Journal of Applied Business, Taxation and Economics Research (JABTER)
Vol. 3, No. 1, October 2023 (Page: 1-13) P-ISSN 2828-4976
DOI: 10.54408/jabter.v3i1.185 E-ISSN 2808-263X

Stock Price Forecasting with the Weight Moving Average Method in Technology Sector Companies on the Indonesia Stock Exchange (IDX)

Syefira Ramadhani [1*)], Nurafni Eltivia [2], Nur Indah Riwajanti [3]

[1*23] Politeknik Negeri Malang, Indonesia

[1*)] *Corresponding Author: syefiramadhani.work@gmail.com*

Keywords**:** *Forecasting, Stock Price, Weight Moving Average, Technology Companies, Indonesia Stock Exchange (IDX)*

Abstract: This study aims to forecast the share price of the technology sector listed on the Indonesia Stock Exchange (IDX). We sampled 26 of the 34 technology companies listed on the IDX in 2022. The data used is secondary data from the official website of the Indonesia Stock Exchange, namely www.idx.co.id and finance.yahoo.co.id for 9 months, namely the period January – September 2022. The results showed that the calculation of the Weight Moving Average (WMA) for the average value of the Absolute value of forecast error is 16,374.70, and the value of the Absolute value of the Percentage of Error is 531.10%. The forecasting assessment method uses Mean Absolute Percent Error (MAPE). The resulting MAPE value is 3.02%. The highest MAPE score was Kioson Komersial Indonesia Tbk (KIOS) with a score of 5.99% while the lowest score was Sat Nusapersada Tbk (PTSN) with a score of 1.23%. From the results of MAPE for technology sector companies, it can be concluded that using the WMA Method and MAPE error valuation falls into the category of excellent forecasting ability in forecasting stock prices. So this study aims to make issuers who are interested in investing in the technology sector have a reference analysis of stock price forecasting before buying shares. Because the stock sector of technology companies is currently predicted to develop in the future.

Introduction

Stock prices are influenced by various internal and external factors, such as domestic and foreign economic environments, international situations, industry prospects, listed company financial data, and stock market operations (Hu et al., 2021) If quoting the Composite Stock Price Index (JCI) closed down 0.29% to 6,581.48 in the last trading of 2021. That way, year to date (YTD), JCI was recorded to increase by 10.08% compared to JCI at the end of 2020 which was at 5,979.07 (Qolbi, N, 2021). From these data, it shows that the Indonesian stock market still has the potential to develop due to the post-pandemic economic recovery.

Hundreds of stocks listed on the Indonesia Stock Exchange (IDX) are divided into several sectors. Share prices in various business sectors represent investor confidence in the future profitability of the company and also is used to represent shareholder wealth. When managing various company resources, he controls and is already reflected in the company's share price in the market (Rahardika et al., 2022). Throughout 2021, the highest growth was recorded by the Technology sector index. This is in line with the pandemic period which encourages people to make adjustments to their daily activities that lead to digital transformation. On August 6, 2021, PT Bukalapak Tbk, was officially listed as the first technology unicorn company listed on the IDX. Bukalapak is listed on the Development Board under the Technology sector and the Software and IT Services sub-sector (IDX, 2021).

Along the way, the performance of technology stocks experienced positive developments in 2021 This can be seen in the chart below

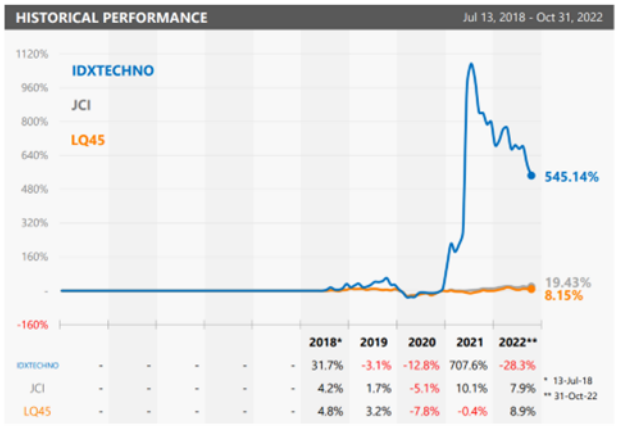


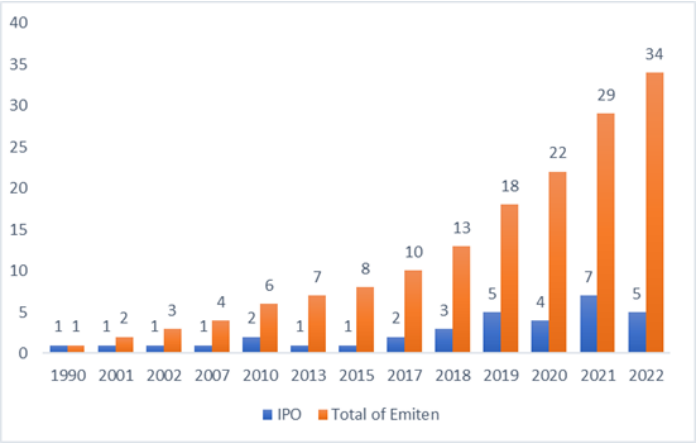
Figure 1: IDX IDXTECHNO Fact Sheet Index as of October 2022

Judging from the Fact Sheet released by the Indonesia Stock Exchange (IDX), IDXTECHNO is the sector that experienced the highest increase compared to the LQ45 and JCI indices. In 2021 IDXTECHNO increased by 707.6%, JCI increased by only 10.1%, and LQ45 decreased by 0.4%.

IDXTECHNO's positive trend also reflects the increasing number of technology companies conducting Initial Public Offerings (IPOs) on the Indonesia Stock Exchange. In 2022, based on (e-ipo.co.id), at least 5 issuers of technology sector companies have IPO, namely as follows: PT. WIR ASIA Tbk. (WIRG), PT. GoTo Gojek Tokopedia Tbk (GOTO), PT. Tera Data Indonusa Tbk. (AXIO), PT. Global Digital Niaga Tbk. (BELI) and PT Techno9 Indonesia Tbk (NINE). For

P-ISSN 2828-4976
E-ISSN 2808-263X

more information to see the development of technology sector issuers, it is stated in the picture as follows.



Graph processed by researchers (source: e-ipo.co.id)

Figure 2: Development Chart of Technology Companies listed on IDX

Available information about the capital market can describe the company's stock price, so the ability and sensitivity to changes in information are also needed to be able to make the right decisions when investing in the capital market (Permata &; Ghoni, 2019). With the fluctuation of stock prices, investors need to analyze to see prospects, especially looking at stock prices and industrial sectors. Fundamental analysis is used to find out whether a price is expensive (overvalued) or cheap (undervalued). Technical analysis only considers price movements without regard to the performance of the company issuing shares (Mustaqim et al., 2022). The decision to buy or sell a stock is made using technical analysis. Stock price patterns usually change quickly, making it difficult to predict (Khanady et al., 2011). Making reasonable and accurate forecasts for changes in stock prices can greatly reduce an investor's investment risk. Such forecasts allow investors to incorporate predicted stock prices into their investment strategies and help investors maximize their investment income (Lu, 2020).

To more accurately predict stock prices, the authors propose a method based on forecasting. Forecasting is an attempt to predict future conditions by taking past samples. Forecasting using the time series method (Nurlifa &; Kusumadewi, 2017). The time series method consists of various methods, one of which is the Weight Moving Average (WMA). In the WMA Method, higher weights are given in periods that are closer to the forecasted period (Sundari et al., 2015).

One way to evaluate forecasting techniques is to use a measure of the difference between forecast results and actual demand. In short, a forecast must be calculated at what level of accuracy. Through forecasting analysis using Mean Absolute Deviation (MAD) and Mean Absolute Percent Error (MAPE) can see how likely stock prices are in the future, so investors can plan the right investment in the future (Alam Akbar Halimawan and Subiakto Sukarno, 2013). This studies the calculation of Mean Absolute Percent Error (MAPE). Because

MAPE calculations show optimal results and consistency minimizes empirical risk (Kim &; Kim, 2016).

Based on the explanation above, this study aims to determine the stock price prediction of technology sector companies using the WMA forecasting method. The author is interested in analyzing technology stock prices in Indonesia because companies that have IPOs in the 2021-2022 period have increased rapidly and there has not been much research on technology sector stocks. So, the latest study is needed related to forecasting stock prices. By using the WMA forecasting method, in previous studies that proved effective in predicting stock prices. In addition, the calculations carried out are easy to understand. Because every day using technology is a daily need to carry out all activities, the company that produces these needs will increase. It is projected that companies listed in the technology sector will have good prospects in the future. Issuers can also monitor stocks in this technology sector as an alternative to their investment decisions.

Technology Companies

The existence of Industry 4.0 is one of the proofs that currently industrial development cannot be separated from technological development. With the help of digital technology, the country can lead its economy towards a digital economy (Ministry of Communication and Information Technology of the Republic of Indonesia, 2019). Industry 4.0 has been considered as a new industrial stage where several emerging technologies are integrated, to provide digital solutions (Frank et al., 2019). The concept of Industry 4.0 includes the integration of various technologies into autonomous, knowledge-based production systems and self-regulating production systems. Adopting technology can increase industrial efficiency and productivity, the use of management strategies, and the development of science that is useful for increasing company competitiveness in the long term (Dalmarco et al., 2019).

IT companies represent a very attractive sector due to their continuous and rapid development and infiltration into all other areas of business, but also private. The sector, which these companies are engaged in, offers services that are constantly changing. It can be said that today, information technologies are used almost by all people and companies engaged in other business activities, and they acquire a significant position in the market (Malichová & Ďurišová, 2015). Technology companies in developed countries such as the United States, the technology sector contribute as much as 10.5% of total GDP. While in developing countries such as India, the IT industry contributes as much as 8% of the total GDP. Alibaba Group contributed to the average growth in 2014-2019 of 1.1% of China's GDP (Zhukov, 2019). In recent years in Indonesia, e-commerce startup companies such as PT. Bukalapak.com Tbk (BUKA), PT. GoTo Gojek Tokopedia Tbk (GOTO) and PT. Global Digital Niaga Tbk. (BUY). It is expected that this company will develop into the largest technology company that becomes the center of attention of investors on the stock market exchange to invest funds in this sector.

Changes in the way of working and business models of many companies to digital business models certainly require products and services from technology companies. This

P-ISSN 2828-4976
E-ISSN 2808-263X

increase in demand affects business revenues where technology companies provide IT devices and services and is a moment for technology companies to improve business performance by reaping profits in the form of high returns. The right choice for investors to invest in the industry (Rahmentio et al., 2022). That is why investors need to look at the analysis of business entities that earn profits in the future through shares of technology sector companies.

IDX Techno

Information about stock market developments is collected in an index called a stock market index that reflects the performance of stocks in the market. This index describes stock price movement, therefore it is also called the composite stock price index (JCI) (Tandelilin, 2017). Every stock classified in the Technology Sector based on the IDX Industrial Classification (IDX-IC) is included in the IDX Technology Sector Index (IDX-TECHNO) (IDX, 2022). The Technology Industry includes companies that sell Technology Products and Services, such as Internet Service Companies that are not Internet connection providers, IT Service Providers and Consultants, Software Development Companies, Network Device Manufacturers, Computer Devices, Electronic Devices and Components, and Semiconductors (https://idx.co.id/id/produk/saham/).

Forecasting

Forecasting is an important issue that can cover many fields including business and industry, government, economics, environmental sciences, medicine, social sciences, politics, and finance (Montgomery et al., 2015). Predicting stock prices is an important topic in finance because it motivates investors to invest in the capital market (Kamley et al., 2016). Because stocks traded in the capital market display shares at different prices (Modis, 1999). Forecasting is the art and science of predicting events that will occur, using historical data and projecting it into the future with some form of a mathematical model (Nasution, 2019). Data related to stock prices were previously collected, researched, analyzed, and related to the passage of time due to the time factor. Then the results of the analysis can predict what will happen in the future (Sucipto &; Syaharuddin, 2018). The purpose of stock price forecasting is to identify the correct type of stock and take action accordingly. If a stock is identified as overpriced, the investment decision is to short the stock, if the stock is identified as underpriced the investment decision is to buy the stock, and if the stock is identified as having a fair price, the investment decision is to hold the stock (Harel &; Harpaz, 2021).

Two main things that must be considered in the process of accurate and useful forecasting, the first is that data collection must be relevant in the form of information that can produce accurate forecasting. Next is the selection of the right forecasting technique that will utilize the data information obtained as much as possible (Christy et al., 2018). The result of a forecast is more of a statement or quantitative assessment of stock prices for a certain period. However, the estimated results obtained may not be the same as the plan (Bresman et al., 2020). This is because forecasting has certain properties.

According to Isaac (2010), forecasting has properties that must be understood before being used in decision-making, namely:

Forecasting must contain errors, meaning that forecasting can only reduce the uncertainty arising, but cannot eliminate it. Forecasting should provide information about a certain error rate, which means that the forecast should contain errors and it is important for the researcher to show how big the error is. Short-term forecasting is more accurate than long-term forecasts. In the case of short-term forecasting, the factors affecting demand are still relatively constant, while the forecasting period is still long, the more likely it is that the changes in factors affecting demand will occur.

Mean Absolute Percentage Error (MAPE)

There is nono technique that can accurate forecasting, just as the future may not be predicted precisely and perfectly (Hendriani et al., 2017). To test the accuracy of forecasting results using appropriate reliability measures. There are several methods of calculating forecasting accuracy. According to Nasution (2011), there are commonly used measures, one of which is the Mean Absolute Percent Error (MAPE). MAPE is to calculate the absolute error value for each period divided by the actual value for that period, then calculate the average percentage of that absolute value. Quoting from (de Myttenaere et al., 2016), the following is the MAPE calculation formula.

$$MAPE = \left(\frac{1}{n}\sum_{t=1}^{n}\frac{A_t - F_t}{A_t}\right) \times 100\%$$

Note :

A_t = The Expected value in a period of time

F_t = Forecasting value at the time of the period t

n = The total number of periods

The MAPE used can evaluate the performance of various types of forecasting models. The forecasting model with the smallest MAPE value is the best result (Chang et al., 2007). The following is a table of determining the MAPE Value.

Table 1. MAPE value

MAPE value	Significance Level
<10%	Excellent forecasting ability
10-20%	Good forecasting ability
20-50%	Reasonable forecasting ability
>50%	Poor forecasting ability

Weight Moving Average (WMA)

Weight Moving Average (WMA) is a method used to determine the trend of a time series based on recent data. In the WMA method, assessment weighting is carried out, the last data has a greater weight than the previous data (Solikin et al., 2019). This can be based

P-ISSN 2828-4976
E-ISSN 2808-263X

if the influence of newer data is greater than older data on future conditions (Ramadania, 2018).

The weighted moving average method also uses data from the last n periods as historical data to perform forecasting, but each period gets a different weight. Gives greater weight to the latest data because the latest data is considered to have a value that is more responsive to changes in value (Hendriani et al., 2017). The equation of the WMA method can be written as follows:

$$F_t = \frac{C_1X_{t-1} + C_2X_{t-2} + \cdots + C_nX_{t-n}}{C_1 + C_2 + \cdots + C_n}$$

Note :

F_t = Forecast period *to t*

C = Weights used

X_t = Actual Data in the *period to t*

n = The Number of periods used for forecasting

Research Method

This research uses quantitative approaches and forecasting methods to determine future stock prices for technology sector companies on the IDX. The technique used uses purposive sampling. According to Sugiyono (2012), the purposive sampling technique is sampling using certain considerations by the desired criteria to be able to determine the number of samples to be studied. Examples of criteria determined in sampling are as follows.

Table 2. Sampling Criteria

No.	Information	Sum
1	The sample is a technology company listed on the Indonesia Stock Exchange (IDX) until 2022	34
2	The sample has stock price data that can be accessed and downloaded on idx.co.id or finance.yahoo.com	30
3	Sample of available stock prices in the period January to September 2022	26
	Number of Research Samples	26

Based on the selection of sample criteria, research samples will be obtained and later the data can be accounted for. From the table above, the sample criteria are 26 companies. The following is a sample of 26 technology companies listed on the IDX.

Table 3. Sample of Technology Sector Companies

No.	Code	Company Name
1	MTDL	Metrodata Electronics Tbk.
2	KREN	Kresna Graha Investama Tbk.
3	PTSN	Sat Nusapersada Tbk
4	EMTK	Elang Mahkota Teknologi Tbk.
5	MLPT	Multipolar Technology Tbk.

No.	Code	Company Name
6	ATIC	Anabatic Technologies Tbk.
7	KIOS	Kioson Komersial Indonesia Tbk
8	MCAS	M Cash Integrasi Tbk.
9	NFCX	NFC Indonesia Tbk.
10	DIVA	Distribusi Voucher Nusantara Tbk.
11	LUCK	Sentral Mitra Informatika Tbk.
12	HDIT	Hensel Davest Indonesia Tbk.
13	TFAS	Telefast Indonesia Tbk.
14	DMMX	Digital Mediatama Maxima Tbk.
15	GLVA	Galva Technologies Tbk.
16	PGJO	Tourindo Guide Indonesia Tbk.
17	CASH	Cashlez Worldwide Indonesia Tbk,
18	TECH	Indosterling Technomedia Tbk.
19	WIFI	Solusi Sinergi Digital Tbk.
20	DCII	DCI Indonesia Tbk.
21	EDGE	Indointernet Tbk.
22	ZYRX	Zyrexindo Mandiri Buana Tbk.
23	UVCR	Trimegah Karya Pratama Tbk.
24	BUKA	Bukalapak.com Tbk.
25	RUNS	Global Sukses Solusi Tbk.
26	WGSH	Wira Global Solusi Tbk.

Source: IDX.co.id

This research uses secondary data obtained through the official website of the Indonesia Stock Exchange, namely www.idx.com and finance.yahoo.com. The research data used is stock price data for January – September 2022 or 9 months on the Indonesia Stock Exchange. The analysis method used is the Weight Moving Average (WMA) based on historical data, then predictions can be made for the next period using the forecasting method. Microsoft Excel is used to generate stock price forecasts calculated based on historical data. After that, calculate forecasting accuracy using Mean Absolute Percent Error (MAPE). The research procedure for forecasting the stock price of the technology sector on the Indonesia Stock Exchange is shown in the following figure.

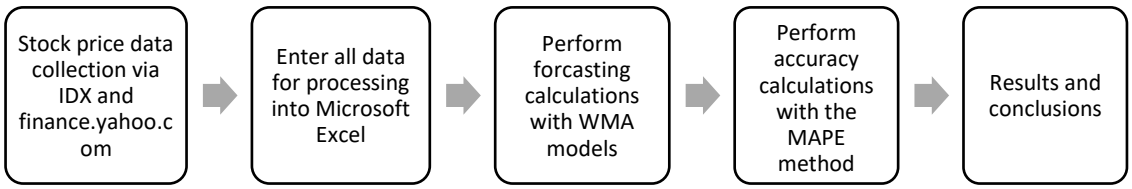


Figure 3: Research Procedure

P-ISSN 2828-4976
E-ISSN 2808-263X

Result and Discussion

WMA Calculation Results

Through the forecasting steps described in the previous subchapter, researchers try to apply the WMA method to stock price data. The amount of data used is 26 technology sector companies recorded from January 3, 2022, to September 30, 2022, daily. Completion Period using WMA 5 daily periods. The following is an example of WMA calculation using Microsoft Excel from one of the samples of technology companies, namely PT. Metrodata Electronics Tbk (MTDL).

Table 4. WMA Calculation Results on MTDL

Date	Closing Stock Price	Forecast	Forecast Error	The absolute value of forecast error	Percentage Error	The absolute value of the Percentage Error
03/01/22	750					
04/01/22	800					
05/01/22	780					
06/01/22	765					
07/01/22	770					
10/01/22	805	773,33	31,67	31,67	3,93%	3,93%
11/01/22	780	784,00	- 4,00	4,00	-0,51%	0,51%
12/01/22	785	782,67	2,33	2,33	0,30%	0,30%
13/01/22	790	784,33	5,67	5,67	0,72%	0,72%
14/01/22	785	787,33	- 2,33	2,33	-0,30%	0,30%
...	...	...	...	...	...	...
...	...	...	...	...	...	...
19/09/22	640	654,00	-14,00	14,00	-2,19%	2,19%
20/09/22	630	646,33	-16,33	16,33	-2,59%	2,59%
21/09/22	615	638,67	-23,67	23,67	-3,85%	3,85%
22/09/22	630	629,00	-23,67	23,67	-3,85%	3,85%
23/09/22	620	627,67	1,00	1,00	0,16%	0,16%
26/09/22	610	624,33	-7,67	7,67	-1,24%	1,24%
27/09/22	615	618,67	-14,33	14,33	-2,35%	2,35%
28/09/22	605	616,67	-3,67	3,67	-0,60%	0,60%
29/09/22	575	612,33	-11,67	11,67	-1,93%	1,93%
30/09/22	585	598,67	-37,33	37,33	-6,49%	6,49%
Total		117.218,00	-428,00	2.558,00	-74,22%	385,89%

Source: Processed Data, 2022

WMA and MAPE Calculation Results

The WMA calculation mentioned above was also used for the 26 samples that had been selected. The next step is to calculate the accuracy rate using the MAPE method. The following is a summary of the MAPE calculations of 26 sample companies that have been calculated through *Microsoft Excel.*

Table 5. WMA and MAPE Calculation Results

No.	Code	Forecast	Forecast Error	The absolute value of forecast error	Percentage of Error	The absolute value of the Percentage of Error	MAPE
1	MTDL	117.218,00	- 428,00	2.558,00	-74,22%	385,89%	2,19%
2	KREN	10.509,07	- 90,07	193,80	-145,83%	297,35%	1,69%
3	PTSN	37.093,20	- 108,20	463,93	-53,83%	216,22%	1,23%
4	EMTK	356.017,33	- 2.097,33	14.084,00	-138,79%	688,44%	3,91%
5	MLPT	538.265,67	- 3.630,67	13.729,33	-140,86%	444,07%	2,52%
6	ATIC	82.779,60	- 652,60	1.794,47	-136,27%	390,70%	2,22%
7	KIOS	70.146,47	101,53	4.095,93	-72,33%	1054,65%	5,99%
8	MCAS	2.099.051,67	3.388,33	46.071,67	18,25%	392,27%	2,23%
9	NFCX	1.342.096,67	8.043,33	53.498,00	25,88%	690,93%	3,93%
10	DIVA	192.304,00	- 2.199,00	5.341,00	-173,47%	481,58%	2,74%
11	LUCK	45.652,27	- 379,27	1.234,33	-159,07%	425,29%	2,42%
12	HDIT	28.680,80	- 536,80	1.173,60	-344,45%	785,01%	4,46%
13	TFAS	754.069,67	750,33	30.121,67	-26,67%	703,58%	4,00%
14	DMMX	309.035,67	- 3.465,67	9.925,67	-212,78%	576,34%	3,27%
15	GLVA	47.966,20	56,80	751,73	13,33%	274,26%	1,56%
16	PGJO	12.794,40	- 16,40	330,53	-40,51%	458,29%	2,60%
17	CASH	34.473,07	- 217,07	1.181,20	-133,31%	573,33%	3,26%
18	TECH	973.093,33	- 1.323,33	46.317,33	-70,68%	875,98%	4,98%
19	WIFI	67.581,67	- 672,67	1.878,13	-209,80%	475,69%	2,70%
20	DCII	6.986.181,67	- 25.741,67	127.191,67	-71,27%	323,06%	1,84%
21	EDGE	3.679.143,33	- 2.778,33	55.668,33	-19,22%	268,47%	1,53%
22	ZYRX	90.455,33	- 95,33	1.909,73	-30,78%	356,55%	2,03%
23	UVCR	36.382,00	- 833,00	1.592,07	-366,40%	745,30%	4,23%
24	BUKA	56.029,80	- 460,80	2.301,33	-161,29%	715,81%	4,07%
25	RUNS	35.539,07	- 315,07	1.436,93	-188,21%	715,17%	4,06%
26	WGSH	31.130,60	3,40	897,80	-18,91%	494,32%	2,81%
Rata-rata		693.603,48	- 1.296,06	16.374,70	-112,75%	531,10%	3,02%

Source: Processed Data, 2022

From the table above, it can be seen that the results of 26 samples of the average WMA calculation for the Absolute value of forecast error are 16,374.70, and the *Absolute value of* the *Percentage of Error* is 531.10%. The resulting MAPE value is 3.02%. The highest MAPE score was Kioson Komersial Indonesia Tbk (KIOS) with a score of 5.99% while the lowest score was Sat Nusapersada Tbk (PTSN) with a score of 1.23%. From the results of MAPE for the 26 technology sector companies above, it can be concluded that using the WMA Method and assessing the level of accuracy using MAPE is included in the category of excellent forecasting capabilities.

Conclusions

From the results of the trials that have been carried out, it can be concluded that the approach using the moving average method, namely the Weight Moving Average (WMA) has been successfully applied to forecast stock prices in technology sector companies. The results of trials on 26 samples of technology companies listed on the IDX showed excellent forecasting results, as seen from the small MAPE value. Thus, market participants can take

P-ISSN 2828-4976
E-ISSN 2808-263X

advantage of forecasting results with the WMA approach, to forecast future stock price movements.

Acknowledgments

The limitation of the research that has been done is that only one method of forecasting and testing is used, namely using WMA and MAPE. Further research development is by adding or using other methods such as the Relative Strength Index (RSI), further identifying oversold and overbought levels in detecting buy signals and sell signals of a stock. In addition, the range of research periods needs to be extended, especially in technology companies. Because companies in this sector always grow every year further research can add the number of companies and the period span.

References

Alam Akbar Halimawan and Subiakto Sukarno. (2013). Stock Price Forecasting Accuracy Analysis Using Mean Absolute Deviation (MAD) And Mean Absolute Percentage Error (MAPE) On Smoothing Moving Average And Exponential Moving Average Indicator (Empirical Study 10 LQ45 STOCK With Largest Capitalization From PE. X(X), 1613–1626.

Andreinna, S., Ayu P, M., Ula, U., Rizqi, S., Nissa, F., & Cahyo, H. (2020). PENGARUH COVID-19 TERHADAP HARGA SAHAM DI INDONESIA TAHUN 2019-2020 Studi Kasus di Indonesia. https://doi.org/https://doi.org/10.34123/semnasoffstat.v2020i1.427

Bresman, Fajrizal, & Guntoro. (2020). Aplikasi Forecasting Stok Barang Menggunakan Metode Single Exponential Smoothing Pada a&W Restaurant Mall Ciputra Seraya Pekanbaru. Prosiding-Seminar Nasional Teknologi Informasi & Ilmu Komputer (SEMASTER), 1(1), 323–330. https://journal.unilak.ac.id/index.php/Semaster/article/view/6147

Chang, P. C., Wang, Y. W., & Liu, C. H. (2007). The development of a weighted evolving fuzzy neural network for PCB sales forecasting. Expert Systems with Applications, 32(1), 86–96. https://doi.org/10.1016/j.eswa.2005.11.021

Christy, J., Hintarsyah, A. P., & Spits Warnars, H. L. H. (2018). Forecasting Sebagai Decision Support Systems Aplikasi dan Penerapannya Untuk Mendukung Proses Pengambilan Keputusan. Jurnal Sistem Komputer, 8(1), 19–27.

Dalmarco, G., Ramalho, F. R., Barros, A. C., & Soares, A. L. (2019). Providing industry 4.0 technologies: The case of a production technology cluster. Journal of High Technology Management Research, 30(2), 100355. https://doi.org/10.1016/j.hitech.2019.100355

Frank, A. G., Dalenogare, L. S., & Ayala, N. F. (2019). Industry 4.0 technologies: Implementation patterns in manufacturing companies. International Journal of Production Economics, 210(September 2018), 15–26. https://doi.org/10.1016/j.ijpe.2019.01.004

Hendriani, T., Yamin, M., & Dewi, A. P. (2017). Sistem Peramalan Persediaan Obat Dengan Metode Weight Moving Average Dan Reorder Point (Studi Kasus: Puskesmas Soropia). SemanTIK, 2(2), 207–214. http://ojs.uho.ac.id/index.php/semantik/article/view/1811/0

Hu, Z., Zhao, Y., & Khushi, M. (2021). A Survey of Forex and Stock Price Prediction Using Deep Learning. 1–30.

IDX. (2022). IDX INDEX FACT SHEET IDX TECHNO. American Journal of Orthodontics and Dentofacial Orthopedics, 162(4), 584.e1-584.e2. (Accessed December 5, 2022).

IDX. (2021). Outperforming Expectations amidst Uncertainties. Annual Report of IDX 2021. https://www.idx.co.id/media/11311/2021-completed.pdf. (Accessed December 5, 2022).

Ishak, Aulia. (2010). Manajemen Operasi. Yogyakarta: Graha Ilmu

Kementerian Komunikasi dan Informatika Republik Indonesia. (2019). Perkembangan Ekonomi Digital di Indonesia Strategi dan Sektor Potensial. Badan Penelitian Dan Pengembangan SDM Puslitbang Aptika Dan IKP, 3(2), 1–75.

Khanady, L., Harga, P., Dengan, S., & Nababan, D. (2011). Prediksi Harga Saham Dengan Menggunakan JST (Jaringan Syaraf Tiruan). In Jalan Imam Bonjol (Issue 6).

Kim, S., & Kim, H. (2016). A new metric of absolute percentage error for intermittent demand forecasts. International Journal of Forecasting, 32(3), 669–679. https://doi.org/10.1016/j.ijforecast.2015.12.003

Lu, W. (2020). A CNN-BiLSTM-AM method for stock price prediction. Neural Computing and Applications, 0123456789. https://doi.org/10.1007/s00521-020-05532-z

Malichová, E., & Ďurišová, M. (2015). Evaluation of Financial Performance of Enterprises in the IT Sector. Procedia Economics and Finance, 34(15), 238–243. https://doi.org/10.1016/s2212-5671(15)01625-1

Montgomery, D. C., Jennings, C. L., & Kulahci, M. (2015). Introduction Time Series Analysis and Forecasting. 671.

Mustaqim, M., Putrihadiningirum, D. C., & Wahyuningtiyas, N. (2022). Analisis Teknikal Saham Kalbe Farma Dengan Menggunakan Moving Average Convergence Divergence Dan Stochastic Ocilator Selama Pandemi Covid-19 Periode 2020-2021. Journal of Islamic Accounting and Finance, II(1), 98–117. www.idx.co.id

Nasution, A. (2019). Metode Weighted Moving Average Dalam M-Forecasting. JURTEKSI (Jurnal Teknologi Dan Sistem Informasi), 5(2), 119–124. https://doi.org/10.33330/jurteksi.v5i2.355

Nurlifa, A., & Kusumadewi, S. (2017). Sistem Peramalan Jumlah Penjualan Menggunakan Metode Moving Average Pada Rumah Jilbab Zaky. INOVTEK Polbeng - Seri Informatika, 2(1), 18. https://doi.org/10.35314/isi.v2i1.112

Permata, C. P., & Ghoni, M. A. (2019). Peranan Pasar Modal Dalam Perekonomian Negara Indonesia. Jurnal Akun Stie, 5(2), 50–61.

Qolbi, N (2021) "IHSG Naik 10,08% Sepanjang 2021" https://investasi.kontan.co.id/news/ihsg-naik-1008-sepanjang-2021. (Accessed December 5, 2022).

Rahardika, H., Permata, A., Anggianni, R. H., & Mulyantini, S. (2022). Jurnal Ilmiah Manajemen Dan Kewirausahaan Review Analisis Determinan Harga Saham Perusahaan Sektor Teknologi. Jimak, 1(1).

Rahmentio, Y., Rahman, A., Putra, D. G., & Aprayuda, R. (2022). Apakah Efek Pandemi Covid-19 Meningkatkan Return Saham Perusahaan Teknologi ? Jurnal Ecogen, 5(2), 194. https://doi.org/10.24036/jmpe.v5i2.13107

Ramadania, R. (2018). Peramalan Harga Beras Bulanan di Tingkat Penggilingan dengan Metode Weighted Moving Average. Bimaster, 7(4), 329–334. http://jurnal.untan.ac.id/index.php/jbmstr/article/view/28402/75676578415

Sugiyono. (2012). Metode Penelitian Kuantitatif kualitatif dan R&D. Bandung: Alfabeta

Sutrisno. (2012) Manajemen Keuangan Teori, Konsep dan Aplikasi. Yogyakarta: EKONISIA

Tandelilin, E. (2017) Pasar Modal: Manajemen Portofolio dan Investasi. Yogyakarta: PT Kanisius

Simuru, J. K., Saerang, I. S., & Maramis, J. B. (2021). Pengujian akurasi metode moving average dalam memprediksi harga saham masa depan pada bank bumn yang terdaftar di bursa efek Indonesia. Testing The Accuracy Of The Moving Average Method In Predicting Future

Share Prices In Bumn Banks Listed In Indonesia. 1664 Jurnal EMBA, 9(3), 1664–1673. https://doi.org/DOI: https://doi.org/10.35794/emba.v9i3.35948

Sundari, S. S., Susanto, & Revianti, W. (2015). Sistem Peramalan Persediaan Barang Dengan Weight Moving Average Di Toko The Kids 24. Konferensi Nasional Sistem Dan Informatika, 598–603.

Yahoo! Finance (2022). PT Metrodata Electronics Tbk. Historical Data PT Metrodata Electronics Tbk (MTDL.JK) https://finance.yahoo.com/quote/MTDL.JK/history?p=MTDL.JK. (Accessed December 8, 2022).

Zhukov, P. E. (2019). The Impact of Electronic Commerce on Economic Development-Assessment of Contribution to the Chinese Economic Growth from Alibaba Group. 2nd International Workshop on Advances in Social Sciences, Iwass, 196–200. https://doi.org/10.25236/iwass.2019.028