

# Rice Price Forecasting Using the Arima Model

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**Abstract—** *In the Philippines, paddy is the primary source of income for Filipino farmers; however, a problem was pointed out along with the rice price. To monitor the price of rice, an autoregressive integrated moving average is employed (ARIMA). In the context of the price of rice for farmers, ARIMA can be applied to analyze historical price data and make predictions about future prices. Consequently, some factors affect the price of rice, and these factors should be identified to be able to develop a reliable forecast of the retail price in Eastern Pangasinan for the next 5 years, from 2024 to 2028. Descriptive statistics were used to analyze the factors that can affect the increase in the price of rice and the factors that greatly affect the increase in the price of rice. As a result, the increase in rice prices was affected by these factors: fertilizer, fuel, machinery, and insects. In 2024, the price of regular well-milled rice per kilogram has increased to 0.46% every month compared to the 2023 forecasted price of regular well-milled rice. Then, the price of regular well-milled rice will increase by 5.68% every year starting in 2025–2028.*

**Indexed Terms—** *Farmers, Filipino, Paddy, Price, Well-Milled Rice*

## I. INTRODUCTION

A tropical crop, rice can be produced in two distinct seasons: the dry and the rainy. It is the food that is most frequently consumed worldwide. A major component of the common diet in East and Southeast Asia is rice. Rice is a staple meal consumed three times a day or more frequently by Filipinos. For Filipino farmers in the Philippines, palay is their main source of revenue. The Philippine Statistics Authority stated that a total of nine (9) million metric tons of palay were harvested between January and June of 2023. The Ilocos Region was one of the top ten regions in the Philippines,

contributing 322,359 metric tons, or 7%, of the nation's total palay production in 2021 (Durrand-Morat, et al., 2023). In our nation, palay production was conducted throughout 4.8 million hectares of land. According to Timmer (2023), there are 87,000 hectares of irrigated rice land in Pangasinan. Wet season planting takes place from April to September, whereas dry season planting occurs from October through March. The tractor is one piece of farm equipment that handles most of the labor in contemporary farming. They also use a local riding-type transplanter and a harvester/reaper. Fuel is essential to transportation. not just in the machinery required for contemporary farming, but also in transportation. It is a material that can be worked with or manufactured to react with other substances to release thermal energy. The primary input for producing rice with a high yield is fertilizer. It's a material, either synthetic or natural, that has the components to improve plant growth and productivity. Three essential plant nutrients are included in the fertilizer that farmers use the most: nitrogen, phosphorus, and potassium (Ibarra, et al., 2023). A person's salary is the amount of money that their employer pays them, particularly if they work in a profession like teaching, law, medical, or government service. People use their salary, or income, to cover their everyday expenses, particularly Filipinos, who eat rice as a staple diet. The Philippines is estimated to have 10 million rice farmers. Every Filipino depends on rice farmers for their crops as stated by Jane-Atilano (2023). Filipino rice producers deal with several challenges, including high prices, a lack of post-harvest infrastructure, market forces, climate change, and land rent. The Federation of Free Farmers (FFF), a farmer's association, issued a warning that the current situation could lead to a similar scarcity and increase in rice prices as the one that occurred in 2018. According to FFF national manager Raul Montemayor, the nation will have an adequate supply

of rice until June 2023. The shortage of staple foods will occur between July and September 2023, when there will be a limited supply of palay.

## II. METHODOLOGY

A descriptive-correlational research design was employed in the study. Through interviews with the respondents, the researcher employed this methodology. In a descriptive-correlational study, the main goal was to characterize the correlations between the variables without attempting to determine a cause-and-effect link. The purpose of this study is to identify a suitable ARIMA model for Pangasinan's Eastern Pangasinan rice price forecast. This approach was used to support the researcher's goal of obtaining data on the subject at hand. The farmers of Pangasinan are the study's target population. The interview is one of the most used methods for gathering data. One qualitative research approach that uses questioning to get data is the interview. The Philippine Statistics Authority (PSA) website provided the time-series data utilized in this analysis of rice prices in the Philippines. Descriptive statistics were used to evaluate the elements that can affect the price of rice as well as the factors that have a significant impact on the price increase to identify the factors that can affect the price increase as well as the factors that have a significant impact. The Statistical Package for Social Science (SPSS), a program for statistical data analysis, was utilized to arrange and examine the data. However, the Expert Modeler exclusively employs the Auto-Regressive Integrated Moving Average (ARIMA) model in this study's statistical analysis to deliver a trustworthy estimate of the retail price in Eastern Pangasinan for the upcoming 2024–2028. An ARIMA model is a univariate model that forecasts or predicts future values of time-series data using historical or past values. Three components make up the time-series data:  $p$ ,  $q$ , and  $d$ . The number of lag observations—also referred to as the lag order—that make up the autoregressive component is represented by the symbol  $p$ . The number of times the raw observations are differenced to achieve stationarity is known as the differencing component or the degree of differencing  $d$ . The outer model is described by the  $q$ , which also indicates the moving average component or order. The price of rice was predicted using time series analysis. One particular method of examining a

set of data points gathered over some time is time series analysis. Instead of only sometimes or arbitrarily capturing data points, time series analyzers record the data points at regular intervals throughout a predetermined period. A succession of measurements taken one after the other at different times is called a time series. Time series can be used to create models that forecast values in the future by using data that has already been observed. A time series consists of a collection of periodic, time-ordered measurements of a quantitative feature of a single or group phenomenon made at successive, usually equally spaced, periods or points in the period.

## III. RESULTS AND DISCUSSION

Fertilizers, fuel, machinery, weather or natural disasters, pests, productivity and cropping, imports from other nations, rice supply stockpiles, rising consumer demand, and rice seeds are some of the variables that contribute to rising rice prices. The fundamental economic concept of supply and demand is a major factor in rice pricing. Prices typically increase when there is a demand for rice and a supply shortage, and vice versa (Balilla, et al., n.d.). The dynamics of import/export and population growth can all affect the supply and demand balance. Rice cultivation is heavily dependent on weather conditions. Typhoons, floods, and droughts are a few examples of natural calamities that can significantly affect rice output. Unfavorable weather patterns have the potential to reduce yields, which might diminish the supply overall and raise costs. Moreover, the market value and manufacturing costs of various rice types may differ. Furthermore, the market price of rice can be influenced by several aspects related to its quality, such as processing and milling. According to Bin Rahman (2023), prices are also impacted by the degree of rivalry between rice growers, wholesalers, and retailers in the market while less competition may result in higher costs, more competition may lead to lower costs.

Table I. Forecasted Price of Regular Well-Milled Rice, 1kg for the year 2024

Month	2023	2024	INCREASE	Increase in Percentage (%)
January	36.29	49.11	12.82	35.31
February	37.93	49.33	11.40	30.06
March	37.76	49.56	11.80	31.25
April	38.38	49.79	11.41	29.72
May	38.87	50.02	11.15	28.68
June	39.23	50.25	11.02	28.09
July	40.95	50.48	9.53	23.27
August	43.40	50.71	7.31	16.85
September	46.22	50.95	4.73	10.23
October	46.47	51.18	4.71	10.14
November	43.77	51.42	7.65	17.47
December	43.15	51.66	8.51	19.71

According to the above table, the price of a kilogram of normal well-milled rice in January 2024 is 49.11 pesos, up from 39.26 pesos in January 2023. This indicates a PHP increase in the price of regular well-milled rice. 12.82 percent, or 35.31 percent. Additionally, it demonstrates that prices would rise by 0.46% every month in 2024.

Table 2. Forecasted Price of Regular Well-Milled Rice, 1kg. from the year 2025-2028

Month	Year					Increase by Percentage
	2024	2025	2026	2027	2028	
January	49.11	51.89	54.84	57.95	61.24	5.68
February	49.33	52.13	55.09	58.22	61.53	5.68
March	49.56	52.37	55.35	58.49	61.81	5.68

April	49.79	52.62	55.60	58.76	62.10	5.68
May	50.02	52.86	55.86	59.03	62.38	5.68
June	50.25	53.10	56.12	59.30	62.67	5.68
July	50.48	53.35	56.38	59.58	62.96	5.68
August	50.71	53.59	56.64	59.85	63.25	5.68
September	50.95	53.84	56.90	60.13	63.54	5.68
October	51.18	54.09	57.16	60.40	63.83	5.68
November	51.42	54.34	57.42	60.68	64.13	5.68
December	51.66	54.59	57.69	60.96	64.42	5.68

Compared to the above table, the cost of normal, well-milled rice will rise by 5.68% annually beginning in 2025 and continuing through 2028. According to the study of Parreño (2023), an increase in the rice price could be affected by the weather's drastic change. Storms, droughts, and floods are a few examples of natural catastrophes that can affect rice production and affect supply and pricing. The distribution of rice can be impacted by supply chain disruptions, such as problems with logistics and transportation, which can raise prices. Higher pricing may result from an increase in demand for rice, either domestically or internationally, without a matching increase in supply.

Table 3. Forecasted Price of Regular Milled Rice, 1kg for the year 2024

Month	Year		Increase	Increase by %	Increase in % per Month
	2023	2024			
January	31.66	46.52	14.86	46.94	
February	32.77	46.79	14.02	42.79	0.58
March	33.54	47.07	13.53	40.33	0.58

April	33.98	47.34	13.36	39.32	0.58
May	34.10	47.62	13.52	39.64	0.58
June	34.32	47.89	13.57	39.55	0.58
July	34.54	48.17	13.63	39.47	0.58
August	36.20	48.46	12.26	33.86	0.58
September	39.53	48.74	9.21	23.30	0.58
October	39.42	49.02	9.60	24.36	0.58
November	38.19	49.31	11.12	29.12	0.58
December	37.20	49.60	12.40	33.33	0.58

There is a Php rise in the above table. By January 2024, the price of normal milled rice will increase by 14.52, or 46.94%. Additionally, it indicates that monthly rice consumption would rise by 0.58% in 2024.

Table 4. Forecasted Price of Regular Milled Rice, 1kg for the year 2025-2028.

Month	Year					Increase by % by year
	2024	2025	2026	2027	2028	
January	46.52	49.89	53.50	57.37	61.52	7.24
February	46.79	50.18	53.81	57.71	61.88	7.24
March	47.07	50.47	54.13	58.04	62.24	7.24
April	47.34	50.77	54.44	58.38	62.61	7.24
May	47.62	51.06	54.76	58.72	62.97	7.24
June	47.89	51.36	55.08	59.07	63.34	7.24
July	48.17	51.66	55.40	59.41	63.71	7.24
August	48.46	51.96	55.72	59.76	64.08	7.24
September	48.74	52.27	56.05	60.11	64.46	7.24
October	49.02	52.57	56.38	60.46	64.83	7.24
November	49.31	52.88	56.71	60.81	65.21	7.24
December	49.60	53.19	57.04	61.17	65.59	7.24

The price of normal milled rice per kilogram will rise by 7.24% year beginning in 2025–2028, according to the table.

Table 5. Forecasted Price of Special Rice, 1kg for the year 2024

Month	Year		Increase	Increase by %	Increase in % per Month
	2023	2024			
January	49.70	55.72	6.02	12.12	
February	49.82	55.81	5.99	12.02	0.15
March	51.09	55.89	4.80	9.40	0.15
April	51.22	55.97	4.75	9.28	0.15
May	51.47	56.06	4.59	8.91	0.15
June	51.47	56.14	4.67	9.08	0.15
July	50.58	56.23	5.65	11.16	0.15
August	50.83	56.31	5.48	10.78	0.15
September	54.13	56.39	2.26	4.18	0.15
October	54.13	56.48	2.35	4.34	0.15
November	54.13	56.56	2.43	4.49	0.15
December	52.99	56.64	3.65	6.90	0.15

As shown in Table 5, there is an increase of Php. 6.02 or 12.12% from the month of January 2024 and 0.15 % increase in the succeeding month of the year 2024 in the price of special milled rice per kilogram. As stated by Alcuitas and Petralba (2023), the whole cost of production and delivery can be impacted by economic factors like inflation, which might affect rice prices. Commodity market speculation has the potential to increase price volatility and cause abrupt price increases. The cost of production and distribution can be affected by changes in government policy pertaining to trade agreements, tariffs, and subsidies, which can affect rice prices.

Table 6. Forecasted Price of Special Rice, 1kg for the year 2025-2028

Month	Year					Increase by % by year				
	2024	2025	2026	2027	2028	2024	2025	2026	2027	2028
January	55.72	56.73	57.73	58.74	59.74	1.80	1.77	1.74	1.71	1.68
February	55.81	56.81	57.82	58.82	59.82	1.80	1.77	1.74	1.71	1.68
March	55.89	56.89	57.90	58.90	59.91	1.80	1.77	1.74	1.71	1.68
April	55.97	56.98	57.98	58.99	59.99	1.80	1.77	1.74	1.71	1.68
May	56.06	57.06	58.07	59.07	60.07	1.80	1.77	1.74	1.71	1.68
June	56.14	57.15	58.15	59.16	60.16	1.80	1.77	1.74	1.71	1.68
July	56.23	57.23	58.24	59.24	60.24	1.80	1.77	1.74	1.71	1.68
August	56.31	57.32	58.32	59.33	60.33	1.80	1.77	1.74	1.71	1.68
September	56.39	57.40	58.40	59.41	60.41	1.80	1.77	1.74	1.71	1.68
October	56.48	57.48	58.49	59.49	60.49	1.80	1.77	1.74	1.71	1.68
November	56.56	57.57	58.57	59.58	60.58	1.80	1.77	1.74	1.71	1.68
December	56.64	57.65	58.65	59.66	60.66	1.80	1.77	1.74	1.71	1.68

The price of special milled rice is expected to rise by 1.80% in 2025, 1.77% in 2026, 1.74% in 2027, and 1.71% in 2028, according to Table 6. For the

Statement of Problem 3, based on the projected price of rice, we observe that the price of regular well-milled rice increases by 35.31% for every 2% increase in consumer salaries annually, and by 5.68% for the years 2025–2028. This means that the price of rice is nearly three times higher than the annual increase in consumer salaries. In 2024, the price of normal milled rice increased by 46.94%, and in 2025–2028, it increased by four times the consumer salary growth. Additionally, there will be a 12.12% increase in price for special rice in 2024. However, we note that consumer wage increases are higher by 0.20% compared to price increases for 2025–2028.

#### IV. CONCLUSIONS AND RECOMMENDATIONS

Determined by research on the following variables: weather, planting period, pests and insects, machinery, fuel, fertilizer, imports from other countries, low supply and stock, and rising rice consumption. The respondents claimed that gasoline, machinery, pests and insects, fertilizer, and fuel all had a significant impact on the rise in rice costs. The ordinary well-milled rice will rise by 5.68%, the regular milled rice by 7.28%, and the special rice by 1.80% to 1.68% between 2025 and 2028, according to the results of the projected rice price. The researchers strongly advise utilizing a different statistical tool that makes use of time series analysis and comparing the ARIMA model anticipated price of rice in Pangasinan with that of Expert Modeler.

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