INCOME: Innovation of Economics and Management
Vol. 3 No. 3 February 2024, Page. 24 - 28
E-ISSN: 2797-0450

Analysis of Lampung Export Value 2015-2023 with The Arima Method Approach (Autoregressive Integrated Moving Average)

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ABSTRACT
One indicator to see the economic development of a country is to look at the value of international trade or what is commonly referred to as export-import activities. This activity is one of the foreign exchanges for the country. Proper planning will increase this activity which will also have an impact on increasing the country's foreign exchange. To improve the welfare of the Indonesian people, one alternative is to increase the rate of economic activity in Indonesia, one of which is export activity. Increasing export activities is inseparable from the right economic strategy. The strategy can be formed by knowing the economic market conditions, namely by forecasting. One of the forecasting methods that can be applied is the Autoregressive Integrated Moving Average or ARIMA method. The best ARIMA model that fulfills is the ARIMA (2,1,0) model because of the smallest AIC value.

Keywords: *Lampung Export Value, Forecasting, Autoregressive Integrated Moving Average Method.*

INTRODUCTION

International trade, specifically export-import activities, is a critical component of a nation's economic growth. These activities involve the transaction of goods and services between domestic and foreign entities. In this context, export value serves as a key indicator of economic performance. According to the Central Statistics Agency (Badan Pusat Statistik, BPS), the export value is calculated based on the Free on Board (FOB) value, which reflects the cost of delivering a commodity to the nearest port from its point of origin. This value is typically expressed in U.S. dollars. Fluctuations in export value, particularly those that are unstable, can significantly impact the sustainability of economic activities in Indonesia.

The Export-Led Growth Hypothesis (ELGH), as proposed by Dave et al. (2021), posits that an increase in exports can be a major driver of economic growth. Therefore, it is crucial for the government and economic actors to manage export values through appropriate strategies. One effective approach to achieving this is by forecasting future export values, which can provide essential guidance for decision-making.

Lampung Province, as one of Indonesia's significant contributors to national export values, has experienced variable export value movements from January 2015 to September 2023, according to BPS records. These fluctuations reflect underlying patterns and trends in export activities that require further analysis. Time series analysis is an effective method for providing short-term forecasts based on historical data, as discussed by Engle & Granger (1987).

In this context, the ARIMA (Autoregressive Integrated Moving Average) method emerges as a promising approach for modeling and forecasting export values. The study by Hasin MAA et al. (2011) demonstrated that the ARIMA method outperforms the Simple Exponential Smoothing (SES) and Holt Two Parameters Exponential Smoothing (HES) methods in accurately forecasting cotton exports. Therefore, employing the ARIMA method to model the time series data of Lampung Province's export values is expected to yield accurate forecasts that are valuable for economic decision-making in the future.

However, selecting the appropriate ARIMA model is not straightforward. The model consists of three main components: autoregressive, integrated, and moving average, each requiring rigorous testing and adjustment. Consequently, this study will identify the best-fitting ARIMA model based on various

criteria such as Mean Square Error (MSE) and Akaike Information Criterion (AIC), as well as the Box-Jenkins approach developed by George Box and Gwilym Jenkins.

This research aims to model and predict the export values of Lampung Province using the ARIMA method, focusing on selecting the most suitable model based on historical data from January 2015 to September 2023. The findings of this study are expected to contribute meaningfully to efforts to manage export values and support economic growth in Indonesia.

METHOD

This research is a type of case study research on the problem of export value in Indonesia. The data used in this study is a set of secondary data obtained from the Central Bureau of Statistics (BPS). This data is data on the value of exports every month expressed in US Dollars. The stages that will be carried out in this study will be presented in the flow diagram as follows:

a. The data series used is from January 2015 to September 2023.
b. Identify data. At this stage, the non-stationary data is the data that meets the use of the ARIMA method. (Mohamed et al., 2020.)
    a) The data station can be determined by conducting the Dickey Fuller Augmented test. If the data is not stationary in the mean, then the process of differentencing or differentiation is carried out. If the data is not stationary with respect to variance, it is necessary to transform the Box-Cox logarithm.
    b) Define the temporary model. The ARIMA model is formed by determining the order p, d, and q. the order p is determined based on the PACF plot of a stationary data, the d order is determined based on the number of differencing processes carried out to convert non-stationary data into stationary data, and the q order is determined based on the ACF plot of a stationary data.
    c) Conducting parameter assessment and parameter significance test. At this stage, parameter estimation is carried out using the maximum likelihood estimation method. Meanwhile, the significance test uses a t-test approach.
    d) Conducting diagnostic checking. This stage is carried out to determine the suitability of the model to be used by testing its residual. The test is a white noise condition test and a normally distributed residual test.
    e) Determine the best model. The best model is obtained when the residue of the temporary model has met the test statistics. If the model obtained is more than one, it is necessary to select the best model by calculating the error value and AIC on each temporary model.
    f) Carry out the forecasting process by using the best model on the data out series and several periods to come.

RESULT AND DISCUSSION

Based on data obtained from BPS, Lampung Province has statistics as follows:

Table 1. Descriptive statistics of historical data.

Lots of data	Mean	Std. Dev.
105	326867680	98019132

Source: E Views 10 Analysis Results

Based on the table above, it can be concluded that the value of the mean is greater than the standard deviation value. This indicates that the export value is not stationary with respect to means and variance. This can also be seen from the time series plot image in figure 1.

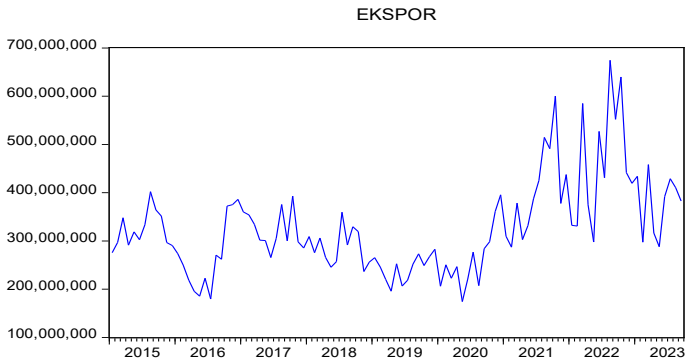

Figure 1. Plot time series image of Lampung Province's export value data.

In the data plot figure above, it can be explained that the growth of Lampung Province's export value in the period from January 2015 to September 2023 has experienced various movements. In that period, the highest increase occurred in 2022 and a fairly extreme decline in export value occurred in 2016 and 2020. Many factors cause this condition, such as the trade war between China and the United States, the Covid-19 outbreak, and others.

Stationary Test

Based on the results of the stationarity test using *the Augmented Dickey-Fuller* (ADF) test, the variable export value of Lampung Province can be seen in the table below.

Table 2. Results of the stationarity test of variable export value of Lampung Province

Stationary Test	t-count	Probability	Information
Level	-2666689	0.0834	Not Stationary
1st difference	-1688873	0.0000	Stationary

Source: E Views 10 Analysis Results

Based on the results of the stationary value test, the export value of Lampung Province at the level shows a probability value greater than 5% so that the data is categorized as non-stationary. Therefore, to continue the forecasting process using the ARIMA method, the data is differentiated once (1st *difference).* From these results, the data has a probability value of less than 5% so that the data can be interpreted as stationary. The next step of the ARIMA model is to conduct a diagnostic test of the ARIMA model, namely by detecting AIC, BIC, and HQ values

Table 3. Comparison of AIC, BIC, and HQ Values

Type	LogL	AIC*	BIC	HQ
(2,1) (0,0)	-2.021.943.677	**38.979.686**	39.106.820	39.031.192
(2,2) (0,0)	-2.021.462.196	38.989.658	39.142.219	39.051.465
(1,0) (0,0)	-2.024.785.651	38.995.878	39.072.158	39.026.781
(0,1) (0,0)	-2.024.978.005	38.999.577	39.075.858	39.030.480
(2,0) (0,0)	-2.024.041.853	39.000.805	39.102.512	39.042.009
(1,1) (0,0)	-2.024.199.234	39.003.831	39.105.539	39.045.036
(0,2) (0,0)	-2.024.505.520	39.009.722	39.111.429	39.050.926
(1,2) (0,0)	-2.024.189.290	39.022.871	39.150.005	39.074.377
(0,0) (0,0)	-2.038.092.565	39.232.549	39.283.403	39.253.152

Source: E Views 10 Analysis Results

Based on parameter estimation, the ARIMA model (2.1.0) is the best model because it has an AIC value, which is the smallest compared to other models, namely AIC **38,979,686**, so it can be concluded that the ARIMA model (2,1,0) is the best model for export value data in Lampung Province. Furthermore, diagnostic checking is carried out on the model that is selected as the best model to determine the suitability of the model. Diagnostic examination to determine the suitability of the temporary model that meets the residual assumptions. There are two stages of conformity test, the first is a heteroskedastisitas test using a white test and a *white noise* test for the ARIMA model (2,1,0) with the following models

Export = 985265.1+ 0.154093 Xt−1 + -0.562446εt−1 + εt

Testing using *white noise,* in this case, the author uses the ARMA Structure test.

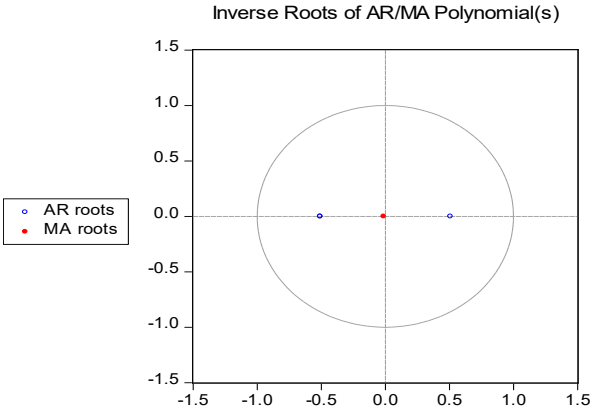

Figure 2. ARMA Structure

Based on the image above, the AR and MA points are in a *circle* which shows that this data does not contain *white noise* and can be forced. With this model, it is possible to forecast the export value in Lampung Province for the next period. The results of the forecast will be presented in the form of a graph as follows.

Results of Forcesting

Because the ARIMA model (2, 1, 0) was obtained from a grid search because it has the lowest AIC value, and as a model that matches the export data of the Lampung province. Keep in mind that this result is only a prediction value, but the economy of Lampung Province is a complex and dynamic system. Therefore, we must pay attention to the risk of adjustment in economic operations and maintain the stability and continuity of microeconomic regulation and control as well as prevent the economy from severe fluctuations and adjust the target value in accordance with the actual situation.

From the graph above, it can be seen that for the next 6 months the value of Lampung's exports will experience a significant increase. The projected data using the ARIMA model provides the result that the number of exports of Lampung Province has increased for each period ending with an export amount of 42.8104 (Million $) in the period of March 2024 with the forecast graph shown in the figure above. In general, based on the results of projection analysis with the ARIMA (AR) model from period to period, it gives results that increase or an upward trend from the data used. The model used looks stable from the resulting modulus value. These results are also relevant that this mode is indeed suitable for short-term projection and requires considerable historical data in analysis. The results of the analysis are also easy to interpret because the coefficients of the model are known, although on the other hand, this model does not have the ability to capture the relationship between the research variables used.

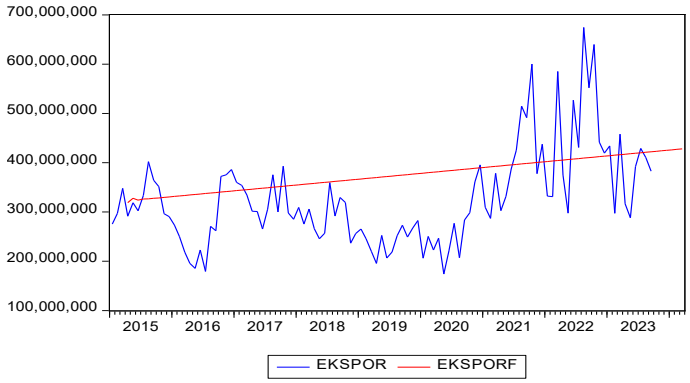

Figure 3. ARIMA Model

CONCLUSIONS

This study provides results that the occurrence of an upward trend or increase for each period is related to the condition of the number of exports in the Lampung province. The results of this projection analysis are also expected to provide an overview of the type of strategic policies that will be carried out for stakeholders considering that the increase in Lampung Porvinsi export revenue has an effect on Indonesia's economic performance

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