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# ARIMA and ARIMAX Modeling for Forecasting the Value of Non-Oil and Gas Exports

**Saputri Dyah Pratiwi[1], Alfisyahrina Hapsery[2], Artanti Indrasetianingsih[3*]**

[1,2,3]Department of Statistics, Sains and Technic Faculty, PGRI Adi Buana Surabaya University
Dukuh Menanggal XII Street, Surabaya 60234 East Java,

**E-mail Correspondence Author:** *artanti.indra@unipasby.ac.id*

***Abstract***

*Non-oil and gas exports are the sale of commodities other than oil and gas to foreign countries, which play a role in providing foreign exchange, creating jobs, increasing competitiveness, and driving economic growth, making them a key focus of economic policy. West Java is the province with the highest value of non-oil and gas exports, but this value has been declining every year, which is thought to be influenced by the Eid al-Fitr holiday, which falls on different months. The research data was obtained from the Central Statistics Agency (BPS) website in the form of monthly data on West Java's non-oil and gas exports for the period 2015–2024. Therefore, statistical analysis was performed using the ARIMA and ARIMAX methods by including calendar variations as dummy variables. The best model was selected based on the smallest RMSE, MAE, and MAPE values. The results showed that the ARIMA model had the best accuracy in predicting non-oil and gas export values with an RMSE of 175,176.6, MAE of 130,034.6, and MAPE of 4.09%, while the ARIMAX model produced an RMSE of 285,244.6, MAE of 249,402.4, and MAPE of 7.69%.*

***Keywords:*** *ARIMA, ARIMAX, Forecast, Exports.*

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***Research Aritcle · Open Acces***
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*Homepage: https://ojs3.unpatti.ac.id/index.php/parameter*

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## 1. INTRODUCTION

Indonesia the world's largest archipelago holds great economic potential, especially in the trade sector. As a G20 member, Indonesia holds a strategic position in the global economic recovery, provided it can effectively manage both opportunities and challenges [1]. According to Head of the Fiscal Policy Agency (BKF), Indonesia's economic growth is projected to remain above 5 percent at least until September 2024 driven by strong trade performance [2]. However, high logistics costs remain a key challenge, undermining the competitiveness of Indonesian exports and potentially leading to a trade balance deficit. To address this issue, the government promotes non-oil and gas exports, including through inter-ministerial synergies such as the Ministry of Trade and the Ministry of Agriculture [3].

Non-oil and gas exports are exports of commodities other than oil and gas [4], with a focus on agricultural products, industry, and mining. This sector plays an important role in creating foreign exchange, employment, and economic growth [5]. During 2015-2023, the value of non-oil and gas exports increased as well as decreased. The decline occurred in 2020 when the covid-19 occurred and the decline was thought to be due to the Idul Fitri holiday [6]. West Java is the largest contributor due to the dominance of the manufacturing industry and access to the main port of Tanjung Priok. West Java's import-export data shows an improving trade surplus trend, although fluctuations in export value occur every year, especially the decline during Ramadan and Idul Fitri due to reduced industrial activity. In West Java Province itself, the export-import activities of the oil and gas and non-oil and gas sectors can be said to experience changes every year [7].

The manufacturing sector in West Java is highly dependent on imports of raw materials and capital, which makes the regional economy more vulnerable to global dynamics and changes in foreign exchange rates. Another challenge is the low absorption of local labor due to technology-based and capital-intensive industrialization. Modern manufacturing industries require more highly skilled labor, while many local workers still have relatively low skills. If not addressed, this could hamper industrial expansion and reduce the competitiveness of non-oil and gas exports products from West Java in the global market. Therefore, improving the quality of human resources through vocational education, industrial training, and cooperation with the private sector is key in maintaining the competitiveness of the export industry.

To understand future export patterns, a reliable prediction method is needed, one of which is ARIMA (Autoregressive Integrated Moving Average) developed by Box-Jenkins in 1976 [8] widely used in time series analysis. A time series model or forecasting is a series of regular observations of a variable taken over time and recorded sequentially according to the order in which they occur at fixed time intervals [9]. ARIMA is effective in capturing trends and seasonality, but is less optimal if there are external variables that affect the data [10]. Therefore, the ARIMAX model, which is the development of ARIMA by including exogenous variables, is used to capture the influence of external factors such as calendar variations, including the Eid holiday, which has been shown to be significant to economic patterns [11]. The calender variation model is a time series model used to forecast data based on seasonal patterns with varying periods [12].

In the process of estimating ARIMA and ARIMAX parameters, the Maximum Likelihood (ML) method is an option because it is able to utilize all data information and produce optimal estimates [13]. In the context of West Java's non-oil and gas exports, this approach is expected to improve prediction accuracy by considering the influence of seasonal and calendar variations.

Previous research conducted by [14] predicted the value of non-oil and gas exports in West Java using SARIMA without considering external factors and only until 2021 data. Research by [15] which forecasts the value of non-oil and gas exports from the Indonesian agricultural sector. The research focused on the agricultural sector using ARIMA. In addition, there is also research by [16] who conducted ARIMA and ARIMAX modeling to forecast the average price of premium rice in East Java province. The study used the transfer function in the ARIMAX method. While [17] who forecast the value of non-oil and gas exports with Islamic calendar variations using X-13-ARIMA-Seats which can be used to overcome the moving holiday effect associated with Eid al-Fitr. Therefore, this study is novel in its application of the ARIMAX model, which includes a dummy variable for the Eid al-Fitr calendar in the analysis of West Java's non-oil and gas exports. This approach differs from previous studies, which generally used the ARIMA model without considering the effect of Eid al-Fitr on export patterns. By utilizing the latest data from the 2015–2024 period, this study is able to produce more accurate projections and provide a stronger basis for the formulation of regional export policies.

## 2. METHOD

### 2.1. Research Data

This study utilizes secondary data on the value of non-oil and gas exports in West Java. The dataset covers the period from January 1, 2015 to December 2024 obtained through the website of the Central Statistics Agency (BPS) in West Java Province [18]. The data are divided into two parts : in-sample and out-sample. The in-sample data cover the period from January 2015 until December 2023, while the out-sample data cover from January 2024 until December 2024.

Building an ARIMA model in analyzing monthly non-oil gas export data in West Java, a sufficient amount of data is needed so that trend and seasonal patterns can be properly recognized. Based on a table from the book [19] the Box Jenkins or ARIMA method requires at least 36 observation data for monthly data that is seasonal, equivalent to three times the seasonal period (12 months). As for non-seasonal data a minimum of 24 observations is recommended or about two years of monthly data. The availability of adequate data is very important to ensure that the stages of model identification, parameter estimation, and diagnostic checks can be carried out accurately and reliably.

The variable used in the ARIMA method is the value of non-oil and gas exports. In the ARIMAX model, the same export value variable is used, with the addition of trend, monthly, and calendar variation dummy variables.

**Table 1.** Research Variable

| Month-Year | Non-Oil and Gas | Tren | Dummy Variable | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Month | | | Calendar Variation | | | Covid |
| | | | $M_{1,t}$ | … | $M_{12,t}$ | $L_{1,t-1}$ | … | $L_{4,t+1}$ | |
| Jan-15 | $Y_1$ | 1 | 1 | … | 0 | 0 | … | 0 | 0 |
| Feb-15 | $Y_2$ | 2 | 0 | … | 0 | 0 | … | 0 | 0 |
| Mar-15 | $Y_3$ | 3 | 0 | … | 0 | 0 | … | 0 | 0 |
| . | . | . | . | . | . | . | . | . | . |
| . | . | . | . | . | . | . | . | . | . |
| . | . | . | . | . | . | . | . | . | . |
| Des-24 | $Y_{120}$ | 120 | 0 | … | 1 | 0 | … | 0 | 0 |

Calendar variation dummy as follows:

$L_{1,t-1}, L_{2,t-1}, L_{3,t-1}, L_{4,t-1},$ : one month before Eid al-Fitr

$L_{1,t}, L_{2,t}, L_{3,t}, L_{4,t},$ : Eid al-Fitr week

$L_{1,t+1}, L_{2,t+1}, L_{3,t+1}, L_{4,t+1},$ : one month after Eid al-Fitr

Seasonal dummy (month) as follows:

$M_{1,t}, M_{2,t}, ..., M_{12,t}$ : Month of January, February,..., December

Research steps:

1. Collect data from the West Java Province BPS website
2. Divide data into in-sample and out of sample
3. Analyzing using the ARIMA method
   a) Model identification using time series plot, ACF plot and PACF plot. If the data are not stationary in variance a Box-Cox transformation is applied while if not stationary in mean, differencing is performed.
   b) Estimate the orde p from the ACF plot and q from the PACF plot,
   c) Parameter estimation and ARIMA modeling
   d) Perform residual assumptions: white noise test and normality test.
   e) If the residuals fail the normality test, perform outlier detection,
   f) Re-estimate parameters and re-model the ARIMA model with outliers included,
   g) Perform residual assumptions with outliers
   h) Compare the MAPE, MAE, and RMSE values,
4. Analyze the data using the ARIMAX method
   a) Determine the dummy variable for the calendar variation period,
   b) Regress the trend, seasonal and calendar variation dummy variables,
   c) Estimate the significance of time series regression parameters. If any variable is not significant apply backward elimination,
   d) Perform residual assumption tests: white noise and normality tests on the residuals of the time series regression model,
   e) If the residuals are not white noise, proceed with ARIMAX modeling,
   f) Estimate the orde p and q,
   g) Parameter estimation and ARIMAX modeling
   h) Perform residual assumption test
   i) Comparing the MAPE, MAE, and RMSE values
5. Comparing the Mean Absolute Percentage Error (MAPE), Mean Absolute Error (MAE), and Root Mean Square Error (RMSE) values of the ARIMA and ARIMAX models.

### 2.2. ARIMA

ARIMA is a statistical method used to analyze time series data. The general equation of the ARIMA model is as follows :

$$\phi_p(B)(1-B)^d Y_t = \theta_0 + \theta_q(B) a_t, \quad (1)$$

Where $(p)$ represent the AR, $(d)$ differencing, and $(q)$ MA orde, respectively; $\theta_0$ denotes a constant, $B$ refers to the backshift operators, $Y_t$ indicates the time series variable $Y$ at time $t$, $\phi_p$ signifies the AR coefficient at the orde $p$ , $(1-B)^d$ corresponds to the differencing series of orde $d$ ; $\theta_q$ represnt the MA coefficient at orde $q$ , and $a_t$ stands for the error term at time $t$ .

### 2.3. Outliers Detection

Outlier detection is the process of identifying observations that deviate significantly from normal data patterns in time series analysis. There are four types of outliers: Additive Outlier (AO), Innovative Outlier (IO), Level Shift (LS), and Temporary Change (TC).

$$Y_t = \sum_{j=1}^{k} \omega_j v_j(B) I_t^{(T)} + \frac{\theta(B)}{\phi(B)} a_t \tag{2}$$

Where $I_t^{(T)}$ represents the variable that indicates the presence of an outlier at time $T_j$ . The function $v_j(B)$ is defined as follows: it equals 1 for an Additive Outlier (AO); $\frac{\theta(B)}{\phi(B)}$ equals for an Innovational Outlier (IO); $\frac{1}{1-B}$ equals for a Level Shift (LS); and $\frac{1}{1-\delta B}$ equals for a Temporary Change (TC), with $0 < \delta < 1$.

### 2.4. ARIMAX

The Autoregressive Integrated Moving Average Exogenous (ARIMAX) model is an ARIMA model that allows the use of independent variables, such as dummy variables for calendar variations and deterministic trends. The equation of the ARIMAX model is as follows :

$$\begin{aligned} Y_t &= \beta_1 t + \beta_2 D_{1,t} + \ldots + \beta_5 t D_{2,t} + \alpha_1 M_{1,t} + \alpha_2 M_{2,t} + \ldots \\ &+ \alpha_{12} M_{12,t} + \delta_1 L_{1,t} + \delta_2 L_{2,t} + \ldots + \gamma_4 L_{4,t+1} + \frac{\theta_q(B)}{\phi_p(B)} a_t , \end{aligned} \tag{3}$$

### 2.5. Selection of The Best Model

The selection of the best model in this study was conducted using the forecasting error criteria RMSE, MAE, and MAPE on both in-sample and out-sample data. MSE is generally used to compare methods on data of the same scale, but RMSE is more often chosen because the results are proportional to the data scale. Meanwhile, MAPE is used to assess the closeness of the prediction results to the actual values through the average error percentage. The formulas used for RMSE, MAPE, and MAE are as follows :

$$RMSE = \sqrt{\frac{\sum_{l=1}^{L} \left( Y_{n+1} - \hat{Y}_n(l) \right)^2}{L}} \tag{4}$$

$$MAPE = \frac{1}{L} \sum_{i=1}^{L} \left| \frac{Y_{n+1} - \hat{Y}_n(l)}{Y_{n+1}} \right| 100\% \tag{5}$$

$$MAE = \frac{1}{L} \sum_{i=1}^{L} \left| Y_{n+1} - \hat{Y}_n(l) \right| \tag{6}$$

Where $Y_{n+1}$ represents out sample data; $\hat{Y}_n(l)$ is predicted value; and $L$ represents amount of out sample data.

## 3. RESULTS AND DISCUSSION

### 3.1. Data Plot

Descriptive statistics aim to present data clearly so that certain understandings or meanings can be derived based on the description presented [20]. Descriptive statistics do not involve inference or prediction, but rather serve to summarize and communicate information in a way that is accessible to individuals without advanced statistical knowledge. Below are the descriptive statistics for non-oil and gas exports.

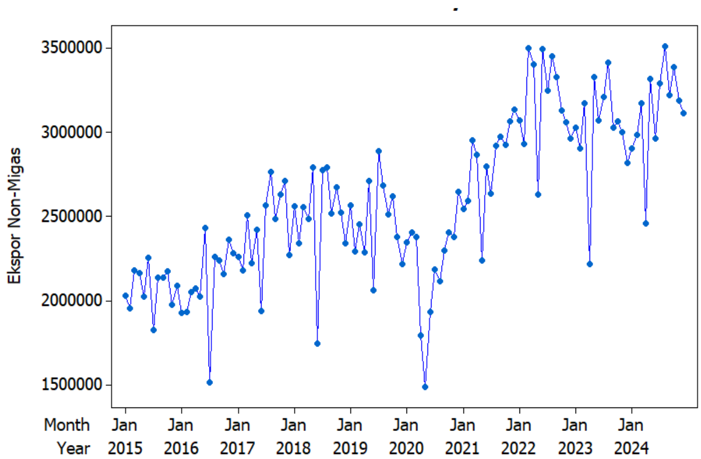
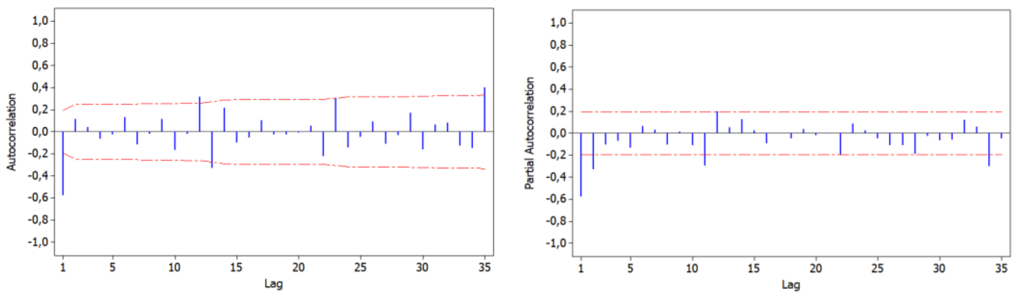



**Figure 1. Time Series Plot of Non-Oil and Gas Exports Data**

Figure 1 shows the trend of West Java's non-oil and gas exports from January 2015 to early 2024. A non-oil and gas exports looks quite stable until early 2020, before experiencing a sharp decline. However, after mid-2020, exports again showed a fairly strong recovery, even increasing beyond the levels of the previous period. In months where the Eid holiday occurred, the value of non-oil and gas exports decreased. The graph reflects the long-term growth of Indonesia's non-oil and gas exports with strong recovery capabilities after global disruptions.

### 3.2. Modeling Non-Oil and Gas Exports with ARIMA

Model identification is conducted to determine whether the data is stationary in terms of mean and variance. This can be assessed by examining the patterns in the time series plot, ACF plot, PACF plot, and Box-Cox plot. ARIMA modeling begins with checking the stationarity of the variance, which yields a lambda value of 1.00. This indicates that the data is already stationary in variance, as the lambda value includes 1. Subsequently, the data is tested for stationarity in the mean. The results show that the mean is not yet stationary, so differencing is applied, with the following results.




(a) (b)

**Figure 2. (a) ACF Plot and (b) PACF Plot After Differencing 1**

Figure 2 shows how the ACF plot decreases rapidly which means the data is stationary in the mean. Thus, the order p and q can be determined based on the ACF and PACF plots. The ARIMA subset obtained ([1,2,11,12,22,34],1,[1,12,13,23,35]). The model will be tested first to see which one is significant so that it forms a temporary ARIMA model. The results show that only the ARIMA model (1,1,[2,12]) and the ARIMA model ([1,12],1,[35]) are significant by looking at the p-value < alpha (0.05). Both models will be tested for residual assumptions, it is found that the ARIMA Model (1,1,[2,12]) shows significant but not normally distributed so that the model will be outlier detection followed by a residual assumption test with outliers. so that the results of testing the residual assumptions of the arima model are obtained as follows.

**Table 2. Residual Assumption Testing Results of ARIMA Model**

| ARIMA Model | White Noise Test | | | | Normality Test | |
|---|---|---|---|---|---|---|
| | Lag | Chi Square | DF | P-Value | P-Value | Statistical Test (D) |
| (1,1,[2,12]) | 6 | 4,27 | 3 | 0,2340 | 0,1500 | 0,045113 |
| | 12 | 14,78 | 9 | 0,0972 | | |
| | 18 | 19,94 | 15 | 0,1744 | | |
| | 24 | 24,42 | 21 | 0,2734 | | |
| ([1,12],1,[35]) | 6 | 5,81 | 3 | 0,1214 | 0,1258 | 0,076449 |
| | 12 | 7,98 | 9 | 0,5365 | | |
| | 18 | 9,72 | 15 | 0,8371 | | |
| | 24 | 16,28 | 21 | 0,7537 | | |
| | 30 | 19,12 | 27 | 0,8655 | | |

Table 2 shows the assumptions of white noise and normally distributed residuals with outlier detection. In the ARIMA (1,1,[2,12]) model with outlier detection, the p-value > alpha (0.05) is obtained, which means that the white noise assumption has been met. While the normality test has been fulfilled as indicated by the p-value (0.1500) > alpha (0.05). For the ARIMA ([1,12],1,[35]) model has met the assumptions of white noise residuals and normal distribution. so that in both models the best model selection will be made based on the RMSE, MAE, and MAPE values with the criteria for the smallest value, then the model is used.

**Table 3. RMSE, MAE, and MAPE Values**

| ARIMA Model | *In-Sample* | | | *Out-Sample* | | |
|---|---|---|---|---|---|---|
| | RMSE | MAPE | MAE | RMSE | MAPE | MAE |
| (1,1,[2,12]) | 184282,15 | 5,95% | 143927,29 | 297457,31 | 8,40% | 262603,65 |
| ([1,12],1,[35]) | 240060,55 | 7,54% | 179366,72 | 175176,59 | 4,09% | 130034,58 |

The best model selection aims to evaluate the feasibility of the model with in-sample and out-sample approaches. This stage is done before forecasting to get the best model. Table 3 can be seen that the ARIMA model based on RMSE, MAE, and MAPE criteria that has the smallest value in the out-sample approach is the ARIMA ([1,12],1,[35]) model with an RMSE value of 175176,59; MAE value of 130034,58; and a MAPE value of 4,09%. So the best model obtained based on the smallest RMSE, MAE, and MAPE values in the out-sample approach is ARIMA ([1,12],1,[35]).

### 3.3. Modeling Non-Oil and Gas Exports with ARIMAX

The decline in the value of non-oil and gas exports is thought to be due to the Eid al-Fitr holiday, therefore it is necessary to model non-oil and gas exports with ARIMAX using calendar variation dummy variables. To see the decline, first know when Eid al-Fitr occurs. The following presents data on the time of Eid al-Fitr from 2015 to 2024.

**Table 4. Eid Al-Fitr Dates 2015-2024**

| Year | Date of Eid Al-Fitr | Week of Eid Al-Fitr |
|---|---|---|
| 2015 | 17-18 July | Week 3 |
| 2016 | 06-07 July | Week 1 |
| 2017 | 25-26 June | Week 4 |
| 2018 | 15-16 June | Week 3 |
| 2019 | 06-07 June | Week 1 |
| 2020 | 24-25 Mei | Week 4 |
| 2021 | 13-14 Mei | Week 2 |
| 2022 | 02-03 Mei | Week 1 |
| 2023 | 22-23 April | Week 3 |
| 2024 | 10-11 April | Week 2 |

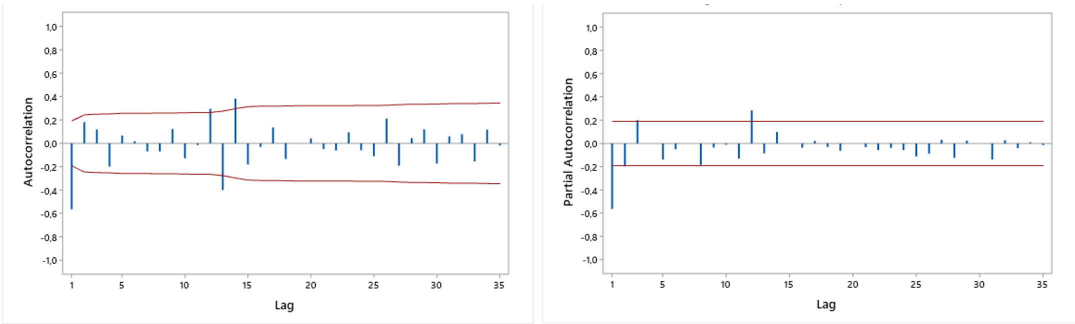
After knowing the time of Eid, the next step is to determine the dummy variable. This variable is used to show the effect of calendar variation, based on weekly data for one month before Eid, during Eid, and one month after. In addition, the dummy variables in this study also include trend variables, the impact of Covid-19, monthly seasonal effects, as well as the special period mentioned earlier, which is around Eid al-Fitr time.

The next step is to perform time series regression, time series regression is a statistical method used to study patterns and factors that affect variations in time series data. continued by estimating parameters to see which variables are significant. If there are variables that are not significant, it is necessary to eliminate the variables, namely backward elimination. The following are the results of parameter estimation with significant variables and backward elimination.

**Table 5. Parameter Estimation Results Using Backward Elimination**

| Variable | Coef | SE Coef | T-Value | P-Value |
|---|---|---|---|---|
| Trend | 10323 | 800 | 12,90 | 0,000 |
| $L_{4,t-1}$ | -401035 | 184575 | -2,17 | 0,032 |
| $L_{1,t}$ | -516205 | 151369 | -3,41 | 0,001 |
| $L_{2,t}$ | -585454 | 260152 | -2,25 | 0,027 |
| $L_{3,t}$ | -611578 | 151422 | -4,04 | 0,000 |
| $L_{4,t}$ | -805275 | 184549 | -4,36 | 0,000 |

Table 5 shows all variables are statistically significant, indicated by a p-value <0.05. Furthermore, the residual assumption test is carried out through the white noise test using the Ljung-Box and normality tests. The white noise test results show that the residuals of the time series regression model have not met the assumptions, with p-values at lags 6, 12, 18, 24, and 30 < 0.05. However, the normality test is met with a p-value > 0.1500. Therefore, the analysis proceeds to ARIMAX modeling to overcome the violation of the white noise assumption.




(a) (b)

**Figure 3. (a) ACF Plot and (b) PACF Plot Residuals of Time Series Regression Model After Differencing 1**

The residuals in the previous time series regression model are not yet white noise, so differencing 1 is performed. The differencing results are shown through the ACF and PACF plots in **Figure 3**, which indicate the data is stationary. Based on this pattern, a temporary subset model ARIMAX([1,3,12],1,[1,12,13,14]) is obtained. In the previous parameter estimation, the variables Trend, $L_{4,t-1}$, $L_{1,t}$, $L_{2,t}$, $L_{3,t}$, and $L_{4,t}$ were found to be significant. However, when used in this subset model, the Trend variable is always insignificant so it is removed to obtain a model with significant parameters.

The estimate parameter significance test resulted in two models that met the criteria, namely ARIMAX ([1,3],1,[12]) and ARIMAX ([1,12],1,[14]). Both have met the residual assumptions, which are white noise and normally distributed. Furthermore, a comparison of the RMSE and MAPE values was conducted to determine the best model.

**Table 6. RMSE, MAE, and MAPE Values**

| **ARIMAX** | ***In-Sample*** | | | ***Out-Sample*** | | |
|---|---|---|---|---|---|---|
| **Model** | **RMSE** | **MAPE** | **MAE** | **RMSE** | **MAPE** | **MAE** |
| ([1,3],1,[12]) | 162160,57 | 5,31% | 127752,50 | 285244,6 | 7,69% | 249402,42 |
| ([1,12],1,14) | 162034 | 5,28% | 129335,35 | 345379,4 | 9,93% | 316272,95 |

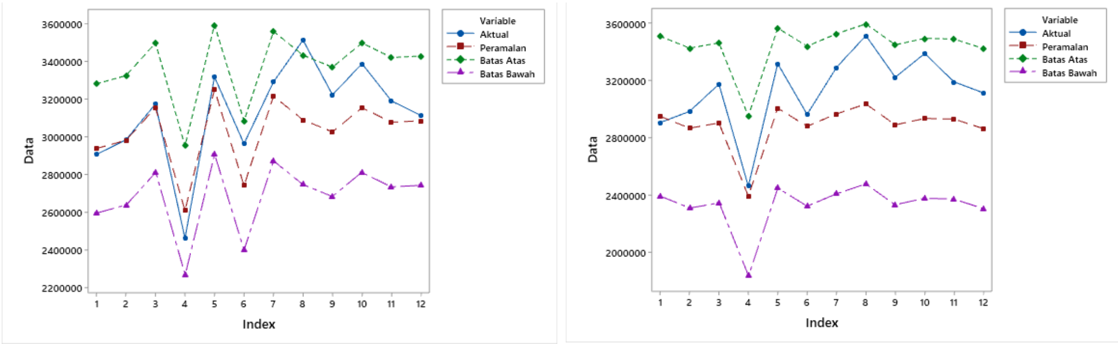
Table 6 shows that the ARIMAX ([1,3],1,[12]) model is yields the lowest RMSE, MAE, and MAPE values of 285244,6; 249402,42; and 7,69% with the out-sample approach.

### 3.4. Comparison of ARIMA and ARIMAX Models

**Table 7. Comparison of RMSE, MAE, and MAPE Values for Best Model Selection**

| **Model** | ***In-Sample*** | | | ***Out-Sample*** | | |
|---|---|---|---|---|---|---|
| | **RMSE** | **MAPE** | **MAE** | **RMSE** | **MAPE** | **MAE** |
| ARIMA ([1,12],1,[35]) | 240060,55 | 7,54% | 179366,72 | 175176,59 | 4,09% | 130034,58 |
| ARIMAX ([1,3],1,[12]) | 162160,57 | 5,31% | 127752,50 | 285244,6 | 7,69% | 249402,42 |

Table 7 shows the ARIMA model provides the best results with an RMSE value of 175176,59; MAE value of 130034,58; and a MAPE of 4,09%. Thus, the ARIMA model is chosen as the best model to forecast the next period. In addition, the MAPE values of the ARIMA and ARIMAX models are both below 10%, which means that both models are actually good enough for forecasting.




(a) (b)

**Figure 4. (a) ARIMA Model and (b) ARIMAX Model Plot of Forecast Result**

A comparison of the forecast result the two model is shown in Figure 4 which shows that the ARIMAX model produces prediction intervals (upper and lower limits) wider than ARIMA which indicates a higher level of uncertainty. This means that the ARIMA model is better than ARIMAX.

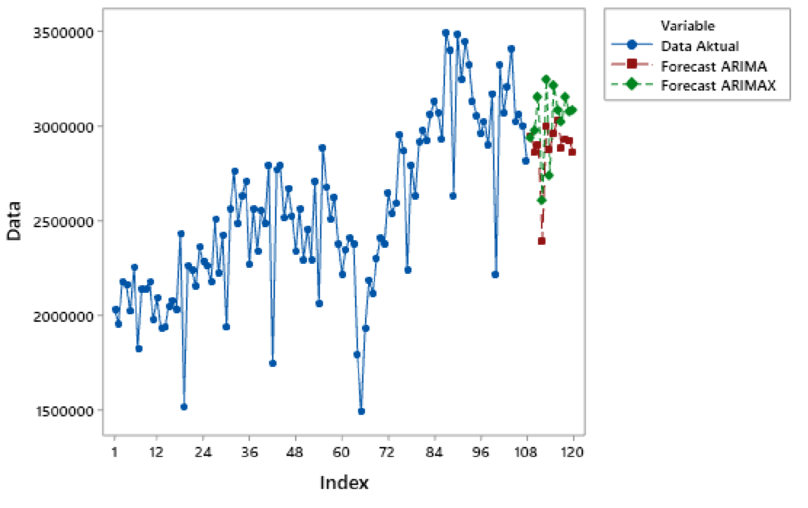



**Figure 5. Forecasting Plot of ARIMA and ARIMAX Methods**

Figure 5 shows shows that the ARIMAX model produces projections that are closer to actual data than ARIMA. This can be seen from the green line, which follows the pattern of export fluctuations more stably and consistently, while the red line tends to deviate from the actual values. The superior performance of ARIMAX indicates that including calendar variations as dummy variables contributes significantly to capturing changes in export activity that cannot be fully explained by historical patterns alone.

## 4. CONCLUSION

The value of West Java's non-oil and gas exports showed an increasing trend with an average value of USD 2,080,795 in 2015. However, in 2020 there was a decrease in the value of exports to USD 2,805,698 which was thought to be caused by the COVID-19 pandemic. Along with the end of the COVID-19 pandemic, the average value of non-oil and gas exports increased again, as seen in 2021 with a value of USD 2,805,698. non-oil and gas exports value data is divided into two, namely in-sample and out-sample. in-sample data starts in January 2015 to December 2023 while out-sample starts in January 2024 to December 2024 data. next, ARIMA modeling is carried out to get the best model that is significant and meets the residual assumptions, namely ARIMA ([1,12],1,[35]). The best model can be seen through the smallest RMSE, MAE, and MAPE values in the out-sample. Continued arimax modeling with calendar variations obtained the best model in ARIMAX ([1,3],1,[12]) with an RMSE value of 285244,6; MAE value of 249402,42, and a MAPE of 7.69%. ARIMA and ARIMAX models can be compared to the smallest RMSE and MAPE values to get the best model and it is found that the ARIMA model is the best compared to the ARIMAX model.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### Author Contributions Statement
Saputri Dyah Pratiwi: Conceptualization, writing-original draft, software, validation, data curation, resources, visualization, & editing. Alfisyahrina Hapsery: Methodology, software, validation, draft preparation, format analysis, visualization & writing-review. Artanti Indrasetianingsih: Methodology, writing-original draft, software, validation, draft preparation, formal analysis, validation, & writing-review.

### Conflict Of Interest Statement
Authors state no conflict of interest.

### Data Availability
The data that support the findings of this study are openly available in the website of the Central Statistics Ageency (BPS) at https://jabar.bps.go.id/id/statistics-table/2/MzU2IzI=/neraca-perdagangan--ribu-usd-.html, reference number [18].

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