Analysis of Rice Demand in Klaten Regency

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Abstract

This study aims to analyze the influence of rice prices, population size, and income on rice demand, as well as to determine the elasticity of rice demand in Klaten Regency. A descriptive analysis method was employed using secondary time series data over a period of 10 years (2013-2022), which included rice demand and population data. The data analysis model applied was multiple linear regression and classical assumption tests. Hypotheses were tested using t-tests, F-tests, and R squared tests. The results indicate that: 1) Rice prices have a negative influence on rice demand; 2) Population size has a positive influence on rice demand, 3) Per capita income positively influences rice demand, and 4) Rice demand is inelastic, as the price elasticity coefficient suggests that changes in rice demand are smaller than changes in rice prices. Income elasticity indicates that rice demand increases significantly with higher income levels.

Keywords: demand, elasticity, income, population size, price, rice

Introduction

Rice is the staple food for the people of Indonesia, yet domestic rice production has consistently fallen short of meeting the country's demand. Consequently, the government has been compelled to import rice from abroad. As a critical food crop, rice plays an irreplaceable role within Indonesia's agricultural sector, contributing directly to food security, which is closely linked to political and economic stability. Achieving food security is most efficiently realized through food self-sufficiency, which requires a concerted effort to increase national production.

Advancements in the agricultural sub-sector, particularly in food crops, are expected to enhance both productivity and farmer welfare, as reflected in increased income and production efficiency. However, Indonesian farming still faces significant challenges, particularly in farm management. Small-scale farming operations often neglect key management aspects such as proper bookkeeping, market orientation, and planting schedule optimization, all of which are critical to meeting market demand effectively.

Indonesia's population continues to grow steadily. According to the latest data from the Central Bureau of Statistics, the population reached 278.69 million in mid-2023, a 1.05% increase from the previous year. This growing population drives increased demand for goods and services, including the daily requirement for staple foods like rice. Therefore, rising population numbers necessitate a corresponding rise in production to ensure food supply sufficiency.

In Klaten Regency, rice remains a prominent agricultural commodity, with the majority of the area's farmland dedicated to rice cultivation. Data from the Klaten Regency Central Bureau of Statistics (2023) illustrates the fluctuation in rice production. The highest production was recorded in 2016, with 425,916 tons produced from 73,604 hectares of harvested area. Production declined in

subsequent years, notably in 2017, where it fell to 380,268 tons due to the El Niño phenomenon, which caused drought conditions across much of Indonesia.

The conversion rate from paddy to rice is approximately 62.74%, and rice consumption per capita is 83.93 kg per year (BPS). Fluctuations in rice production and availability have prompted an analysis of the factors driving rice demand in Klaten Regency. Over the past decade, rice production in Klaten Regency has shown a fluctuating but generally increasing trend, while rice demand has steadily risen. Factors influencing rice demand include rice prices, income, substitute and complementary goods, population distribution, future expectations, and population growth. However, variables like consumer preferences and future expectations are difficult to quantify, so this study focuses on the analysis of rice prices, income, and population size

Given these considerations, rice price stability is a key economic indicator at both regional and national levels. Rising rice prices are influenced by the interplay of supply and demand, and the ability to purchase rice depends on per capita income. Additionally, the growing population drives higher demand for rice. Understanding these dynamics is critical for developing effective policies to stabilize rice prices and ensure food security in Klaten Regency.

This study seeks to investigate the factors influencing rice demand in Klaten Regency, focusing on the relationship between rice prices, population size, and income. Given the growing population and fluctuating rice production, understanding how these variables affect rice demand is crucial for ensuring food security and price stability in the region. Additionally, the study aims to explore the elasticity of rice demand, which will provide insights into how sensitive rice consumption is to changes in price and income. By analyzing these dynamics, the research aims to contribute to the development of effective policies to stabilize rice demand and support sustainable agricultural practices in Klaten Regency.

Method

This study employs a descriptive analytical method to examine rice demand in Klaten Regency from 2013 to 2022. Descriptive analysis involves summarizing large volumes of raw data to facilitate interpretation, while separating relevant components for easier data management (Kuncuro, 2009). The research site, Klaten Regency, was selected purposively, as the researcher resides in the area and population growth has led to increased rice demand. Data was collected between January and February 2024.

Data Collection

This study relies on secondary data obtained from relevant institutions, including the Central Bureau of Statistics (BPS), the Food Security and Agriculture Office of Klaten, BULOG, and the Klaten Regional Library. The data spans a 10-year period from 2013 to 2022 and includes information on rice demand, population growth, rice prices, and per capita income.

Data Sources and Variables

The research uses secondary data from official sources such as BPS, BULOG, and the Food Security and Agriculture Office of Klaten. Key variables include rice demand (measured in kilograms per year), rice prices (in Rp/Kg), population (in number of people), and per capita income (in Rp per person per year). The data will be analyzed using multiple linear regression, with demand elasticity calculated to determine how rice demand responds to changes in prices and other factors.

Data Analysis

The data will be analyzed using a multiple linear regression model transformed into a logarithmic form.

$$\text{Ln Qd} = \text{Ln } b_0 + b_1 \text{ Ln } X_1 + b_2 \text{ Ln } X_2 + b_3 \text{ Ln } X_3 + e$$

Information :

Qd = rice demand (kg/year)

b_0 = constant
X_1 = rice price (IDR/kg)
X_2 = population (person)
X_3 = per capita income (IDR)
b_1-b_3 = coefficient regression
e = error

This method allows the study to estimate the relationship between rice demand and influencing factors. Classic assumption tests, including normality, heteroskedasticity, multicollinearity, and autocorrelation tests, will be applied to ensure model accuracy. A good regression model is one that has a normal or close to normal data distribution (Ghozali, 2019). The Heteroscedasticity Test aims to test whether in the regression model there is an inequality of variance from the residuals of one observation to another. The multicollinearity test aims to test whether in the regression model a correlation is found between the independent variables. A good model should have no correlation between independent variables and not be orthogonal or the correlation value between independent variables is equal to zero. The autocorrelation test aims to test whether in linear regression there is a correlation between residual errors in period t and errors in period t-1 (previous). The study will also calculate the demand elasticity for rice to assess the responsiveness of rice demand to price changes. The partial regression coefficient value of each variable describes the percentage change in the quantity of goods demanded by the factors, which is called the elasticity value. Therefore, the regression coefficient values of the variables in question are elasticity values.

Result and Discussion
This section provides a concise analysis of the results and interprets their implications for the study.
1. Classical Assumption Tests
   The classical assumption tests confirmed the reliability of the regression model used in this study
   a. Normality Test
      The One-Sample Kolmogorov-Smirnov test shows that the residuals of the regression model are normally distributed, with a p-value of 0.200, which is greater than 0.05. Therefore, the assumption of normality is satisfied.
   b. Heteroscedasticity Test
      The scatter plot between the predicted dependent variable (zPRED) and residuals (sRESID) did not show any specific pattern, indicating that there is no heteroscedasticity present in the model.
   c. Autocorrelation Test
      Using the Durbin-Watson test, the autocorrelation test result was 2.190, which falls between the acceptable range of 1.5 to 2.5. This indicates that there is no autocorrelation in the regression model.

   d. Multicollinearity Test
      Multicollinearity was tested using the Variance Inflation Factor (VIF) and tolerance values. All VIF values were below 10, and tolerance values were close to 1, suggesting that multicollinearity is not a concern in this model.
2. Regression Analysis and Interpretation

Multiple regression analysis was conducted to determine the effect of the independent variables (rice price, population, and income per capita) on rice demand. Table 1 shows the result of the multiple regression analysis.

Table 1. The Result of Regression Analysis

	Unstandardized Coefficient B	Std. Error	Beta	t	Sig.
Constant	42.181	7.295		5.782	0.002
X1	-0.648	0.223	-0.579	-2.910	0.006
X2	1.920	0.359	0.960	5.347	0.003
X3	1.146	0.225	1.419	5.087	0.004

Source: Data Analysis, 2024

The rice price variable has a negative effect on the rice demand variable, meaning that the higher the rice variable and price, the higher the rice demand variable low. The results of the analysis on Table 1, show that the population and income variables have a positive effect on the rice demand variable, meaning that the higher the population and income variables, the higher the rice demand variable. The income variable has a greater influence on rice demand than the GRDP variable because the b coefficient value (1.419) is greater than the b coefficient of the other variables.

The regression model was found to be:

$$\text{Ln Qd} = 42.181 - 0.648 \ln X_1 + 1.920 \ln X_2 + 1.146 \ln X_3$$

Information :
Qd = rice demand
X1 = rice price (IDR/kg)
X2 = population (person)
X3 = per capita income (IDR)

The negative coefficient for rice price (-0.648) indicates that higher rice prices lead to lower rice demand, confirming the inverse relationship between price and demand, consistent with the law of demand. Conversely, both population and income positively influence rice demand, as indicated by their positive coefficients (1.920 for population and 1.146 for income).

a. Coefficient of Determination (R^2)

The model's adjusted R^2 value of 0.869 indicates that 86.9% of the variation in rice demand is explained by the independent variables: rice price, population, and income. The remaining 13.1% is attributed to other factors outside the model.

b. F-Test (ANOVA)

The F-test results showed a p-value of 0.000, which is less than 0.05, indicating that rice price, population, and income, together, significantly influence rice demand.

c. t-Test (Partial Test)

Each independent variable also showed a significant effect on rice demand when analyzed individually (partial t-test). Rice price negatively impacts rice demand (p-value =

0.006), while population (p-value = 0.003) and income (p-value = 0.004) positively influence rice demand.

From the Table 1, can be seen that the influence of the rice price variable on rice demand is shown by a regression coefficient of -0.579 with a calculated t value of -2.910 > t table (df = 6; α 5%) 1.874 and a p-value of 0.006 which is greater than p -value 0.05. then h0 is rejected, this shows that there is a very real influence between the rice price variable on the rice demand variable with the ceteries paribus assumption, other factors besides the price of rice are considered fixed.

The influence of the population variable on rice demand is shown by a regression coefficient of 0.960 with a calculated t value of 5.347 > t table (df = 6; α 5%) 1.874 and a p-value of 0.003 which is smaller than the p-value of 0.05. then h0 is rejected, this shows that there is a very real influence between the population variable on the rice demand variable with the ceteris paribus assumption, factors other than population are considered fixed.

The variable per capita income on rice demand is shown by a regression coefficient of 1,419 with a calculated t value of 5,087> t table (df = 6; α 5%) 1,874 and a p-value of 0.004 which is smaller than the p-value of 0.05. then h0 is rejected, this shows that there is a very real influence between the per capita income variable on the rice demand variable with the ceteris paribus assumption, other factors besides per capita income are considered fixed.

3. Elasticity of Rice Demand

The elasticity analysis reveals that rice demand in Klaten responds to changes in both price and income, show in Table 2.

Table 2. Elasticity of Rice Demand

Variabel	Elasticity	
	Price	Income
Rice price	-0.579	
Per capita income		1.419

Source: Data Analysis, 2024

Price Elasticity (Ep): The price elasticity of -0.579 indicates that rice demand is inelastic, meaning that a 1% increase in rice price results in a 0.579% decrease in rice demand. This shows that rice is a necessity, with demand not significantly affected by price changes. Income Elasticity (EI): The income elasticity of 1.419 indicates that a 1% increase in income leads to a 1.419% increase in rice demand. This high sensitivity to income changes highlights the importance of income growth in increasing rice consumption.

4. Integrated Discussion

The findings of this study are consistent with economic theories on demand. The inverse relationship between rice price and demand confirms the law of demand, where an increase in price results in a decrease in quantity demanded. This relationship holds true in Klaten, as rice is a staple food with inelastic demand, meaning that even when prices rise, the reduction in demand is relatively small due to its necessity.

The research results show that the rice price variable has a negative and real effect on rice demand. This is because the relationship between the goods demanded and the price of the goods is also called an inverse relationship, namely when the price increases or rises, the quantity of

goods demanded will decrease and conversely, if the price falls, the quantity of goods demanded will increase. In economic theory, it is assumed that the demand for a commodity is mainly influenced by the price of the commodity itself, assuming that other factors do not change or ceteris paribus (Sugiarto et al., 2002).

Population has a positive and real effect on rice demand. The increasing population will cause the need for rice to also increase. This causes the demand for rice in Klaten Regency to also increase. According to Rahardja (2004) as the staple food of the Indonesian people, demand for rice is positively related to population. The greater the population, the greater the demand for rice.

Per capita income has a positive and very real effect on rice demand. This is because the price of rice tends to rise in Klaten Regency so that many poor people cannot afford it and this causes demand for rice to decrease. According to Rahardja (2004) if income distribution is poor, it means that purchasing power in general is weakening, so that demand for an item decreases. The distribution of people's income also determines the level of demand for goods. High people's income is able to encourage people to fulfill their desires, with high income they are able to fulfill people's desires to buy these goods so that demand for these goods increases because people's purchasing power and income increase.

However, when per capita income increases, people's purchasing power will increase and they will be able to buy rice so that demand for rice will also increase. Similarly, the positive influence of population and income on rice demand reflects the fact that as the population grows, so does the need for essential goods like rice. The significant positive impact of income indicates that higher earnings boost purchasing power, allowing households to buy more rice, thereby increasing overall demand. The elasticity analysis supports these findings. Rice demand is inelastic with respect to price, confirming its status as a staple good with limited substitutes. The high income elasticity suggests that as economic conditions improve and incomes rise, rice consumption will also increase, underlining the importance of income growth for ensuring food security.

Conclusion

In conclusion, the study confirms that rice demand in Klaten is significantly affected by price, population, and income. Policymakers should focus on stabilizing rice prices and promoting income growth to maintain stable and sufficient rice demand for the region. Understanding the dynamics of price and income elasticity can also assist in making informed decisions regarding market interventions and supply chain management. Based on the data analysis, it can be concluded that there is a negative relationship between rice prices and rice demand, meaning that as rice prices rise, the demand for rice decreases. Conversely, there is a positive relationship between population growth and rice demand, indicating that an increase in population leads to higher demand for rice. Additionally, a positive correlation was found between per capita income and rice demand, showing that as per capita income increases, the demand for rice also rises. The price elasticity of rice was found to be negative, with a value of -0.579, indicating that rice demand is inelastic. On the other hand, the income elasticity of rice was positive, with a value of 1.419, suggesting that higher per capita income results in a significant increase in rice demand.

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