

# Investigation of Simple Moving Average: Pre-COVID-19 Evidence from the Tokyo Stock Exchange

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## Abstract

Investment strategies have important theoretical and practical implications. As one of the main strategies, technical analysis (TA) is a well-known investment analysis for investors. Usually used with fundamental analysis, it helps the investors to analyze stock performance. TA helps investors to predict the future pattern of an investment by using historical market data. In contrast, efficient market hypothesis (EMH) is the ideal market which the price reflects all information in the market. The purpose of this study is to investigate market efficiency of Japanese equity market, Tokyo Stock Exchange (TSE), by using TA. We use a sample of three (3) stocks from the TSE for selection and analysis based on simple moving average (SMA). The period performance and performance ratio are also determined to test the validation of SMA. Our results show that SMA failed to predict the market. The inverse result between SMA and stock performance, and the poor performance of ratios indicate that SMA failed to predict TSE, thus implying market efficiency. This paper builds the foundation for other researchers to analyze the Japanese stock market.

## Keywords

Technical analysis, efficient market hypothesis, simple moving average and Tokyo Stock Exchange.

## 1. Introduction

There are many techniques being used in the stock market for investors to gain profit, such as portfolio diversification (Markowitz, 1952; Nor & Islam, 2016, 2017), fundamental analysis (FA) (Piotroski & So 2012; Nor & Zawawi, 2020) and technical analysis (Park & Irwin, 2007). The first corresponds with market efficiency and deals with optimal portfolio selection based on sufficient number of stocks. Whereas FA and TA contradict efficient market hypothesis. In particular, TA is used to predict the future walk of an investment by using historical market data from financial market such as price, volume and other obtainable data (Yamato, 2012). It usually used to forecast the price movements of the investment. Generally, academic research on technical analysis is focused to techniques that can be expressed in the mathematical form, which be called as technical trading strategy (TTS) (Park & Irwin, 2007). Moving average and candlestick charts are some of the famous TA. EMH is a market that the price is “fully reflect” available information (Fama, 1970). According to Jensen (1978, p.96), he defined it where “[a] market is efficient with respect to information set  $\theta t$  if it is impossible to make economic profits by trading on the basis of information set  $\theta t$ .”

In testing EMH, TA is commonly used to analysis its validation (Bassino & Lagoarde-Segot, 2013; Nagayasu, 2003; Nor & Wickremasinghe 2017). If TA can predict future share prices, it would say that the EMT is not applicable on that particular market because EMH said that the market is at random walk, which is unpredictable. Therefore, the profitability of TA has significant implications to practice (investment returns and fund performance) and also theory (EMH). This study contributes by exploring TA in the Japanese market, specifically Tokyo Stock Exchange.

### **1.1 Objective**

In this paper, we investigate the effectiveness of TSE by using the TA. Specifically, we explore moving average and several measures namely standard deviation, beta, Sharpe ratio and Treynor ratio to determine the performance of TA in the Japanese market. The rest of this paper is structured as follows. Section 2 reviews related literature. Section 3 describes the methods. Section 4 provides the results and discussion. Section 5 is the conclusion.

## **2. Literature Review**

There is a lot of study which used to study the validation of TA and EMT. Park & Irwin (2007) had reviewed the previous done research in order to determine the profitability of technical analysis. They categorized the literature into 2 groups, which are “early” and “modern” studies, according to the characteristics of testing procedures. The major different of the studies is early studies indicate TTS are not profitable in stock markets but profitable in foreign exchange markets and future markets. Modern studies said that TTS is profitable in any market. For result, early studies result vary from different market. Modern studies show that mostly half of the literature (56 studies out of 95 modern studies) shows a positive result regarding to TTS.

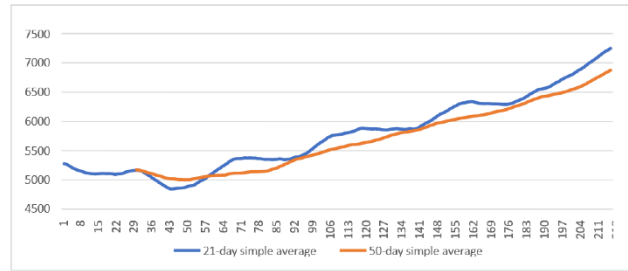
Lui and Mole (1998) had analysis the use of fundamental and technical analysis by foreign exchange dealers in Hong Kong. It shows that dealers are more rely on TA on short term analysis and when determine the turning point. Ratner & Leal (1999) had use ten Variable Length Moving Average technical to analysis 10 emerging equity markets in Latin America and Asia from January 1982 through April 1995. Even though that it shows that this technical only profitable in Taiwan, Thailand and Mexico, but it shows that this technical is correctly predict the mostly direction of change in return series (82 out of 100 country). Nor and Wickremasinghe (2014) show profit potential of TA in Australia. However, Nor and Wickremasinghe (2017) and Nor and Zawawi (2019) indicate that stocks markets of Malaysia and Russia, respectively, are moving towards market efficiency. In Taiwan, Ko et al. (2014) had successfully proven that the moving average timing strategy does substantially outperform the buy-and-hold strategy. There are researcher using candlestick TTS to determine profitable in the Japanese equity market for a 30-year period. However, it shows that candlestick TTS are not profitable in Japanese equity market (Marshall et al., 2007).

## **3. Methods**

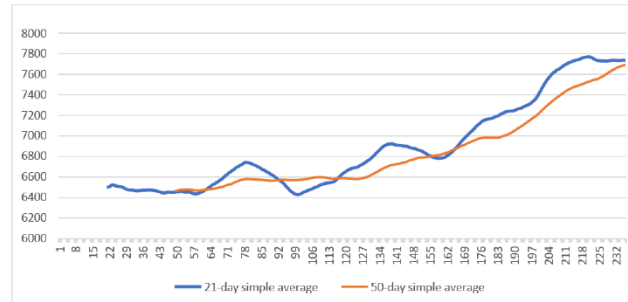
In this paper, SMA will be used as TA tools. In this paper, 21 days simple average (short term) will be compared with 50 days simple average (long term) to determine the sell or buy period. If the 21 days simple average is smaller than 50 days simple average, it will be considered as selling point and vice versa. After that, holding period return (HPR) will be calculated after determining the buy/sell signal. Moreover, performing ratio which is Sharpe ratio, Treynor ratio and debt to equity ratio will be calculated for additional analysis. For debt-to-equity ratio, we obtained the value from morningstar.com. Data of three companies listed in TSE is explored during the 1-year period of 2019. We choose this time period to mitigate the impact of COVID-19 pandemic, because it has a serious impact on stock market returns (Liu et al., 2020).

## **4. Results and Discussion**

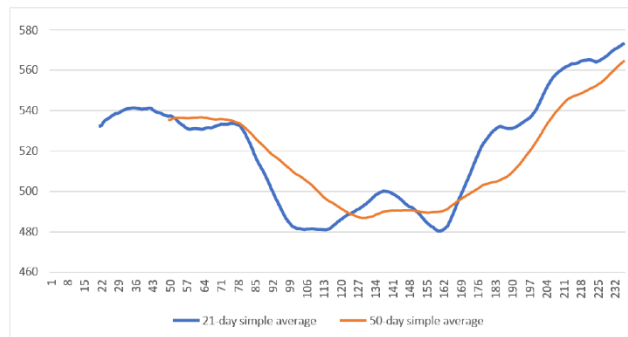
Using the methods described in the previous section, we present the results in this section. Figure 1 (Panels A to C) show the SMA for the 3 companies. Table 1 shows the results for TA. Comparing the SMA to the period performance, mostly the result is inverse to each other. This means that when there is a sale signal shown at SMA at the first day, the period performance will show a negative return and vice versa. For Sony Corp., there are 2 changes of trading signal shown and both show the inverse return to the signal. For Toyota Motor Corp., there are 6 changes of trading signal shown and only 3 of the trading signals show the inverse return to the signal. For Mitsubishi UFJ Financial Group, Inc., there are 4 changes of trading signal shown and only 1 trading signals show inverse return to signal.



Panel A: Sony Corp



Panel B: Toyota Motor Corp.



Panel C: Mitsubishi UFJ Financial Group, Inc.

Figure 1. Simple moving averages (SMA) of 3 TSE companies

Table 1: Performance of selected TSE stocks

Company name	Sony Corp.	Toyota Motor Corp.	Mitsubishi UFJ FinancialGroup, Inc
Stock Code	6758.T	7203.T	8306.T
Standard deviation	720.29	477.77	31.23
Beta	0.54	0.42	0.02
Risk free rate	1.22%		
Market rate	0.08%		
Required rate (CAPM model)	0.60%	0.74%	1.19%
Sharpe ratio	-0.0000085	-0.0000099	-0.0000086
Treynor ratio	-0.0224121	-0.0291023	-0.5143847
Debt to equity ratio (DE ratio)	2.45	1.03	0.45

For performance ratio, it shows that all the selected stocks are performing poorly under the benchmark, which the 3-month treasury bills in Japan. In other words, it is better to invest in 3-month treasury bills rather than in the selected

stocks. Mitsubishi UFJ Financial Group, Inc shows the lowest DE ratio while Sony Corp. shows the highest DE ratio. This means that Sony Corp. will have the highest risk to invest as the company might not be able to pay their debt and bankrupt. Overall, the SMA failed to analyze the TSE market as the period performance shows negative result with SMA analysis. Moreover, the performance ratios indicate the poor performance of the selected stock, which the result suggests that the best investment is invest in 3-month treasury bond. However, there are still some limitations in this paper. In particular, this paper only analyzes 1-year period and 3 stocks from the market.

## 5. Conclusion

In this paper, we explored the profitability of SMA in the TSE. We find that SMA fails to find any historical pattern, and our results suggest the Japanese stock market is weak form efficient. However, our study only utilizes simple strategy, which is SMA. Therefore, there might still be possibility that the market is inefficient, but the SMA is unable to identify any pattern. Indeed, the profitability of TA relies on market inefficiency. If the market already reflects all available information (in this case historical stock prices), TA is hence useless. However, several studies such as Nor and Wickremasinghe (2014), Nor and Zawawi (2019) and Shahzad et al. (2017) show that not all markets are efficient. Although this might be true, technological advancements can also lead to market efficiency, as argued in Nor and Wickremasinghe (2017) in the Malaysian stock market.

Moreover, stock prices can also be affected by different factors, including macroeconomic variables, economic policy uncertainty and oil prices. These issues have been explored by researchers such as Abuolien et al. (2019a,b), Hasan et al. (2020a,b), Naeem et al. (2021) and Shahzad et al. (2017a,b). Bearing these in mind, further studies are needed to investigate the profitability of TA by using different TA models and markets. Rather than using simple rule such as SMA, future studies can investigate rules such as moving average convergence divergence (MACD) and the relative strength index (RSI). In addition, issues such as environment, social and governance (ESG) can also be explored to enhance TA decision making process. For example, in the context of portfolios, Nor and Zawawi (2018) focused on the differences of performance in the investment portfolios between strong and weak corporate governance. This line of research is further supported by Rehman et al. (2021), who show that investors in the emerging markets are now seriously looking into socially responsible investing.

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