

Average Forecasting Analysis of Premium Quality Rice Prices at the Milling Level Using the Moving Average Time Series Method

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Abstract

The aim of this research is to estimate the average price of premium-quality rice at the mill level until August 2025. From October to November 2023, the study in Meulaboh, West Aceh Regency, analyzed the price of premium quality rice at the milling level using BPS secondary data. We employed a quantitative descriptive analysis, leveraging time series analysis to uncover trends and forecast future rice prices. Time series data, which tracks changes over time in variables such as production, prices, and sales, helps identify trends, constants, or seasonal patterns. Since the price of premium rice at the milling level consistently increased from January 2022 to August 2023, we classify this data as trend data. The analysis used the exponential smoothing model and the weighted moving average to calculate the expected future prices. The moving average method, based on the analysis of average data, forecasts the mean squared error (MSE), mean absolute deviation (MAD), mean absolute percent error (MAPE), and mean error of estimation (MFE). The moving average method forecasts the average price of premium quality rice from January 2022 to August 2023. Based on the forecast results, there will be fluctuations in accuracy during this period, with MAPE values ranging from 0.015 to 0.094. The dotted line displays the average price results, while the straight line indicates the actual price. The stars indicate the actual price in the forecast graph, which displays the trend of premium rice prices at the milling level. This final assessment shows how well the forecasting model performs and provides information on the trend of premium rice prices to help with future decision-making.

Keywords: rice price, central statistics agency (bps), forecasting.

INTRODUCTION

Given that food is a necessity for human survival, every nation must be able to maintain its supply. The demand for food will increase as the world's population increases. Rice is one of the staple foods eaten by people all over the world. According to FAO, rice is the staple food of more than half of the world's population, including the Indonesian people. The majority of Indonesians get most of their daily nutrition from processed rice. Rice is a strategic food commodity and a major contributor to the growth of the agricultural industry in Indonesia. The fact that six Asian countries China, India, Bangladesh, Vietnam, and Japan

have 80 percent of the world's rice production and consumption supports this. In fact, rice, as a staple food source, can influence aspects of state policy in the economic, social, political, and environmental fields. Therefore, increasing food security and encouraging national development are highly dependent on maintaining the stability of rice supply and prices (Aulia, 2023).

The Indonesian people consistently consume rice in proportion to their population growth. Although domestic rice production is still not sufficient for national needs, the demand for rice continues to increase. To address this, the government has implemented a rice import policy through the BULOG, which aims to maintain domestic rice supply and price stability. Availability influences rice prices; an increase in demand and a decrease in production lead to a rise in rice imports. The current low rice production stems from the depletion of agricultural land due to its continued use for housing and industry (Aulia, 2022). Inflation and previous rice prices influence rice prices, along with variations in supply and demand, import and production levels, and the prices of other staple foods. Moreover, environmental factors such as weather, pest attacks, and drought can significantly influence rice prices. Cyprianus (2022) estimates that seasonal factors and rice supply at the factory level significantly influence rice prices at the regional level.

The government has instituted a minimum price and floor price policy in an attempt to regulate the market price of rice products. The government sets the maximum price to safeguard the public as consumers from soaring prices during the lean season, while the floor price protects farmers as producers when the price of grain falls (Simbolon, 2021). In this scenario, BULOG procures grain from farmers during the primary harvest season and then resells it to consumers, aiming to optimize the price policy. Therefore, accurate and comprehensive information on rice prices is crucial for the efficiency of the marketing and distribution process (Agustia, 2022). Monitoring and predicting rice commodity prices may be useful for the government to support rice price stability. Several studies have forecast rice prices using various forecasting techniques such as moving average (MA), exponential smoothing, vector autoregressive, K-Nearest Neighbor (KNN), and ARIMA.

This study determines the average price of premium quality rice at the national milling level in 2023. As part of a quantitative research approach, we analyze estimates and build models using the single Moving Average method. We chose this approach because observational findings indicate a tendency or pattern in the research data. The Central Statistics Agency (BPS) provides data used for January 2022 to August 2023. This study aims to provide an overview of future conditions by forecasting the average price of rice (Aulia, 2024). We expect this research to provide farmers with broader knowledge to choose planting and harvesting times. Furthermore, the government expects this study to assist in determining the best actions to maintain rice price stability (Hartini, 2024).

METHOD

Meulaboh, West Aceh Regency, hosted the study from October to November 2023. This study collected data on the price of premium quality rice at the milling level using BPS secondary data. This study used quantitative descriptive analysis, a data analysis method that involves calculations or procedures to characterize a set of data obtained from observations. We used time series analysis as the data analysis method. Time series data can reveal and predict the average price of premium quality rice. Periodic data collection, known as time series, describes changes in production, prices, sales figures, workforce, population, accident frequency, and other variables. A periodic data analysis can reveal the evolution of one or more events and their effects on others. It is crucial to determine whether the data being

analyzed is trend, constant, or seasonal data. Time series calculations use different data models.

This study will use trend data, as the total cost of premium quality rice at the milling level will continue to increase between January 2022 and August 2023. Therefore, we should perform the calculation using the time series method, the exponential smoothing model, and the weighted moving average. If the time at which the value of the variable (event) is recorded is represented by the symbol X_1 , $f(X)$ is the value of the variable Y depending on the time of the event, and the value of the time series variable or the severity of the symptoms of an event is represented by the symbols $Y_1, Y_2, \dots Y_n$.

RESULT AND DISCUSSION

This study utilizes price data for premium quality rice, which is more expensive than other types of rice at the average market price. The selection of premium quality rice aims to obtain a more specific picture of the price dynamics in the premium rice segment in the market. The data analyzed in this study includes the average monthly price of premium quality rice from January 2022 to August 2023. Table 1 presents the average monthly rice price data during the period. This data provides information on premium rice price fluctuations and trends that occur during the study period. With this data, researchers can identify factors that influence price changes and evaluate the stability of premium rice prices over a certain period of time.

Table 1. Rice Milling Costs at Quality Levels

Month	Price
January	9824.23
February	9826.88
March	9786.63
April	9576.75
May	9512.63
June	9497.4
July	9628.57
August	9901.15
September	10252.31
October	10402.23
November	10511.71
December	10954.01
January	11345.1
February	11818.17
March	11681.09
April	11672.19
May	11623.61
June	11525.14
July	11537.44
August	11754.39

Source: BPS Data January 2022-August 2023

Data Processing Results Using POM QM Software with Moving Average Method

Table 2. Forecast Error Measurement

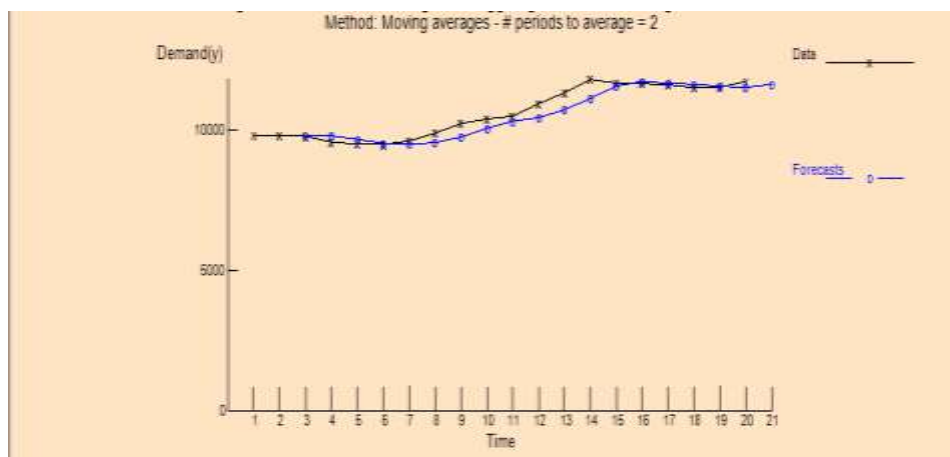
Measure	Value
Incorrect Action	
Bias (Average Error)	154.673
MAD (Mean Absolute Deviation)	240.833
MSE (Mean Squared Error)	97015.11
Standard Error (denom= $n-2=16$)	330.367
MAPE (Mean Absolute Percent Error)	2.237%
Forecast	
Next period	11645.92

This study utilized various metrics to forecast the price of premium quality rice at the milling level and measure forecasting errors. Some of the metrics used include Mean Squared Error (MSE), Mean Absolute Deviation (MAD), Mean Absolute Percent Error (MAPE), and Mean Forecast Error (MFE). We use these metrics to assess the accuracy of our price forecasting. MSE measures the variance of the forecasting error, while MAD calculates the average forecasting error in the same units as the actual data. Additionally, MAPE measures the error level as a percentage of the actual data, offering a comparative overview of the accuracy level. MFE measures the bias or average forecasting error, revealing whether the model tends to over- or under-predict. In this study, the MSE value was 97015.11, MAD was 240.833, MAPE was 2.237%, and MFE was 154.673. These values indicate quite good forecasting performance, with a low percentage error rate. Based on the results of data processing, the average forecast of premium rice prices for the next period is 11,645.92. Decision-makers can use this figure as a reference to understand premium rice price trends and assist in setting relevant policies. We can design strategic steps to maintain rice price stability at the milling level by utilizing these forecasting results.

Table 3. MAPE Value Comparison Data

Period	Year	Month	Forecasting (RP)
1	2022-2023	January	.015
2		February	.022
3		March	.03
4		April	.035
5		May	.041
6		June	.047
7		July	.056
8		August	.065
9		September	.073
10		October	.081
11		November	.089
12		December	.094
13		January	.097
14		February	.094

Based on the data results presented in Table 3, the MAPE value provides a comparison of forecasting errors for the period spanning from January 2022 to February 2023. The metric known as MAPE, or Mean Absolute Percentage Error, gauges the extent of forecasting errors in percentage terms relative to the actual value. The lower the MAPE value, the better the accuracy of the forecasting model used. Therefore, MAPE is an important indicator in evaluating the effectiveness of the price forecasting model. Based on the table, the MAPE value starts at 0.015 in January 2022 and increases gradually until it reaches 0.094 in February 2023. This increase indicates fluctuations in the level of forecasting accuracy during the period. Despite the increase, the MAPE value in February 2023 is still quite low, which means that the forecasting model is still quite accurate in predicting premium rice prices. January 2023 recorded the highest MAPE value, with a figure of 0.097. This value indicates a greater forecasting error compared to other months. However, we can evaluate the accuracy of various forecasting models by comparing MAPE values throughout the analyzed period. It is crucial to select the most suitable model to generate more precise forecasts in the future and to reduce forecasting errors that could influence rice price decisions.

**Figure 1. Price of Premium Quality Rice at the Milling Level**

The above-mentioned graph illustrates the application of the moving average method in forecasting premium rice prices. In this graph, the x-axis (in blue) represents the time period, consisting of 19 periods, while the y-axis (in black) shows the actual demand data recorded in that period. This data illustrates the fluctuations in premium rice prices that occurred during the analyzed period. In the graph, the straight line with stars represents the price of premium rice that occurred during the last two years, providing an overview of the actual price movements. This line helps us see the general trend and fluctuations in rice prices over a longer period of time. On the other hand, a dotted line on the forecasting results graph using the moving average method represents the prediction of premium rice prices based on the moving average. The moving average method calculates the average price of premium rice at the milling stage and displays it as a dotted line, indicating the expected development of prices in the upcoming period. This line offers a clear comparison between the actual and predicted prices, enabling one to assess the accuracy of the method's forecast.

CONCLUSION

We carry out premium rice price forecasting using the moving average method, measuring errors using several metrics such as Mean Squared Error (MSE), Mean Absolute Deviation (MAD), Mean Absolute Percentage Error (MAPE), and Mean Forecast Error (MFE). This analysis is based on average rice price data recorded from January 2022 to August 2023. The forecasting results show fluctuations in model accuracy during the period, with MAPE values varying between 0.015 and 0.094. A lower MAPE value indicates better accuracy, while a higher value indicates a greater error in the forecast. In the forecasting graph, the dotted line depicts the results of the average premium rice price forecast, while the solid line with stars shows the actual price that occurred during the same period. The dotted line provides an overview of the estimated price movement based on the moving average method, while the line with stars depicts the actual fluctuations in premium rice prices, providing a clear sense of the difference between predictions and price reality. The final assessment conducted on this forecasting model aims to evaluate the performance of the model in predicting premium rice prices, as well as providing insight into price trends that can be used for future decision-making. The results of this analysis provide a clearer picture of the stability and accuracy of rice price forecasting at the milling level, which is important for price planning and marketing strategies in the agricultural and rice distribution sectors.

REFERENCES

- Agustia, D., & Aulia, M. R. (2022). ANALISIS TRANSMISI DAN INTEGRASI PASAR BAWANG MERAH ANTARA PUSAT PASAR MEDAN DENGAN PASAR PENGECER BINA USAHA MEULABOH. *Jurnal Bisnis Tani*, 8(1), 38-48.
- Aulia, M. R., Deras, S., & Hutabarat, Y. (2022). Partisipasi Petani Dalam Kegiatan Kelompok Tani dan Kaitannya dengan Produktivitas Padi Sawah di Desa Wonosari Kecamatan Tanjung Morawa Kabupaten Deli Serdang. *Jurnal Agrisep*, 23(2), 13-21.
- Aulia, M. R., Deras, S., Aminah, S., Siregar, M. P. A., & Berutu, P. (2023). Peran Penyuluh Pertanian dalam Kegiatan Kelompok Tani dan Hubungannya dengan Produktivitas Padi Sawah. *Fruitset Sains: Jurnal Pertanian Agroteknologi*, 11(3), 157-164.
- Aulia, M. R., Fitria, D., Ulfa, F., Aristia, F., Susiana, E., Syarbaini, S., & Rakhmat, G. (2024). Peramalan Penjualan Crude Palm Oil (CPO) Di PT. Surya Panen Subur 2 Dengan Metode Time Series. *Jurnal Pertanian Agros*, 26(1), 4378-4392.

- Badan Pusat Statistik (2023). Rata-Rata Harga Beras Bulanan di Tingkat Penggilingan Menurut Kualitas (Rupiah/Kg).
- Hartini, H., Aulia, M. R., & Nasution, A. (2024). Economic Openness: A Key Success or a Threat to Economic Growth in Indonesia for the Period 1988-2022? And How Does It Relate to the Development of Agribusiness? *Mimbar Agribisnis: Jurnal Pemikiran Masyarakat Ilmiah Berwawasan Agribisnis*, 10(2), 1797-1803.
- Listiowarni, I., Puspa Dewi, N., & Hapantenda, A. K. W. (2020). Perbandingan Metode Double Exponential Smoothing dan Double Moving Average Untuk Peramalan Harga Beras Eceran di Kabupaten Pamekasan. *Jurnal Komputer Terapan*, 6(2), 158-169.
- Ramadania, R. (2018). Peramalan Harga Beras Bulanan di Tingkat Penggilingan dengan Metode Weighted Moving Average. *Buletin Ilmiah Math. Stat. Dan Terpaannya (Bimaster)*, 7(4), 329-334.
- Saragi, C. P., Aulia, M. R., & Manihuruk, R. A. (2022). Analisis Pendapatan Usahatani Padi Sawah di Desa Simpang Panei Raya, Kecamatan Panei, Kabupaten Simalungun. *Jurnal Agriust*, 26-31.
- Saragi, C. P., Sitohang, M., & Aulia, M. R. (2023). Feasibility and Swot Analysis of Upland Rice Farming in Cingkes, Simalungun, Indonesia. *International Journal of Engineering Business and Social Science*, 1(06), 544-552.
- Shidiq, B. G. A., Furqon, M. T., & Muflikhah, L. (2022). Prediksi Harga Beras menggunakan Metode Least Square. *Pengembangan Teknologi Informasi Dan Ilmu Komputer*, 6(3), 1149-1154.
- Simbolon, R., Aulia, M. R., & Zebua, A. R. (2021). Analisis Faktor-Faktor Yang Mempengaruhi Harga Jual Gabah Usahatani Padi Sawah di CV. Sidomakmur Desa Saentis Kecamatan Percut Sei Tuan Kabupaten Deli Serdang. *Jurnal Agriust*, 24-32.
- Visakha, M. (2023). Peramalan Harga Beras Menggunakan Metode Hybrid Autoregressive Integrated Moving Average dan Neural Network (Arima-NN). *Jurnal Kajian Dan Terapan Matematika*, 8, 114-128.