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Forecasting Analysis of Share Price Index in Construction Companies Registered in Indonesia Stock Exchange 2015-2019

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Abstract: Stock is one of the investment instruments that many investors choose, both short and long term. Meanwhile, the stock price index is an essential indicator for investors deciding whether to buy, sell, or hold the stock. This study aims to determine what methods are suitable for predicting the Stock Price Index of Construction Companies Listed on the Indonesia Stock Exchange in 2015-2019. By selecting a model that matches the existing time series data, to evaluate the results of the forecasting, the researcher uses a measure of accuracy with Mean Absolute Percentage Error (MAPE), Mean Absolute Deviation (MAD), and Mean Squared Deviation (MSD). This type of research is a quantitative study with a research population of 16 companies listed on the Indonesia Stock Exchange. Only four samples were used that fit the specified criteria, and only five years of research were conducted, namely in 2015 to 2019. data can be seen from historical data or actual data and tested using Minitab software version 19.
The results showed that Double Exponential Smoothing (Holt's) and Double Moving Average Method could be used to forecast the Construction Company Stock Price Index. Obtaining the smallest error value of the four construction companies, namely WSKT company with MAPE = 7.3, MAD = 148.8, and MSD = 40506.0 for the Holt's and MAPE method = 5.3, MAD = 110.1, and MSD = 22006.9 for the Double Moving Average method.
Keywords: Forecasting; Stock Price Index; Double Exponential Smoothing (Holt's); Double Moving Average; MAPE; MAD; MSD
JEL Classification: G17, G15

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Introduction

Stock is one of the investment instruments that many investors choose, both short and long term. Meanwhile, the stock price index is an essential indicator for investors deciding whether to buy, sell, or hold the stock. The index is an indicator or measure of something. In the world of capital markets, an index of stocks and bonds is an imaginary portfolio that measures changes in the market price or part of that market. When the stock index moves up, it means that the price of most of the shares measured by the index moves up. By looking at the stock index movement, investors can determine the general price performance of the stocks they own.

Table 1 describes the estimated construction value and the increasing growth in construction value. It shows Indonesia's construction industry's vital role in economic growth, employment, and national development.

Table 1 Contribution of Construction in Indonesia

Year	Industry value Construction (billion rupiahs)	Construction value growth (% YoY)	The value of the construction industry from GDP
2015	1 174 591.92	6.50	10.0
2016[F]	1 303 983.75	6.82	10.1
2017[F]	1 464 459.29	7.31	10.1
2018[F]	1 652 034.67	7.81	10.3
2019[F]	1 855 404.26	7.31	10.3
2020[F]	2 096 825.89	8.01	10.5
2021[F]	2 315 980.54	8.31	10.6

Source: Data processed

Investments in the capital market in the form of company share ownership or other forms are desirable and lucrative. They can promise substantial returns compared to other products such as gold and deposits. However, if the calculation is wrong, it will be a huge problem and can even be detrimental. Therefore, analysis is a crucial factor in successful trading.

Forecasting is the art or science of predicting future events. It can be done by involving historical data and projecting it into the future in a systematic model. Alternatively, it could be using a combination of mathematical models tailored to the manager. The forecast is increasing because an increasingly complex world economy is accelerating it the underlying future time horizon groups forecasts. Accurate calculations are needed so that the right approach is needed to do forecasting. There are two general approaches used in forecasting, namely the qualitative approach and the quantitative approach. This type of quantitative forecasting approach can be seen from historical data about stock prices from a set of events taken in a specific time where the data is in the form of time-series data.

The basic theory of stock price forecasting is the Efficient Market Hypothesis (EMH), which states that stock prices reflect all available information. Everyone has some level of access to that information. EMH implies that it is said to be efficient if the value of a security at any time reflects all available information, which results in the price of a security at its equilibrium level. However, with the controversy over the level of market efficiency, many believe that a person can conquer the market in a short time (Gigerenzer & Goldstein, 2011).

In this research, the writer will study the stock price index in construction companies. Forecasting is carried out using two-time series analysis methods, namely the Moving Average (average) and Exponential Smoothing methods, which identify the data pattern to obtain the best model to be used.

To detect the accuracy of forecasting results, forecasting evaluation tools such as Mean Absolute Deviation (MAD), Mean Absolute Percentage Error (MAPE), and Mean Squared Deviation (MSD) is used. By evaluating this forecast, it can be seen which forecasting model has a smaller error rate (error) in calculating forecasting.

The study of the forecasting model's application shows that information tends to increase the accuracy of the forecasting results for specific conditions. However, there is no evidence that a forecasting model can be consistent and better than other models (Song, Smeral, Li, & Chen, 2008, Armstrong, 2005). With the selection of an appropriate model, it is expected to provide more accurate results.

According to Kasmir and Jakfar (2015), Investment can be interpreted as an investment in an activity with a relatively long time as a business field. Investment in a narrow sense is in the form of specific projects, either physical or non-physical, such as projects for establishing factories, roads, bridges, building construction, research, and development projects.

According to Fahmi (2012), the stock price index is an indicator that describes a stock price movement. This index is used as a reference for investors to make investments, especially stocks in the capital market. Currently, the Indonesia Stock Exchange has 11 stock price indexes, which are continuously disseminated through print and electronic media.

According to Render and Heizer (2009), forecasting is an art and science in predicting future events. Forecasting involves taking historical data and projecting them into the future using mathematical models. According to Nafitry (2010), quantitative forecasting methods can be divided into two categories: Time Series and Causal Models or Associative Models.

As the forecasting research is quite extensive in number, we need to know which method is precise. So this research comes with that thing in mind and fills the gap with those background mentioned before. While the stock prices are a volatile thing, we want to forecast it to give us a feeling of security to invest in it.

The relevant research results are used as material for consideration and comparison for the basis of the research carried out, so this study uses references to research that has been done before. Jonnius' research (2016) entitled Forecasting the Sectoral Stock Price Index with the 2013-2015 Exponential Smoothing Model Approach. The study results using the exponential smoothing method are more suitable for forecasting the stock price index of the nine sectors. Of the several methods used, the better method is the Holt-winters multiplicative method with three parameters with a smaller level of forecast error.

Rachman's (2018) research entitled Application of the Moving Average and Exponential Smoothing Methods in Forecasting Production of the Garment Industry for the 2017-2018 Period. The prediction research results with two alternative methods and added with the calculation of forecast errors can be concluded that forecasting with the exponential smoothing method a = 0.9 because the forecast results for consumer demand are more significant than other methods.

According to Nafitry (2010) research with the title Application of Forecasting Methods as the Basis for Determining the Level of Needs for Safety Stock in the Electronic Industry. Research on Safety Stock in the Electronic Industry, holt winters exponential smoothing and naïve, with a decrease in the mean absolute percentage error (MAPE) by 63%.

Meanwhile, Putri and Setiawan research (2015) is entitled Forecasting the LQ-45 Financial Company Stock Price Index Using the Autoregressive Integrated Moving Average (ARIMA) and Vector Autoregressive (VAR) Methods. This study indicates that the best forecasting model for the closing price of BBRI shares is by using the ARIMA method while forecasting stock prices of BMRI and BBCA using the VAR method.

Research Bachtiar (2013) with the title Comparative Analysis of Stock Price Forecasting with Artificial Neural Methods and the Box-Jenkis ARIMA Method (Study in Forecasting LQ-45 Share Prices Listed on the Indonesia Stock Exchange from 2008 to 2012). Based on the research results, the ANN model can more accurately predict 14 LQ-45 sample stocks (93.34%), compared to the Box-Jenkis ARIMA model, which only accurately models one share (6.66%).

Research Method

This research's object is the stock price index of construction companies on the Indonesia Stock Exchange (BEI). This research activity uses secondary data, namely data obtained indirectly or through intermediaries (recorded and processed by other parties) in the form of monthly construction company stock price index data obtained from the official website of the IDX (www.idx.co.id). The population in this study was all the construction company's stock price index data. At the same time, the sample is the monthly period data from 2015-2019.

This study uses panel data regression for data analysis techniques. Panel data regression is a regression that combines cross-section and time-series data simultaneously in one equation. Cross-section data consists of several or many objects such as regions, companies, and people with several types of data examples such as assets in the company, income, expenses, inflation rates, and others. Simultaneously, time-series data includes one variable such as stock prices, currency exchange rates, or others with data consisting of several periods such as daily, monthly, quarterly, and annually (Sriyana, 2015). Panel data regression in this study was processed using Minitab software.

Double Moving Average

In this study, the Double Moving Average method is used, which is one way to predict time series data with a linear trend. This method is indirectly called the first set of calculated moving averages, and the second set is calculated as the moving average of the first set. The following equation is used to calculate the moving average from the k-order:

$$Mt = \hat{Y}t + 1 = \frac{Y_t + Y_{t-1} + Y_{t-2} + \cdots + Y_{t-k+1}}{k}$$

Double Exponential Smoothing (Holt's)

It is a development of the Exponential Smoothing method, namely:

$$\hat{Y}t + p = Lt + pTt$$

Evaluation Method / Forecasting Technique

The evaluation of the methods used in this study are:

1. Mean Absolute Deviation (MAD)

Measure the forecast's proviso by averaging the error with (the absolute value of each error). MAD is most useful when the analyzer wants to measure the forecast error in the same units as the original series.

$$MAD = \frac{1}{n} \sum_{i=1}^{n} \left| Y_t - \hat{Y}_t \right|$$

2. Mean Absolute Percentage Error (MAPE)

It is calculated using the absolute error for each period divided by the actual observed value for that period. Then, average those absolute percentage errors. This approach is useful when the forecast variable's size or size is essential in evaluating the forecast's accuracy. MAPE indicates how much error in forecasting is compared to the real value in the series. MAPE can be calculated using the following formula:

$$MAPE = \frac{1}{n} \sum_{i=1}^{n} \frac{\left| Y_t - \hat{Y}_t \right|}{Y_t}$$

3. Mean Squared Deviation (MSD)

Another way to avoid deviating from the positive values and the negative deviations from overlapping is by squaring the error values. MSD is a measure of the forecast's deviation by averaging the squared error (deviation of all forecasts). The equation is as follows:

$$MSD = (1/n) \sum (Y_{(t)} - Y'_{(t)})^2$$

Result and Discussion

Descriptive Statistics

In Table 2, it can be seen the characteristics of construction companies based on the mean, standard deviation, maximum, and minimum. The descriptive statistics used are as follows:

Table 2 Descriptive Construction Company Statistics

Variable	Mean	Std. Deviation	Minimum	Maximum
ADHI	2,069	417,8705	1,125	2,919
PTPP	2,998	747.8613	1,330	4,135
WIKA	2,222	490,163	1,100	3,389
WSKT	2,100	395.4535	1,440	2,910

Source: Ms. Excel processed

Time series plots are used to see data patterns from historical data visually. Data from four construction companies from 1 February 2015 to 31 July 2019 totaled 216 data. The following is a time series plot from IHS data for four companies each month:
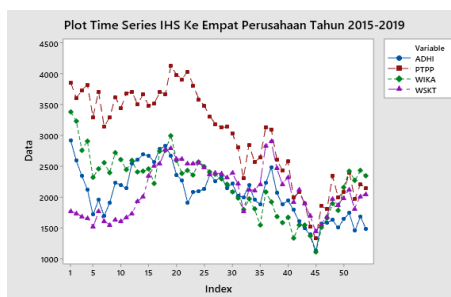
Figure 1 Time Series Plots for the Four Construction Companies
Source: Processed data

Based on Figure 1, it can be seen that in the time series plots of the four construction companies, each of them has almost the same pattern characteristics, namely a secular decline, so that the IHS data for February 2015 to July 2019 contains a trend.

Stationarity in Variance

In this case, the data stationarity invariance was checked. This check uses Box-Cox Transformation. If a data is said to be stationary invariance, then the Rounded Value = 1, then to stationary the variance, it is necessary to transform it. The results of checking the stationarity in the variance of each company are as follows Table 3.

Table 3 Stationarity Check Recap in Variance

Variable	Transformation
ADHI	Not transformed
PTPP	Transformed
WIKA	Not transformed
WSKT	Not transformed

Source: Minitab Software Output Results

Stationarity in Mean (average)

In this case, checking the data's stationarity in the mean is done using a graph with an ACF (Autocorrelation Function) plot. If the data is not stationary in the mean, differencing is necessary to stationary the mean. The results of checking the stationarity in the mean are as follows:

(a) ADHI (b) PTPP

(c) WIKA (d) WSKT
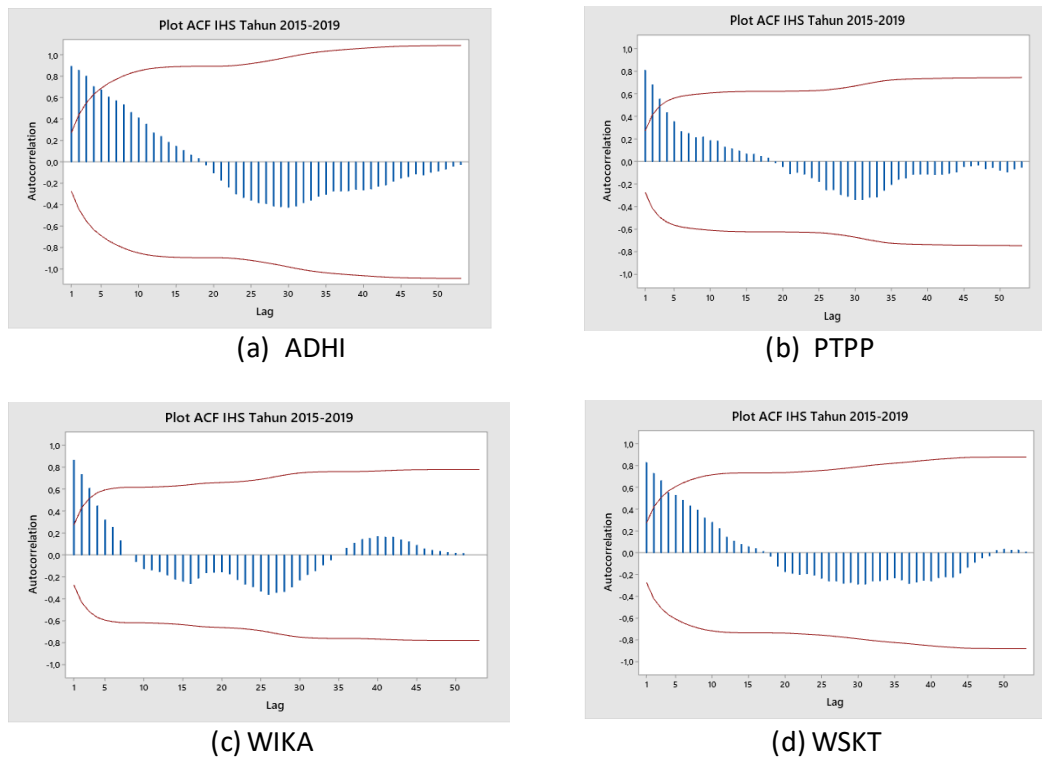
Figure 2 ACF Plot of IHS Data for Four Construction Companies
Source: Processed data

In the ACF plot in Figure 2, it can be identified that there are <3 first lags that come out of the red line in each company. The red line is the confidence interval or significant limit of autocorrelation. It shows that the data are not stationary in the mean, so it is necessary to process the difference to get the mean's stationarity data.

Forecasting Methods and Assumptions Test

After obtaining the results from identifying the data plots and their stationarity, the next step is to predict the stock prices of ADHI, PTPP, WIKA, and WSKT for the next five periods. The forecasting selection for the next five periods is carried out to anticipate significant changes in the model. For the IHS data for the four companies, the possible methods to forecast are as follows:

1. Holt's method (Double Exponential Smoothing)
2. Double Moving Average method

A diagnostic examination is performed to determine whether the two methods can predict IHS for the next five periods. The diagnostic examination consists of a normality test. The normality test of a model is useful if the error value is random (random), indicating no autocorrelation, which means that the residual is not a specific pattern. The way to see the normality test on the model is by using the Kolmogorov-Smirnov statistical test. The Kolmogorov-Smirnov test uses residuals from a provisional model. The hypothesis for the normality test is that H0 is rejected if the residuals are not normally distributed. Residuals are normally distributed if the significance value (p-value) is more than α with α value is 0.05. The residual is declared not generally distributed if the significance value (p-value) is less than equal to α.

Holt's method (Double Exponential Smoothing)

With the Minitab software, we can get a Double Exponential Smoothing plot, and the forecasting model is as follows:

$$\hat{Y}t + p = Lt + pTt \qquad (6)$$
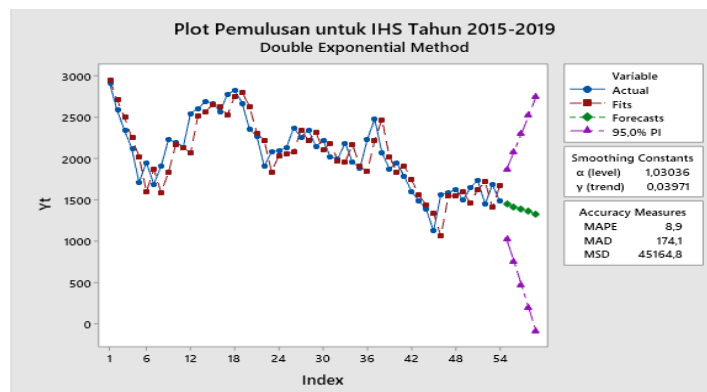
ADHI
Source: Processed data

With
Lt = 1.03036 + (1-1.03036) (Lt-1 + Tt-1)
Tt = 0.03971 (Lt - Lt-1) + (1-0.03971) Tt-1

Normality test

Source: Processed data

H_O : the residue is not normally distributed
H_1 : residues are normally distributed
α = 0.05

Critical Areas
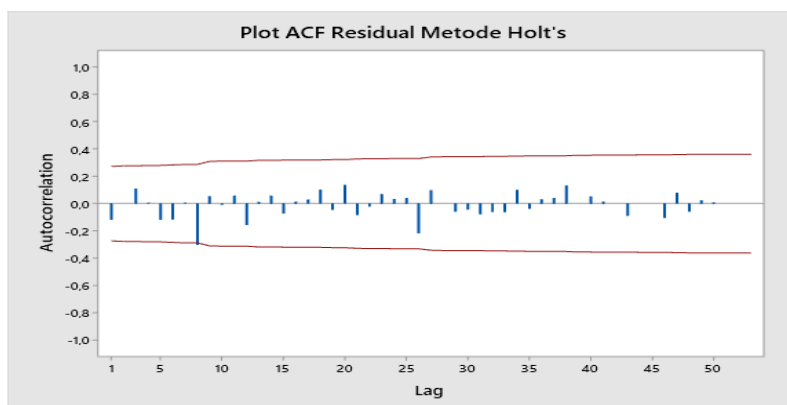H_O is rejected if the p-value $< \alpha = 0.05$
Test statistic: p-value > 0.150

Conclusion
Based on the values in Normality test, it can be concluded that the data is normally distributed.

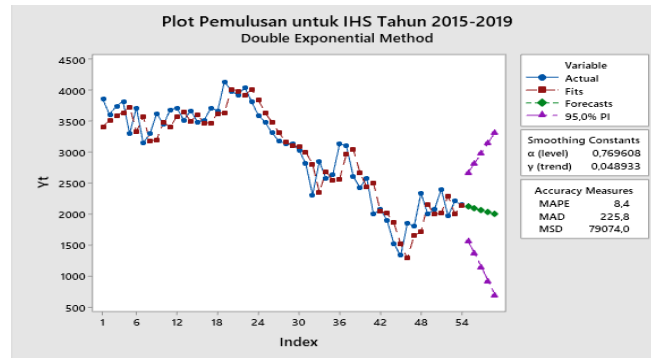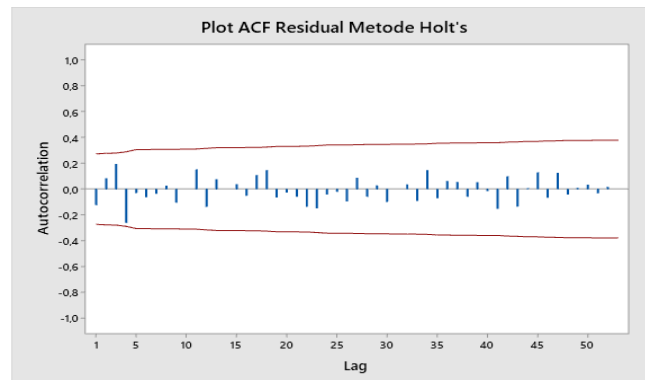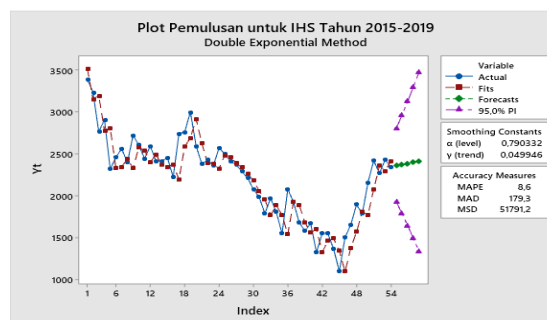Residual Homeland Test

Source: Processed data

From the ACF plot, it can be seen that all the lags are in the confidence band, so it can be said that the residue is random (random)

Based on the Model Normality Test, the error value obtained to predict the IHS ADHI is as follows:

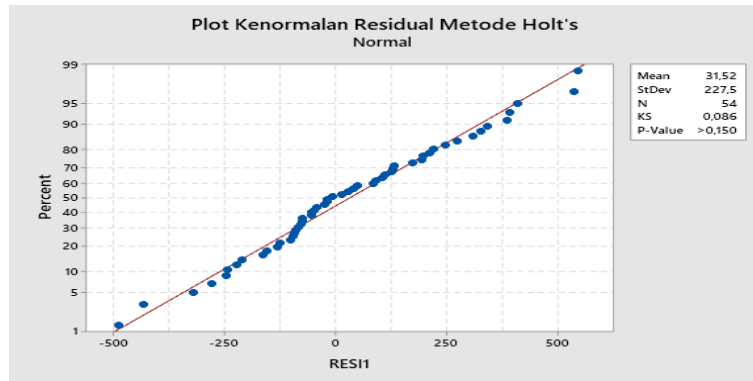1. MAPE   = 8.9
2. MAD   = 174.1
3. MSD   = 45164.8

PTPP
Source: Processed data

With
Lt = 0.769608 + (1-0.769608) (Lt-1 + Ht-1)
Tt = 0.048933 (Fl - Lt-1) + (1-0.048933) Tt-1

Normality test

Source: Processed data

H_O : the residue is not normally distributed
H_1 : residues are normally distributed
α = 0.05
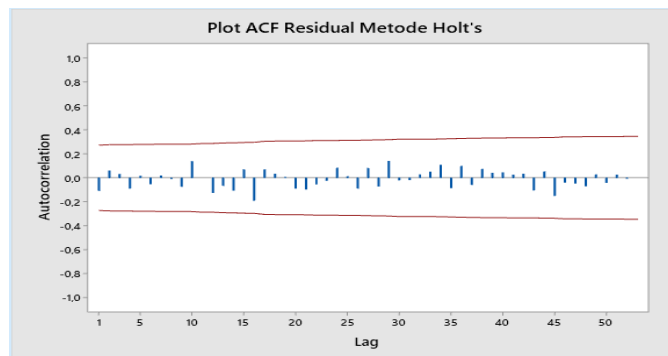
Critical Areas
H_O is rejected if the p-value $< \alpha = 0.05$

Test statistic: p-value > 0.150

Conclusion:
Based on the values in Normality test, it can be concluded that the data is normally distributed.
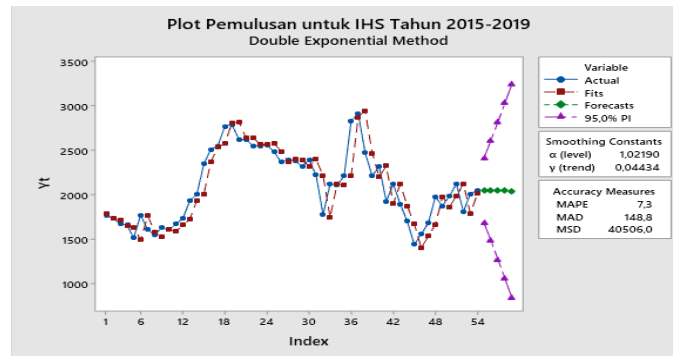
Residual Homeland Test

Source: Processed data

From the ACF plot, it can be seen that all the lags are in the confidence band, so it can be said that the residue is random.

Based on the Normality Test of the model, the error values obtained to predict the IHS PTPP are as follows:

1. MAPE   = 8.4
2. MAD   = 225.8
3. MSD   = 79074.0

WIKA
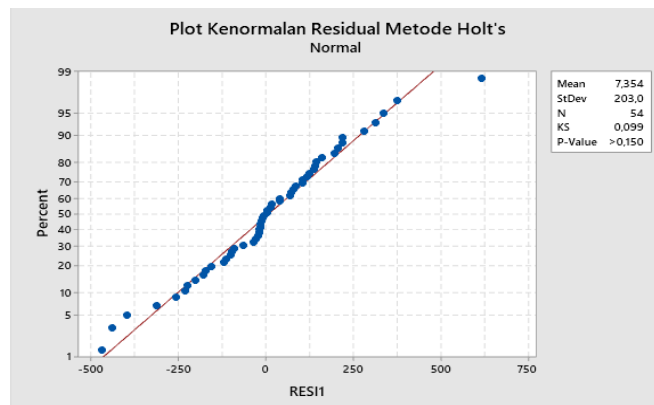Source: Processed data

With
Lt = 0.769608 + (1-0.769608) (Lt-1 + Ht-1)
Tt = 0.048933 (Fl - Lt-1) + (1-0.048933) Tt-1

Normality test

Source: Processed data

H_O : the residue is not normally distributed
H_1 : residues are normally distributed
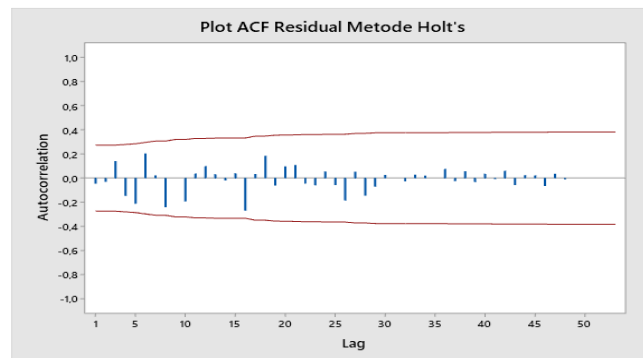α = 0.05

Critical Areas
HO is rejected if the p-value $< \alpha = 0.05$
Test statistic: p-value > 0.150

Conclusion:
Based on the values in Normality test, it can be concluded that the data is normally distributed.

Residual Homeland Test

Source: Processed data

From the ACF plot, it can be seen that all the lags are in the confidence band, so it can be said that the residue is random.

Based on the Normality Test of the model, the error value obtained to predict the IHS WIKA is as follows:

1. MAPE   = 8.6
2. MAD   = 179.3
3. MSD   = 51791.2

WSKT
Source: processed data

With
Lt = 0.769608 + (1-0.769608) (Lt-1 + Ht-1)
Tt = 0.048933 (Fl - Lt-1) + (1-0.048933) Tt-1

Normality Test

Source: processed data

H_O : the residue is not normally distributed
H_1 : residues are normally distributed
α = 0.05

Critical Areas
H_O is rejected if the p-value $< \alpha = 0.05$
Test statistic: p-value > 0.150

Conclusion:
Based on the values in Normality test, it can be concluded that the data is normally distributed.

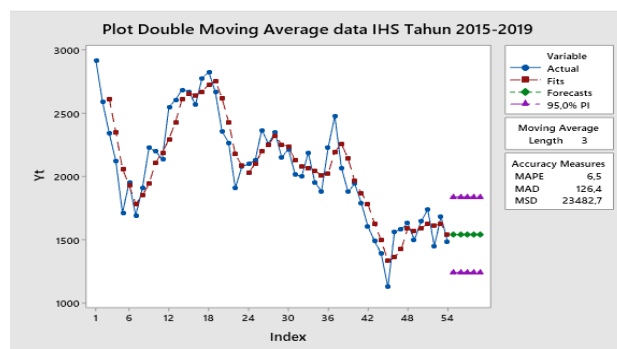Residual Homeland Test

Source: processed data

From the ACF plot, it can be seen that all the lags are in the confidence band, so it can be said that the residue is random (random)

Based on the Normality Test of the model, the error values obtained to predict the IHS WSKT are as follows:

1. MAPE   = 7.3
2. MAD   = 148.8
3. MSD   = 40506.0
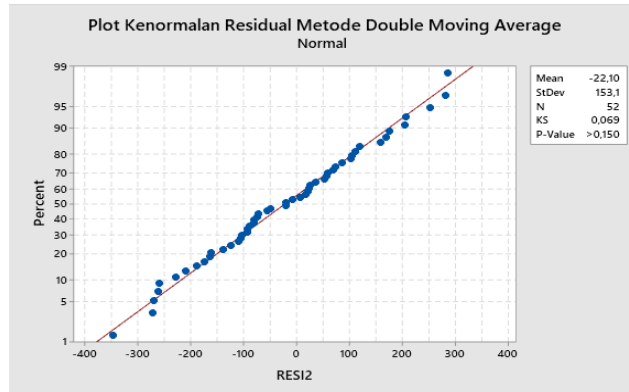
Double Moving Average method

With the Minitab software, we obtained IHS forecasting for the four companies using the Double Moving Average method with a Moving Average length of three (k = 3) as follows:

ADHI
Source: processed data

Normality test

Source: processed data

H$_O$: the residue is not normally distributed
H$_1$: residues are normally distributed
α   = 0.05

Critical Areas
H$_O$ is rejected if the p-value < α = 0.05
Test statistic: p-value > 0.150

Conclusion:
Because the p-value > α = 0.05, H$_O$ is rejected, so it can be concluded that the residue is normally distributed.
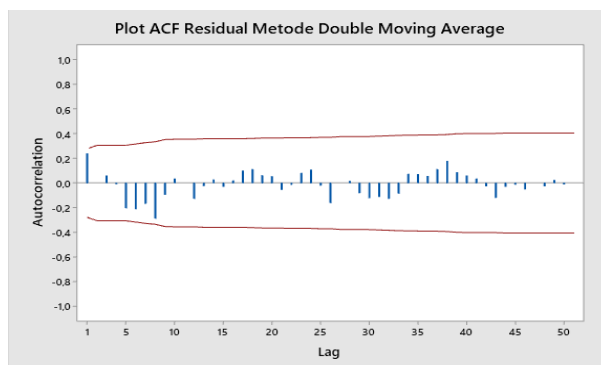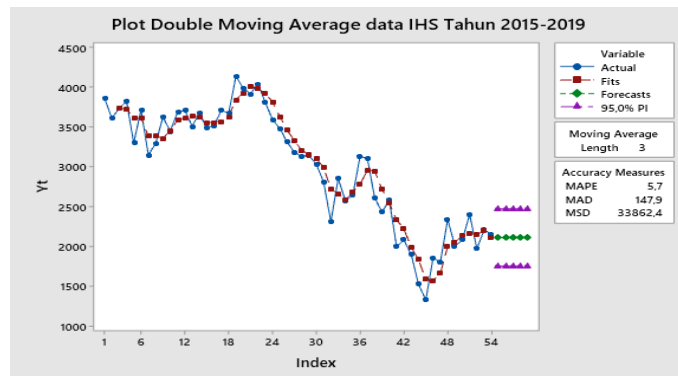
Residual Homeland Test

Source: Processed data

From the ACF plot, it can be seen that all the lags are in the confidence band, so it can be said that the residue is random.

Based on the Normality Test of the model, the error value obtained to predict the IHS ADHI is as follows:
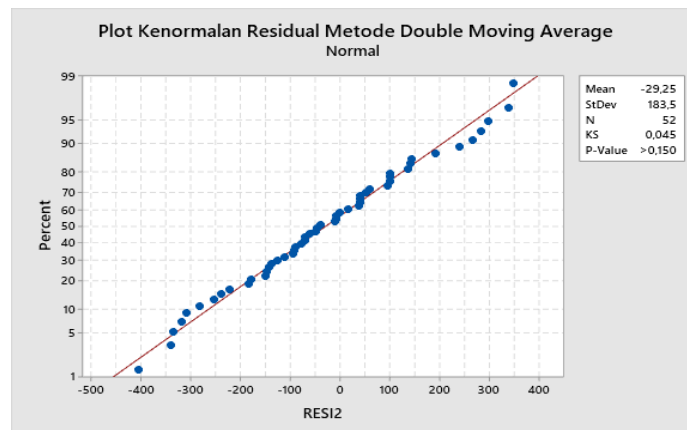
1. MAPE   = 6.5
2. MAD   = 126.4
3. MSD   = 23482.7

PTPP
Source: Processed data

Normality test

Source: Processed data

H_O : the residue is not normally distributed
H_1 : residues are normally distributed
α   = 0.05

Critical Areas
HO is rejected if the p-value < α = 0.05
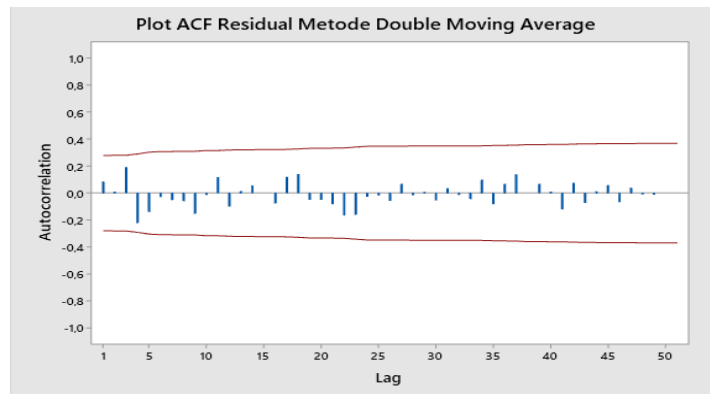Test statistic: p-value > 0.150

Conclusion:
Based on the values in Normality test, it can be concluded that the data is normally distributed.
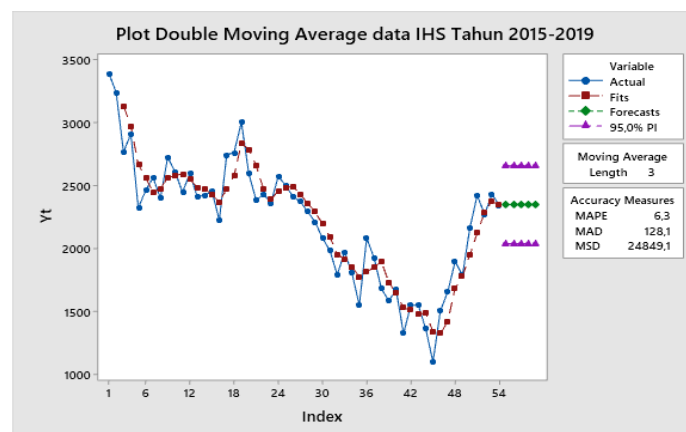
Residual Homeland Test

From the ACF plot, it can be seen that all the lags are in the confidence band, so it can be said that the residue is random.

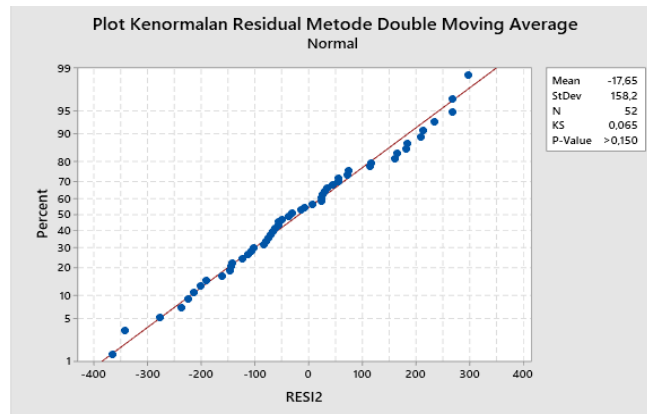Based on the Model Normality Test, the error value obtained to predict the IHS PTPP is as follows:

1. MAPE   = 5.7
2. MAD   = 147.9
3. MSD   = 33262.4

WIKA
Source: Processed data

Normality test

Source: Processed data

H_O : the residue is not normally distributed
H_1 : residues are normally distributed
α = 0.05

Critical Areas
H_O is rejected if the p-value < α = 0.05
Test statistic: p-value > 0.150

Conclusion:
Based on the values in Normality test, it can be concluded that the data is normally distributed.

Residual Homeland Test

From the ACF plot, it can be seen that all the lags are in the confidence band, so it can be said that the residue is random.

Based on the model normality test, the error values obtained to predict the IHS WIKA are as follows:
1. MAPE   = 5.7
2. MAD   = 147.9
3. MSD   = 33262.4

WSKT
Source: Processed data
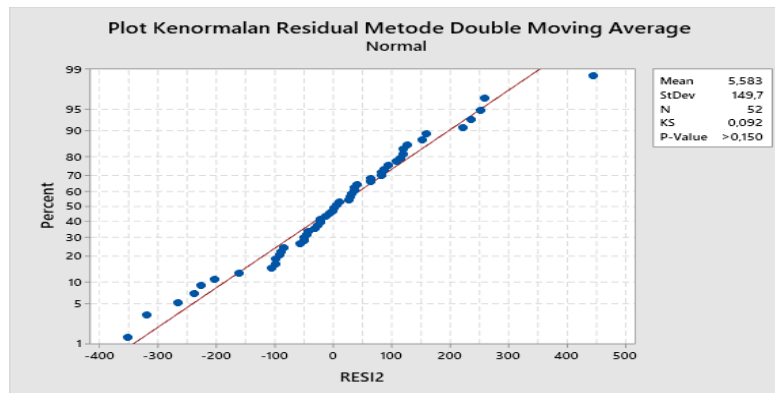
Normality Test

Source: Processed data

H_O : the residue is not normally distributed
H_1 : residues are normally distributed
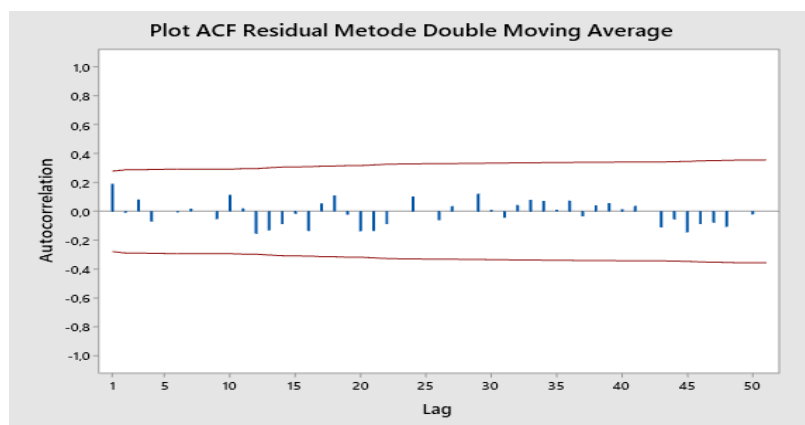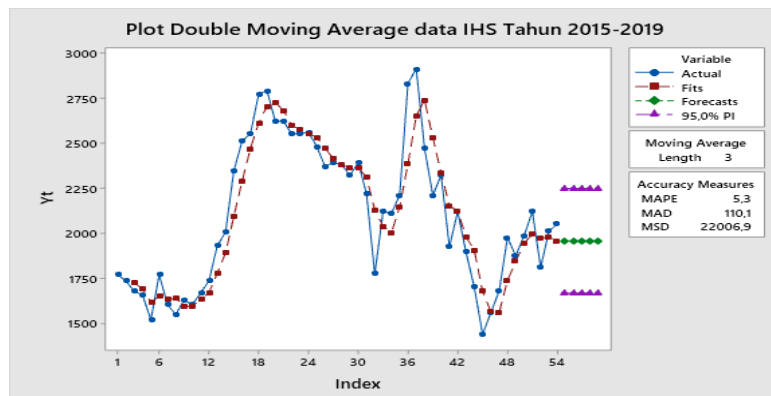α = 0.05

Critical Areas
HO is rejected if the p-value < α = 0.05
Test statistic: p-value > 0.150

Conclusion
Based on the values in Normality test, it can be concluded that the data is normally distributed.

Residual Homeland Test

Source: Processed data

From the ACF plot, it can be seen that all the lags are in the confidence band, so it can be said that the residue is random.

Based on the model normality test, the error values obtained to predict the IHS WSKT are as follows:
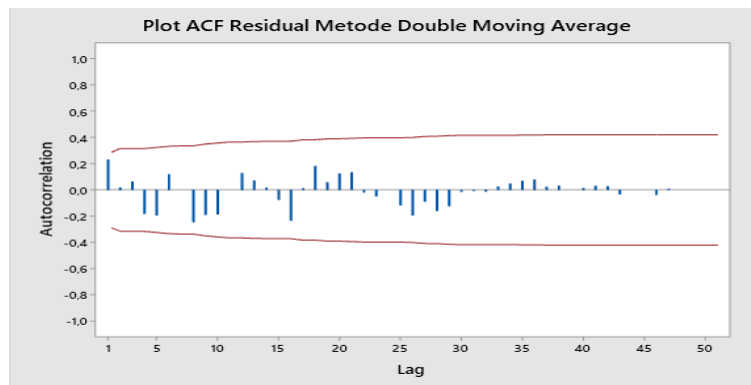
1. MAPE   = 5.3
2. MAD   = 110.1
3. MSD   = 22006.9

From the research results, the data taken is the closing price. For both methods (Double Exponential Smoothing and Double Moving Average), the forecast value results' accuracy is detected compared to observations (actual data) for time series data. Determined the values of MAPE, MAD, and MSD. The following is a comparison table between the measurement accuracy/evaluation of MAPE, MAD, and MSD forecasting for the two forecasting methods:

Table 3 Comparison of MAPE, MAD, and MSD

Forecasting Methods	Forecasting Evaluation	Company name			
		ADHI	PTPP	WIKA	WSKT
Double Exponential Smoothing (Holt's)	MAPE	8.9	8.4	8.6	7.3
	MAD	174.1	225.8	179.3	148.8
	MSD	45164.8	79074.0	51791.2	40506.0
Double Moving Average	MAPE	6.5	5.7	6.3	5.3
	MAD	126.4	147.9	128.1	110.1
	MSD	23482.4	33262.4	24849.1	22006.9

Ali

Forecasting Analysis of Share Price Index in Construction Companies Registered ...

Source: Minitab Software Output Results

Table 3 shows that the comparison results of MAPE, MAD, and MSD show that the Double Moving Average forecasting method produces a minimum value. The forecasting method is considered the best method that can be used for forecasting the 2015-2019 Construction Company Stock Price Index.

Conclusion

This research was conducted to obtain the appropriate method for predicting the Stock Price Index in construction companies for 2015-2019 by calculating the smallest error value and then obtaining the best forecasting method. From the calculation results, several conclusions can be drawn, including: (1) The methods used to predict construction companies' stock price index in 2015-2019 are the Double Exponential Smoothing (Holt's) Method and the Double Moving Average Method for trend-patterned data. (2) In the Double Exponential Smoothing (Holt's) method, the four construction companies' smallest error value is the company Waskita Karya (Persero) Tbk. (3) In the Double Moving Average Method, the four construction companies' smallest error value, namely the company Waskita Karya (Persero) Tbk. (4) Forecasting with the best method for forecasting the 2015-2019 Stock Price Index for Construction Companies by comparing the smallest error value of the two methods chosen, namely the Double Moving Average Method. (5) For forecasting the Stock Price Index of construction companies for the next 5 years using the Double Moving Average Method, namely ADHI = 1,540, PTPP = 2,110, WIKA = 2,346, and WSKT = 1,956

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