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## The use of moving average trading rules in Indonesian Stock Market

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**Abstract:** The development of behavioural finance stimulates the usefulness of simple trading rule. Decision biases are reflected in price movement, which is utilised by technical analysis indicators to generate trading rules. The main objective of this research is to evaluate the performance of the moving average (MA) trading rules, as a popular indicator in stock markets. The sensitivity of MA length is also examined to generate optimal return. We employ daily data of Indonesia composite index from the beginning of 1998 to the end of 2016 to examine the profitability of MA trading rule. The findings show that investors can apply MA trading rules in Indonesia stock market. Our supplementary analysis indicates that shorter (longer) MA produce higher (lower) return. The return of MA trading rules is also affected by trend. This paper contributes to trading strategy studies, particularly for stock exchanges in emerging markets. Our results recommend that selection of MA length in trading rules is important to create optimal return.

**Keywords:** technical analysis; trading strategy; moving average; weak-form efficiency; behaviour; trading rule; return; emerging markets; investors; Indonesia.

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## 1 Introduction

The weak form of efficient market theory states that stock prices are efficiently set by rational investors and reflect previous information. Trading strategies using historical price should be unprofitable. Most of text-books in investing support that theory. However, the idea is critiqued by several recent studies that find evidence that simple technical trading strategies can be used for profit (Sweeney, 1988; Brock et al., 1992; Fifield et al., 2005; Nazário et al., 2017). Our study is developed by behavioural finance literatures, instead of efficient market theory. The use of behavioural finance and psychology of financial markets can increase the understanding of how and why the stock price change (Flanegin and Rudd, 2005).

Behavioural finance theory states that investors are not fully rational because of bounded rationality. They tend to employ heuristics judgment, therefore all the information in past prices may not be quickly impounded into current prices. The decision biases may generate patterns in stock-price data. Technicians or chartists employ chart pattern to generate buy and sell signal. Investors need to have certain strategies that can be used to help them make decisions. Strategy is very important and has been used since ancient times to gain a stronger position (Medarac et al., 2016). This also applies in capital markets, that to obtain abnormal returns, investors must have certain strategies. In this study, we explore the use of stock trading strategies.

Investors prepare for changes, because the change or new events that contain information will establish a market reaction. For most people, change challenges and threatens our routines and established practices, but for some people this threat becomes an opportunity (Anderson, 2015). While the changes surround us constantly and continuously, their shape, pattern and formation cannot be known before (Anderson and Atkins, 2001). Technical analysis tries to capture those forms and patterns and uses them to predict future price movements through trading rules.

There are many trading strategies that can generate technical signals. Our study uses moving average (MA) indicators because of several reasons:

- 1 it is the representation of simple trading rule
- 2 it is very popular in investment communities.

Our hypothesis is that MA trading rules produce substantial return. In our robustness test, we also use the sensitivity of MA length. That is an important step to generate optimal return based on MA trading rule.

Our research uses Indonesia Stock Market as its object. In Indonesia, the source of capital for big companies is from banking industry. Small entrepreneurs had limited access to banking system, but after 1990, the banking sector was liberalised to increase lending to small firms (Dana, 1999). The development of small firms do not stimulate the growth of public companies. Until the end of 2016, there are only 529 public companies (Indonesian Stock Exchange, 2016). We use Indonesian Stock Market because it represents one of emerging stock markets with low market capitalisation.

The use of technical analysis in this study is considered in accordance with the object under study. One feature of emerging market stock exchanges is that the market is considered inefficient, which gives investors an opportunity to gain superior results. In efficient market, technical analysis does not work because prices already represent all available information. Chartists or technicians have no possibility to produce extra return

in the long-run period. Conversely, in inefficient market, price is more determined by irrational factors that lead to mispricing.

Furthermore, financial information in emerging market is less reliable compare to those of developed market. This condition refers to weak investors' protection (Leuz et al., 2003) and less governance transparency (Dong and Xue, 2010). Numerous studies suggest that governance will affect financial performance (Ahmad, 2013). However, in countries with less transparency in the implementation of corporate governance, this relationship is difficult to see by investors. So, investors need other sources of information to support their decision in order to attain optimal return. There are many competing information of financial statement. Technical analysis is one of them. Overall, based on previous studies, technical analysis produces higher (lower) return in emerging (developed) market. That condition represents the environment of inefficient markets (Fifield et al., 2005; Millionis and Papanagiotou, 2008; McKenzie, 2007; Ahmed et al., 2000).

We hope that our study gives contribution to:

- 1 trading strategy researches, especially in emerging markets
- 2 support the use of behavioural finance theory
- 3 trading rule for investment communities.

The remainder article is presented as follows. Literature review to establish the concept of MA trading rule. Data and methodology section introduces the dataset. Results and analysis section discusses the empirical results. The last section offers several concluding observations.

## **2 Literature review**

Technical analysis is more popular to investors than professors (Flanegin and Rudd, 2005). Many textbooks on investment and financial management show that academics are sceptical of the technical analysis.

On the other hand, technical analysis has been dominating information in stock market. Most of brokerage firms announce technical analysis commentary on the stock market. Many of the newsletters published by various 'experts' are based on technical analysis (Brock et al., 1992). Until now, Yahoo Finance also provides chart based on technical analysis and so do online brokerage firms around the world. Investors face charts daily.

We believe that previous and current stock-price contains partial information of future price movement. Price is determined by investor decision that represents their behaviour. If human behaviours can be partially estimated, then stock price can also be predicted. Our argument is supported by several researches that show the superiority of technical analysis (Sweeney, 1988; Brock et al., 1992).

From international perspective, technical analysis produces better performance when implemented in developing markets. Fifield et al. (2005) present that technical analysis in developing markets generates higher return than that in developed markets. Millionis and Papanagiotou (2008) show that MA trading rule is more useful in Greece market than in US market. Ahmed et al. (2000) also present the same evidence.

Fifield et al. (2005), Milionis and Papanagiotou (2008) and Nazário et al. (2017) conduct literature review about technical analysis in stock markets. They analysed 85 articles about technical analysis, but only found 23 studies using developing economies data. They expose the analysis that emerging markets can be explored further. Based on their review, they conclude that less (more) mature markets may be less (more) efficient in the weak form. Related to that idea, this study used Indonesian Stock Market as the representation of emerging stock market. Application of technical trading rule in this market is expected to produce superior return.

All technical analysis researches that we refer employ MA trading rule. Specifically, MA trading rule is a trend following strategy. This trading rule is very popular in practice. We expect that the use MA trading rule in Indonesian Stock Market produces benefit to investors, as they do in other emerging markets. The hypothesis is stated below.

Hypothesis MA trading rule produce positive return in Indonesian Stock Market.

### 3 Data and methodology

This study employs composite index of Indonesian Stock Market since 1998 to 2016. We use daily market return that is computed as the percentage change of daily market prices. Table 1 documents the descriptive statistics of Indonesian composite index return over the 18 years.

From Table 1, Indonesia Composite Index's average return movement is very fluctuating. This is indicated by the magnitude of the standard deviation that exceeds three times its average. A very sharp increase occurred from 2002 to 2003, where the increase in average return reached 1,117% (from 0.0001 in 2002 to 0.0018 in 2003). In general, one-year return of Indonesia Composite Index increases from year to year.

Investing communities have addressed numerous technical analysis strategies. Among those documented, the widely used strategy is MA (Milionis and Papanagiotou, 2008; McKenzie, 2007; Fifield et al., 2005; Wong et al., 2003). We also use keywords 'trading strategy using moving average' in Google to ensure that practitioners also believe in this trading rule. We find around 13,400,000 results. It indicates that our study is based on a real phenomenon. Based on those information, simple moving average (SMA) and weighted moving average (WMA) are used to generate technical analysis indicators.

$$SMA_n = \frac{(P_n + P_{n-1} + \dots + P_1)}{n} \quad (1)$$

$$WMA_n = \frac{(P_n \cdot n + P_{n-1} \cdot (n-1) + P_{n-2} \cdot (n-2) + \dots + P_1 \cdot 1)}{(n(n+1) + (n-2) + \dots + 1)} \quad (2)$$

$P_n$  is price on previous  $n$  days,  $P_1$  is price on previous day, and  $n$  is period used in the indicators. We employ

- 1 closing price to determine  $P$  on each day
- 2 3–10 days to produce  $SMA_n$  and  $WMA_n$  charts.

**Table 1** Descriptive statistics of Indonesian Composite Index Return period 1998–2016

Year	Mean daily return	Median daily return	Max. daily return	Min. daily return	Std. dev. daily return	One-year return
1998	-0.0009	-0.0021	0.1413	-0.0925	0.0299	-0.0292
1999	0.0017	-0.0011	0.1121	-0.0566	0.0213	0.7160
2000	-0.0022	-0.0019	0.0386	-0.0761	0.0160	-0.4054
2001	-0.0005	0.0006	0.0505	-0.0696	0.0153	-0.0443
2002	0.0001	0.0012	0.0409	-0.1066	0.0154	0.1082
2003	0.0018	0.0008	0.0395	-0.0404	0.0113	0.6912
2004	0.0014	0.0013	0.0438	-0.0767	0.0137	0.4198
2005	0.0005	0.0014	0.0434	-0.0523	0.0113	0.1616
2006	0.0016	0.0022	0.0509	-0.0778	0.0133	0.5409
2007	0.0016	0.0024	0.0597	-0.0631	0.0143	0.5418
2008	-0.0035	0.0000	0.0778	-0.1359	0.0265	-0.5038
2009	0.0023	0.0021	0.0625	-0.0349	0.0145	0.7632
2010	0.0014	0.0020	0.0625	-0.0401	0.0122	0.4380
2011	0.0001	0.0011	0.0426	-0.0891	0.0145	0.0253
2012	0.0005	0.0012	0.0305	-0.0367	0.0084	0.1189
2013	-0.0001	0.0014	0.0456	-0.0583	0.0138	-0.0166
2014	0.0008	0.0012	0.0317	-0.0318	0.0083	0.2079
2015	-0.0006	0.0006	0.0454	-0.0393	0.0110	-0.1239
2016	0.0006	0.0012	0.0274	-0.0412	0.0087	0.1703

SMA3 (WMA3) means that SMA (WMA) indicator is built using  $P_1$ ,  $P_2$  and  $P_3$ . Based on those combinations, we produce 194 indicators of SMA and WMA. Our simulation applies from SMA3 to SMA 100 and WMA3 to WMA100. After forming indicators chart, we determine buy and sell signal using simple trading-rule. Buy (sell) signals are emitted when the MA exceeds (falls below) the closing price on a certain day. We describe the signals using these formulas. Buy signal is determined when  $P_0 > SMA_n | P_{-1} < SMA_n$ . While sell signal is produced when  $P_0 < SMA_n | P_{-1} > SMA_n$ . We also use the same trading-rule for WMA indicators. Each signal starts with buy signal and it is ended by sell signal. The difference closing price of buy days and sell days produce return. It is calculated in equation (3).

$$R_{signal} = \frac{(P_{buy} - P_{sell})}{P_{buy}} \quad (3)$$

We combine return of each signal by accumulating it as described in equation (4)

$$R_{ta} = \frac{(\sum R_{signal})}{n} \quad (4)$$

This study only uses long strategy, instead of short strategy, because short-selling is prohibited by regulation and that action is not provided by on-line stock trading software in Indonesia. We expect that  $R_{it} > 0$  which means technical analysis produce profit.

#### 4 Results and analysis

Since this study uses time series analysis, then as a first step we test whether the return of Indonesia Composite Index is stationary. We use the unit root test unit to test data stationary. Table 2 displays the unit root test results.

**Table 2** Unit root test

<i>Variable</i>	<i>Coeff.</i>	<i>p-value</i>
C	0.0003	1.3756
$R_{t-1}$	-0.8776	-60.0828***
F-test		3,609.9372***
Adj $R^2$		0.4387
ADF test		-60.0828***

Notes: \*\*\*, \*\*, \* is significant level at 1%.5% and 10% respectively. Dependent variable is Indonesia Composite Index's Return on t ( $R_t$ ). Unit root test is tested using Augmented Dickey-Fuller (ADF) test statistic.  $R_{t-1}$  is the Indonesia Composite Index's change over the previous period or equivalent to the Indonesia Composite Index at first level difference.

From Table 2, the ADF test is significant at  $\alpha = 1\%$ . These results indicate that the return of the Indonesia Composite Index during the study period is stationary.

**Table 3** Autoregressive result

<i>Variables</i>	<i>t - 1</i>		<i>t - 2</i>		<i>t - 3</i>		<i>t - 4</i>	
	<i>Coef.</i>	<i>p-value</i>	<i>Coef.</i>	<i>p-value</i>	<i>Coef.</i>	<i>p-value</i>	<i>Coef.</i>	<i>p-value</i>
C	0.0003	1.3838	0.0003	1.3634	0.0003	1.3827	0.0003	1.3932
$R_{t-1}$	0.1225	8.3856***	0.1207	8.2005***	0.1209	8.2140***	0.1208	8.2048***
$R_{t-2}$			0.0147	0.9959	0.0164	1.1055	0.0165	1.1140
$R_{t-3}$					-0.0144	-0.9775	-0.0134	-0.9059
$R_{t-4}$							-0.0079	-0.5380
F-test		70.3191***		35.6554***		24.0885***		18.1359***
Adj $R^2$		0.01479		0.01478		0.01477		0.01462

Notes: \*\*\*, \*\*, \* is significant level at 1%, 5% and 10% respectively. Dependent variable is Indonesia Composite Index's Return on t ( $R_t$ ). Independent variable is Indonesia Composite Index's Return on  $t - 1$ ,  $t - 2$ ,  $t - 3$  and  $t - 4$ .

After we test data stationary, we run an autoregressive test. The objective is to determine whether Indonesia Composite Index's return in current period is affected by Indonesia Composite Index's return in the previous period. The results can be seen in Table 3.

Table 3 shows that  $R_{t-1}$  has a positive and significant effect on  $R_t$ . This influence is consistent across models. Adding  $R_{t-n}$  to the regression does not make the model better. The value of F test and adjusted  $R^2$  decreases as the amount of  $R_{t-n}$  is entered the model.

So, only  $R_{t-1}$  has a significant effect on  $R_t$ . Generally, in the presence of new events, market will react quickly to this current information (Gunaasih and Nursasmito, 2015). But, in this study, by using these indicators, the current price movement is partially still influenced by previous return, but current return only absorbs previous one-day return. Events before  $t - 1$  do not affect current return. Using the autoregressive technique, the Indonesian market is efficient in weak form. In this paper, we develop the test using MA trading rule to examine the predictive power of historical price.

To expand the analysis, we also present the performance of technical analysis. Can we use it in Indonesian composite index? The summary of performance is listed in Table 4.

Table 4 present the performance of technical analysis based on SMA using 3 until 10 days. In 1998, SMA3 is MA rule that use price of previous three days produce 77.47%. It also produces 48.19% when we use SMA4. SMA10 generate 22.12%.

**Table 4** The performance of MA trading rule: SMA

Year	Simple moving average							
	3	4	5	6	7	8	9	10
1998	77.47%	48.19%	44.71%	62.65%	63.16%	18.77%	24.52%	22.12%
1999	95.38%	116.87%	99.41%	92.23%	68.41%	70.40%	65.19%	66.98%
2000	4.78%	-0.05%	0.17%	-0.04%	-3.23%	-8.93%	-7.84%	-8.68%
2001	26.73%	24.01%	18.84%	21.05%	18.57%	18.93%	21.94%	18.38%
2002	34.47%	41.66%	27.90%	24.44%	14.52%	13.16%	19.16%	26.26%
2003	52.35%	68.07%	67.81%	69.61%	66.72%	62.96%	67.86%	71.21%
2004	58.19%	54.83%	45.37%	44.84%	46.15%	53.98%	49.92%	48.56%
2005	30.70%	30.68%	40.04%	40.42%	37.82%	32.10%	29.63%	29.27%
2006	24.27%	21.71%	32.71%	33.23%	31.83%	28.42%	35.29%	35.07%
2007	54.07%	46.32%	59.77%	58.38%	47.98%	48.44%	49.72%	43.41%
2008	28.00%	18.27%	10.43%	15.79%	14.09%	15.41%	13.71%	-1.53%
2009	42.69%	66.62%	57.26%	42.43%	50.03%	48.47%	43.27%	44.60%
2010	30.29%	17.86%	21.46%	15.89%	15.11%	15.51%	18.71%	30.71%
2011	4.20%	7.68%	4.24%	5.43%	1.19%	1.17%	3.07%	3.41%
2012	4.15%	-6.64%	-4.06%	-1.96%	-4.25%	-3.96%	-4.54%	-2.15%
2013	4.03%	5.71%	5.01%	5.40%	1.67%	-2.06%	-4.83%	-1.86%
2014	3.74%	5.82%	11.11%	14.19%	4.15%	6.05%	4.56%	4.40%
2015	5.55%	-6.86%	0.56%	-3.15%	-6.17%	-7.53%	-5.51%	-7.81%
2016	8.46%	5.07%	6.71%	2.53%	1.48%	2.21%	2.12%	5.33%
Mean	31.03%	29.78%	28.92%	28.60%	24.70%	21.76%	22.42%	22.51%

In 2015, SMA4, SMA6, SMA7, SMA8, SMA9, and SMA10 produce negative return. In this year, MA rule is not a reliable indicator in stock trading. Overall, SMA3 until SMA10 generate positive return in most years and strategies.

Table 5 present the performance of MA rule. WMA3 generate profit in every year from 1998–2016. It produces 80.46% and 97.54% in 1998 and 1999. In 2016, all WMA indicators produce positive return. Although in several years WMA rule provide negative

return, most of years and indicators give benefit to investors by generating positive return.

Actually, we also conduct additional tests using SMA11 until SMA100 and WMA11 until WMA100. It means that our additional tests examine 97 SMA indicators and 97 WMA indicators. The results tend to have similar conclusion, but the longer SMA or WMA tend to yield lower return. The results are not tabulated.

**Table 5** The performance of MA trading rule: WMA

Year	Weighted moving average							
	3	4	5	6	7	8	9	10
1998	80.46%	68.03%	62.69%	50.09%	82.80%	30.15%	19.23%	20.36%
1999	97.54%	115.99%	120.55%	104.00%	99.94%	82.34%	67.20%	61.88%
2000	2.55%	2.40%	-0.27%	2.99%	4.55%	1.93%	1.17%	-3.93%
2001	22.05%	21.05%	25.13%	18.89%	18.43%	22.09%	22.79%	24.92%
2002	28.13%	40.63%	32.22%	28.56%	24.62%	24.71%	17.50%	18.78%
2003	61.90%	63.21%	68.20%	65.60%	62.28%	63.88%	69.37%	68.21%
2004	57.64%	53.09%	43.61%	46.71%	49.72%	51.79%	53.86%	52.41%
2005	36.61%	34.60%	36.68%	35.05%	34.06%	37.40%	35.32%	32.39%
2006	23.93%	31.03%	26.06%	34.50%	35.37%	34.22%	30.65%	28.95%
2007	45.23%	55.58%	40.02%	58.37%	56.35%	50.23%	51.40%	42.24%
2008	35.03%	22.07%	24.23%	17.44%	10.61%	12.95%	16.69%	12.36%
2009	48.94%	59.73%	64.53%	67.70%	45.70%	41.57%	49.55%	49.60%
2010	29.21%	22.89%	26.21%	24.09%	15.96%	20.64%	17.10%	17.13%
2011	7.26%	3.29%	2.47%	-2.07%	1.29%	1.02%	-1.39%	1.52%
2012	8.12%	0.97%	-4.24%	-3.54%	-4.43%	-3.63%	-2.82%	-3.02%
2013	6.64%	5.15%	8.71%	5.51%	3.39%	1.98%	2.88%	0.98%
2014	10.94%	6.82%	11.11%	7.64%	5.73%	7.09%	5.43%	3.52%
2015	6.29%	2.54%	-2.55%	-4.71%	-4.68%	-2.86%	-6.97%	-7.34%
2016	8.84%	6.67%	8.26%	5.89%	5.54%	7.50%	6.67%	2.56%
Mean	32.49%	32.41%	31.24%	29.62%	28.80%	25.53%	23.98%	22.29%

Results in Tables 4 and 5 show us the profitability of MA rule. The limitation of those results is still not use buy and hold strategy to compare its performance. In Tables 6 and 7, we adjust the return after considering buy and hold strategy. If the return is positive, then MA rule provide better strategy than buy and hold strategy. Conversely, buy and hold strategy perform better than MA rule when return is negative.

Table 6 shows the performances of SMA indicators after adjusted by buy and hold strategy. SMA3 generates profit in every year from 1998–2016, except in 2006. In 2006, SMA 3 produces negative return as much as -11.88%. Although in several years SMA rule provides negative return, most of years and indicators give benefit to investors by producing positive return.



**Table 6** The performance of MA trading rule after adjusted by buy-and-hold return: SMA

Year	Simple moving average							
	3	4	5	6	7	8	9	10
1998	55.78%	26.50%	23.02%	40.96%	41.47%	-2.92%	2.83%	0.43%
1999	46.22%	67.71%	50.25%	43.07%	19.25%	21.24%	16.03%	17.82%
2000	12.66%	7.83%	8.05%	7.84%	4.65%	-1.05%	0.04%	-0.80%
2001	16.87%	14.15%	8.98%	11.19%	8.71%	9.07%	12.08%	8.52%
2002	23.65%	30.84%	17.08%	13.62%	3.70%	2.34%	8.34%	15.44%
2003	6.69%	22.41%	22.15%	23.95%	21.06%	17.30%	22.20%	25.55%
2004	24.96%	21.60%	12.14%	11.61%	12.92%	20.75%	16.69%	15.33%
2005	20.04%	20.02%	29.38%	29.76%	27.16%	21.44%	18.97%	18.61%
2006	-11.88%	-14.44%	-3.44%	-2.92%	-4.32%	-7.73%	-0.86%	-1.08%
2007	21.66%	13.91%	27.36%	25.97%	15.57%	16.03%	17.31%	11.00%
2008	31.11%	21.38%	13.54%	18.90%	17.20%	18.52%	16.82%	1.58%
2009	10.33%	34.26%	24.90%	10.07%	17.67%	16.11%	10.91%	12.24%
2010	2.90%	-9.53%	-5.93%	-11.50%	-12.28%	-11.88%	-8.68%	3.32%
2011	7.24%	10.72%	7.28%	8.47%	4.23%	4.21%	6.11%	6.45%
2012	0.63%	-10.16%	-7.58%	-5.48%	-7.77%	-7.48%	-8.06%	-5.67%
2013	9.68%	11.36%	10.66%	11.05%	7.32%	3.59%	0.82%	3.79%
2014	0.97%	3.05%	8.34%	11.42%	1.38%	3.28%	1.79%	1.63%
2015	11.76%	-0.65%	6.77%	3.06%	0.04%	-1.32%	0.70%	-1.60%
2016	5.01%	1.62%	3.26%	-0.92%	-1.97%	-1.24%	-1.33%	1.88%
Mean	15.59%	14.35%	13.48%	13.16%	9.26%	6.33%	6.98%	7.08%

Table 7 presents the performance of WMA indicators after adjusted by buy and hold strategy. In 2006, 2009, 2010, 2012, 2014 and 2016 all WMA indicators yield negative returns. Conversely, in 1998, 2000, 2001, 2002, 2004, 2005, 2008, 2013, and 2015 all WMA indicators produce positive return. Although in several years WMA rule provide negative return, most of years and indicators give benefit to investors by producing positive return.

Tables 6 and 7 show that the performance of SMA and WMA trading rule with buy and hold strategy fluctuates from year to year. The highest performances are achieved in 1998 and in 2008 for WMA, which may be related to the financial crisis that hit Indonesia at that time. From Tables 6 and 7, it is also seen that the longer (shorter) MA tend to produce lower (higher) return.

Based on the presentation of previous tests, our data show that technical analysis using SMA and WMA rule tend to provide positive return to investors. Although our autoregressive test present that return  $t - 2$ ,  $t - 3$ , and  $t - 4$  do not affect current return, trading strategy test give evidence that previous stock price movement is useful. Actually, we also conduct auto regressive test using  $t - 5$  until  $t - 10$  data. The autoregressive results indicate that past return affect future return. We believe that even though our test does not produce perfect strategy, but most of indicators adjusted by buy-and-hold return still generate positive results.

**Table 7** The performance of MA trading rule after adjusted by buy-and-hold return: WMA

Year	Weighted moving average							
	3	4	5	6	7	8	9	10
1998	83.38%	70.95%	65.61%	53.01%	85.72%	33.07%	22.15%	23.28%
1999	25.94%	44.39%	48.95%	32.40%	28.34%	10.74%	-4.40%	-9.72%
2000	43.09%	42.94%	40.27%	43.53%	45.09%	42.47%	41.71%	36.61%
2001	26.48%	25.48%	29.56%	23.32%	22.86%	26.52%	27.22%	29.35%
2002	17.31%	29.81%	21.40%	17.74%	13.80%	13.89%	6.68%	7.96%
2003	-7.22%	-5.91%	-0.92%	-3.52%	-6.84%	-5.24%	0.25%	-0.91%
2004	15.66%	11.11%	1.63%	4.73%	7.74%	9.81%	11.88%	10.43%
2005	20.45%	18.44%	20.52%	18.89%	17.90%	21.24%	19.16%	16.23%
2006	-30.16%	-23.06%	-28.03%	-19.59%	-18.72%	-19.87%	-23.44%	-25.14%
2007	-8.95%	1.40%	-14.16%	4.19%	2.17%	-3.95%	-2.78%	-11.94%
2008	85.41%	72.45%	74.61%	67.82%	60.99%	63.33%	67.07%	62.74%
2009	-27.38%	-16.59%	-11.79%	-8.62%	-30.62%	-34.75%	-26.77%	-26.72%
2010	-14.59%	-20.91%	-17.59%	-19.71%	-27.84%	-23.16%	-26.70%	-26.67%
2011	4.73%	0.76%	-0.06%	-4.60%	-1.24%	-1.51%	-3.92%	-1.01%
2012	-3.77%	-10.92%	-16.13%	-15.43%	-16.32%	-15.52%	-14.71%	-14.91%
2013	8.30%	6.81%	10.37%	7.17%	5.05%	3.64%	4.54%	2.64%
2014	-9.85%	-13.97%	-9.68%	-13.15%	-15.06%	-13.70%	-15.36%	-17.27%
2015	18.68%	14.93%	9.84%	7.68%	7.71%	9.53%	5.42%	5.05%
2016	-8.19%	-10.36%	-8.77%	-11.14%	-11.49%	-9.53%	-10.36%	-14.47%
Mean	12.60%	12.51%	11.35%	9.72%	8.91%	5.63%	4.09%	2.40%

Our findings confirm previous studies that the use of MA trading rule in emerging market is useful. Our study support Sweeney (1988), Brock et al. (1992), Fifield et al. (2005) and Milionis and Papanagiotou (2008) about the use of MA trading rule. Although our tests have similar conclusion with previous researches, this paper specifically contributes to stock trading strategy in Indonesia. We also present the optimum strategy for MA trading rule. By examining various WMA and SMA strategies to provide the best trading strategy produce recommendations for stock traders in Indonesia. Trading strategies using historical price produce profit. Implicitly, these findings also support behavioural finance literatures. Irrational investors are the basic assumption of technical analysis.

## 5 Conclusions

We present the performance of MA rule using Indonesian Composite Index. Using data from beginning January 1998 until December 2016, we find that MA rule is useful in Indonesian Stock Market. The profitability of MA trading rule is robust after return adjusted by buy-and-hold strategy. Overall, either SMA or WMA indicators produce benefit to investors, although the results are not comprehensive because SMA or WMA trading rule in some years generate negative return. Our results recommend that selection of MA length in trading rules is important to create optimal return. Although it is

untabulated, the findings also show that MA's performance is decreasing year by year. So there is a tendency that Indonesian market is more efficient in the future. Technical analysis indicators using MA rule tend to produce lower profit after 2010. We also present evidence that longer (shorter) MA tend to produce lower (higher) return.

There are several potential developments of this research in the future. The first, application of MA rule to individual stocks would provide more interesting findings because individual stocks generate more fluctuating price. The second, future studies could analyse the relation between technical analysis performance and firm characteristics.

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## Title: [The use of moving average trading rules in Indonesian Stock Market](#)

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**Abstract:** The development of behavioural finance stimulates the usefulness of simple trading rule. Decision biases are reflected in price movement, which is utilised by technical analysis indicators to generate trading rules. The main objective of this research is to evaluate the performance of the moving average (MA) trading rule, as a popular indicator in stock markets. The sensitivity of MA length is also examined to generate optimal return. We employ daily data of Indonesia composite index from the beginning of 1998 to the end of 2016 to examine the profitability of MA trading rule. The findings show that investors can apply MA trading rules in Indonesia stock market. Our supplementary analysis indicates that shorter (longer) MA produce higher (lower) return. The return of MA trading rules is also affected by trend. This paper contributes to trading strategy studies, particularly for stock exchanges in emerging markets. Our results recommend that selection of MA length in trading rules is important to create optimal return.

**Keywords:** technical analysis; trading strategy; moving average; weak-form efficiency; behaviour; trading rule; return; emerging markets; investors; Indonesia.

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