Jurnal Info Sains : Informatika dan Sains
Volume 14 , Number 02, 2024, DOI 10.58471/infosains.v14i02
ESSN 2797-7889 (Online)
https://ejournal.seaninstitute.or.id/index.php/InfoSains

Forecasting The Export Value Of Indonesian Footwear Using Arima And Fuzzy Time Series Lee Methods

Mira Zayan[1] , Wellie Sulistijanti[2]
[1,2]Faculty of Science and Technology, Muhammadiyah Institute of Statistics and Business Technology, Ngaliyan, Semarang, Indonesia

Article Info
Keywords:
Forecasting,
Export,
ARIMA,
Lee's Fuzzy Time Series.

ABSTRACT
Industrial sector exports have a large contribution to total exports in the Indonesian economy. A forecasting model is needed that is able to forecast the export value of the industrial sector well. The data used in this study are monthly data on the Export Value of Indonesian Footwear. The ARIMA method can forecast data well linearly but has a decrease in accuracy for data with nonlinear components. Lee's Fuzzy Time Series method is good for nonlinear data and has a level of accuracy that is easy to understand. The ARIMA method requires assumptions to be met such as the data must be stationary, then the Fuzzy Time Series Lee method can be used for non-stationary data, because the Fuzzy Time Series Lee does not require certain assumptions to be met. The results of forecasting the value of Indonesian footwear exports using ARIMA have a MAPE value of 18.5% with good criteria, the Fuzzy Time Series Lee method has a MAPE value of 18.2% with good criteria, so it can be used to forecast the value of Indonesian footwear exports for the August 2023 period of 46,563,984 USD. The forecasting results can be a reference for future policy making.

Corresponding Author:
Mira Zayan
Muhammadiyah Institute of Statistics and Business Technology
mirazayann@gmail.com

INTRODUCTION

Indonesia is a country that uses an open economic system, which means that the country cooperates with economic transactions with other countries in the world or what is commonly called international trade with the main purpose of implementing it is to improve welfare and meet national needs. By doing this international trade can provide many benefits for the country, because the country can sell domestic goods abroad, or what is commonly referred to as export activities (Hardenta et al., 2023).

Export is a trade activity that brings goods from a country outside the customs area to another country by implementing applicable regulations in accordance with customs regulations according to (Tandjung Marolop, 2011) in (Ferry, 2021). In foreign trade, exports consist of oil and gas exports and non-oil and gas exports. Oil and gas exports are export activities consisting of petroleum and natural gas commodities. While non-oil and gas exports are export activities consisting of commodities other than oil and gas, in general, non-oil and gas exports are divided into three main sectors, namely, the mining sector, the agricultural sector, and the industrial sector (Salsabila, 2021).

Jurnal Info Sains : Informatika dan Sains
Volume 14 , Number 02, 2024, DOI 10.58471/infosains.v14i02
ESSN 2797-7889 (Online)
https://ejournal.seaninstitute.or.id/index.php/InfoSains

The manufacturing industry sector is a leading subsector of the industrial sector. The manufacturing industry sector is one of the subsectors that plays an important role in national economic growth. The manufacturing industry sector seeks to convert raw materials into finished products that have selling value and can be consumed or used by consumers. (Azwina et al., 2023). One of the products that accounts for the majority of Indonesia's manufacturing subsector exports is footwear. Footwear is a product in the form of shoes and sandals that are used to protect the soles of the feet and as an addition to fashion style. Materials used to make shoes include wood, plastic, rubber, leather and fabric (Ahdiat, 2023).

The footwear industry is one of the leading manufacturing industry sectors according to the Coordinating Minister for Economic Affairs, Airlangga Hartarto, the footwear industry can make a major contribution to the national economy. Throughout 2019, the number of shoe product industries in Indonesia was recorded at 18,687 business units consisting of 18,091 small business units, followed by 441 medium business units and 155 large business units (Fortuna Marlim, 2021). The Central Bureau of Statistics stated that throughout 2022, the export volume of Indonesia's footwear manufacturing industry reached 438,000 tons with a total value of 8.9 billion USD. The value of this achievement increased by approximately 20% compared to 2021 in the same period, this value is also the highest record in the last 8 years. Exports from the industrial sector play an important role in increasing foreign exchange and developing Indonesia's economic conditions, which contribute greatly to overall export earnings (Laili, 2021). Therefore, a forecasting model is needed that can predict well the data on the export value of Indonesian footwear products to the world from the industrial sector. *Forecasting* is a tool in predicting future needs as a guide in decision making (Marlina et al., 2023). Forecasting is an approach to quantitatively estimate an event that will occur in several future periods, based on relevant and relevant historical data that has occurred in the previous period (Ahmad, 2020). The purpose of forecasting is to help prepare planning decisions for the benefit of the company so that it can anticipate various possibilities and conditions that may arise in the future (Novyta & Alhazami, 2022). Time series analysis is a quantitative method for identifying sequential patterns in past data. The forecasting methods currently being developed involve the use of time series data.

Time series are commonly used for forecasting, the resulting forecasts can be used to plan future export activities because they can predict the value of industrial exports in the next few periods. This forecast value is an indicator or consideration for the government, especially in making export policy decisions in the next period. In addition, the forecast results can be used as a reference to determine how much foreign exchange is received from the export of Indonesian shoes to the world in the industrial sector. Forecasting can be done through various methods.

The ARIMA method stands for (*Autoregressive Integreated MovinggAverage*) which was first developed by George Box and Gwilym Jenkins for modeling time series analysis (Rahmadayanti et al., 2015). The ARIMA method uses past and present values of the dependent variable to make accurate short-term forecasts. The purpose of the ARIMA model is to determine a good statistical relationship between the expected variable and its historical value so that the model can predict it for the next period (Trisnawati, et al, 2021). Forecasting

Jurnal Info Sains : Informatika dan Sains
Volume 14 , Number 02, 2024, DOI 10.58471/infosains.v14i02
ESSN 2797-7889 (Online)
https://ejournal.seaninstitute.or.id/index.php/InfoSains

with ARIMA modeling is suitable for short-term forecasting and forecasting future market trends.

Research with the ARIMA method has been conducted previously by (Novyta and Lutfi Alhazami, 2022) with the research title "Forecasting Demand for Nata De Coco Products in *Supply Chain Management* with the ARIMA Model" from this study obtained the results that the best ARIMA model is ARIMA (0,2,1). From the results of the forecasting model choosing the smallest MSE value with a value of 3.071, the ARIMA model can be used to predict demand for nata de coco in June 2021 to May 2022.

Based on various studies that have been conducted, it is found that the ARIMA method is a method that can predict data values well in a linear manner, but the ARIMA method also has shortcomings such as a decrease in the accuracy of values in predicting time series data with nonlinear components. (Vista Magdalena Sihombing et al., 2022). One method that has developed to overcome the weaknesses in previous forecasting methods is the *Fuzzy Time Series* method.

The fuzzy time series method is a statistical method used to make forecasts based on past data that includes fuzzy logic, fuzzy sets, and the forecast results can be discussed and an accurate main model for short-term forecasting can be created. Fuzzy time series can be used to predict time series data with fixed or seasonal patterns that do not contain trends. In addition, fuzzy time series can be used to predict time series data containing nonlinear patterns. (Ayudya & Saputro, 2017). *Lee's fuzzy time series* is a forecasting method that does not require the fulfillment of certain assumptions and can be applied to short-term historical data with stationary or nonstationary data models. Therefore, this method can be used to predict the export value of Indonesian footwear products to the world from the Indonesian industry.

Similar research was conducted by (Regina Maulisya, Nur Azizah Komara Rifai, 2023) with the research title "Application of the Lee Model *Fuzzy Time Series* Method to Forecasting the Number of Student Enrollments of SMA Negeri 1 Senayang Riau Islands". The results obtained from this study are forecasting for the 2023/2024 period using the *Fuzzy Time Series* Lee model, which is 48 students with an error rate or MAPE value of 13.9883 or 14%, the MAPE value is considered good because it is less than 20%.

Based on previous research, research using Lee's Fuzzy Time Series method is suitable for nonlinear data and has an accuracy level that can be easier to understand. Based on previous research that only focuses on one method, namely the ARIMA method alone or the Fuzzy Time Series Lee method alone, it can be concluded that time series can have linear and non-linear models. Thus, in this study related to the application of forecasting in linear models and nonlinear models needs to be further investigated by applying the ARIMA method as a linear model and the Fuzzy Time Series Lee method as a nonlinear model and seeing the difference in accuracy using the same data. This research was conducted to determine the forecasting of the value of Indonesian footwear exports for the August 2023 period using the ARIMA method and the Fuzzy Time Series Lee method, and to determine the level of accuracy of the ARIMA method and the Fuzzy Time Series Lee method.

Jurnal Info Sains : Informatika dan Sains
Volume 14 , Number 02, 2024, DOI 10.58471/infosains.v14i02
ESSN 2797-7889 (Online)
https://ejournal.seaninstitute.or.id/index.php/InfoSains

With regard to the urgency of research, the results of this study can be used as reference material for other researchers as well as additional insights for readers, and as a material consideration regarding market trend management, as well as for exporters in observing market and economic growth, as well as considerations in conducting better export activities in the future.

METHODS

The data used in this study are secondary data obtained from the Ministry of Trade's hero website, namely monthly data on the Export Value of Indonesian Footwear Products with all countries in the world from July 2021 to July 2023, totaling 25 data. The analysis technique in this study uses the ARIMA method, namely by the first step of conducting a seasonality test in the variance and average data to determine data from time to time that has constant fluctuations and to determine changes in data around a fixed average value (Tasna Yunita, 2020). Then identify the ARIMA model through the ACF and PACF plots to determine the parameter estimate. After knowing the parameters, *diagnostic checking* can be done*, then* determine the best ARIMA model from the *Mean Square Error* (MSE) value and then do forecasting. After finding the best ARIMA model, the error rate can be calculated using the MAPE calculation*. The* analysis technique using Lee's Fuzzy Time Series method can be done with the first step, namely determining the fuzzy set which consists of several steps, namely calculating the number of fuzzy sets, then calculating the average value, and determining the degree of membership *Ui* to *Ai* for the fuzzification process, the next step is forming a fuzzy logic relationship (FLR), then forming a fuzzy logic group relationship (FLRG) and then defuzzification can be done for the predicted value. To determine the accuracy of forecasting using Lee's fuzzy time series method, it can be done by calculating MAPE using MS Excel software.

RESULTS AND DISCUSSION

Results

The results of the classical test of the ARIMA method consist of several tests, namely: first the results of the Stationarity Test of Indonesian Footwear Export Values can be found as follows:

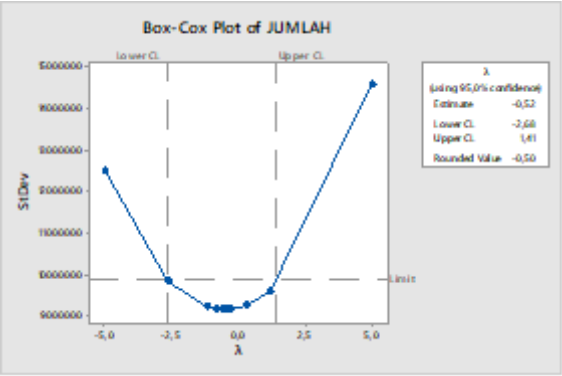

Image 1. Stationarity Test Results of Footwear Export Value
Source: Minitab data processing

Jurnal Info Sains : Informatika dan Sains
Volume 14 , Number 02, 2024, DOI 10.58471/infosains.v14i02
ESSN 2797-7889 (Online)
https://ejournal.seaninstitute.or.id/index.php/InfoSains

The data results in Figure 1 show a *Rounded Value of* -0.50 so it can be explained that the data is not stationary in its variance so it is necessary to do a BoxCox transformation. Obtained data that is stationary in its variance, the next step is to see the data is stationary on average by referring to the ACF and PACF graphs as follows:

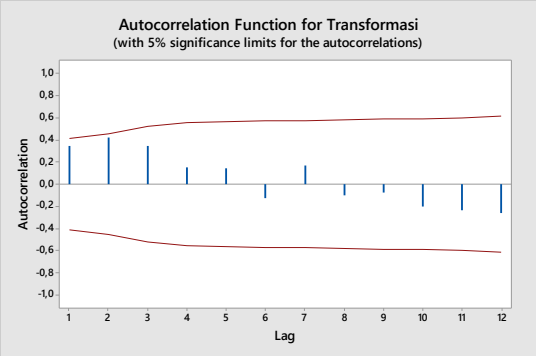

Image 2. ACF Plot of Footwear Export Values
Source: Minitab data processing

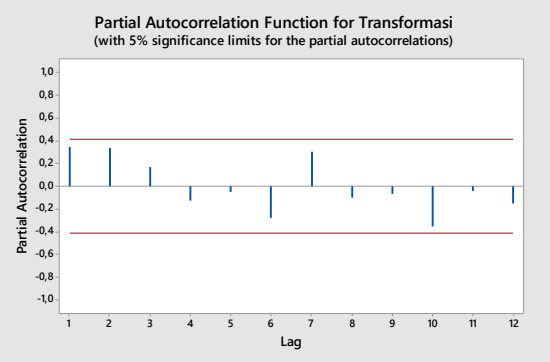

Image 3. PACF Plot of Footwear Export Value
Source: Minitab data processing

The results of the ACF and PACF plots can be seen that the *cut off* value at the lag is still high and the pattern on the lag is less random, so *differencing is* done*. The* results of the ACF and PACF plots after *differencing* are as follows

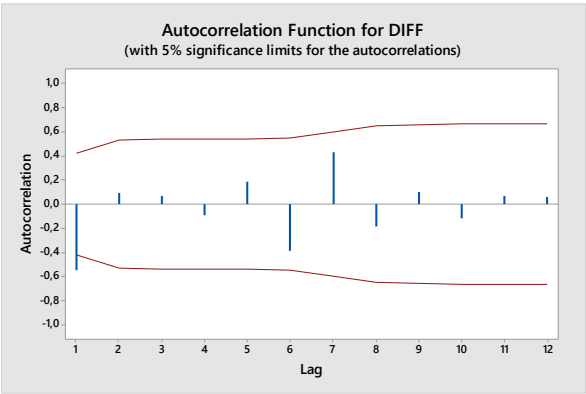

Image 4. ACF Plot of Footwear Export Value After Differentiation
Source: Minitab data processing

Jurnal Info Sains : Informatika dan Sains
Volume 14 , Number 02, 2024, DOI 10.58471/infosains.v14i02
ESSN 2797-7889 (Online)
https://ejournal.seaninstitute.or.id/index.php/InfoSains

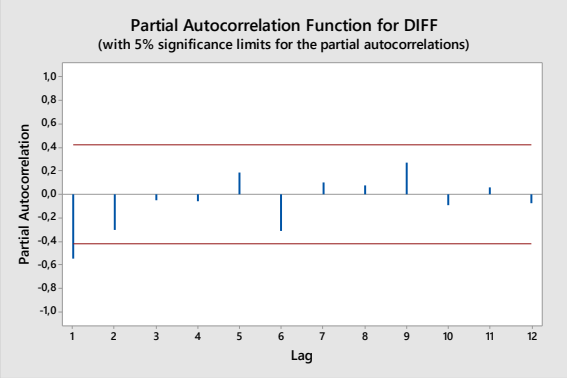

Image 5. PACF Plot of Footwear Export Value After Differentiation
Source: Minitab data processing

The results of the ACF and PACF plot data processing after differencing can be seen that the *cut off* value or the real difference in the lag is more significant and the value is low, indicating that the differenced data is stationary on average. Furthermore, from figures 4. and 5. ARIMA model estimation is carried out, then the reference value for the ARIMA model can be taken, namely the value of *p* (AR) is 2, *d* (*Differencing*) is 1, and *q* (MA) is 2, thus the estimation of the ARIMA model is ARIMA (2,1,2), ARIMA (2,1,1), ARIMA (2,1,0), ARIMA (1,1,2), ARIMA (1,1,1), ARIMA (1,1,0), ARIMA (0,1,2), and ARIMA (0,1,1). Parameter estimation of the ARIMA model by looking at the significance value, as follows:

Table 1. ARIMA Parameter Estimation Results.

Model	Parameters	P-Value	Description
ARIMA (2,1,2)	AR 1	0,000	Not Significant
	AR 2	0,065	
	MA 1	0,053	
	MA 2	0,347	
ARIMA (2,1,1)	AR 1	0,229	Not Significant
	AR 2	0,394	
	MA 1	0,856	
ARIMA (2,1,0)	AR 1	0,001	Not Significant
	AR 2	0,071	
ARIMA (1,1,2)	AR 1	0,000	Not Significant
	MA 2	0,086	
ARIMA (1,1,1)	MA 2	0,000	Not Significant
	AR 1	0,306	
	MA 2	0,104	
ARIMA (1,0,2)	MA 1	0,001	Not Significant
	MA 2	0,177	
ARIMA (1,1,0)	AR 1	0,003	Significant
ARIMA (0,1,1)	MA 1	0,001	Significant

Source: Minitab Data Processing

Jurnal Info Sains : Informatika dan Sains
Volume 14 , Number 02, 2024, DOI 10.58471/infosains.v14i02
ESSN 2797-7889 (Online)
https://ejournal.seaninstitute.or.id/index.php/InfoSains

From the parameter estimation results, two ARIMA models are obtained that have significant values, so the next step is to do *diagnostic checking to* see the *white noise* value and normality of the error. *Diagnostic checking* is shown as below:

Table 2. ARIMA diignostic checking results

Model	White Noise	Normality	MSE
ARIMA (1,1,0)	Yes	Normal	0,00000
ARIMA (0,1,1)	Yes	Normal	0,00000

Source: Minitab Data Processing

From the results of data processing in *diagnostic checking,* it is obtained that the ARIMA (1,1,0) and ARIMA (0,1,1) models meet the *white noise* and normality values, so to determine the best ARIMA model, it can be seen in the smallest MAPE value, namely the ARIMA (0,1,1) MAPE value of 19.4% is greater than the ARIMA (1,1,0) model with a MAPE value of 18.5%, where this value is included in the good criteria. In Lee's Fuzzy time series method, the steps that can be taken are different from the previous ARIMA method. The forecasting steps using the Fuzzy time series method are:

Determine the set of universe of speech *U* (Univers Discourse)

From the data on the export value of Indonesian footwear, it is known that the minimum value of the data is 32,806,586, and the maximum value is 74,600,186, where the value of d is an arbitrary positive value taken D1 = 3000, D2 = 5000, the value of the universe set *U* = [32,803,586, 74,605186].

Establishment of the number of Fuzzy sets

To form many fuzzy sets, several calculations are carried out such as, determining the length of the interval (R), the results of R = 41,801,000, calculating the average absolute difference in the data and the resulting value of 12,428,747, calculating half the average absolute difference (K), the results of K = 6,214,374, determining the number of intervals (n), the results of n = 7, calculating the middle value of the fuzzy set and the results of the fuzzy set formed as below:

U_1 = [32,803,586, 39,017,960] m_1 = 35,910,773
U_2 = [39.017.960, 45.232.333] m_2 = 42.125.146
U_3 = [45,232,333, 51,446,707] m_3 = 48,339,520
U_4 = [51,446,707, 57,661,080] m_4 = 54,553,893
U_5 = [57,661,080, 63,875,454] m_5 = 60,768,267
U_6 = [63,875,454, 70,089,827] m_6 = 66,982,640
U_7 = [70,089,827, 76,304,201] m_7 = 73,197,014

Define the degree of membership of the fuzzy set

Defining the *fuzzy* set on A_i (A_i is the *i-th* fuzzification) through membership values. The first membership sequence is located at u_1 which is 1 and the interval is [32,803,586, 39,017,960], based on the first membership sequence, the fuzzyfication resulting from the

Jurnal Info Sains : Informatika dan Sains
Volume 14 , Number 02, 2024, DOI 10.58471/infosains.v14i02
ESSN 2797-7889 (Online)
https://ejournal.seaninstitute.or.id/index.php/InfoSains

value in the interval [32,803,586, 39,017,960] is A_1 . The next fuzzyfication on the definition of the membership sequence u_i against A_1 Others follow the previous steps. Then the definition of the *fuzzy* set is obtained as follows:

Table 3. Definition of Fuzzy Membership Degrees

$$\mu_{A1}(u_i) = {}^{1}/_{u_i} + {}^{0,5}/_{u_2} + {}^{0}/_{u_3} + \cdots + {}^{0}/_{u_7}$$
$$\mu_{A2}(u_i) = {}^{1}/_{u_i} + {}^{0,5}/_{u_2} + {}^{0}/_{u_3} + \cdots + {}^{0}/_{u_7}$$
$$\mu_{A3}(u_i) = {}^{1}/_{u_i} + {}^{0,5}/_{u_2} + {}^{0}/_{u_3} + \cdots + {}^{0}/_{u_7}$$
$$\vdots \quad \vdots \quad \vdots \quad \vdots \quad \cdots \quad \vdots$$
$$\mu_{A7}(u_i) = {}^{1}/_{u_i} + {}^{0,5}/_{u_2} + {}^{0}/_{u_3} + \cdots + {}^{0}/_{u_7}$$

Source: MS Excel calculation

Based on the definition of the fuzzy set, the fuzzyfication value is obtained with the table below:

Table 4. Data Fuzzification Results

No.	Time Period	Close	FUZZYFICATION
1	202107	39.166.324	A2
2	202108	41.042.481	A2
3	202109	32.806.586	A1
4	202110	36.427.886	A1
	:	:	:
25	202307	41.459.337	A2

Source: MS Excel calculation

Determining Fuzzy Logical Relationship (FLR)

FLR determination is carried out based on the results of fuzzification, the results of FLR or fuzzy relations are shown in the table below:

Table 5. Fuzzy Logical Relationship (FLR) Results

No.	Time Period	Close	FUZZYFICATION	FLR
1	202107	39.166.324	A2	NA
2	202108	41.042.481	A2	A2
3	202109	32.806.586	A1	A2
4	202110	36.427.886	A1	A1
	:	:	:	:
25	202307	41.459.337	A2	A4

Source: MS Excel calculation

Jurnal Info Sains : Informatika dan Sains
Volume 14 , Number 02, 2024, DOI 10.58471/infosains.v14i02
ESSN 2797-7889 (Online)
https://ejournal.seaninstitute.or.id/index.php/InfoSains

Determining Fuzzy Logical Relationship Group (FLRG)

FLRG determination is carried out based on the FLR results that have been obtained previously and then grouped each Ai in the same FLR in one group, The FLRG results that have been successfully formed are shown in the table below:

Table 6. Fuzzy Logical Relationship Group (FLRG) Results

Current Stage	NEXT STAGE
A1	A1,A2,A6
A2	A2,A1,A2,A3,A5,A1,A5
A3	A2,A5,A4
A4	A4,A5,A2,A2
A5	A2,A6,A3,A4
A6	A3,A7
A7	A4

Source: MS Excel calculation

Based on table 8 Current Stage is taken from the previously formed fuzzy membership and Next Stage is taken based on the grouping of previous FLR values.

Defuzzification

The defuzzification process is the calculation stage of the *fuzzy* output results into numerical numbers to produce forecasting values.

Table 7. Data Defuzzification Results

Current Stage	NEXT STAGE	m_i	Predicted Value
A1	A1,A2,A6	35.910.773	48.339.520
A2	A2,A1,A2,A3,A5,A1,A5	42.125.146	46.563.984
A3	A2,A5,A4	48.339.520	52.482.435
A4	A4,A5,A2,A2	54.553.893	49.893.113
A5	A2,A6,A3,A4	60.768.267	53.000.300
A6	A3,A7	66.982.640	60.768.267
A7	A4	73.197.014	54.553.893

Source: MS Excel calculation

Lee Fuzzy Time Series Forecasting Result Data

Based on the steps that have been taken, the results of forecasting the export value of Indonesian footwear using Lee's Fuzzy Time Series method as a whole are shown in the table below:

Table 8. Lee's Fuzzy Time Series Forecasting Results

No.	Time Period	Close	FLR	Forecasting
1	202107	39.166.324	NA	
2	202108	41.042.481	A2	46.563.984
3	202109	32.806.586	A2	46.563.984
4	202110	36.427.886	A1	48.339.520

Jurnal Info Sains : Informatika dan Sains
Volume 14 , Number 02, 2024, DOI 10.58471/infosains.v14i02
ESSN 2797-7889 (Online)
https://ejournal.seaninstitute.or.id/index.php/InfoSains

No.	Time Period	Close	FLR	Forecasting
	:	:	:	:
25	202307	41.459.337	A4	49.893.113
26	202308		A2	46.563.984

Source: MS Excel calculation

Based on Table 8, the results of forecasting the export value of footwear for the next period, namely August 2023, amounted to 46,563,984 USD.

Calculating the error rate of forecasting

The smaller the MAPE value, the more accurate the forecasting technique and vice versa. Forecasting results are excellent if the MAPE value is less than 10% and has good forecasting ability if the MAPE value *is* less than 20%.

Table 9. MAPE Results of Lee's Fuzzy Time Series Forecast

No.	Time Period	Close	Forecasting	(MAPE)
1	202107	39.166.324		
2	202108	41.042.481	46.563.984	13
3	202109	32.806.586	46.563.984	42
4	202110	36.427.886	48.339.520	33
	:	:	:	:
25	202307	41.459.337	49.893.113	20
	Average value of MAPE			**18**

Source: MS Excel calculation

Based on Table 9, the results of the forecasting error rate in the Lee model with a MAPE value of 18.2%, based on the MAPE accuracy criteria, a value < 20% is good value, so this forecasting model is of good value and can be used in forecasting the monthly value of Indonesian footwear exports in August 2023.

Discussion

The results of data processing on the value of Indonesian footwear exports using the ARIMA method at the statistical test stage, the data is not stationary in variance, so BoxCox Transformation is performed so that the data is stationary in variance. Then parameter estimation is carried out to form the best ARIMA model, but from the results of the ACF and PACF Plot test the cut off at the lag is still quite high, so differencing is carried out to facilitate parameter estimation, a temporary model is obtained, namely ARIMA (2,1,2), ARIMA (2,1,1), ARIMA (2,1,0), ARIMA (1,1,2), ARIMA (1,1,1), ARIMA (1,1,0), ARIMA (0,1,2), and ARIMA (0,1,1) as a reference for the best ARIMA model, then parameter estimation is carried out to see the significance value with the condition that if the P-Value <0.05 then it is said to be significant. 0.05 then it is said to be significant. There are two ARIMA models whose parameters are significant, namely ARIMA (1,1,0) and ARIMA (0,1,1), then the two models are carried out diagnostic checking to determine the best ARIMA model and ARIMA (1,1,0) and ARIMA (0,1,1) meet the criteria of diagnostic checking where the parameter value is

Jurnal Info Sains : Informatika dan Sains
Volume 14 , Number 02, 2024, DOI 10.58471/infosains.v14i02
ESSN 2797-7889 (Online)
https://ejournal.seaninstitute.or.id/index.php/InfoSains

<0.05, the value of the Ljung Box test or white noise>0.05, and is normal after the normality test. Then the MAPE calculation is carried out to see the level of accuracy of the ARIMA (1,1,0) and ARIMA (0,1,1) models. The MAPE value obtained is in the ARIMA (0,1,1) model, the MAPE value of 19.4% is greater than the ARIMA (1,1,0) model with a MAPE value of 18.5%, where the value is included in the good criteria. Thus, the best ARIMA model is ARIMA (1,1,0) because it meets all the assumptions and has the smallest MAPE value with good criteria.

The results of data processing on the value of Indonesian footwear exports using the Fuzzy time series Lee method can be used for data that is non-stationary and does not require a stationarity test, calculations are carried out to determine the universe set, the number of intervals is obtained as many as 7 then fuzzyfication is carried out, based on the results of fuzzyfication, a Fuzzy Logical Relationship (FLR) is determined, then a Fuzzy Logical Relationship Group (FLRG) is determined and defuzzyfication is obtained so that the results of forecasting the value of footwear exports for the next period, namely August 2023 of 46,563,984 USD with a MAPE value of 18.2%.

CONCLUSIONS

Based on the results and discussion of this research, conclusions can be drawn, namely: The method of forecasting the export value of Indonesian footwear using the ARIMA method, obtained the best model, namely ARIMA 1,1,0 with the error rate of forecasting results using the MAPE value obtained of 18.5% with good forecasting model criteria. In the Fuzzy Time Series Lee method, the error rate of forecasting results using Fuzzy Time Series Lee in forecasting the export value of Indonesian footwear obtained a MAPE value of 18.2% with good forecasting model criteria and smaller than the ARIMA 1,1,0 model so that it can be used for forecasting the next period. The results of forecasting the export value of Indonesian footwear for the period August 2023 amounted to 46,563,984 USD using the Lee Fuzzy Time Series method.

ACKNOWLEDGEMENT

During this research process, the author received many good things that added to the learning for the author, and the author received a lot of support and guidance from various parties. With that, the author would like to thank the relevant parties who have helped.

REFERENCES

Ahdiat, A. (2023). Footwear Exports Surge in 2022, Set New Record. *Katadata Media Network*, *d*, 1. https://databoks.katadata.co.id/datapublish/2023/03/17/ekspor-alas-kaki-melesat-pada-2022-cetak-rekor-baru

Ahmad, F. (2020). DETERMINATION OF FORECASTING METHODS ON THE PRODUCTION OF NEW GRANADA BOWL ST PART at PT.X. *JISI: Journal of Industrial Systems Integration*, *7*(1), 31. https://doi.org/10.24853/jisi.7.1.31-39

Ayudya, D. F., & Saputro, D. R. S. (2017). Hybrid ARIMA and Fuzzy Time Series Markov Chain Model. *Seminar on Mathematics and Mathematics Education UNY 2017*, 17-22. http://seminar.uny.ac.id/semnasmatematika/sites/seminar.uny.ac.id.semnasmatematik

a/files/full/S-3.pdf

Azwina, R., Wardani, P., Sitanggang, F., & Silalahi, P. R. (2023). Manufacturing Industry Strategy in Increasing the Acceleration of Economic Growth in Indonesia. *Profit: Journal of Management, Business and Accounting*, *2*(1), 44-55. https://journal.unimar-amni.ac.id/index.php/profit/article/view/442

FERRY, A. (2021). Settlement Process of "Export Yarn" Documentation Owned by Pt. Bitratex Industries by Sea Shipload Expedition Company Pt. ..... *Paper*, 6-20. http://repository.unimar-amni.ac.id/id/eprint/3578%0Ahttp://repository.unimar-amni.ac.id/3578/2/35. CHAPTER II LITERATURE REVIEW.pdf

Fortuna Marlim, W. (2021). (2021). *DONDILLO Functionality Footwear Business Design*. *01*, 1-23. https://doi.org/https://kc.umn.ac.id/id/eprint/18220/

Hardenta, A. D., Ariefti, S. D., & Abyapta, W. R. (2023). Effect of Protectionism Policy Implementation through Domestic Component Level on International Tender/Selection. *Ius Quia Iustum Law Journal*, *30*(1), 114-137. https://doi.org/10.20885/iustum.vol30.iss1.art6

Laili, N. (2021). Analysis of Competitiveness and Factors Affecting Exports of Indonesian Footwear Products to the United States Viewed from an Islamic Economic Perspective. *Scientific Journal of Islamic Economics*, *7*(2), 1019-1029. https://doi.org/10.29040/jiei.v7i2.2385

Marlina, W. A., Nisa, M. K., & Ardy, M. (2023). *Analysis of box jenkins forecasting of sales at umkm im catfish, payakumbuh*. *September*, 105-115.

Novyta, N., & Alhazami, L. (2022). Forecasting Demand for Nata De Coco Products in Supply Chain Management with the Arima Model. *THEOREMS (THE JOuRnal of MathEMatics)*, *7*(2), 152-162. https://doi.org/10.36665/theorems.v7i2.655

Rahmadayanti, R., Susilo, B., & Puspitaningrum, D. (2015). Comparison of the accuracy of autoregressive integrated moving average and exponential smoothing methods in cement sales forecasting at PT Sinar Abadi. *Recursive Journal*, *3*(1), 23-36.

Salsabila, D. R. N. (2021). Analysis of the Effect of Oil and Gas and Non-Oil and Gas Exports on Indonesia's Economic Growth. *Journal of Accounting and Management*, *18*(01), 01-08. https://doi.org/10.36406/jam.v18i01.374

Tasna Yunita. (2020). Forecasting the Number of Internet Quota Usage Using the Autoregressive Integrated Moving Average (ARIMA) Method. *Journal of Mathematics: Theory and Applications*, *1*(2), 16-22. https://doi.org/10.31605/jomta.v2i1.777

Trisnawati, Eva, Pagalung, Gagarin and H.Kara, M. (2021). Autoregressive Integrated Moving Average (Arima) Model in Forecasting the Development of Ijarah in Islamic Commercial Banks. *SEIKO: Journal of Management & Business*, *5*(1), 2021-2022. https://doi.org/10.37531/sejaman.v5i1.1260

Vista Magdalena Sihombing, C., Martha, S., & Miftahul Huda, ainul. (2022). Analysis of Hybrid Arima-Svr Method on Composite Stock Price Index. *Scientific Bulletin of Math. Stat. And Applied (Bimaster)*, *11*(3), 413-422.