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APPLICATION OF SEASONAL AUTOREGRESSIVE INTEGRATED MOVING AVERAGE (SARIMA) METHOD IN FORECASTING CHICKEN EGG PRICES IN INDONESIA

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ABSTRAK

Telur ayam ras merupakan salah satu komoditas pangan yang banyak dikenal dan rutin digunakan untuk menu makanan sehari-hari. Oleh karena itu, harganya sering berfluktuasi. sehingga Peramalan harga telur ayam di Indonesia sangat diperlukan agar pemerintah dapat memantau kestabilan harga dan merencanakan langkah ke depannya. Metode yang cocok untuk peramalan ini adalah Seasonal Autoregressive Integrated Moving Average (SARIMA). Hasil analisis data menggunakan metode SARIMA menunjukkan bahwa model terbaik yang digunakan untuk peramalan adalah SARIMA $(2,1,3)(0,1,1)^{12}$. Karena model tersebut memiliki nilai Mean Square Error sebesar 195417,5 dan Mean Absolute Percentage Error sebesar 0,2%. Dari model tersebut, diperkirakan harga telur ayam ras akan cenderung berfluktuasi dan meningkat dalam 24 bulan ke depan, yaitu mulai Januari 2025 sampai dengan Desember 2026.

Kata Kunci: harga, telur ayam ras, peramalan, metode sarima

ABSTRACT

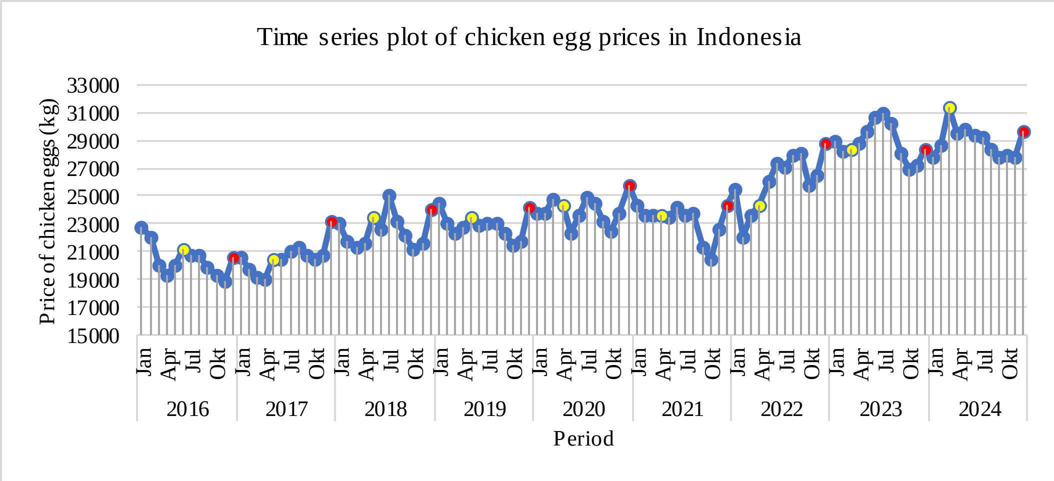
Chicken eggs are one of the widely known food commodities and are routinely used for daily food menus. Therefore, the price often fluctuates. So that the forecasting of chicken egg prices in Indonesia is very necessary so that the government can monitor price stability and plan future steps. The method that is suitable for this forecast is the Seasonal Autoregressive Integrated Moving Average (SARIMA). The results of data analysis using the SARIMA method show that the best model used for forecasting is SARIMA $(2,1,3)(0,1,1)^{12}$. This model has a Mean Square Error value of 195417,5 and a Mean Absolute Percentage Error of 0,2% so it is good for forecasting. From this model, it is estimated that the price of broiler chicken eggs will tend to fluctuate and increase in the next 24 months, namely from January 2025 to December 2026.

Keywords: price, chiken eggs, forcasting, sarima method.

INTRODUCTION

Eggs are a food ingredient that is very close to everyday life. Its popularity is supported by ease of processing, delicious taste, relatively affordable price compared to other commodities such as meat and fish, and its abundant availability. Eggs can come from various types of poultry, such as broiler chickens, free-range chickens, ducks, and quail. However, among these types, broiler chicken eggs have the highest demand among consumers. Because broiler chicken eggs have affordable prices, abundant availability, easy to process and are widely known and used routinely in daily food menus. Eggs produced from poultry are one of the animal products that are widely known as a source of high-quality protein. As a food ingredient, eggs have various advantages, such as their rich nutritional content and more affordable prices compared to other protein sources (Ramadhani dkk, 2019).

Broiler chicken eggs are one of the food commodities whose prices often fluctuate. As a result, the government continues to monitor price changes to ensure their stability. Price fluctuations can be influenced by various factors, including the celebration of religious holidays. For example, during Eid al-Fitr, the price of food ingredients such as chicken eggs tends to increase (Rahmadia, 2020). This increase occurred due to a spike in demand and public consumption of chicken eggs during that period. Based on data from BPS Indonesia, entering December 2024 which coincides with the end of the year, the price of eggs increased by IDR 29,735/kg. This price has increased compared to the price in November 2024, which was IDR 27,815/kg (Badan Pusat Statistik, 2024). This increase in the price of chicken eggs also occurred last year, for example in December 2023 which coincided with the end of the holiday season, the price of chicken eggs was IDR 28,411, which increased from the price in the previous month, namely November 2023, which was IDR 27,253 253 (Badan Pusat Statistik, 2023). The plot of chicken egg price data in Indonesia for the period January 2016 to December 2024 can be seen in Figure 1.



Ramadan month Christmas or end of year
Source: BPS Indonesia Socio-Economic Data Report

Figure 1. Plot of monthly data on chicken egg prices in Indonesia for the period January 2016-December 2024

Based on Figure 1, it can be seen that the price of chicken eggs in Indonesia shows a fluctuating pattern every month, with a tendency to increase over time. The increase in the price of chicken eggs has an important influence, one of which is on consumer welfare. The increase in the price of chicken eggs in Indonesia consistently occurs before the National Religious Holidays (HBKN). and slowly decreases after that. However, in 2020, the price of eggs actually decreased during the month of Ramadan which falls in April. This is due to the circulation of infertile eggs or what are commonly called HE eggs from breeding companies (Muhammad Idris, 2025).

Eggs are one of the staple food commodities widely consumed by the Indonesian people. Fluctuations in egg prices can have a direct impact on people's purchasing power, especially the lower middle class. Therefore, accurate price forecasting can help the government maintain price stability and design targeted market intervention policies. In addition, for farmers and business actors in the livestock sector, price prediction information is very useful for planning production, distribution, and marketing strategies, so that they can minimize the risk of losses due to price uncertainty. This research also supports decision-making in formulating government policies, such as food subsidies, social assistance programs, or regulations on imports and exports of livestock products. On the other hand, egg price forecasting is also closely related to the issue of national food security, because the stability of the price of this commodity can help maintain the availability of affordable animal protein for all levels of society. From an academic perspective, this research opens up opportunities to develop and apply various statistical and technology-based forecasting methods such as machine learning, which are relevant to the development of modern data analysis. Therefore, it is necessary to conduct a forecast of the price of chicken eggs in Indonesia so that the government can make some future plans.

RESEARCH METHOD

Based on the data and results to be achieved, this type of research is applied research. Applied research is a type of research used to test and apply theories in solving real problems, developing and producing products, and collecting data for decision making (Jaedun, 2010). Based on the type of approach, this research is included in quantitative research. Quantitative research is a systematic study of phenomena by collecting data that can be measured using statistical, mathematical and computational methods (Abdullah, 2015). The data used in this study are secondary data, namely monthly data on the price of chicken eggs in Indonesia for the period January 2016 to December 2024 obtained from the website of the Indonesian Central Statistics Agency. Secondary data is data collected indirectly through other sources or media (Setiawan, 2010).

The method used in this study is the Seasonal-ARIMA (SARIMA) method. The Seasonal-ARIMA (SARIMA) method is a statistical model used for time series analysis that considers seasonal components. SARIMA is also a combined model of ARIMA components, namely autoregressive and moving average components and seasonal. The advantages of the SARIMA method can be used to predict seasonal data with various patterns and has a fairly high level of accuracy if used to predict historical data with a long period. The disadvantage of this method is that SARIMA forecasting requires large amounts of data (Khoiri, 2022).

Analysis using the SARIMA method is carried out through the following steps:

a. Collecting data on the price of chicken eggs in Indonesia from January 2016 to December 2024.
b. Making a plot of the original data against time (time series) to determine the behavior of the data pattern. Checking the stationarity of the data. If the data is

not stationary in variance, then a Box-Cox transformation is carried out. In this study, the value of $\lambda = 0.5$ then the form of the Box-Cox power transformation is $\sqrt{Zt}$. Meanwhile, if the data is not stationary in the mean, the process carried out is differencing using the equation $Y_t' = Y_t - Y_{t-1}$

c. Identifying and estimating the order p, d, and q of the non-seasonal temporary model based on the ACF using the equation

$$r_k = \frac{\sum_{t=1}^{n-k}(Y_t - \bar{Y})(Y_{t+k} - \bar{Y})}{\sum_{t=1}^{n}(Y_t - \bar{Y})^2}$$

and PACF using the equation

$$\phi_{kk} = \frac{r_k - \sum_{j=1}^{k-1}\phi_{k-1,j}r_{k-j}}{1 - \sum_{j=1}^{k-1}\phi_{k-1,j}r_j}$$

plots of the data that has been stationary.

d. Showing seasonal patterns 12 on the ACF and non-seasonal PACF plots, where lag 12 on the ACF plot passes the significant limit.

e. Performing differencing lag 12 (subtracting the current value from the previous value, to eliminate trends and make the data stationary).

f. Determining the order of the temporary seasonal model (SARIMA) P, D, and Q based on the ACF and PACF plots of the data that has been differencing. So that later the model is shaped SARIMA (p,d,q)(P,D,Q)^s

g. Performing Overfitting on the temporary SARIMA model that has been obtained.

h. Performing parameter significance tests and parameter estimates on the model. With the following steps:

1. Hypothesis

   H_0 : $\phi = 0$ atau $\theta = 0$ (AR or MA parameters are not significant)

   H_1 : $\phi \neq 0$ atau $\theta \neq 0$ (AR or MA parameters are significant)

   Significance level $\alpha = 0{,}05$

2. Test statistics:

$$t_{count} = \frac{\phi}{SE(\phi)} \qquad t_{count} = \frac{\theta}{SE(\theta)}$$

Where:

Standard Error $(\mathrm{SE}) = \sqrt{\frac{\mathrm{e}^2}{\mathrm{n}-1}}$

$e^2 = \sum_{t=1}^{n}(X_t - \phi X_{t-1})^2$

N : number of observations

X_t : actual value at time t

3. Reject H_0 if $|t_{count}| > t_{\frac{\alpha}{2}}; df = n - n_p, n_p$ = number of parameters or using $P - value < \alpha$ with α is a tolerance level of 0.05 then the coefficient can be used for the forecasting model.

i. Testing the adequacy of the model, the model is tested through the white noise test, and the normality test.

The white noise test is carried out with the following steps:

1. Hypothesis:

   H_0 : $\rho_1 = \rho_2 = \rho_3 = \cdots = \rho_k = 0$ (residual white noise)

   H_1 : Minimal ada satu $\rho_j \neq 0$ untuk $j = 1,2,3, \ldots k$ (residual is not white noise)

2. Test statistic:

   $Q = n(n+2)\sum_{k=1}^{k}\frac{\hat{\rho}_k^2}{(n-k)}$

   Description:

   Q = Ljung-Box Test

   n = Number of observations

   $\hat{p}_k$ = Autocorrelation value lag k

   k = Time lag

   K = Maximum lag

3. Reject H_0 if $Q > \chi^2{}_{(\alpha/_{df:K-k})}$ (K means at lag K and k is the number of parameters) or the value P-value $<$ α (α value $= 0{,}05$)

The normality test is carried out with the following steps:

1. Hypothesis:

   H_0 : $F(x) = F_0(x)$ (residuals are normally distributed for all x)

   H_1 : $F(x) \neq F_0(x)$ ((residuals are not normally distributed for some x)

2. Test Statistics:

   $D_{count} = sup_x|F_n(x) - F_0(x)|$

3. Rejection criteria: Reject H_0 if $D_{hitung} > D_{\alpha,n}$ or $p - \text{value} < \alpha$ using $\alpha = 0{,}05$

j. Perform MSE and MAPE calculations on the temporary model obtained.

1. Mean Squared Error (MSE) is one of the commonly used metrics to measure how well a prediction model predicts the actual value.

$$MSE = \frac{\sum_{t=1}^{N}(Y_t - \bar{Y}_t)^2}{N}$$

2. MAPE is the average absolute difference between the forecast value and the actual value, expressed as a percentage of the actual value.

$$MAPE = \left(\frac{1}{n}\sum_{t=1}^{n}\left|\frac{Y_t - \hat{Y}_t}{Y_t}\right|\right) \times 100\%$$

Table 1. MAPE value criteria

MAPE (x)	Definition
$x < 10\%$	Forecasting ability is very good
$10\% \leq x \leq 20\%$	Good forecasting ability
$20\% \leq x \leq 50\%$	Sufficient ability
$x \geq 50\%$	Bad ability

k. From the best models, one model is selected based on the smallest MSE value.

l. After the model is selected, the last step is to forecast for several future periods.

RESEARCH RESULTS AND DISCUSSIONS

A. Research Result

1. Data Description

Monthly data on the price of c hicken eggs in Indonesia from 2016 to 2024 (Kg/Rp) is presented in Table 2 and Table 3.

Table 2. Price Data for Chicken Eggs in Indonesia January 2016 – December 2020

Number	Month	Price of chicken eggs in Indonesia (Rp/kg)				
		2016	2017	2018	2019	2020
1	January	22760	20590	22990	24422	23767
2	February	22007	19703	21808	23015	23769
3	March	20009	19181	21396	22329	24779
4	April	19361	19008	21681	22811	24412
5	May	19965	20515	23550	23443	22335

Number	Month	Price of chicken eggs in Indonesia (Rp/kg)				
		2016	2017	2018	2019	2020
6	June	21134	20439	22688	22972	23677
7	July	20786	21034	25100	23062	24915
8	August	20815	21374	23243	23090	24459
9	September	19897	20811	22195	22303	23263
10	October	19374	20395	21234	21411	22533
11	November	18909	20772	21565	21809	23739
12	Desember	20654	23138	24120	24221	25762

Table 3. Price Data for Chicken Eggs in Indonesia January 2021 – December 2024

Number	Month	Price of chicken eggs in Indonesia (Rp/kg)			
		2021	2022	2023	2024
1	January	24319	25547	28921	27735
2	February	23692	22111	28176	28730
3	March	23576	23606	28401	31421
4	April	23626	24409	28764	29516
5	May	23463	26079	29732	29812
6	June	24141	27417	30641	29334
7	July	23632	27135	30916	29202
8	August	23736	27914	30267	28395
9	September	21398	28093	28140	27783
10	October	20433	25832	26924	27895
11	November	22666	26548	27253	27815
12	Desember	24389	28826	28411	29735

Source: BPS Indonesia Socio-Economic Data Report

Table 2 and Tabel 3 shows the price data of chicken eggs in Indonesia, with a total of 108 months analyzed. From Table 2 and Table 3, it can be seen that the average price of chicken eggs consistently increases at the end of each year or in December.

2. Data Analysis

The steps of the SARIMA method to predict the price of chicken eggs in Indonesia are as follows:

a. Model Identification

The purpose of this stage is to obtain a temporary SARIMA model resulting from the estimation process.

1) Creating a data plot

The data plot of chicken egg prices in Indonesia from 2016 to 2024 can be seen in Figure 2.

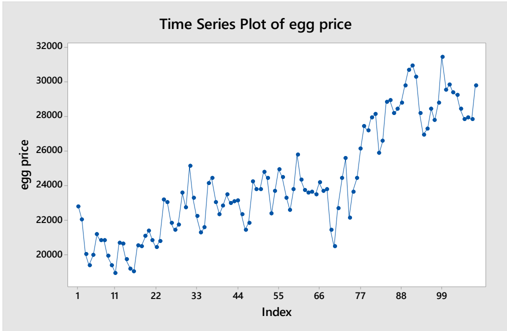


Figure 2. Plot of Chicken Egg Price Data in Indonesia January 2016-December 2024

Figure 2 shows that the price of chicken eggs in Indonesia fluctuates every month. In addition, the data shows an increasing trend pattern. The data is not constant in terms of mean and variance. This indicates that the data is not stationary in terms of mean and variance. Since the stationarity assumption has not been met, the data cannot be directly used to obtain the right SARIMA model.Stationarity test of data.

2) Data stationarity test

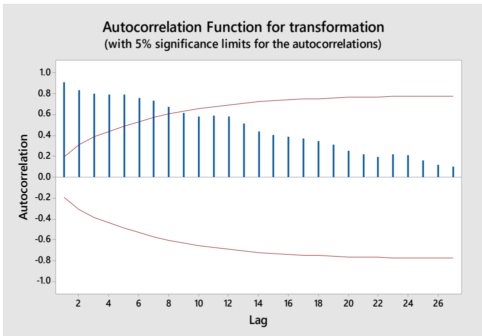


Figure 3. ACF Plot of Chicken Egg Price Data in Indonesia January 2016-December 2024

Figure 3 shows the ACF plot which shows that the autocorrelation value decreases slowly towards zero, and there are still many autocorrelation values that exceed the significance limit. This shows that the data is not yet stationary in terms of variance and mean. Therefore, it is necessary to transform the data with the form $\sqrt{Z_t}$ and differencing. The data plot after transformation and differencing can be seen in the Figure 4.

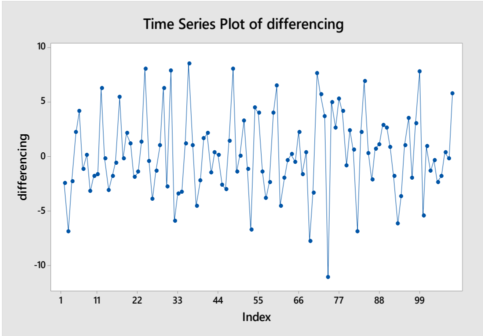


Figure 4. Plot of Data on Price Differences of Chicken Eggs in Indonesia January 2016-December 2024

3) Creating and Analyzing ACF and PACF Plots

Since stationarity in the mean has been achieved, the next step is to determine the estimated value of the ACF. The maximum number of ACF estimates is as follows:

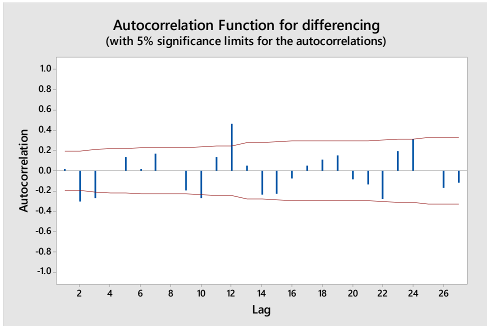


Figure 5. ACF Plot of Price Differentiation Data of Chicken Eggs in Indonesia January 2016-December 2024

Based on Figure 5, it can be seen that the autocorrelation value is no longer relatively large, and the autocorrelation value has shown positive and negative signs. This indicates that the data is already stationary in the mean. Figure 5 also shows that the ACF at lags 2, 3, 10, and 12 exceeds the significant line limit, so it is determined that the MA process is q = 4. To determine the PACF estimate.

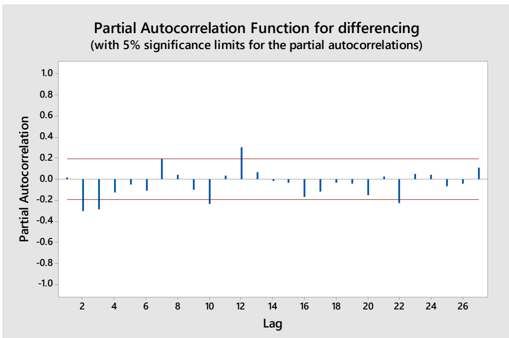


Figure 6. PACF Plot of Chicken Egg Price Difference Data in Indonesia January 2016-December 2024

Based on Figure 6, it can be seen that the PACF values at lags 2, 3, 10, 12, and 22 exceed the significant limit. Therefore, it is determined that the ongoing AR process is AR(5) or AR, which is p=5 for non-seasonal components.

From the analysis of the ACF and PACF plots, it can be concluded that the data after differentiation is stationary. Based on the time series pattern in Figure 5, the ACF plot of the results of the differentiation of the price transformation data of chicken eggs in Indonesia shows a seasonal pattern of 12 which at lag 12 exceeds the significant limit. Therefore, a seasonal differentiation of 12 is carried out from the non-seasonal differentiation data to eliminate the seasonal pattern in the ACF plot. The time series data plot of the data resulting from the seasonal differentiation process 12 can be seen in Figure 7.

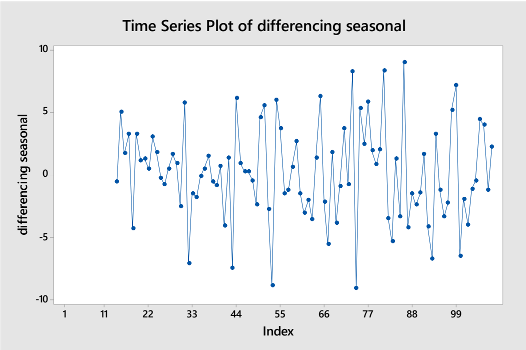


Figure 7. Time Series Data Pattern of Chicken Egg Price Differences in Indonesia January 2016-December 2024 for Season 12

By identifying the ACF and PACF of the 12-Seasonal differencing of the non-seasonal differencing data, it is found that the AR process with p = 1 AR(1) and MA with q = 1 MA(1) are taking place for the seasonal AR and MA orders. The following are the ACF and PACF plots of the 12-seasonal differencing in Figure 8 and Figure 9.

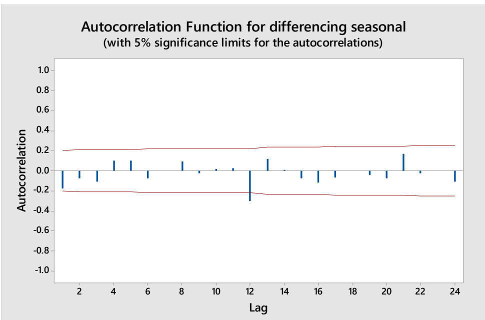


Figure 8. ACF Plot of Price Differences of Chicken Eggs in Indonesia January 2016-December 2024 for Season 12

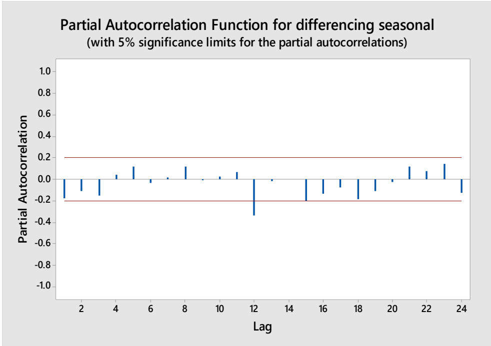


Figure 9. PACF Plot of Price Differences of Chicken Eggs in Indonesia January 2016-December 2024 for Season 12

Based on the analysis of time series plots, as well as ACF and PACF plots for non-seasonal and seasonal difference data 12, it is concluded that the data has been stationary. From this analysis, a temporary model for the price of chicken eggs is obtained, namely the SARIMA model $(5,1,4)(1,1,1)^{12}$.

4) Performing Overfitting

Once the temporary model is obtained, the next step is to perform overfitting by changing the order of AR and MA, as shown in Table 4.

Table 4. Other SARIMA Estimation Models of Chicken Egg Prices in Indonesia

Number	Model
1	$(5,1,4)(1,1,1)^{12}$
2	$(5,1,3)(1,1,1)^{12}$
3	$(5,1,2)(1,1,1)^{12}$
4	$(5,1,1)(1,1,1)^{12}$
5	$(5,1,0)(1,1,1)^{12}$
⋮	⋮
118	$(0,1,2)(0,1,0)^{12}$
119	$(0,1,1)(0,1,0)^{12}$
120	$(0,1,0)(0,1,0)^{12}$

Based on Table 4 in carrying out overfitting by changing the AR and MA orders, 120 estimated models were obtained from the specified temporary model.

b. Significance Test and Model Parameter Estimation

The next step is to conduct a significant test and parameter estimation which aims to obtain a model that can be considered as a model of the data. The results of the significant test show that there are 12 significant models, namely: SARIMA $(4,1,4)(1,1,0)^{12}$, SARIMA $(2,1,3)(1,1,0)^{12}$, SARIMA $(2,1,2)(1,1,0)^{12}$, SARIMA $(0,1,1)(1,1,0)^{12}$, SARIMA $(0,1,0)(1,1,0)^{12}$, SARIMA $(2,1,3)(0,1,1)^{12}$, SARIMA $(2,1,2)(0,1,1)^{12}$, SARIMA $(0,1,1)(0,1,1)^{12}$, SARIMA $(0,1,0)(0,1,1)^{12}$, SARIMA $(2,1,3)(0,1,0)^{12}$, SARIMA $(2,1,2)(0,1,0)^{12}$, SARIMA $(0,1,1)(0,1,0)^{12}$.

Table 5. Significance Test and Parameter Estimation of the SARIMA Model of Chicken Egg Prices in Indonesia January 2016-December 2024

Number	Model SARIMA	Parameter	Coefficient	$\|t\ Count\|$	t Table	P-Value	Information
1	SARIMA $(4,1,4)(1,1,0)^{12}$	ϕ_1	$0{,}729$	5,12	1,98761	0,000	Signifikan
		ϕ_2	$-0{,}349$	-2,37		0,020	Signifikan
		ϕ_3	$0{,}543$	3,69		0,000	Signifikan
		ϕ_4	$-0{,}371$	-2,61		0,011	Signifikan
		φ_1	$-0{,}415$	-3,46		0,001	Signifikan
		θ_1	$0{,}9227$	10,15		0,000	Signifikan
		θ_2	$-0{,}3903$	-4,51		0,000	Signifikan
		θ_3	$0{,}9116$	10,53		0,000	Signifikan
		θ_4	$-0{,}8881$	-10,43		0,000	Signifikan
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
6	SARIMA $(2,1,3)(0,1,1)^{12}$	ϕ_1	$-0{,}5634$	-5,82	1,98667	0,000	Signifikan
		ϕ_2	$-0{,}7637$	-8,79		0,000	Signifikan
		θ_1	$-0{,}356$	-3,05		0,003	Signifikan
		θ_2	$-0{,}6297$	-7,35		0,000	Signifikan
		θ_3	$0{,}424$	4,23		0,000	Signifikan
		Θ_1	$0{,}851$	8,30		0,000	Signifikan
7	SARIMA $(2,1,2)(0,1,1)^{12}$	ϕ_1	$-1{,}5457$	19,10	1,98638	0,000	Signifikan
		ϕ_2	$-0{,}7185$	-7,51		0,000	Signifikan
		θ_1	$1{,}8241$	150,11		0,000	Signifikan
		θ_2	$-0{,}9694$	-94,62		0,000	Signifikan
		Θ_1	$0{,}8571$	9,13		0,000	Signifikan
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
11	SARIMA $(2,1,2)(0,1,0)^{12}$	ϕ_1	$1{,}4590$	16,51	1,98609	0,000	Signifikan
		ϕ_2	$-0{,}668$	-5,90		0,000	Signifikan
		θ_1	$1{,}7577$	41,36		0,000	Signifikan
		θ_2	$-0{,}9516$	-42,77		0,000	Signifikan
12	SARIMA $(0,1,1)(0,1,0)^{12}$	θ_1	$0{,}236$	2,33	1,98525	0,022	Signifikan

Based on Table 6, 12 models passed the parameter significance test, where out of 12 models have p-value for each parameter $< \alpha = 0{,}05$ and all 12 models each parameter produces $|t_{hitung}| > t_{0{,}05/2}$. So it can be concluded for all models that H_0 is rejected, meaning that all 12 SARIMA models can be considered as models of the data.

c. Diagnostic Examination

From the results of the white noise test and the normality test, five models were obtained that met both tests, namely: SARIMA $(4,1,4)(1,1,0)^{12}$, SARIMA $(2,1,3)(1,1,0)^{12}$, SARIMA $(2,1,2)(1,1,0)^{12}$, SARIMA $(2,1,3)(0,1,1)^{12}$, SARIMA $(2,1,2)(0,1,0)^{12}$. Of the five models, at the stage of selecting the best model based on the smallest MSE value, the best model obtained was $(2,1,3)(0,1,1)^{12}$.

1. White noise test

Table 7. Ljung-Box Test of SARIMA Model $(2,1,3)(0,1,1)^{12}$

Lag	Chi-Square	DF	P-Value	Information
12	3,13	5	0,680	White Noise
24	16,65	17	0,478	White Noise
36	28,50	29	0,487	White Noise
48	47,74	41	0,218	White Noise

2. Normality test

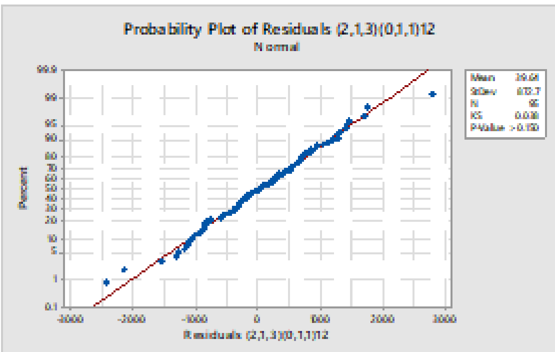


Figure 10. Normal Probability Residual Plot SARIMA $(2,1,3)(0,1,1)^{12}$

From Figure 10, it can be seen that the data is around the diagonal line or normal line. The results of the Kolmogorov-Smirnov test show a value of $0.150 > 0.05$, which indicates that the residuals have been normally distributed.

d. Selection of the best model

1) Calculating the MSE value of the SARIMA model

At this stage, the best SARIMA model research will be conducted based on the smallest Mean Square Error (MSE) value. The selected SARIMA model is a model that has met the white noise test and is normally distributed. The MSE value of each SARIMA model is presented in Table 8.

Table 8. MSE values of the SARIMA model

No	Model	MSE
1	SARIMA $(4,1,4)(1,1,0)^{12}$	427184
2	SARIMA $(2,1,3)(1,1,0)^{12}$	1018308
3	SARIMA $(2,1,2)(1,1,0)^{12}$	614756
4	SARIMA $(2,1,3)(0,1,1)^{12}$	195417
5	SARIMA $(2,1,2)(0,1,0)^{12}$	2250120

2) Calculating the MAPE value of the SARIMA model

$$MAPE = \left(\frac{1}{n}\sum_{t=1}^{n}\left|\frac{Y_t - \hat{Y}_t}{Y_t}\right|\right) \times 100\%$$

$$= \frac{1}{4}\left|\frac{(29815-29861{,}5)+(29400-29738)+(29856-29555{,}9)+(28605-29363)}{29815+29400+29856+28605}\right|$$

$$= \left(\frac{1}{4} \times 0{,}007162\right) \times 100\% = 0{,}2\%$$

Based on these results, the smallest MSE value is obtained, namely 195417.5. With MAPE reaching 0.2%, it can be concluded that the SARIMA $(2,1,3)(0,1,1)^{12}$ model has good predictive ability.

e. Creating and analyzing RACF and RPACF plots

Next, we will check whether the RACF and RPACF values of the model are significantly different from zero. The RACF plot for the SARIMA $(2,1,3)(0,1,1)^{12}$ model can be seen in Figure 11.

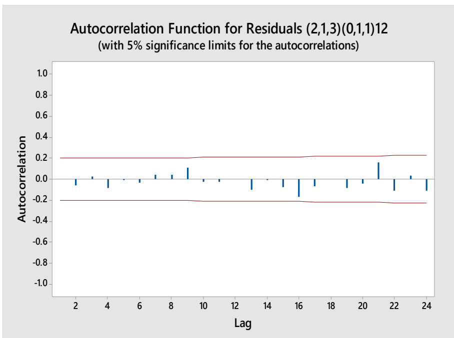


Figure 11. RACF Plot of Chicken Egg Prices in Indonesia January 2016-December 2024

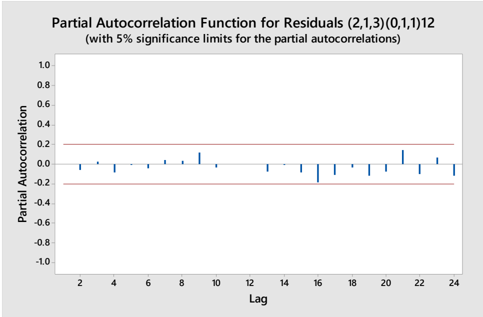


Figure 12. PACF Plot of Chicken Egg Prices in Indonesia January 2016-December 2024

Based on Figure 11 and Figure 12, it appears that the RACF and RPACF values are not significantly different from zero, indicating that the model is adequate. Therefore, the SARIMA $(2,1,3)(0,1,1)^{12}$ model can be used to predict the price of chicken eggs in Indonesia and can be continued to the next stage.

f. Mathematical equation of forecasting model

The following are the results of the price forecast for chicken eggs in Indonesia for the next 24 periods using the SARIMA $(2,1,3)(0,1,1)^{12}$ model with the values, $\phi_1 = -0{,}5634$, $\phi_2 = -0{,}7637$, $\theta_1 = -0{,}356$, $\theta_2 = -0{,}6297$, $\theta_3 = 0{,}424$, $\Theta_1 = 0{,}851$, $\mu = 35{,}5$. The mathematical equation of the SARIMA $(2,1,3)(0,1,1)^{12}$ model is as follows

$$
\begin{aligned}
Y_t = {} & 35{,}5 + (0{,}4366)Y_{t-1} + (-0{,}2003)Y_{t-2} + 0{,}7637Y_{t-3} + Y_{t-12} \\
& + (-0{,}4366)Y_{t-13} + (0{,}2003)Y_{t-14} + (-0{,}7637)Y_{t-15} + e_t - (0{,}851)e_{t-12} \\
& + (0{,}356)e_{t-1} + (-0{,}30296)e_{t-13} - (-0{,}6297)e_{t-2} + (-053587)e_{t-14} \\
& - (0{,}424)e_{t-3} + (0{,}36082)e_{t-15}
\end{aligned}
$$

Table 9. Results of Chicken Egg Price Forecast in Indonesia January 2025-December 2026

Year	Month	Period	Prediction Results	Year	Month	Period	Prediction Results
2025	January	109	29861.5	2026	January	121	31633.6
	February	110	29738.0		February	122	30981.7
	March	111	29555.9		March	123	31517.6
	April	112	29363.4		April	124	31359.6
	May	113	30613.0		May	125	32076.9
	June	114	30881.5		June	126	32654.5
	July	115	30915.0		July	127	32955.8
	August	116	31046.2		August	128	32735.6
	September	117	30016.4		September	129	31734.7
	October	118	28845.6		October	130	30851.4
	November	119	29622.1		November	131	31479.3
	December	120	31791.6		December	132	33548.4

B. Discussion

The forecasting results show that the SARIMA model successfully captures the seasonal patterns and trends in the price of chicken eggs. From the error analysis, the Mean Square Error (MSE) value was obtained as 195417.5 and the Mean Absolute Percentage Error (MAPE) was 0.2%, which shows the accuracy of the model in predicting prices. Previous research by Ilham (2024), which also used data on the price of chicken eggs in Manokwari Regency, found an MSE of 1491.30 and a MAPE of 0.34%. In the journal, the analysis shows that the price of chicken eggs in Manokwari Regency increased in December 2023. Likewise, the results of this study show that the application of the SARIMA method to forecasting the average price of chicken eggs in Indonesia also increased in December 2025 and December 2026. These results provide an illustration that the SARIMA method is effective in various contexts, both data at the district level and average data at the national level. Residual analysis shows that the residuals are not autocorrelated, as seen in Figure 11 and Figure 12. This indicates that the model has met the assumptions required for forecast validity. Overall, these findings indicate that the application of the SARIMA method is reliable for forecasting the price of broiler chicken eggs, as in the previous research object. Further research can consider other external variables.

CONCLUSION

This study shows that the forecast of chicken egg prices in Indonesia from January 2025 to December 2026 will experience an upward fluctuation. The application of the Seasonal Autoregressive Integrated Moving Average (SARIMA) method is effective in forecasting the price of chicken eggs in Indonesia. For farmers and distributors, the results of this forecast allow them to plan production and price settings, thereby reducing detrimental price fluctuations. For policy makers, these findings support the formulation of policies for price stability and food security. This study adds insight into the literature on commodity price analysis by demonstrating the effectiveness of the SARIMA method and offering a more accurate approach to price forecasting. However, this study has limitations, including unmeasured external factors, such as policy changes, extreme weather conditions, and global market fluctuations that can affect egg prices.

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