Compare Buy and Hold Strategy with Technical Indicators Strategy on Index Trading with Empirical Studies

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Abstract

This is a quantitative research on the validity of two common trading strategies. One of it is buy and hold strategy. Another one is long and short strategy trading by the signal generated by technical indicators. The aim of this research is to find out the appropriate strategy. Besides, combination of technical indicators is tested in order to find out any difference in performance. Also, this research wants to find out the market different on these strategies. This study is useful for investor to determine his strategy. This study is rare in academic research. The method in this research is back test historical data of nine stock markets. Use statistic analysis to find out any significance different in mean/median of the profit generated by two strategies. It found that buy and hold strategy is better than long and short strategy.

Keywords: Stochastic Oscillator, Average Directional Index, EMH, Exponential Moving Average, MACD, Capital Flow, Lead-Lag Relation, Stock Market

1. Introduction

This paper aims to find out if any extra profit can gain from investing on index by individual or combination of technical indicators compare with buy and hold strategy. In academic field, some researchers attributed the extra profit gain by technical indicators strategy is due to extra risk. Some of them proved that the price is random walk. Efficient market hypotheses (EMH) are dominated in the academic field for many years. One of its model suggested that investors cannot make extra profit by trading according to historical data. This paper can indirectly provide knowledge concerned with the EMH. If trading according to the technical indicator signal can provide extra profit than buy and hold strategy, it proves indirectly that market is inefficient and cannot be classified in any model of EMH. In practical, a lot of traders still use conventional technical analysis (TA) to make trading decision. Besides, newspapers and some investing adviser often use technical indicators as a tool for their investment advice. Indeed, ordinary investor only wants to know the validity of technical indicators. However, academic article compare such strategy with simple buy and hold strategy is rare. This paper want to compare the different of profit by using buy and hold (B&H) strategy against Long and Short (L&S) strategy according to technical indicators. Simple find out the performance of any technical analysis is useless if not compare with bench mark. This research use B&H strategy as benchmark is similar to compare the performance of TA to the performance of market. If the difference between these two strategies is significant, investors should choose the better strategy. This paper is important for investors to choose appropriate investment strategy. Firstly, the purpose of this study was to determine which strategy is better. Secondly, this research want to find out if performance of strategies same in all major market or especially useful in certain market. Finally, this research wants to find out if use of combine signal of indicators has any different when compare with use single indicator. This paper investigates the index of major stock markets. The performance of such index will undergo back test. Such index includes S&P500(SP), Dow Jones Industrial Average(DJ), NASDAQ composite(NA), FTSE 100(FT), DAX(DA), CAC 40(CA), Nikkei 225(NI), Hang Seng (HS) and Shanghai composite index(SS).

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Such indexes cover all the major market in United States, Europe and Asia. Three commonly used technical indicators will be used to make trading decisions. They are Moving Average Convergence-Divergence (MACD), Average Directional Index (ADX) and Stochastic Oscillator (SO). Besides, trading decision on combination of the above indicators will also be back tested. The returns by using such strategies will used to compare with buy and hold strategy of same period. The rest of the study is structured as follow: First, the literature on EMH and technical analysis will be reviewed. Secondly, the sampling and research method will describe. The result will discuss in following part. Finally, general result, limitation, implication, possible explanation and suggestion for further study are mentioned.

2. Literature Review

The EMH is an important hypothesis in finance research in past twenty years. It is developed by Professor Eugene Fama in the early 1960. Recently, he also shared the 2013 Nobel Prize with other two researchers in Economic Sciences. This hypothesis contradicts the principle of technical analysis. Hence, EMH is discussed in the following part as background knowledge. This hypothesis states that stock prices already represent all the information that affect the prices, investors cannot gain extra profit by this information. EMH states that it is not possible to gain extra profit by predict stock price as prices change according to information that cannot be predicted. In other word, the price of market fully represent available information is called efficient (Fama, 1970). Some researchers point out that the market is weak form. Roberts (1965) and Osborne (1959) thought that US stocks prices did not follow pattern. It means that the US stocks price cannot be predicted by technical analysis. Moreover, Osborne (1959) Granger and Morgenstern (1963) and Fama (1965) failed to found any pattern of US stocks price too. In addition, Fama and Blume (1966) found that if use very small filters; it may produce extra profit than buy-and-hold strategy. However, the transaction cost makes it unprofitable.

On the other hand, some of researches suggest the market is not weak form. That means that the market is not effective. Levy (1967) found that invest on momentum can gain profit. Moreover, Merton (1980) stated that variance change can be figure out from historical information. Furthermore, French (1980) found a weekend patterns in US stocks. In addition, Keim (1983) found a January effect in US stocks. Also, Gultekin and Gultekin (1983) and Jaffe and Westerfield (1985) found seasonal patterns in international markets. Furthermore, Debondt and Thaler (1985) and Lehmann (1990) found reversal effect in US stocks. Jegadeesh and Titman (1993) found momentum effect. Generally, all the above researches show that one can gain extra profit by making investment according to historical information.

Another form of the EMT is semi-strong form. A market is called semi strong form when prices reflected all the public available information. In other words, investors cannot gain extra profit by take a position according to public information. Public available information includes historical prices and all market available information. Some research support the efficiency of semi strong form market. Fama (1969) found that investors cannot get extra return by the stock splits public information. Post and van Vliet (2004) thought that market efficiency is high. However, other researchers found that the market is not efficient. Jaffe (1974) found out that insiders can gain return from open information of insider trading. Besides, Ball (1978), Bernard and Seyhun (1995) also found that it need certain time for public to react to profit making information. Moreover, Basu (1978) found that invest on small (P/E) ratios stocks can gain extra return.

The last form of EMT is called strong form when prices reflect all the public and insider information. Investors cannot gain extra profit by investment according to this information. A lot of researches show that it is incorrect. Investors that have unexecuted limit orders can use this information to gain return (Niederhoffer and Osborne, 1966). Furthermore, Scholes (1969) pointed out that private information about a company is available to people working in that company. In addition, Jaffe (1974) and Seyhun (1986) claimed that insiders can gain extra return. Also, Kiymaz (2002) found that in Turkish stocks extra profit can found in the price change of stocks before public announcement. The validity of EMT is not conclusive. The evidences on weak form and semi strong form are not always supportive. Besides, a lot of researches shown that strong form effective market is not appropriate. The validity of EMT affects the usefulness of technical analysis. If market is either weak form, semi-strong or strong form, technical analysis is not useful. The predicting power of technical analysis should be due to statistical error and/or bias. This paper want to find out the performance of technical indicators compare with buy and hold strategy. If any form of EMH did correct, use of technical indicators to invest on index should not gain any extra benefit from buy and hold strategy. In contrary, if use of any technical indicators provides significant benefit, it means that weak form EMH do not hold.
“Technical analysis” is too general that it is difficult to define. They have common character of analysis based on linear time series modeling of historical data (Black & Scholes, 1973). It is believed that historical price will reflect the trends of price in future. That is contradicting to the weak form efficient market theory. Murphy (2000) suggested that trends can be divided to three categories: uptrend, downtrend and sideways trend. The trend is changing according to the economic, political and psychological attitudes of investors. As a result, it affects the decision of investors. However, there are over hundred or even thousands of technical indicators used by traders all over the world, it is not appropriate to draw conclusion on the validity of technical analysis if only a few methods are scrutinized. A research showed that at least 90 percent of the chief foreign exchange dealers take reference on technical analysis before making trading decision (Taylor and Allen, 1992). Besides, a lot of investors in Germany use technical analysis during trading (Menkhoff, 1998). As a consequence, the performance of technical analysis affects a lot of investors. Such performance will discuss in the following sections.

The result found in efficiency of technical analysis is controversy. Some research showed that technical analysis is useful. Technical analysis can make extra profit on the Dow Jones Industrial Average Index (Brock, Lakonishok and LeBaron, 1992). Besides, it is anticipated that 35% of all trading in NYSE is initiated by program trading (Braş, 2002). The trading decision should be initiated by historical data. Neely et al. (1997) and Lebaron (1999) proved net profit by using moving average rules. Similarly, Blume et al. (1994) found that combine the volume and price to make trading decision can gain extra benefit. In addition, Antoniou et al. (1997) also proved that price and volume can predict the future trend in market of Istanbul. Besides, Chan et al. (2000) found that momentum strategies provided profit on international stock index trading. Also, Bessembinder and Chan (1995) found that trading strategy is useful in index return in Asian Stock Markets. Los (2001) found that Asian stock market easily affect by the moving price. Ratner and Leal (1999) also found that moving average rules can gain extra profit in Taiwan and Thailand. However, transactions costs generate by huge amount of trading by technical trading rules reduce the profit (Coutts and Chen, 2000). Besides, Hsu and Kuan (2005) found that simple technical analysis can gain significant profit in market that mainly composed of new companies (Hsu and Kuan, 2005). Change signal of simple moving average rule to nonlinear models success to provide good predictive power on Dow Jones Average during 1897 to 1988 (Gency, 1998). Also, Jegadeesh (1990) also found that invest according to momentum technical analysis can gain extra profit on industry stocks. In addition, the performance of stock have tendency to continue its strong or weak performance over period of 3 months to whole year (Jegadeesh and Titman, 1993). A research found that 52-week highs combine with momentum analysis can gain extra profit on America stocks investment (George and Hwang, 2004). Also, use volume as investment signal provide good prediction power (Blume and Easley, 1994). Alexander (1964) suggested that some technical analysis give profit. Theil and Leenders (1965) found that the stock price of Amsterdam Stock Exchange has pattern. They suggested that the price continue to move up and down according to performance of previous day. Moreover, Ratner and Leal (1999) suggested that using moving average in emerging market has some predictive power.

The mechanism of technical analysis is that people think that the observed trend will continue itself. When a trend is showed, it can be detected by technical indicator. Investors can take their position according to the technical indicator. An investor can maintain his investment position until technical analysis show the trend has changed (Pring, 1991).

On the other hand, some researches claimed that technical analysis is useless. Moving average trading rule suggests buy when price moves above a particular moving average and sell when the price below that average. It failed to provide net gain by using this method in Dow Jones (Brock et al., 1992). Als, Fama and Blume (1966) suggested that technical analysis in Dow-Jones Industrial Average cannot provided excess returns if transaction costs are involved in calculation. Bachelier (1900) suggest that price changes are independent from each transaction, and price variation should have normal distributions. Moreover, people familiar with chart analysis cannot find out the different between real chart and random generate chart (Siegel, 1998). Similarly, Arditti (1978) found same observation as Siegel. Also, head-and-shoulders chart pattern analysis cannot provide any predictive power on investment. Investors seem follow random signal on this kind of analysis (Osler, 1998). Moreover, a hedge fund called “Long Term Capital Management” (LTCM) collapsed in 1998. This fund was invested according to mathematical model. It implied that price analysis may not work. In addition, some people argue that the popular of TI is not possible if it is not valid. It may explain by that investors want to decrease uncertainty and stress. This character of human has mentioned by Scott Armstrong (1980). Besides, an early research suggest that forecast of stock market is not accurate (Cowles, 1933). It seems that the validity of technical analysis is not conclusive in different research. This research tries to test the validity of some indicators. The technical indicators will describe in the following section.
There are many tools for technical analysis. It includes bar charts, point-and-figure charts, candlestick charts and many other methods. Besides, some technical indicators are used, such as Moving Average Convergence-Divergence (MACD), Average Directional Index (ADX), Stochastic Oscillator (SO) and many other indicators. Indeed, there are too many technical analysis tools that cannot be described here. However, it is obvious that such tools can divide by two groups. One group has the characteristic that the buy and sale signal is defined by analyst's experience, personal preference and experience. In other words, it is subjective. Bar chart, point-and-figure chart and candlestick chart belongs to this group. For example the trend lines draw by bar chart depends on the time horizon. Different analyst can draw different implications on same data or charts. The pattern and shapes of candlestick chart cannot define precisely. On the other hand, there are many quantitative indicators developed in recent years. This group includes technical indicators such as MACD, ADX and SO. This group of indicators has well defined mathematic definition. The buy and sale signal of such indicators are much objective. Different analysts should draw same buy or sale decision according to the indicators. Technical analysis by such quantitative indicators can prevent bias from psychological fault by human perception. It also prevents decision affected by public opinions. For example, 77% of suggestions from analysts are buying (Groth, 1979).

This essay does not intends to discuss subjective technical analysis tool. It is because define the buy and sale signal is subjective. It is not possible for different person to take same decision on same graph. Proving of validity of such tools is not possible. Although, some research claimed that it can define some subjective technical analysis tool. Since this research is not going to investigate subjective technical analysis tool, such discussion is stopped here. Thus, this essay concentrates on find out the validity of some popular technical indicators. They are MACD, ADX and SO. Moving Average Convergence-Divergence (MACD) is developed by Gerald Appel. MACD composed of two lines and a histogram. It can be use to identify strength, direction, momentum and duration.

12-26 day MACD = EMA (12 day) – EMA (26 day) = Short term moving average – Long term moving average
Signal line = EMA(9day)
MACD Histogram: MACD line – Signal line
EMA stand for Exponential Moving Average.
N-day smoothing constant=2/ (N+1)
N-day EMA=Previous N-day EMA+N-day smoothing constant*(Closing price - Previous N-day EMA)
The first N-day EMA can use simple average as reference.

The histogram is positive if MACD line large than signal line and vice versa. Normally, the number of dayson MACD line and signal are set as 12,26,9 respectively. However, such setting can be change to adjust the sensitivity. The sensitivity of MACD can increase by use smaller short term moving average and larger long term moving average, such as MACD (5, 35, and 5). In this research, normal setting MACD (12, 26, and 5) is used. The MACD lines are moving up and down among the zero lines. When 12-day EMA is larger than 26-day EMA, MACD is positive. It means that upward momentum is increasing and vice versa. When MACD line is going above the signal line, the stock price is forecast to increase and vice versa. The number of signals depends on the volatility of that stock. MACD cannot be use to compare momentum between different stocks. It is because the value of MACD depends on the price size of individual stock. Other price size independent momentum should be used.

MACD can give signal in three situations:
1. MACD line crosses the signal line- buy when MACD line larger than signal line and vice versa.
2. MACD line crosses zero – above zero means stock price trends upward and vice versa.
3. Positive and negative histogram – small histogram imply change of trend or the current trend weaker and vice versa. Positive histogram means a buy signal and vice versa.

Average Directional Index (ADX)

ADX (Average Directional Index) is developed by Welles Wilder. It can identify the trend and strength. It composed of Minus Directional Indicator (-DI) and Plus Directional Indicator (+DI) that can identify trend direction.

\[ +DI = \frac{+DM}{TR} \]
\[ -DI = \frac{-DM}{TR} \]

+ DM= absolute value of (Today’s High – Yesterday’s high)
- DM= absolute value of (Today’s low- Yesterday’s low)
(The definition “-DM” and “+DM” are a description of direction of movement. It is not treated as positive or negative value in the equation.)

True Range (TR) = Maximum value of either the following combination within 14 days
Today’s High - Today’s Low
Today’s high– Yesterday’s Close
Yesterday’s Close- Today’s Low

+ DI, - DI can be calculated by above numbers.

\[
DX = \frac{\left| (+DI) - (-DI) \right|}{(+DI) + (-DI)} \times 100
\]

DX = Directional movement index

In order to make the directional indicator (DI) more accurate and smooth, 14 days data is used.

\[
+DI_{14} = \frac{+DM_{14}}{TR_{14}}
\]

\[
-DI_{14} = \frac{-DM_{14}}{TR_{14}}
\]

Today’s +DM14 = Previous +DM14 + Today’s +DM
Today’s - DM14 = Previous -DM14 - Today’s -DM1
Today’s TR14 = Previous TR14 + Today’s TR1

\[
DX_{14} = \frac{\left| (+DI_{14}) - (-DI_{14}) \right|}{(+DI_{14}) + (-DI_{14})} \times 100
\]

\[
ADX_{14} = \frac{14 \text{ days} \times DX_{14}}{14 + \text{Today’s} \times DX_{14}}
\]

Today’s ADX14 = Previous ADX14 \times 13 + DX14 \text{Today}

When +DI14 larger than -DI14, it means a buy signal and vice versa. Besides, ADX can determine if there are obvious trend in such signals. Some traders use ADX14 equal to 20 as the basic requirement on these indicators. It means that when ADX14 equal or below 20, traders ignore the signal generated by ADX. Same filter is used in this research. This research assume the previous signal is valid until the next reverse signal with ADX14 large than 20 is given.

Stochastic Oscillator(SO)

SO(Stochastic Oscillator) is developed by George C. Lane. It is a momentum indicator.

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from nine major markets are investigated in this research.

This includes S&P500(SP), Dow Jones Industrial Average(DJ), Nasdaq composite(NA), FTSE 100(FT), DAX(DA), CAC 40(CA), Nikkei 225(NI), Hang Seng(HS) and Shanghai composite index(SS). Daily data investigated samples from 1-1-1999 to 1-8-2012. Weekly and monthly data concerned samples from 1-1-1993 to 1-8-2012. All the sample data is collected by server of http://finance.yahoo.com/ and http://markets.wsj.com/. These nine market indexes are the major indexes in United States, Europe and Asia. They are also reported by media in television, newspaper and economic journal as a reference to the economic market of their corresponding area. The research method is back testing of historical data of index. The return of buy and hold strategy and long and short strategy according to technical indicator signal is compared. This research due with the simple buy and sell signal imply by the three indicators only. Neutral position is not considered in this research. According to the strategy, investor either buys (long) or sells (short) the index. Holding cash is not considered in this research. When a buy or sell signal is found after closing of market, this research assume that investor use this strategy can buy or sell the index at the closing price in next trading day. Investor hold that position until an opposite signal was indicated by technical indicator.

Some assumptions are made for the above data.

1. Trading signal is available after closing of relevant period (day, week or month). It is not possible for trader to buy or sell on the closing index at the end of that period. It assumes investors can buy or sale at the closing price on next trading period.
2. Brokerage, slippage and taxes are ignored while calculations.
3. Close price is adjusted for dividends and splits.
4. Cash return is not considered.

The assumption 1 is very important to prevent look-ahead bias (Haugen,1999). This bias occurs when someone undergo back test use technical analysis involves closing price. If a signal generate, and he assume that he can trading according to the closing price. Indeed, he can only trade on the price in the opening of next trading period. However, sometimes investors cannot trade on the opening price during a volatile market. Thus, the research uses the closing price of next date as trading price for conservative. This research wants to find out if there are any different on profit between buy and hold strategy and trading according to technical indicators. Besides, the combine effect of technical indicators will also be scrutinized. Firstly, raw market historical price is input to computer. Then, the signal if technical indicator is calculated. Normally, use +1 as buy signal and -1 as sell signal. When first signal found, the closing price of next period is recorded (P1). When a second signal found, similarly, the closing price of next period is recorded (P2). The profit gain by B&H strategy is P2-P1. The profit gain by L&S strategy is the first signal sign multiple the profit gain by B&H. During the investment period, a lot of sample pairs of profit gain by B&H or L&S provided. This data is use to undergo statistic test in following section. Only samples have df more or equal to 30 are tested. Samples that have f less than 30 are not considered in this research.

4. Empirical Results and Interpretations

Generally, daily and weekly samples provided enough sample pairs to undergo statistic test. However, monthly samples failed to provide enough sample pairs for meaningful statistic test in most cases. Only the samples concerned with SO in monthly samples provided enough samples to undergo statistic test. There are too many samples in this research; reader is recommended to read the note for the abbreviation of samples at the end of table before reading the result. Besides, sometimes the word sample pair is used. Sample pair means the sample come from same source with different strategies.

Daily data

The empirical results are depicted in table 1. Generally, 35 sample pairs show valid significance out of 63 samples pairs in daily data. All sample pairs shows that the median of B&H strategy is larger than L&S strategy. Effect size r of all samples is less than 0.3 means that the effect is low. Since all the daily data cannot pass normality test, the significance of mean values are not know. However, the general trend can also be considered. DA, DJ, FT, HS and SP markets show that the mean of B&H strategy is larger than L&S strategy. This is same as compare the different in median.

However, 6 sample pairs in SS market, 3 sample pairs in NA market and 3 sample pairs in CA market show the opposite relationship. Standard deviation of mean value in all samples is large. It range from the minimum 7 times of its corresponding mean in sample DJDAXLS ($M=-68.956$ $SD=510.763$) to the maximum 300 times of its
corresponding mean in sample CADMXXBH ($M= -0.599\ SD=186.364$). The average standard deviation to mean ratio is 186.

This means that some samples have extreme large value. All samples show positive skewness in L&S strategy. Almost all samples of B&H strategy show negative skewness except FTDMXXBH (Skewness=0.428), FTDAXXBH (Skewness=0.140), HSMXXBH (Skewness=0.662), SSDMXXBH(Skewness=2.218), SSDAXXBH(Skewness=1.316), SSDMAXBH (Skewness=0.219) and SSDMSXXBH(Skewness=2.334). Almost all samples show kurtosis large than 1 range from minimum CADAXXBH (Kurtosis=1.120) to maximum SPDAXLS (Kurtosis=22.434). Some samples show kurtosis less than one, which are CADAXXBH (Kurtosis=0.446), CADAXLS (Kurtosis=0.315), CADAXLS (Kurtosis=0.941), DJDMAXBH (Kurtosis=-0.518) and DJDMAXLS (Kurtosis=-0.189).

When consider market characteristic, all the 7 sample pairs show significant different in HS market. There are 6 sample pairs out of 7 show significant different in DA market. On the contrary, only 1 sample pairs in NI and SS show significant different. TI characteristic of sample is described in the following paragraph. Use MACD as investment strategy show significance low median in CA, DA, DJ, FT, HS, NA and SP market. Besides, the different in median of profit is not significance in NI and SS market. Use ADX as investment strategy show significance low median in DA, DJ, FT, HS and SP market. Besides, the different in median of profit in other market is not significance. SO shows significance low median in all markets.

**Weekly data**

The empirical results are depicted in table 2. There are only 58 sample pairs that have df more than 30. There is only 20 sample pairs providing significance difference. All the sample pairs that show significant difference have larger median of B&H strategy. Effect size $r$ of most samples is less than 0.3 means that the effect on different on median is low. Some exception are found in sample DJWMSABH (effect size $r =0.38$), SPWASXBH(effect size $r =0.307$) and SPAWASBH (effect size $r =0.365$). Effect size is more than 0.3 means medium effect.

Some of weekly data pass normality test, which has been discussed on section 5.2. Apart from that, the mean value of profit gain should be considered. T-test cannot be used to find out the significance. The general trend of means of profit gain by the two strategies shows clear market difference. Such general trend is not likely occurred solely by chance. In the market DJ, FT, NA and SP, all the mean profit of B&H strategy is larger than L&S strategy. In the contrary, in the market NI, all the samples shows that mean value of L&H strategy is larger than B&H strategy. In the market CA, DA and SS, only one exception sample pairs show mean profit of B&H strategy larger than L&S strategy. They are samples CAWSXXBH, CAWSXXLS, DAWSXXBH, DAWSXXLS, SSWSXXBH and SSWSXXLS. The performance of HS market is not consistence. It shows that 3 sample pairs have mean value of B&H strategy larger than LS strategy. Those are samples HSMXXBH, HSMXXLS, HSWXXBH, HSWXXLS, HSWXXBH and HSWXXLS. Other samples of HS market show the opposite trend.

**Monthly data**

Standard deviation of mean value in all samples is large. It range from the minimum 3 times of its corresponding mean in sample SSWWMASLS ($M= 223.629\ SD=694.047$) to the maximum 131 times of its corresponding mean in sample FTWMXXLS ($M= 2.691\ SD=352.474$). The average standard deviation to mean ratio is 15.075. This means that the samples have extreme long tail. There are 10 samples of B&H strategy show positive skewness and other 48 samples show negative skewness. There are 4 samples in L&S show negative skewness and other 54 samples show positive skewness. Samples show negative skewness are HSWAXXLS (Skewness=-0.141), NAWAXXXLS (Skewness=-0.894), NAWMAXXXLS (Skewness=-0.293), and SSWSXXLS (Skewness=-0.300).Almost all samples of B&H strategy show kurtosis more than 1 except sample HSWAXXBH (kurtosis=0.476) and sample HSWAXXXBH (Skewness=0.000). Other samples show kurtosis large than 1 ranged from minimum DJWMXXBH (Kurtosis =1.117) to maximum SSWAXXBBH (Kurtosis=26.143).There are 10 samples of L&S strategy show kurtosis less than 1. Other samples show kurtosis large than 1 ranged from minimum DJWMXXLS (Kurtosis =1.102) to maximum SSWAXXLS (Kurtosis=24.119).When consider market characteristic, all the 7 sample pairs show significant different in NA market. There are 6 sample pairs out of 7 show significant different in SP market. NI, HS and SS market do not show any significant different in median. Other markets show 1 or 2 sample pairs significance. MACD as L&S investment strategy show significance low median in NA and SP markets. Other markets do not show significance different in median by any strategy. ADX as L&S investment strategy show significance low median in NA and SP markets. The use of SO as L&S investment strategy shows significant low median in CA, DA, FT, NA and SP markets.
The empirical results are depicted in Table 3. There are only 9 sample pairs that have more than 30. There are only 3 sample pairs providing significance difference.

All the samples concerned with the SO technical indicator. All the sample pairs that show significant difference have larger median of B&H strategy. Effect size $r$ of most samples is less than 0.1 means that the effect on different on median is small. All the monthly sample pairs cannot pass normality test. Thus, the significance of mean difference cannot be found by t-test. All the mean values of profit gain from B&H strategy are greater than that from L&S strategy with two exceptions. They are CA and NI market. Standard deviations of mean value in all samples are large. It ranges from the minimum 5.8 times of its corresponding mean in sample NIMSXXLS($M=315.646$ $SD=1839.732$) to 74 times in sample SSMSXXLS($M=6.707$ $SD=501.026$). The average standard deviation to mean ratio is 19.87. Majority of samples of B&H strategy show negative skewness except sample DAMSXXBH (Skewness=0.077). All the samples of L&S strategy show positive skewness.

5. Conclusion and Implications

This paper aims to find out that if there are any different on profit by the two investment strategy. The two strategies are buy and hold strategy and long and short strategy according to the signal generated by technical indicators. This research not only compares the performance of three common technical indicators, it also compares the performance of the combine effect of such indicators. Another objective of this research is to find out if there are any markets different by using TI. Besides, this paper covers 9 major stock markets in the world. It is the first study that investigates in such wide market range. The result of this paper is practically useful for investors to decide which investment strategy is appropriate. However, all the research result is based on historical data, it may not reflect the performance of markets in the future. If consider the mean without consider the significance. Daily samples have consistent result. It shows that L&S cannot gain extra profit than B&H. However, the performance of weekly samples is mixed. If someone uses L&S strategy to invest in NI index, it provides consistent profit. It is consistent in any TI or combination of TI. However, as t-test is not feasible in such samples. This observation cannot exclude the possibility of chance. Other markets shows L&S perform better in some samples, such markets are CA, DA, SS and NI. Likewise, this information cannot rule out the possibility that such deviations are solely due to chance. Moreover, all of them have small effect. The samples of long and short strategies mainly show positive skewness. On the contrary, samples of buy and hold strategies mainly show negative skewness. It means that most data of L&S strategy is less than B&H strategy.

The mean profit of daily data shows that B&H strategy is better. Besides, the mean profit of weekly data agrees with daily data on DJ, FT, NA and SP markets only. However, the mean profits of L&S are larger than B&H strategy in NI, CA, DA and SS markets. The performance of SS can be explained by research suggests that new stock market is easily affected by TI (Eui Jung, Eduardo and Benjamin, 2004). SS market is new market relatively. Besides, Los (2001) found that Asian stock market easily affect by the moving price. However, the performance of CA and DA market cannot be explained by this research.

The performance of mean profit of NI in weekly data is special. All the L&S strategy according to any indicators provide profit in certain value. It may explain by the long term declining market price of NI market. In other word, use any TI on weekly data can gain profit more the B&H strategy. However, it may due to the B&H strategy lose profit with the bearish Japan market. As a result, any strategy that provided short signal can outperform the B&H strategy in NI market in the past fifteen years. Use of TI does not give extra benefit in median comparison. On the contrary, it shows significance loss in some cases.

This research finds that most profit gain by investment strategies are not normal distributed. Use of daily data to L&S cannot gain extra profit compare with B&H strategies. However, use of weekly data can gain some profit in certain market. Unfortunately, such implication cannot be proved by t-test due to normal distribution restriction. The samples of profit gain or loss seems affect seriously by outliner. It is support by the large kurtosis and large standard deviation. Investor should watch carefully on the outliner cases, which affect the resultant profit. This research provides some statistic information compare the B&H strategy and L&S strategy. If solely look into the statistical data, L&S strategy cannot provide extra benefit. However, if consider the mean value of samples of weekly data, L&S strategy can provides some benefit in NI, CA, DA and SS. It implies that investors can consider using TI to invest in such markets. This research implies that stock market is not weak form. Use historical data cannot provide extra profit to investors.
This research investigates the technical indicators MACD, ADX and SO only. Indeed, there are a lot of technical indicators need to test. Besides, Ashby’s Law of Requisite Variety (Ashby, 1963), suggest that the solution of problem should have same degree of complexity. It means that if technical indicator can show the trend of complex change of stock market, it should have similar complexity. A research conducts by Hsu and Kuan (2005) shows that complex rules have greater ratio to gain significance profit than simple rules. Their research covered four stock market indexes: Dow Jones, S&P 500, NASDAQ, and Russell 2000. However, when the effect of data mining is compensated, the significance diminished in Dow Jones and S&P 500 Index. Clearly, further research should consider other complex technical indicators. This research excludes the transaction cost. The transaction cost of daily sample is huge. Alexander (1961) found that transaction cost decrease the profit of technical analysis.

Table 1 Mann-Whitney Test and Explore data (Daily)

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<th>Effect size</th>
<th>Mean (M)</th>
<th>Std. Deviation (SD)</th>
<th>Std. Error (SE)</th>
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**Hypothesis**

- **H1(null)** rejected
- **H2(null)** cannot be rejected
- **H3(null)** rejected
- **H4(null)** rejected
- **H5(null)** rejected
- **H6(null)** rejected
- **H7(null)** rejected
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H7(null) rejected
H1(null) cannot be rejected
H2(null) cannot be rejected
H3(null) cannot be rejected
H4(null) cannot be rejected
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H6(null) cannot be rejected
H7(null) rejected
H1(null) cannot be rejected
H2(null) cannot be rejected
| SSWSXXBH | 253 | 258.27 | 30797.500 | .734 | .463 | -33.140 | 0.033 | -30.141 | 848.822 | 53.365 | -.196 | 2.325 | H3(null) cannot be rejected |
| NIWSXXLS | 253 | 248.73 | | | | | | | | | | | |
| NIWMSXRB | 68 | 67.40 | 2237.000 | -.326 | .744 | -147.900 | 0.028 | -132.003 | | | | | |
| NIWMSXLS | 68 | 69.60 | | | | 204.275 | 0.021 | 206.970 | | | | | |
| NIWASXBH | 40 | 41.00 | 780.000 | -.192 | .847 | -1.105 | | 220.375 | 348.226 | -.071 | 1.576 | H6(null) cannot be rejected |
| NIWASXLs | 40 | 40.00 | | | | 306.500 | 0.217 | 293.469 | | | | | |
| NIWMSXBH | 30 | 26.72 | 336.500 | - | .093 | 1.678 | | 343.500 | 103.688 | 220.838 | 349.406 | 1.075 | 1.363 | H7(null) cannot be rejected |
| NIWMSXLS | 30 | 34.28 | | | | 232.390 | 612.734 | 2006.122 | 366.266 | .806 | .714 | |
| SPWMXXBH | 93 | 105.08 | 3247.500 | - | .003* | 2.934 | | 12.080 | 81.171 | 8.417 | 4.913 | H1(null) rejected |
| SPWMSXLS | 93 | 81.92 | | | | -12.080 | -3.270 | 81.797 | 8.482 | 1.706 | 4.691 | |
| SPWAXSBH | 40 | 47.35 | 526.000 | - | .008* | 33.165 | 0.295 | 24.826 | 117.036 | 18.505 | -1.481 | 4.586 | H2(null) rejected |
| SPWXXSBH | 255 | 281.27 | 25942.000 | - | .000* | 7.200 | 1.175 | 4.042 | 47.411 | 2.969 | -.900 | 2.956 | H3(null) rejected |
| SPWXXSXLs | 255 | 229.73 | | | | -7.790 | -2.769 | 47.507 | 2.975 | .690 | 2.787 | |
| SPWMAXBH | 32 | 37.38 | 356.000 | - | .036 | 2.095 | | 38.290 | 31.032 | 24.065 | -1.331 | 2.714 | H4(null) cannot be rejected |
| SPWMAXXLS | 32 | 27.63 | | | | -33.730 | -6.565 | 139.572 | 24.673 | .971 | 1.428 | |
| SPWMSXBS | 71 | 79.28 | 1968.000 | - | .024* | 18.700 | 0.189 | 13.907 | 89.772 | 10.654 | -.1074 | 4.126 | H5(null) rejected |
| SPWMSXBLs | 71 | 63.72 | | | | -12.250 | 1.692 | 90.842 | 10.781 | 1.476 | 3.149 | |
| SPWAXSBH | 35 | 41.74 | 394.000 | - | .010* | 44.390 | 0.307 | 20.345 | 127.243 | 21.508 | -2.152 | 5.830 | H6(null) rejected |
| SPWMSXBH | 40 | 48.98 | 461.000 | - | .001* | 41.940 | 0.365 | 17.617 | 136.661 | 21.680 | -2.643 | 9.566 | H7(null) rejected |
| SSWMXXBH | 72 | 72.82 | 2569.000 | -.092 | .927 | 12.360 | 0.008 | 19.487 | 533.071 | 62.823 | -2.678 | 26.143 | H1(null) cannot be rejected |
| SSWMXXLS | 72 | 72.18 | | | | 2.720 | 96.859 | 524.441 | 61.806 | 4.277 | 24.119 | |
| SSWAXXBH | 44 | 44.43 | 965.000 | - | .025 | .980 | 12.535 | 34.359 | 607.168 | 91.534 | 2.314 | 18.705 | H2(null) cannot be rejected |
| SSWAXXLS | 44 | 44.57 | | | | -14.980 | 109.270 | 598.027 | 90.156 | 3.923 | 17.331 | |
| SSWXXXBH | 214 | 219.73 | 21779.000 | -.875 | .382 | 3.380 | 0.042 | 6.351 | 196.698 | 13.446 | .080 | 3.241 | H5(null) cannot be rejected |
| SSWXXSXLs | 214 | 209.27 | | | | -9.900 | 6.004 | 196.713 | 13.447 | -.300 | 3.214 | |
| SSWMSXBS | 62 | 62.20 | 1903.500 | -.092 | .926 | 7.360 | 0.008 | 20.994 | 588.118 | 74.691 | -2.187 | 20.649 | H5(null) cannot be rejected |
| SSWMSXBLs | 62 | 62.80 | | | | -6.595 | 101.434 | 579.543 | 73.602 | 3.490 | 18.932 | |
| SSWASXBS | 38 | 38.22 | 711.500 | -.109 | .913 | -39.945 | 0.013 | 38.839 | 657.083 | 106.593 | 2.107 | 15.690 | H6(null) cannot be rejected |
| SSWASXLS | 38 | 38.78 | | | | -10.505 | 129.682 | 645.007 | 104.634 | 3.548 | 14.308 | |
| SSWMASXBH | 30 | 28.72 | 396.500 | -.791 | .429 | -56.880 | 0.102 | 50.394 | 728.570 | 133.018 | 1.961 | 13.230 | H7(null) cannot be rejected |
| SSWMASXLS | 30 | 32.28 | | | | 22.545 | 223.629 | 694.047 | 126.715 | 3.322 | 11.884 | |
Table 3 Mann-Whitney Test and Explore data (Monthly)

<table>
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<th>Mann-Whitney Test</th>
<th>Samples</th>
<th>n</th>
<th>Mean Rank</th>
<th>Mean</th>
<th>Z</th>
<th>Asymp. p (2-tailed)</th>
<th>Median (Mdn)</th>
<th>Effect size r</th>
<th>Mean (M)</th>
<th>Explore data</th>
<th>Std. Deviation (SD)</th>
<th>Std. Error (SE)</th>
<th>Skewness</th>
<th>Kurtosis</th>
<th>Hypothesis</th>
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