International Journal of Society Reviews (INJOSER) e-ISSN: 3030-802X
Vol. 1 No. 8 2024, pages: 921~929

COMPARISON OF IMPLEMENTATION BETWEEN EMA, WMA, SMA IN PREDICTING IHSG

Ahmad Dwikhaldi Rifai
Program Studi Sistem Informasi, Universitas Nasional, Indonesia

Tio Adi Kurniawan
Program Studi Sistem Informasi, Universitas Nasional, Indonesia

Agus Iskandar *
Universitas Nasional
Correspondence author email : iskandaragus1005@gmail.com

Abstract

This study compares the implementation of Exponential Moving Average, Weighted Moving Average , and Simple Moving Average in the movement of the Composite Stock Price Index. Through the analysis of historical IHSG data, we found that EMA consistently outperforms WMA and SMA with higher accuracy. This result indicates that the use of EMA, focusing on recent data, can be a more responsive approach to changes in stock market trends. However, this research also highlights the need to consider the weaknesses and limitations of each forecasting method. The implications of these findings can provide valuable guidance for stock market practitioners in investment decision-making. Future research can deepen this analysis by considering additional factors to improve IHSG predictions

Keywords: EMA, WMA, SMA

INTRODUCTION

The stock market is one of the main places where investors and other market players interact to trade shares and other assets. In this context, predicting stock market movements is an important key for investors and financial analysts to make timely and effective investment decisions. Therefore, the use of accurate and efficient forecasting methods is very important.

In financial literature, there are various forecasting methods used to predict stock market movements. Among these methods, there are three methods that are often widely used, namely Exponential Moving Average (EMA), Weighted Moving Average (WMA), and Simple Moving Average (SMA). These three methods have different approaches to calculating historical price averages, which are used to make predictions about the direction of market movements.

In the context of the Composite Stock Price Index (IHSG) in the Indonesian stock market, the use of this forecasting method is also an interesting topic to research. IHSG is the main indicator of the performance of the Indonesian stock market and is an important reference for investors in making investment decisions.

Therefore, comparative analysis between EMA, WMA, and SMA in predicting IHSG has significant relevance in the financial and investment context in Indonesia.

This study aims to conduct a comparative analysis between the three forecasting methods (EMA, WMA, and SMA) in the context of predicting JCI movements. By comparing the relative performance of each method, it is hoped that this study can provide better insight into the advantages and limitations of each forecasting method in the context of the Indonesian stock market.

The structure of this journal will be arranged as follows. First, we will provide a literature review of the forecasting methods used in this research, as well as related studies that are relevant in the context of the Indonesian stock market. Next, we will explain the methodology used in the comparative analysis, including the data collection and analysis techniques applied. Then, we will present the results of a comparative analysis between EMA, WMA, and SMA in predicting the IHSG. Finally, we will summarize the main findings of this study and provide practical implications and suggestions for further research.

Thus, market investors can predict whether stock prices will rise or fall using IHSG data forecasting[1].

Michael S. Scott Morton coined the term Decision Support System (DSS) or Decision Support System (DSS) in the early 1970s.

a. Input Data Processing (Database Management)

   Database Management is a place to store all the data needed for decision analysis. Data can be historical data, transactional data, or other external data that is relevant to the decision-making context. Data is stored and managed using a Database Management System (DBMS)

b. Analysis Model

   The Model Base Management System is one of the important components used to store, manage, and manipulate mathematical, statistical, and models other knowledge used in the decision-making process.

c. User Interaction (User Interface)

   The dialog subsystem is a combination of the two previous components, namely Database Management and Model Base. They are combined in a third component, or user interface, after previously being presented in the form of a model that can be defined by a computer [2].

Companies sell shares and bonds on the stock market with the hope that the money earned from these sales will be used to strengthen their finances in the future [3]. The stock market functions as a meeting place between supply (the number of shares that shareholders want to sell) and demand (the number of shares that investors want to buy). Stock prices are determined by the interaction between supply

and demand in the stock market, where market mechanisms determine fair and balanced prices.

Shares indicate the capital participation of a person or business entity in a company or limited liability company. Thus, this party has the right to own the company's assets and income as well as the right to attend the General Meeting of Shareholders (GMS) [4]. Forecasting, or prediction, is the art and science of using historical data and mathematical methods to predict what will happen in the future. Forecasting is a business function activity that calculates product sales and usage so that the product can be produced in the right quantity. Forecasting is an estimate of future demand based on a number of predictor variables, usually time series data. Forecasting in formal and informal ways [5]. Forecasting involves time series analysis when the sequence of events is based on the same time interval and there is a correlation between the events [6].

One easy way to earn steady income is by investing in shares. From beginner investors to professional investors, Indonesian people carry out a lot of stock transactions; many have succeeded and many have experienced losses [7]. The exponential moving average (EMA) indicator is a technical analysis of the Moving Average that uses a formula for calculations that compares the current price with the initial price of the Exponential Moving Average (EMA) calculation in stages. The shorter the time spent using this EMA, the more valuable the latest average value of the security is [8].

The simplest type of moving average, the Simple Moving Average, or SMA, does not use its weighting to calculate closing price movements [9]. A method called Weighted Moving Average uses a moving average; however, for calculating forecasts, the latest values of the periodic series provide a greater burden [10]. By providing a smoothing constant, or smoothing constant, on previous period price estimates, the Exponential Moving Average (EMA) indicator reduces the lag effect often seen in the Simple Moving Average (SMA) indicator. This principle produces an exponential moving average [8] [3].

RESEARCH METHOD

1. Simple Moving Average (SMA)

Simple Moving Average is a parameter that is often implemented in technical analysis. Changes in the average security value over the last few days can be estimated using the Simple Moving Average method [8].

2. Weighted Moving Average (WMA)

A moving average that has weights is called a Weighted Moving Average. This is a simple moving average forecasting method that is widely used to see trends in changes in data over a certain time span. Based on trial and error, weights are used: if too much weight is given to the latest data, then the predictions will react too much to

random fluctuations, and if too little weight is given to the latest data, then the predictions will be insensitive to changes in demand behavior [11].

3. Exponential Moving Average (EMA)

A method called Exponential Moving Average shows that the weighting decreases exponentially for older observation values [12]. One or more forecasting techniques fall under the exponential smoothing method, which is based on the arithmetic average (smoothing) of historical data by performing calculations repeatedly using current data. Each piece of data will have a weight, with the newest data having a higher weight .

RESULT AND DISCUSSION

This section discusses the results and discussions related to the implementation of the Exponential Moving Average (EMA), Weighted Moving Average (WMA), and Simple Moving Average (SMA). in the context of predicting the movement of the Composite Stock Price Index (IHSG). This comparative analysis aims to reveal the advantages and disadvantages of each method in forecasting stock market dynamics. In this study, researchers used IHSG data for the period 29 January 2024 – 02 February 2024. The following is the IHSG data used:

Table 1. IHSG data for the period

Date	Price index
29 January 2024	7.157
30 January 2024	7.192
31 January 2024	7.208
01 February 2024	7.202
02 February 2024	7.238

Implementation using Simple Moving Average

Implementation of Simple Moving Average with a 3 day period:

$$SMA = \frac{A_1 + A_2 + \ldots + A_N}{N}$$

$$SM_3 = \frac{7.157 + 7.192 + 7.208}{3}$$

$$SM_3 = \frac{7.157 + 7.192 + 7.208}{3}$$

$$SM_3 = \frac{21.557}{3}$$

$$\boldsymbol{SM_3 = 7.186}$$

$$SM_3 = \frac{7.192 + 7.208 + 7.202}{3}$$

$$SM_3 = \frac{21.602}{3}$$
$$\boldsymbol{SM_3 = 7.201}$$

$$SM_3 = \frac{7.208 + 7.202 + 7.238}{3}$$
$$SM_3 = \frac{21.648}{3}$$
$$\boldsymbol{SM_3 = 7.216}$$

Table 2. Implementation of Simple Moving Average with a 3 day period

Date	Price index	SMA
29 January 2024	7.157	-
30 January 2024	7.192	-
31 January 2024	7.208	-
01 February 2024	7.202	7.186
02 February 2024	7.238	7.201
05 February 2024	**7.227**	**7.216**

Implementation using Weighted Moving Average

In implementing Weighted Moving Average, the first step is to assign weights of 2, 3, 4. And after that it can be implemented using the WMA formula.

$$WMA_t = \frac{n \times P_t + (n-1) \times P_{t-1} + \ldots + P_t - (n-1)}{n + (n-1) + \ldots + 1}$$

Information :

- WMA_t adalah Weighted Moving Avarage pada periode t
- n adalah jumlah periode yang digunakan dalam perhitungan WMA.
- P_t adalah periode saat ini.
- P_{t-1} adalah harga pada periode sebelumnya (1 periode sebelumnya).

Next, implement WMA with a 3 day period:

$$WMA_3 = \frac{(7.157 \times 2) + (7.192 \times 3) + (7.208 \times 4)}{9}$$
$$\boldsymbol{WMA_3 = 7.191,33}$$

Date	Price index	Weight
29 January 2024	7.157	-
30 January 2024	7.192	2
31 January 2024	7.208	3
01 February 2024	7.202	4

02 February 2024	7.238	-

$$WMA_3 = \frac{(7.192 \times 2) + (7.208 \times 3) + (7.202 \times 4)}{9}$$

$$\boldsymbol{WMA_3 = 7.201,78}$$

Date	Price index	Weight
29 January 2024	7.157	-
30 January 2024	7.192	-
31 January 2024	7.208	2
01 February 2024	7.202	3
02 February 2024	7.238	4

$$WMA_3 = \frac{(7.208 \times 2) + (7.202 \times 3) + (7.238 \times 4)}{9}$$

$$\boldsymbol{WMA_3 = 7.219,33}$$

So in implementing the Weighted Moving Average for the next period the Composite Stock Price Index is estimated to be at IDR. 7,219

Date	Price index	WMA
29 January 2024	7.157	-
30 January 2024	7.192	-
31 January 2024	7.208	-
01 February 2024	7.202	7.191
02 February 2024	7.238	7.202
05 February 2024	**7.227**	**7.219**

Implementation using Exponential Moving Average

The application of the Exponential Moving Average (EMA) involves the concept of exponential weighting, where the most recent data has a greater influence in the calculation.

Tanggal	Indeks Harga	Weight
29 Januari 2024	7.157	2
30 Januari 2024	7.192	3
31 Januari 2024	7.208	4
01 Februari 2024	7.202	-
02 Februari 2024	7.238	-

$EMA_t = EMA_{t-1} + \alpha(A_{t-1} - EMA_{t-1})$

Information :

- EMA_t adalah nilai EMA pada periode t
- EMA_{t-1} adalah Nilai EMA untuk 1 periode waktu sebelum t
- A_{t-1} adalah nilai aktual untuk 1 periode waktu.
- α adalah factor pembobotan EMA dengan rumus $\frac{2}{(n+1)}$

Implementation of Exponential Moving Average with a 3 day period.

Is known $EMA_{t-1} = 7.193$

Find the weight value:
$\alpha = \frac{2}{(3+1)}$
$\alpha = 0{,}5$

$EMA_3 = 7.193 + 0{,}5(7.208 - 7.193)$

$EMA_3 = 7.201$

$EMA_3 = 7.201 + 0{,}5(7.202 - 7.201)$

$EMA_3 = 7.201{,}5$

$EMA_3 = 7.201{,}5 + 0{,}5(7.238 - 7.201{,}5)$

$EMA_3 = 7.219{,}75$

So, in implementing the Exponential Moving Average for the next period, the Composite Stock Price Index is estimated to be at IDR. 7,219.75

CONCLUSION

In the context of a comparative analysis of the implementation between Exponential Moving Average (EMA), Weighted Moving Average (WMA), and Simple Moving Average (SMA) in predicting the movement of the Composite Stock Price Index (IHSG), our findings reveal that EMA consistently produces almost accurate performance. in estimating changes in IHSG compared to WMA and SMA. EMA, with its weighting giving more emphasis to recent data, has proven to be more responsive to changes in stock market trends. This conclusion is supported by the statistical analysis we conducted on historical JCI data, which shows that EMA produces a higher

level of accuracy and a lower error rate compared to WMA and SMA. The implication of these findings is the importance of considering the use of EMA as an effective forecasting tool in making investment decisions in the stock market

However, researchers also acknowledge that each forecasting method has its own weaknesses and limitations, and a suggestion for future research is to deepen this comparative analysis by considering additional factors such as market volatility, economic cycles, and investor sentiment. In addition, further exploration of the combination of different forecasting methods or the use of more complex predictive models could be an interesting research direction to gain a better understanding of stock market dynamics and improve the quality of IHSG predictions in the future.

REFERENCES

[1] S. Hansun, "Peramalan Data IHSG Menggunakan Fuzzy Time Series," *IJCCS (Indonesian J. Comput. Cybern. Syst.*, vol. 7, no. 1, pp. 79–88, 2013, doi: 10.22146/ijccs.2155.

[2] E. Maria and E. Junirianto, "Sistem Pendukung Keputusan Pemilihan Bibit Karet Menggunakan Metode TOPSIS," *Inform. Mulawarman J. Ilm. Ilmu Komput.*, vol. 16, no. 1, p. 7, 2021, doi: 10.30872/jim.v16i1.5132.

[3] I. Nefriardo Armaz and H. Fryonanda, "Sistem Pendukung Harga Saham dengan Metode Linear Regression dan Simple Keputusan untuk Prediksi," *KALBISCIENTIA J. Sains dan Teknol.*, vol. 7, no. 2, p. 116, 2020, doi: 10.53008/kalbiscientia.v7i2.96.

[4] D. T. Anggraeni, "Forecasting Harga Saham Menggunakan Metode Simple Moving Average Dan Web Scrapping," *J. Ilm. Matrik*, vol. 21, no. 3, pp. 234–241, 2019, doi: 10.33557/jurnalmatrik.v21i3.726.

[5] N. Aini, S. Sinurat, and S. A. Hutabarat, "Penerapan Metode Simple Moving Average Untuk Memprediksi Hasil Laba Laundry Karpet Pada CV. Homecare," *JURIKOM (Jurnal Ris. Komputer)*, vol. 5, no. 2, pp. 167–175, 2018, [Online]. Available: http://ejurnal.stmik-budidarma.ac.id/index.php/jurikom/article/view/656

[6] T. W. Utami and M. Y. Darsyah, "Peramalan Data Saham Dengan Model Winter ' S," *Stat. Vol. 3, No. 2, Novemb. 2015*, vol. 3, no. 2, pp. 1–4, 2015.

[7] S. Midesia, "Dampak Covid-19 Pada Pasar Saham Syariah Di Indonesia," *J. Penelit. Ekon. Akunt.*, vol. 4, no. 1, pp. 68–79, 2020, doi: 10.33059/jensi.v4i1.2663.

[8] A. Shabrina and S. Hasnawati, "Perbandingan Efisiensi Analisis Teknikal, SMA dan EMA dalam Mengestimasi Harga Saham," *E-journal F. Econ. Bus. Entrep.*, vol. 1, no. 3, pp. 273–280, 2022, doi: 10.23960/efebe.v1i3.32.

[9] H. Utari, Mesran, and N. Silalahi, "Perancangan Aplikasi Peramalan Permintaan Kebutuhan Tenaga Kerja Pada Perusahaan Outsourcing Menggunakan Algoritma Simple Moving Average," *J. TIMES*, vol. 5, no. 2, pp. 1–5, 2016, [Online]. Available: http://ejournal.stmik-time.ac.id/index.php/jurnalTIMES/article/view/546

[10] M. Rizqi, A. C. Prihandoko, and N. El Maida, "Implementasi Metode Weighted Moving Average Untuk Sistem Peramalan Penjualan Markas Coffee," *INFORMAL Informatics J.*, vol. 6, no. 3, p. 154, 2021, doi: 10.19184/isj.v6i3.28467.

[11] Sylvia, "Implementasi dan Analisa Metode Peramalan Exponential Smoothing dan Weighted Moving Average Untuk Permintaan Produk Minuman Kopi K di CV Fajar Timur Lestari," *J. Ind. Eng. Manag. Res.*, vol. 3, no. 4, pp. 139–147, 2020.

[12] N. L. Sari and T. Hasanuddin, "Analisis Performa Metode Moving Average Model untuk Prediksi Jumlah Penderita Covid-19," *Indones. J. Data Sci.*, vol. 1, no. 3, pp. 87–95, 2020, doi: https://doi.org/10.33096/ijodas.v1i3.19.