Morris in 2006. Zhu, Atri & Yegen (2015) also conducted the effectiveness of 5 reversal candlestick patterns to predict short-term movement. They use a sample of the Chinese Market from 1999 to 2008 and they find that bearish harami and cross-signal pattern showed good result in a predicted reversal pattern on stocks that have low liquidity. Bullish harami, engulfing and piercing pattern were much better on the stocks that have high liquidity with small size. Lee & Gunaawan (2015) also examined the candlestick pattern on the firms registered on the Taiwan 50 Index. Their findings were that the accuracy of the result is not quite high as they expect. A quantitative association rule which they developed resulted from trade volume, 5-day and 10-day moving average, price range, candlestick 1-day and 2-day patterns. Still, the result, based on this strategy, could generate 122.075% for 1-day pattern for increasing rule and 45.601% for decreasing rule. For 2-day pattern net profit that could be generated using decreasing rule was 84.229%.

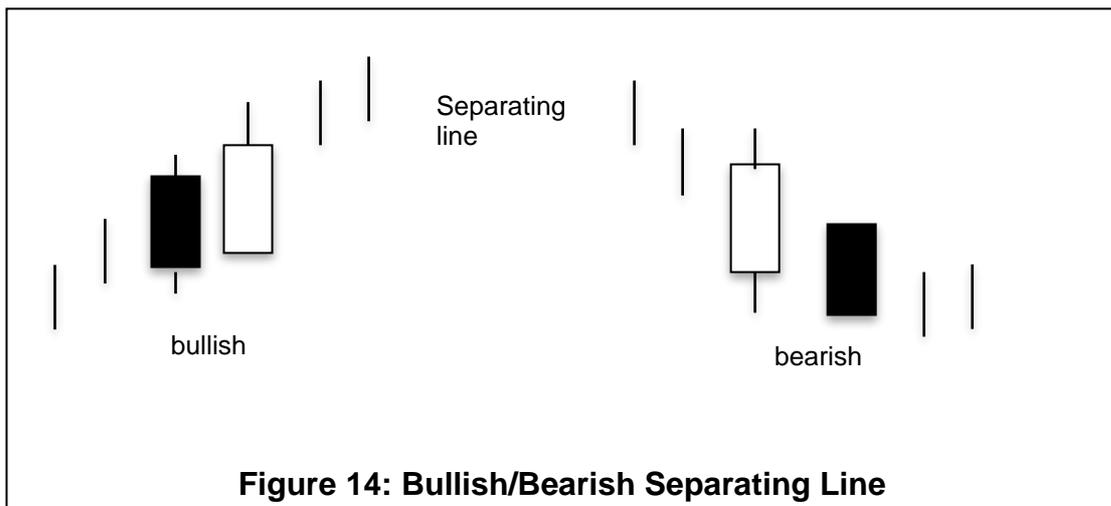
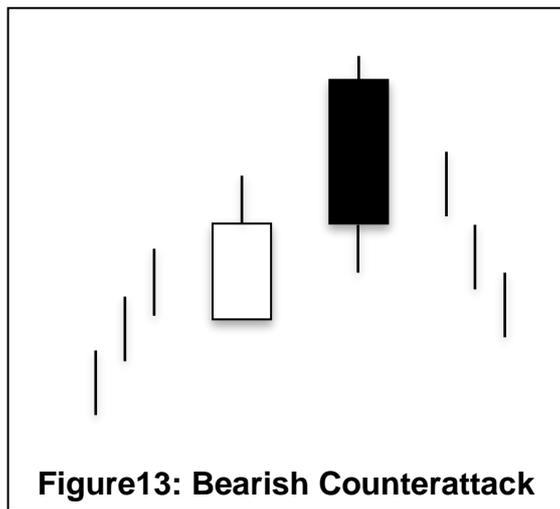
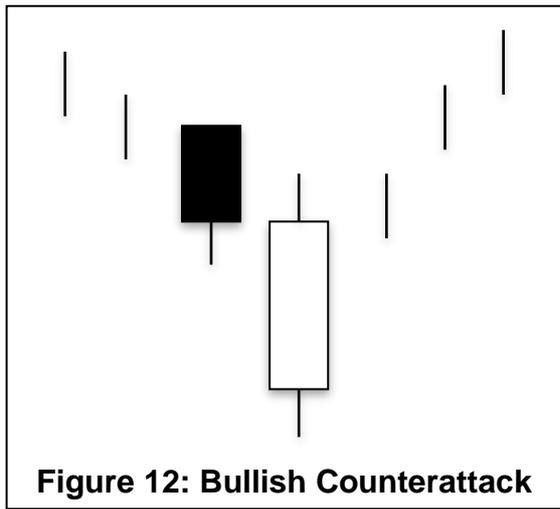
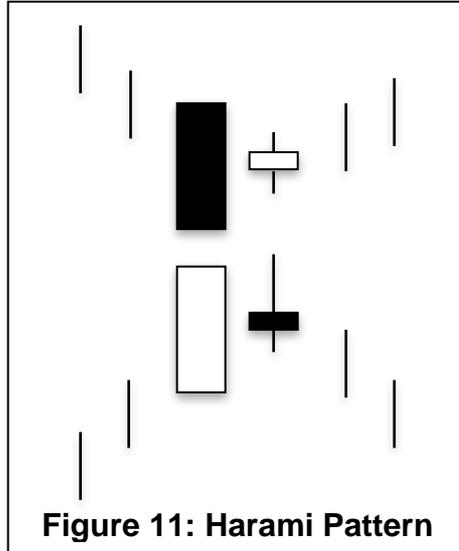
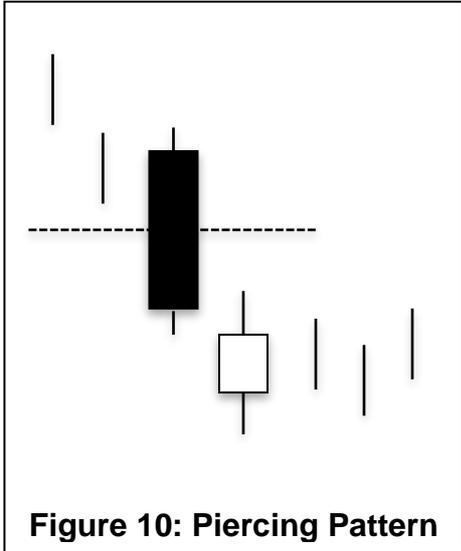
By far all the previous researches focus on the gain and long-term result of the candlestick. The research question that is proposed by the author: Is there any difference between one-day pattern and two-day pattern accuracy of this candlestick pattern? More insightful information can be provided by studying the accuracy of this pattern in a short time period. The gap between previous researches that has not been answered is: Does the time lag between one-day pattern and two-day pattern provides a greater significant difference in accuracy?

The limitation of this research is that the authors do not provide this accuracy result with a certain strategy to optimize the investor gain. If this research could provide us with some proposed strategy the result should be more meaningful for the investor.

3. The Methodology and Model

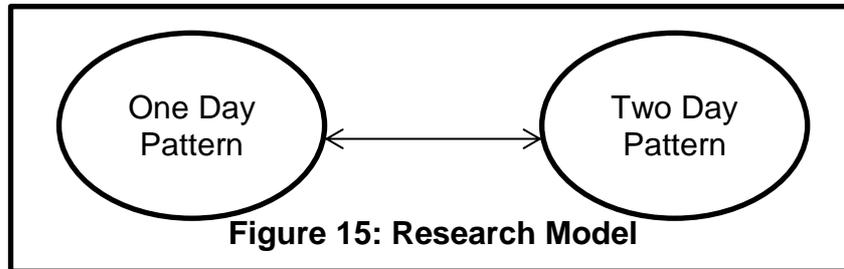
This research will examine daily stock price for ASII and KLBF from January 2012 to December 2015. Each daily open, high, low and closing price will examine, and the authors will use the excel formula stated by Lee & Gunawan (2015) to determine, the pattern. There are six 1-day patterns and nine 2-day patterns that would be examined in this research. Each pattern would be detected by the formula and then compared with next day price. How many patterns show the same result with the next day price and divide it with total patterns found will be counted by the authors. Later t-test will be used by the authors to compare the difference between 1-day pattern and 2-day pattern. Here are some patterns that need to be examined by this research.





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The picture above shows the pattern that should be observed in this research. Figures 2 to 7 show the 1-day pattern while 8 to 14 shows the 2-day pattern. All the patterns will be examined for their accuracy and frequency. After that t-test will be applied by the authors to test the difference between the 1-day pattern and the 2-day pattern. In this research, All trading days during the research periods are examined by the authors. There are about 925 trading days that the authors will examine for each firm. The model of this research is captured in figure 15 below.



This research has improved the gap in candlestick accuracy that has not been measured in previous research. Furthermore, statistic test for two different categories of candlestick pattern that has also not been examined by the previous research are applied by the authors. T-test are used by the authors to examine the difference between these two candlestick pattern categories. Then the research hypothesis is proposed by the authors as:

Ha: There is a difference in candlestick accuracy between 1-day pattern and 2-day pattern.

4. The Findings

Table 1: ASII Candlestick Pattern

Pattern	Future Trend	Freq	Up	Down	No change
1-Day Pattern					
Hammer	UP	23	7	11	5
Hanging Man	DOWN	18	7	8	3
Shooting Star	DOWN	19	8	8	3
Inverted Hammer	UP	15	8	5	2
Bullish Belt Hold	UP	62	25	30	7
Bearish Belt Hold	DOWN	92	41	39	12
2-Day Pattern					
Bullish Engulfing	UP	11	4	7	0
Bearish Engulfing	DOWN	16	9	6	1
Piercing Pattern	UP	6	4	2	0
Harami in downtrend	DOWN	13	6	5	2
Harami in uptrend	UP	9	1	6	2
Bullish Counterattack	UP	9	6	3	0
Bearish Counterattack	DOWN	7	0	5	2
Bullish Separating	UP	2	1	1	0
Bearish Separating	DOWN	0	0	0	0
Total		302	127	136	39

This finding showed that the total pattern found in ASII stock is 302 patterns. This consists of 229 patterns for the 1-day category and 73 patterns for the 2-day category. It seems that the 1-day pattern is more frequently found than the 2-day pattern. The result showed that not all

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the patterns are quite accurate. As you can see in table 1, for example, the hammer pattern is found 23 times, but only 7 of them are accurate up on the next day.

Table 2: KLBF Candlestick Pattern

Pattern	Future Trend	Freq	Up	Down	No change
1-Day Pattern					
Hammer	UP	19	7	8	4
Hanging Man	DOWN	19	6	11	2
Shooting Star	DOWN	25	18	2	5
Inverted Hammer	UP	11	7	2	2
Bullish Belt Hold	UP	66	28	31	7
Bearish Belt Hold	DOWN	90	38	37	15
2-Day Pattern					
Bullish Engulfing	UP	10	1	6	3
Bearish Engulfing	DOWN	15	6	6	3
Piercing Pattern	UP	5	2	2	1
Harami in downtrend	DOWN	5	3	2	0
Harami in uptrend	UP	4	3	1	0
Bullish Counterattack	UP	6	1	2	3
Bearish Counterattack	DOWN	3	2	1	0
Bullish Separating	UP	0	0	0	0
Bearish Separating	DOWN	0	0	0	0
Total		278	122	111	45

For KLBF, the result is quite similar with ASII. In spite of being in different industrial sectors, both of these blue chip stocks seem to have the same accuracy in candlestick pattern. This result found that in total there are 278 candlesticks found in this stock. There are 230 patterns for the 1-day category and 48 candlesticks for the 2-day category. For its accuracy, it is the same with ASII but does not really show very good accuracy.

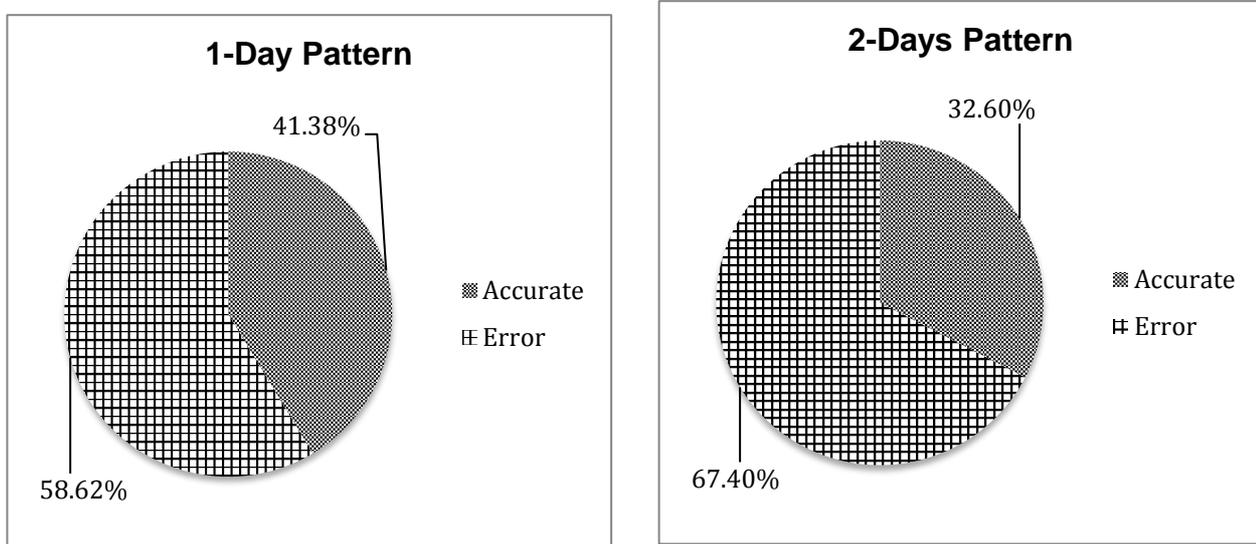


Figure 16: Descriptive Result of 1-Day Pattern and 2-Day Pattern

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Table 3: Accuracy Summary of Candlestick Pattern

Candlestick Pattern	ASII	KLBF
1-Day Pattern		
Hammer	30.43%	36.84%
Hanging Man	44.44%	57.89%
Shooting Star	42.11%	8.00%
Inverted Hammer	53.33%	63.64%
Bullish Belt Hold	40.32%	42.42%
Bearish Belt Hold	42.39%	41.11%
2-Day Pattern		
Bullish Engulfing	36.36%	10.00%
Bearish Engulfing	37.50%	40.00%
Piercing Pattern	66.67%	40.00%
Harami in downtrend	38.46%	40.00%
Harami in uptrend	11.11%	75.00%
Bullish Counterattack	66.67%	16.67%
Bearish Counterattack	71.43%	33.33%
Bullish Separating	50.00%	0.00%
Bearish Separating	0.00%	0.00%

Based on table 3, the authors can see the accuracy is not quite good, but also not quite bad. The authors are surprised that this indicator is close to achieving 50% accuracy. Overall, average accuracy of 1-day pattern is 41.38%, while for 2-day pattern it is 32.60%. The technical indicator tries to predict market movement based on market force and investor activity. This result also suggests that candlestick indicator is quite useful, although, it cannot be referred to as an absolute tool to make an investment decision. Its accuracy is good but not really high enough to reflect the market. An independent t-test to examine the difference between 1-day pattern and 2-day pattern also is applied by the authors. The research hypothesis that needs to be tested is whether there is a difference between the 1-day pattern and the 2-day pattern of the candlestick. And for the statistic hypothesis is proposed by the authors as:

H_0 : There is no difference in candlestick accuracy between 1-day pattern and 2-day pattern.

H_a : There is a difference in candlestick accuracy between 1-day pattern and 2-day pattern.

Based on Levene's F-test, the authors conclude that the authors assume there is no equality in variance ($F \text{ sig} < 0.05$). Therefore, the authors see the t-test for non-equal variance and found that p-value is very high (0.352). Based on these results the authors have no strong evidence to reject the null hypothesis. This conclusion comes to the fact there is no difference between 1-day pattern and 2-day pattern of the candlestick.

Table 4: Independent t-Test Result

Test Indicator	Value
Levene's Test For Equality of Variance (F)	4.677
F Sig	0.039*
Mean Difference	0.06734
Standard Error Difference	0.07118
t-test	0.946
t Sig (2-tailed)	0.352

This finding is quite far from expectation. The authors expect more time frames then it could reflect more information and give a more accurate result. The authors found that the 2-day

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pattern failed to be more accurate than the 1-day pattern. From this finding the authors conclude that the investor needs to be more cautious in using candlestick pattern. The candlestick pattern is not wrong or terribly inaccurate but it is also not 90% sure for next day prediction. The authors suggest that the investor needs to dig more about the market and not rely on single tools to make a decision. The candlestick also needs to be criticized as a tool for speculative purpose. This finding does not recommend the use of this method as a very short-term investment buying, holding or selling decision.

Table 5: Correlation Summary

Correlation Indicator	Volume – Freq (ASII)	Volume – Freq (KLBF)
Pearson Correlation	0.695	0.563
Sig	0.000	0.000
N	925	925

For additional insight, the authors also tried to capture the correlation between Volume and Frequency of trading. The authors found that volume and frequency have a strong correlation to each other. The Pearson correlation indicator showed that there is a strong positive correlation between volume of trading and frequency of trading. This led us to conclude that, in Indonesia, if these two blue-chip stocks are traded frequently by the investor, it causes a high transaction volume rather than be speculatively issued. The authors still tried to find some relationship between trading volume, frequency, value, stock price and technical indicator accuracy but, unfortunately, this research resource is still limited.

Perhaps with intraday data, the authors could develop more sophisticated technical tools to be evaluated and more insight could be gained. In the end the authors conclusion comes to this: there is no perfect way to guess how the market reacts. The best strategy is still to observe the market based on two basic information (fundamental and technical) while not forgetting to get updated on the news. As the information changes the price could react in a way that could not be predicted. This result is different from previous researches. The authors focused on the accuracy rather than gain and strategy of investment. This was a research limitation and the authors hope can improve more by studying some investment strategies. This finding also reveals that investors should pay more attention before making decisions using these candlestick tools. There is no 100% or high accuracy tools that could predict investor behavior or stock price volatility.

5. Summary and Conclusion

This finding is far from the expectation. The authors found that candlestick pattern for 1-day pattern and 2-day pattern shows no difference. The authors do expect more accuracy in the 2-day pattern, but the finding shows as the information added for one more day but in this research found there is no difference at all. The conclusion of this research also contradicts the theory and previous result. From the previous research, the authors found that most candlestick trading strategy generates positive income for the investor. Since there is more gain that investor could obtain from the previous research, the authors also expect more accuracy in candlestick pattern because this pattern can be a signal for the investor to enter and exit the market. Unfortunately, this research found that the accuracy is not more than 50%. Also, 1-day pattern and 2-day pattern showed no difference at all. The authors expect to find greater accuracy, especially for the candlestick of 2-day pattern, because there is more time and market reaction for better signal to the investor.

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This result has a great implication for the investor decision-making process. Investors cannot directly or hastily buy or sell their stock based on a simple information from a historical candlestick pattern. The authors suggest for the investor to be more cautious and careful in judging and using the candlestick pattern as a decision-making tool. The result is not bad, but also not really good enough to be considered accurate. There is about 60% uncertainty for the market reaction. The main goal of an investment is to obtain more wealth from the capital gain of the stocks. There are many decision-making tools and some technical indicators that could help an investor make a better decision. As the authors stated above, the use of the candlestick as a primary decision-making tool needs to be questioned.

The authors suggest the investor should gain more information about the market or stock and also consider the fundamental analysis as another tool for decision-making. The investor cannot rely on just a single candlestick pattern to decide to buy or hold or sell the stock. This candlestick pattern also cannot be suggested as a speculative tool for a very short-term investment time frame. In the end, there is a lot of factors to be considered rather than a simple technical indicator. The main implication of this research is that it gives a warning to the speculator and the daily trader that had only relied on patterns and trends to make their decision, and the authors found that it is not completely useful in a very short time. It is true that this research answers some questions that have not been previously answered regarding candlestick accuracy and also gives some insights into the difference between 1-day pattern and 2-day pattern. But this study is far from complete. The authors do have some limitation regarding investment strategy and some fundamental analysis approach. This research conclusion is limited to very short-term investment time frame and just focuses on the candlestick. The authors think it could be more interesting if the authors could apply this strategy for a longer time period and investment strategy. If the authors could combine this candlestick strategy with some investment strategy such as fundamental analysis, then, the authors also could generate more empirical findings about what is going on in the stock market.

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