วารสารวิชาชีพบัญชี

บทความวิจัย

Profitability of Simple Technical Trading Rules in the Thai Stock Market

Komwut Wissawapaisal*

Gallayanee Parkatt, Ph.D.**

ABSTRACT

This paper illustrates the profitability of market timing using technical analysis, especially the simple and widely used moving average crossover rules. In this study, the technical trading rules were tested extensively on Thailand's stock market index from its first trading day in April 1975 to June 2013. As a part of market timing strategy, different values of short-period and long-period moving averages were used so as to determine "buy" and "sell" signals. Returns and risks obtained under these rules were compared with the buy-and-hold strategy during identical time periods. After adjusting for transaction costs, there is strong evidence that market timing following these rules is capable of generating higher returns with lower risks than the buy-and-hold strategy.

Keywords: Market Timing, Technical Analysis, Moving Average

ปีที่ 10 ฉบับที่ 28
มีนาคม 2557
หน้า 59-76

* Doctoral Student, School of Management Science, Sukhothai Thammathirat Open University

** Associate Professor, School of Management Science, Sukhothai Thammathirat Open University

บทคัดย่อ

บทความนี้นำเสนอความสามารถในการทำกำไรของการจับจังหวะลงทุนด้วยการวิเคราะห์ทางเทคนิค โดยเฉพาะการใช้การตัดกันของเส้นค่าเฉลี่ยเคลื่อนที่ ซึ่งเป็นเกณฑ์การตัดสินใจอย่างง่ายและได้รับความนิยมอย่างกว้างขวาง การศึกษาในครั้งนี้เป็นการนำเกณฑ์การตัดสินใจที่กำหนดขึ้นมาทดสอบกับข้อมูลดัชนีตลาดหลักทรัพย์แห่งประเทศไทย ตั้งแต่เริ่มทำการซื้อขายวันแรกในเดือนเมษายน พ.ศ. 2518 จนถึงเดือนมิถุนายน พ.ศ. 2556 โดยถือว่านำค่าเฉลี่ยเคลื่อนที่ทั้งระยะสั้นและระยะยาวมาใช้กำหนดสัญญาณซื้อและสัญญาณขาย ซึ่งถือเป็นส่วนหนึ่งของการจับจังหวะลงทุน ผลตอบแทนและความเสี่ยงภายใต้เกณฑ์การตัดสินใจถูกนำมาใช้เปรียบเทียบกับกลยุทธ์การซื้อและถือครองหลักทรัพย์ในช่วงระยะเวลาเดียวกัน หลังการปรับลดด้วยต้นทุนในการซื้อขายหลักทรัพย์แล้ว มีหลักฐานเด่นชัดที่แสดงให้เห็นว่าการจับจังหวะลงทุนตามเกณฑ์การตัดสินใจดังกล่าวสามารถสร้างผลตอบแทนที่สูงกว่า และมีความเสี่ยงที่ต่ำกว่ากลยุทธ์การซื้อและถือครองได้

คำสำคัญ: การจับจังหวะตลาด การวิเคราะห์ทางเทคนิค ค่าเฉลี่ยเคลื่อนที่

INTRODUCTION

Market timing for investment is one of the decision-making strategies to buy or sell financial assets by attempting to predict future market price movements. Prediction is based on an outlook of market or economic condition resulting from technical or fundamental analysis. Technical analysis is considered the earliest form of investment analyses with its origins dating back to the 1800s. This is because stock prices and volume have been publicly available prior to other types of financial information. Technical analysis is a reflection of the idea that security prices move in directions that are determined by the changing attitudes of investors towards several factors such as economic, political, and psychological forces. Technical analysts search the past prices for recognizable patterns that have the ability to predict future price movements. Technical analysis has been extensively used among market participants such as brokers, fund managers, speculators, institutional and individual investors in the financial industry.

The purpose of this paper is to examine the empirical evidence on the profitability from applying technical trading rules to the Thai stock market. This includes identifying parametric values that give the highest return according to the rules. It is focused on the simplest and seemingly the most popular technical trading rule using moving averages. Attentions are given to testing procedures of the profitability as well as identifying strengths and weaknesses of the rules. Empirical results regarding technical analysis will be discussed on consistency of returns over time. This will improve general understanding of the profitability of technical trading rules.

The remainder of this paper is organized as the following sections describe literature reviews, data description, research methodology, results and discussions, respectively. The last section provides conclusions and recommendations for future research.

LITERATURE REVIEWS

In contrast to the views of many practitioners, most academics have long been skeptical about the usefulness of technical analysis. From the philosophy behind technical analysis, the notion that historical price data can be used to identify patterns that predict security movements violates the random walk hypothesis [Osborne (1959), Robert (1959), Working (1960), Alexander (1961), Cootner (1962), Campbell et.al (1997)] and the weak form of market efficiency [Working (1949), Fama (1970), Jensen (1978)]. These hypotheses imply that security prices move randomly and, after all transaction costs are factored in, technical analysis should not be able to predict the movement and, therefore, generate excess returns over a simple buy-and-hold strategy.

Technical trading rules are the rules that aim to identify the change of trends. Technical trading rules provide "buy" and "sell" signals, which indicate directions of prices in the future. A profitable rule is defined as the rule that has some predictive value over the future movement of security prices. Investors who follow this rule will be able to generate excess returns. In spite of the conflict with the efficient market hypothesis, a number of research evidence has shown that technical analysis was able to predict price movement as well as to generate excess returns [Brock et.al. (1992), Lo and MacKinlay (1999), LeBaron (1999), Lo et. al. (2000), Neely (2002), Goyal and Welch (2003), Schwert (2003), Ang and Bekaert (2006)].

There are many trading rules currently used by investors. Some of the simpler rules include filter rules, trading range breakouts, and moving averages. This study is primarily focused on the use of moving averages. The moving average is one of the most versatile and widely used among all technical indicators. It is constructed in such a way that it can be easily quantified and tested. For this reason, it is the basis for most mechanical trend-following systems currently in use. Previous studies identify the profitability of moving average especially in emerging markets [Bessembinder and Chan (1995), Raj and Thurston (1996), Ratner and Leal (1999), Coutts and Cheung (2000), Gunasekarage and Power (2001)]. The application of moving averages to the developed markets is useful but less likely to generate excess returns after accounting for the transaction costs. [Hudson, et. al.(1996), Mills (1997), Bessembinder and Chan (1998), Day and Wang (2002), Lento (2008)]

Although there have been many reports on testing the profitability of trading rules using moving averages, very few have drawn a conclusion specifically related to (1) parameters or trading rule optimization for achieving the highest return, and (2) profitability characteristics of the trading rule during different market trends. It is intuitive to understand that using different value

of independent parameters, even under the same rule, will possibly make a big difference to the results. Inappropriate use of the parameters often times lead to the wrong inferential conclusions whether the rule being tested is profitable. Thus, this study is aimed to fulfill such needs in a more practical way.

DATA DESCRIPTION

The technical trading rules were tested on Thailand's stock market index (SET) for the period of April 30, 1975 to June 28, 2013. There are a total of 9,378 daily observations of the SET index's closing prices. Spanning over 38 years, this is the most extensive and up-to-date data observations of the SET index reported in publications so far. The first 200 data points are used to calculate the initial moving averages ranging from 2 to 200 days. Thus, February 19, 1976 becomes the first trading day for all rules with the remaining 9,178 days ahead.

RESEARCH METHODOLOGY

Trading Rules

Trading rules can be described as a simple and straight-forward manner. Moving Average Crossover (MAC) is employed as a tool for technical trading in this study. In financial industry, price crossovers are used by traders to identify shifts in momentum and can be used as a basic entry or exit strategy. The use of MAC is initiated by comparing a short-period simple moving average to a long-period simple moving average of price data. The n-day short-period simple moving average of a security price x_n at time t is expressed as:

$$S_t(n) = \frac{1}{n}\sum_{i=1}^{n} x_n \quad (1)$$

The m-day long-period simple moving average of a security price xm at time t is expressed as:

$$L_t(m) = \frac{1}{m}\sum_{i=1}^{m} x_m \quad (\text{where } m > n) \quad (2)$$

The rule is described as buying (or selling) when the short-period simple moving average rises above (or falls below) the long-period simple moving average.

Buy signal

$$S_t(n) > L_t(m) \quad (3)$$

Sell signal

$$S_t(n) \leq L_t(m) \quad (4)$$

Based on moving averages and daily closing prices, trading decision on any given day depends on the signal generated at the end of the previous trading day. It means that an investor will execute a buy (or sell) order one day after a trading signal was generated. When a buy signal is triggered, the investor will take a long position on the following day, and returns will be calculated based on the market return. When a sell signal is triggered, the investor will be out of the market on the following day by selling of all investment and switching to cash. The investor will hold on to cash until the next buy signal is triggered.

Profitability is determined by comparing the returns generated by the trading rules to the buy-

and-hold strategy. The returns from the buy-and-hold strategy are calculated by investing in the SET index at the beginning of the data set and holding it until the end of the duration being analyzed. In this study, the return generated from every trading rule is adjusted for transaction costs, which include a commission fee and accompanied value-added tax. Therefore, the return is penalized downward every time a trading action takes place.

As shown in the previous equations, the key variable is the number of days or the duration of the simple moving average period. The commonly used time frames in the financial industry are the 5-day, 10-day, 20-day, 50-day, 100-day, and 200-day moving averages. In this study, a combination of the short period of n day and the long period of m day is represented by SMA (n,m) where n = 1 to 199 days and m = 2 to 200 days. The purposes of taking a large combination are (1) to search for the alternative values of "n" and "m" that truly gives the highest return over a broader range, and (2) to characterize the risks and returns subjected to changing variables.

Testing of the Rules

After the trading rule is established, it will be evaluated for profitability under various time frames and market trends. The first test of profitability spans over the whole range of 9,178 daily observations. This is to measure the long-term performance from different pairs of short-period and long-period simple moving averages. Annualized returns and maximum drawdowns of all SMA (n,m) rules are calculated. Consequently, risk-adjusted returns are carried out. The risk-adjusted return is a concept which measures the value of risk involved in an investment return. The risk-adjusted return can be applied to investment portfolio and to individual securities. Conventionally, the Sharpe ratio is one of the most widely used risk measures. By this method one can compute the total amount of return per unit of risk. An increase in values of the Sharpe ratio will bring an increase in return per unit of risk. However, it also has some limitations. The Sharpe ratio measures the risk by the standard deviation. This follows modern portfolio theory, in which risk is defined as the variability of returns. The standard deviation is a measure of uncertainty; however, uncertainty is not necessarily risk. The standard deviation does not differentiate between deviations above the average return and deviations below the average return. If the standard deviation is used as measure of risk, positive performance relative to the average return is penalized just as much as negative performance relative to the mean. In conclusion, the Sharpe ratio penalizes the variability of profitable returns exactly the same as the variability of losses, despite the fact that investors are more concerned about downside volatility of returns rather than total volatility. Instead, a downside approach to risk should be preferred.

While risk can be quantified in a number of ways, maximum drawdown is probably one of the clearest and practical ways to measure risk. Maximum drawdown is defined as the amount by which invested capital has fallen in value

relative to the highest value that was previously attained. The drawdown is usually expressed as a percentage from top to bottom. It can be measured on any asset including investment portfolio and individual stocks. Bear markets are always a part of investing in the last 38 years of the stock market in Thailand. When investors make investment decisions, the maximum drawdown should be at the top of their list of considerations. The reason for this is that large drawdowns destroy almost all of the invested capital and a full recovery may take extended period of time. Results from this study will give us a proof whether the rule is profitable, where excess return over the buy-and-hold strategy is found. Associated risk for each rule is also quantified.

The second test of profitability of the trading rules is conducted during different market trends. This is to examine the consistency of the established rules. According to the historical Dow's theory, market movements consist of 3 major trends namely uptrends, downtrends, and sideways. Although, tremendous amount of effort has been devoted to identifying these trends using various numbers of technical indicators, market trend forecasting is still difficult especially the sideway market. The sideway market occurs where the price trend has been experiencing neither an uptrend nor a downtrend. During this period, the price activity has been oscillating between a relatively narrow range without forming any distinct trends. Therefore, the sideway market is not classified in the current study and is subjected to future investigations.

Generally, there are several ways to separate the uptrends from the downtrends, including the 200-day simple moving average. The 200-day moving average is a popular, long term trend indicator. It helps determine overall health of the stock market. Market trading above the 200-day moving average is considered to be in a long term uptrend. Market trading below the 200-day moving average is considered to be in a long term downtrend. The 200-day moving average usually works as a major support level in a bull market. This implies a low-risk opportunity to buy securities; however, a price drop below it can lead to a large gap downward. In a bear market, the 200-day moving average often works as a major resistance level; however, a price surge above it can lead to a sharp rise. Using this approach, crossovers between the daily closing price and the 200-day moving average can be used to distinguish the market trends. Profitability test for each sub-period is then conducted in a similar way as the first test.

RESULTS AND DISCUSSIONS

Empirical results will be described throughout this section. The first and, essentially, the major point of interest in this study is the profitability among technical rules. The profitability of the technical trading rules is illustrated in Figure 1 together with Table 1. During the examination process of the MAC rules, simulations take place with different values of short-period simple moving average (n) and long-period simple moving average (m). Since there are approximately twenty

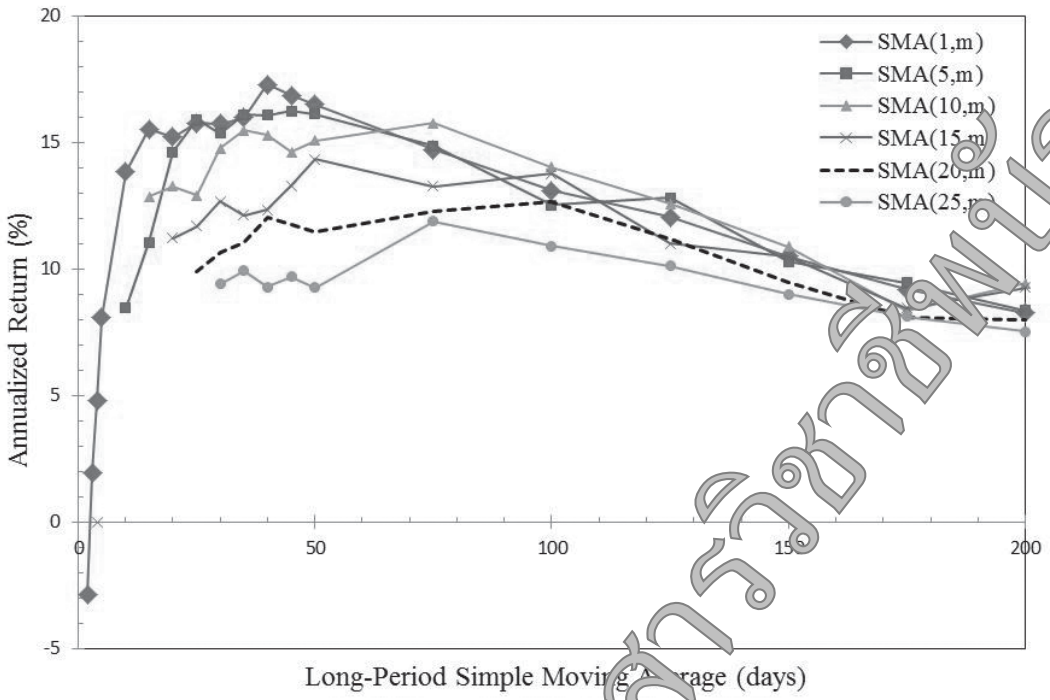

Figure 1 Profitability of the Market-timing Strategy using Technical Trading Rules

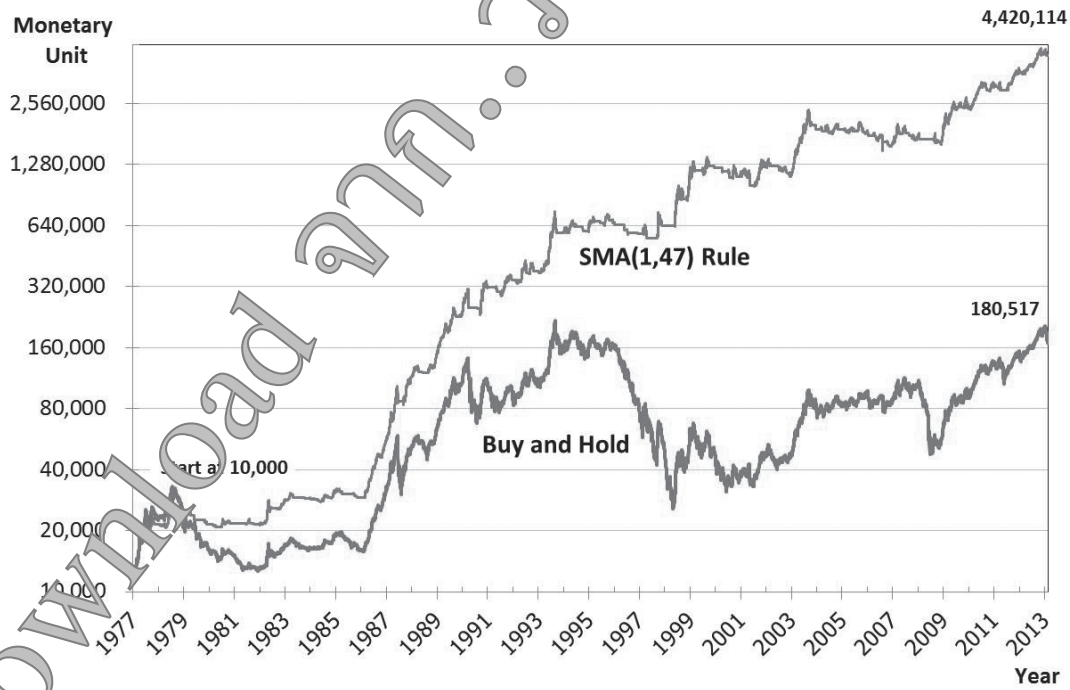

Figure 2 Profitability of SMA(1,47) Trading Rules versus Buy-and-Hold Strategy

Table 1 Profitability of the Market-timing Strategy using Technical Trading Rules

Annualized Return (%)						
Long-Period Simple Moving Average (days)	Short-Period Simple Moving Average (days)					
	1	5	10	15	20	25
2	–2.88					
3	1.95					
4	4.80			Buy & Hold 8.06%		
5	8.07					
10	13.83	8.44				
15	15.53	11.05	12.86			
20	15.22	14.62	13.25	11.22		
25	15.76	15.91	12.90	11.6[illegible]	9.87	
30	15.74	15.36	14.76	1[illegible].66	10.65	9.41
35	15.98	16.09	15.47	12.11	11.04	9.92
40	17.28	16.07	15.[illegible]6	12.34	12.05	9.28
45	16.85	16.23	14.62	13.28	11.75	9.69
50	16.49	16.12	15.07	14.32	11.47	9.25
75	14.72	14.86	15.77	13.27	12.29	11.89
100	13.10	13.[illegible]1	14.03	13.77	12.63	10.91
125	12.04	12.[illegible]1	12.58	11.01	11.16	10.12
150	10.51	10.29	10.89	10.49	9.47	9.00
175	9.18	9.45	8.33	8.44	8.07	8.12
200	8.[illegible]7	8.36	9.42	9.27	7.98	7.53

thousand possible matching pairs between the values of “n” and “m”, some parts of the results are presented so as to prevent confusion. For this reason, the value of n varies from 1 to 25, while the value of m varies from 5 to 200. Results from this part are generated using a full-range of data from February 19, 1976 to June, 28 2013. For the overall performance, the best result is given when value of n is equal to 1 for the majority values of m. The results indicate that the 1-day short-period moving average generates the highest annualized returns, followed by 5-day, 10-day, 15-day, 20-day, and 25-day moving averages, respectively. Hence, the diminishing returns correlate with increasing values of n. Because the 1-day moving average is indeed the daily closing price, the MAC rules

simply require only the calculation of m values. For exact solution of all SMA(1,m) rules, the highest annualized return of 17.73% comes from SMA(1,47). This is substantially higher than the benchmark provided by the buy-and-hold strategy, which only gives 8.06% annualized return. The 9.67% excess return is quite large even in a short run. According to our calculations, applications of the rule to the entire 38 years historical data would be able to raise an initial investment from 10,000 monetary units to 4,420,114 units (Figure 2). During the same stretch, a buy-and-hold investor would end up with the minimal 180,517 units. The profitability of the trading rules is not only limited to SMA(1,47), but also to the majority of the SMA(n,m) rules presented in Table 1.

On the contrary, it cannot be neglected to mention that some returns listed in Table 1 are comparatively low or even negative. For instance, SMA(1,2) yields a negative return of –2.48% while SMA(1,3) gives a small return slightly under two percent. This is due to the fact that responsiveness to changing conditions is accounted for the value of time periods used in the moving averages. The shorter the time periods used in the calculations, the more sensitive the average is to small price changes. This higher sensitivity level implies more frequent trading activities and, thus, higher transaction costs. Figure 3 shows the effect of trading activity and transaction costs on the investment returns. Trading activity is represented by trading cycles. A trading cycle is counted

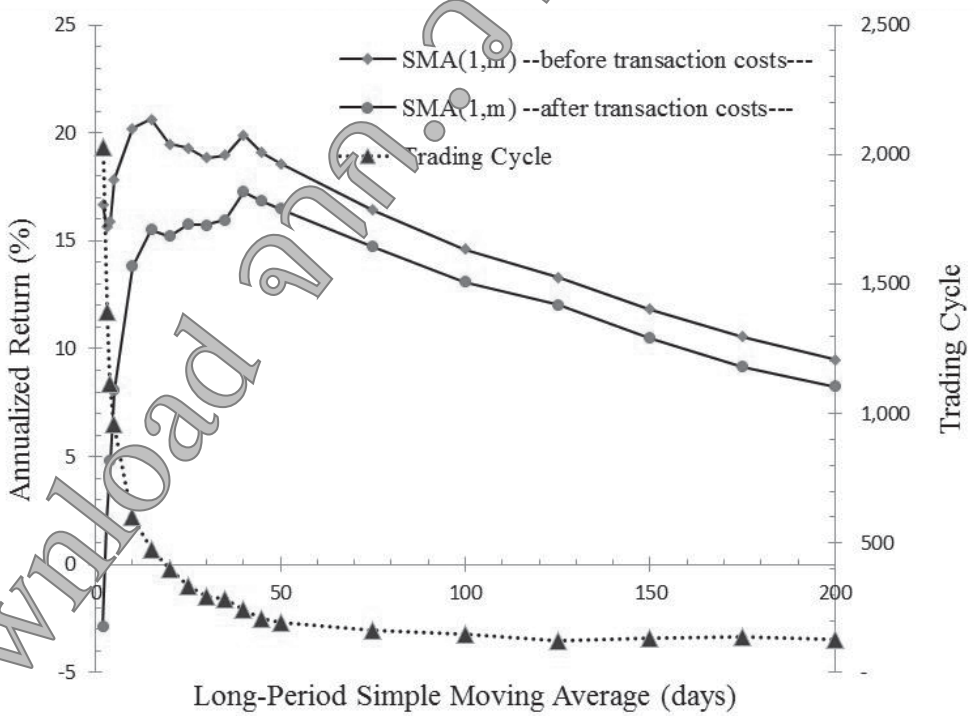

Figure 3 Reductions of Annualized Returns due to Transaction Costs

when a buy order is executed followed by a sell order. This figure shows that exponentially high number of trading cycles is the outcome from using trading rules with smaller values of m. A specific example can be seen from Table 2, where the annualized return of SMA(1,2) greatly reduces from 16.69% (without transaction costs) to -2.88% (with transaction costs). Another example of this nature can be seen in Figure 3 where there is a shift of the peaks from point A, representing SMA(1,15), to point B, representing SMA(1,40). The values listed in Table 2 give further details that without transaction costs SMA(1,15) gives a higher return (implying a better market-timing ability) than SMA(1,40). However, after transaction costs were determined, trading activity under SMA(1,15) rule is considered too frequent with 478 trading cycles and, therefore, the return on investment cannot

Table 2 Reductions of Annualized Returns due to Transaction Costs

Long-Period Simple Moving Average (days)	Trading Cycles	Annulized Return before transaction costs	Annulized Return after transaction costs	Difference (%)
2	2,028	16.69	–2.88	19.57
3	1,396	15.68	1.95	13.73
4	1,114	15.91	4.80	11.11
5	958	17.86	8.07	9.79
10	604	20.22	13.83	6.39
15	478	20.68	15.53	5.10
20	402	19.49	15.22	4.27
25	334	19.31	15.76	3.55
30	293	18.85	15.74	3.11
35	282	18.97	15.98	2.99
40	244	19.89	17.28	2.61
45	209	19.08	16.85	2.23
50	196	18.57	16.49	2.08
75	163	16.42	14.72	1.70
100	146	14.60	13.10	1.50
125	124	13.30	12.04	1.26
150	133	11.84	10.51	1.33
175	138	10.55	9.18	1.37
200	126	9.50	8.27	1.23

overcome higher transaction costs in comparison with 244 cycles generated by SMA(1,40) rule. It can be observed from Table 2 that when m value is less than 5 days, investors will be forced to trade more often and will not be able to outperform the market due to heavy transaction costs. Trading activity will be declined dramatically, when the m value is greater than 50 days. Investors who trade less often will lose a smaller portion of returns caused by the transaction costs; however, they will receive lower rate of returns because the rules become less sensitive to price movements.

Achieving satisfactorily consistent performance of long-term investment requires a trading rule that improves the ability to capture market advances while still avoiding a good portion of major declines. The maximum drawdowns based on SMA(n,m) trading rules are shown in Table 3. It can be seen that each and every trading rule shown in this table sustains a lower level of maximum drawdown in comparison with the benchmarked buy-and-hold portfolio. For example, SMA(1,40) rule gives the maximum drawdown of 32.06% whereas the buy-and-hold portfolio gives the maximum drawdown of 88.18%. A graphical presentation in Figure 2 shows 88.18% drawdown during Thailand's most severe economic crisis in the late 1990s, when SET index dropped from the top 1753.53 points (January 4, 1994) to the bottom 207.31 points (September 4, 1998). Investors with a buy-and-hold strategy in financial assets during this crisis will lose the greater part of their original values. For about 15 years later, SET index has climbed up from the bottom and reached the next high level at 1630.09 points on May 15, 2013. The buy-and-hold strategy is, however, still unable to fully recover from this situation, let alone the psychological impact that those investors have to endure for such a long period of time without selling off their investments prematurely. Disciplined investors who follow trading rules will be out of the market when the sell signal is designated. They will accept a smaller portion of losses to preserve a larger portion of invested capital. From January 20, 1998 to December 16, 1998, simulated results show that an investor who applies the SMA(1,40) rule during this market collapse would be able to fully recover in less than one year. A comparison between Table 2 and Table 3 shows that risk and return characteristics of trading rules are correlated in either favorable or non-favorable fashion. The more profitable trading rules with higher returns show superior ability of limiting losses of capitals whereas the less profitable rules experience some deeper losses. As earlier described, avoiding deep losses is an essential part of long-term investment success because deep losses difficult to recover.

Incorporate returns and risks together, one can simply calculate risk-adjusted return in order to determine the overall performance of each trading rule. The risk-adjusted return is obtained by dividing an annualized return of each trading rule by the absolute value of its corresponding maximum drawdown. As shown in Table 4, the overall risk-adjusted return of each rule is still higher than the one from the buy-and-hold portfolio. Using the best rule shown in this table, SMA(1,40), for example, gives the risk-adjusted

Table 3 Maximum Drawdown under Different Trading Rules

Maximum Drawdown (%)						
Long-Period Simple Moving Average (days)	Short-Period Simple Moving Average (days)					
	1	5	10	15	20	25
2	–82.14					
3	–61.09					
4	–58.14			Buy & Hold: –88.18%		
5	–51.05					
10	–60.00	–67.54				
15	–47.03	–50.39	–49.36			
20	–40.94	–50.72	–49.47	–48.96		
25	–43.71	–49.87	–56.65	–56.54	–65.73	
30	–45.70	–55.12	–49.25	–53.76	–65.82	–77.96
35	–43.12	–55.12	–45.98	–51.05	–61.13	–64.58
40	–32.06	–38.54	–38.82	–50.45	–53.37	–71.68
45	–34.62	–36.74	–41.62	–45.12	–63.23	–66.56
50	–41.75	–35.59	–40.40	–42.98	–61.94	–65.26
75	–38.64	–43.24	–48.58	–62.60	–55.26	–62.26
100	–57.86	–62.14	–55.70	–61.06	–66.74	–69.77
125	–55.86	–59.10	–63.88	–64.76	–63.61	–71.67
150	–61.45	–67.31	–61.71	–61.33	–68.48	–73.90
175	–68.05	–69.54	–71.82	–69.39	–71.69	–71.34
200	–72.30	–72.61	–65.74	–67.35	–70.28	–70.80

return of 0.54, which is much higher than the value of 0.09, provided by the buy-and-hold strategy. Even trading rules with lower returns, such as SMA(20,200), still have better performance than the benchmark after considering risk-adjusted returns. Up to this point, the overall results are in favor of the market-timing strategy using appropriate technical trading rules.

Over the entire observation period, there are several SMA(1,n) rules providing the returns within the same range around 17% where SMA(1,47) rule gives the highest returns among others. In order to investigate the potential trading profitability of the best rule, it is useful to inspect the consistency of this rule during different market trends. Using 200-day moving average as a trend indicator, the

Table 4 Risk-Adjusted Returns under SMA(n,m) Rules

Risk-Adjusted Return						
Long-Period Simple Moving Average (days)	Short-Period Simple Moving Average (days)					
	1	5	10	15	20	25
2	–0.04					
3	0.03					
4	0.08			Buy & Hold: –38.18%		
5	0.16					
10	0.23	0.12				
15	0.33	0.22	0.26			
20	0.37	0.29	0.27	0.2[illegible]		
25	0.36	0.32	0.23	0.21	0.15	
30	0.34	0.28	0.30	0.24	0.16	0.12
35	0.37	0.29	0.3[illegible]	0.24	0.18	0.15
40	0.54	0.42	0.39	0.24	0.23	0.13
45	0.49	0.44	0.35	0.29	0.19	0.15
50	0.39	0.45	0.37	0.33	0.19	0.14
75	0.38	0.34	0.32	0.21	0.22	0.19
100	0.23	0.20	0.25	0.23	0.19	0.16
125	0.22	0.22	0.20	0.17	0.18	0.14
150	0.17	0.15	0.18	0.17	0.14	0.12
175	0.13	0.14	0.12	0.12	0.11	0.11
200	0.11	0.12	0.14	0.14	0.11	0.11

closing price of SET index above the average indicates an uptrend market and the closing below the average indicates a downtrend market. A total of 9,178 daily observations were divided into sub-periods, which can be specified as "uptrend" or "downtrend". Durations of all sub-period vary from a short and inconclusive period of 1 day to a long and recognizable trend of 442 days.

Table 5 and Table 6 demonstrate the profitability of SMA(1,47) rule during the uptrend sub-periods and the downtrend sub-periods, respectively. Under this time frame, sub-periods shorter than or equal to 47 days are inadequate for the long-period moving average calculation. Therefore, only sub-periods, which last longer than 47 days, were tested. A total number of 7,155 days falls

Table 5 Profitability of the Technical Trading Rules during Market Uptrends

No	Date		Duration (days)	SET Index		Net Return (%)		Net Return Difference (%)	Outperformance (Yes/No)
	from	to		from	to	SMA	B&H		
1	8/10/1976	26/7/1978	442	80.30	188.81	122.65	135.13	−12.48	No
2	8/8/1978	19/3/1979	153	192.50	221.17	20.66	14.89	5.76	Yes
3	12/1/1981	31/3/1981	56	125.61	124.31	−1.37	−1.03	−0.34	No
4	17/6/1982	18/10/1983	332	105.88	135.99	34.68	28.44	[illegible]	Yes
5	18/9/1984	20/9/1985	248	132.41	148.34	8.49	12.03	[illegible]	No
6	9/7/1986	16/11/1987	337	137.60	304.01	183.22	120.94	62.28	Yes
7	8/2/1988	31/10/1988	180	323.09	418.74	34.59	[illegible]	4.99	Yes
8	9/3/1989	20/8/1990	357	433.26	895.71	96.39	106.74	−10.35	No
9	6/3/1991	2/7/1991	79	803.21	739.54	5.48	−7.93	13.41	Yes
10	15/1/1992	4/5/1992	74	742.99	760.98	[illegible]	2.42	3.31	Yes
11	1/9/1992	29/3/1993	144	753.53	858.04	11.[illegible]	13.87	-2.46	No
12	28/7/1993	1/4/1994	170	908.36	1,232.53	5[illegible]3	35.69	15.74	Yes
13	15/7/1994	22/11/1994	90	1,344.17	1,403.81	6.80	4.36	2.43	Yes
14	8/12/1998	21/9/1999	192	350.27	425.54	32.60	21.49	11.11	Yes
15	24/4/2001	27/7/2001	65	296.95	301.09	0.66	1.39	−0.73	No
16	24/12/2001	30/8/2002	168	302.[illegible]	361.16	21.45	19.59	1.86	Yes
17	3/4/2003	4/5/2004	264	365.[illegible]	644.10	67.83	76.41	−8.58	No
18	15/12/2004	22/4/2005	86	[illegible].18	677.25	5.51	3.05	2.46	Yes
19	7/12/2005	23/5/2006	[illegible]09	694.87	727.21	−4.85	4.65	−9.50	No
20	27/4/2007	10/1/2008	174	695.11	800.18	11.65	15.12	−3.46	No
21	6/5/2009	24/6/2011	[illegible]5[illegible]	523.14	1,022.94	44.65	95.54	−50.88	No
22	4/1/2012	12/6/201[illegible]	354	1,036.21	1,433.47	38.51	38.34	0.18	Yes
		Total	4,593	days	Average (%)	36.28	35.03	1.25	Yes = 55%

Table 6 Profitability of the Technical Trading Rules during Market Downtrends

No	Date		Duration (days)	SET Index		Net Return (%)		Net Return Difference (%)	Outperformance (Yes/No)
	from	to		from	to	SMA	B&H		
1	20/3/1979	14/11/1980	412	214.00	125.14	−13.35	−41.52	28.17	Yes
2	10/4/1981	19/5/1982	270	123.31	105.62	−0.54	−14.35	13.81	Yes
3	28/11/1983	10/8/1984	175	137.40	132.19	−2.68	−3.79	1.11	Yes
4	23/9/1985	8/7/1986	195	147.11	135.60	−0.24	−7.82	7.58	Yes
5	4/9/1990	15/2/1991	113	873.34	774.52	15.23	−11.32	26.55	Yes
6	31/7/1991	14/1/1992	112	728.70	732.10	1.42	0.47	0.95	Yes
7	23/11/1994	11/5/1995	112	1,332.85	1,345.55	2.56	0.95	1.61	Yes
8	18/10/1995	29/12/1995	50	1,298.43	1,280.81	−0.24	−1.36	1.11	Yes
9	3/6/1996	30/1/1998	411	1,294.11	495.23	−9.88	−61.73	64.01	Yes
10	18/3/1998	3/11/1998	154	500.46	343.16	−31.79	−31.43	63.22	Yes
11	14/2/2000	12/1/2001	226	447.56	311.25	−7.57	−30.46	22.89	Yes
12	14/9/2001	29/11/2001	54	288.10	297.87	2.11	3.39	−1.28	No
13	2/9/2002	13/1/2003	90	357.36	364.05	−5.08	1.87	−6.96	No
14	12/7/2004	1/10/2004	58	661.49	661.23	−0.09	−0.04	−0.05	No
15	19/12/2006	3/4/2007	72	622.14	686.53	4.94	10.35	−5.41	No
16	12/9/2011	1/12/2011	58	1,020.83	1,019.15	5.12	−2.08	7.21	Yes
		Total	2,562	days	Average (%)	2.23	−11.80	14.03	Yes = 75%

in this category, which is approximately 78% of the analyzed historical data. Results from Table 5 show that using SMA(1,47) rule during the uptrends outperforms the buy-and-hold strategy 12 out of 22 sub-periods (55%). SMA(1,47) rule also shows an arithmetic mean returns about 36.28%, which is considered a small margin of 1.25% over the buy-and-hold strategy with the 35.03% average mean return. On the down side of the market, more consistent results can be achieved during the downtrends since 12 out of 16 sub-periods (75%) are profitable. SMA(1,47) rule surprisingly gives a positive mean return of 2.23% whereas the buy-and-hold strategy give a negative mean return of −11.80%. A wider margin of 14.03% between these strategies clearly demonstrates a major benefit of using technical trading rules especially during downtrends.

CONCLUSIONS AND RECOMMENDATIONS

The study was conducted to determine if the simple moving average crossover rule is profitable on the Thai stock market index. Profitability was defined as excess returns over the buy-and-hold portfolio. Trading strategy following simple moving average crossover rules was tested based on 38 years history of the market. The empirical study carried out in this paper has presented evidence against the weak-form of efficiency of a stock market. Overall results indicate a possibility that, before trading costs were factored in, following several technical trading rules is capable of producing excess returns by considerable margins over the buy-and-hold strategy. Even though the profitability was partially scaled down after adjusting for transaction costs, the excess returns still give positive values for the majority of the rules presented in this study. Profitability of the rules was further examined during the market's uptrends and downtrends. An in-depth study of the most profitable rule shows a distinct ability to avoid major losses during downtrends, where 14.03% average excess return was obtained on a more consistent basis. Profitability of the rule during the uptrends provides a less impressive average excess return of 1.25%. This is due to the fact that the data used to calculate a moving average is historic. As a result, this study confirms the weakness of the rules such that signals generated by MAC rules always lag behind the market. However, in the overall picture, the risk-adjusted returns exhibit satisfactory results in favor of the rule. From a practical point of view successful trading is about controlling losses as it is making profits. Investors must preserve their capitals during the downtrends to become successful in the long run. It is not unusual if an individual investor can make large profits and accumulate his wealth in many consecutive years until the next bear market swipes out most parts of his capital within a short period of time. The true test of any trading rule should be focused on the ability to avoid large drawdowns during market crashes. In this study, the ability to avoid a large drawdown is appeared to be a major benefit from applying the trading rules to the Thai stock market.

The results from applying the technical trading rules are encouraging, and indicate that further research in this topic is potentially useful in both academics and real-world applications. Future researchers are encouraged to continually develop upon trading strategies based on individual or combined technical indicators. A quantitative study in specifying market trends is highly recommended, especially the sideway market which is not included in this study. Alternative researches should be focused on weighting schemes and adaptable trading rules that are more flexible and likely to be successful in each particular market trend. All of these recommended research topics should also be focused on both profitability and risks in conjunction with the investor's expectation of returns and risk tolerance.

References

Alexander, S. (1961). Price Movements in Speculative Markets: Trends or Random Walks. *Industrial Management Review, 2*, 7–26.

Ang, A. and Bekaert, G. (2006). Stock Return Predictability: Is it there?. *Review of Financial Studies, 20*, 651–707.

Brock, W., Lakonishok, J., and LeBaron, B. (1992). Simple Technical Trading Rules and the Stochastic Properties of Stock Returns. *Journal of Finance, 47*, 1731–1764.

Bessembinder H. and Chan, K. (1995). The Profitability of Technical Trading Rules in the Asian Stock Markets. *Pacific-Basin Finance Journal, 3*, 257–284.

Bessembinder H. and Chan, K. (1998). Market Efficiency and the Returns to Technical Analysis. *Financial Management, 27*, 5–17.

Cootner, P.H. (1962). Stock Prices: Random V.S. Systematic Changes. *Industrial Management Review, 3*, 24–45.

Campbell, J.Y., Lo, A.W. and MacKinlay, A.C. (1997). *The Econometrics of Financial Markets*. Princeton University Press, Princeton, NJ.

Coutts, J. A. and Cheung, K. C. (2000). Trading Rules and Stock Returns: Some Preliminary Short Run Evidence from the Hang Seng 1985–1997. *Applied Financial Economics, 10*, 579–586.

Day, T. E. and Wang, P. (2002). Dividends, Nonsynchronous Prices, and the Returns from Trading the Dow Jones Industrial Average. *Journal of Empirical Finance, 9*, 431–454.

Fama, E. (1970). Efficient Captal Markets: A Review of Theory and Empirical Work. *Journal of Finance, 25*, 383–417.

Gunasekarage, A. and Power, D.M. (2001). The Profitability of Moving Average Trading Rules in South Asian Stock Markets. *Emerging Markets Review, 2*, 17–33.

Goyal, A. and Welch, I. (2003). Predicting the Equity Premium with Dividend Ratios. *Management Science, 49*, 639–654.

Hudson, R., Dempsey, M., and Keasey, K. (1996). A Note on the Weak Form Efficiency of Capital Markets: The Application of Simple Technical Trading Rules to UK Stock Prices – 1935 to 1964. *Journal of Banking and Finance, 20*, 1121–1132.

Jensen, M.C. (1978). Some Anomalous Evidence Regarding Market Efficiency. *Financial Economics, 6*, 95–101.

LeBaron, B., (1999). Technical Trading Rule Profitability and Foreign Exchange Intervention. *Journal of International Economics, 49*, 125–143.

Lo, A. and Mackinlay, C. (1999). *A Non-Random Walk Down Wall Street*. Princeton University Press, Princeton, NJ.

Lo, A., Mamaysky, H., and Wang, J. (2000). Foundations of Technical Analysis: Computational Algorithms, Statistical Inference, and Empirical Implementation. *Journal of Finance, 55*, 1705–1765.

Lento, C. (2008). A Combined Signal Approach to Technical Analysis on the S&P 500. *Journal of Business and Economic Research, 8*, 41–52.

Mills, T. C. (1997). Technical Analysis and the London Stock Exchange: Testing Trading Rules Using the FT30. *International Journal of Finance and Economics, 2*, 319–331.

Neely, C.J. (2002). The Temporal Pattern of Trading Rule Returns and Exchange Rate Intervention: Intervention Does Not Generate Technical Trading Profits. *Journal of International Economics, 58*, 211–232.

Osborne, M. (1959). Brownian Motion in the Stock Market. *Operation Research, 7*, 145–173.

Roberts, H. (1959). Stock-Market Patterns and Financial Analysis: Methodological Suggestions, *Journal of Finance, 14*, 1–10.

Raj, M. and Thurston, D. (1996). Effectiveness of Simple Technical Trading Rules in the Hong Kong Futures Markets. *Applied Economics Letters, 3*, 33–36.

Ratner, M. and Leal, R.P.C. (1999). Tests of Technical Trading Strategies in the Emerging Equity Markets of Latin America and Asia. *Journal of Banking & Finance, 23*, 1887–1905.

Schwert, B. (2003). Anomalies and Market Efficiency. *Handbook of the Economics of Finance*, North-Holland, Amsterdam: 939–974.

Working, H. (1949). The Investigation of Economic Expectation. *American Economic Review, 39*, 150–166.

Working, H. (1960). Note on the Correlation of First Differences for Latin American Emerging Equity Markets. *Journal of Financial Research, 18*, 299–309.