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Chicken Egg Demand in Riau Province, Indonesia

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Abstract. This study analyzes the dominant factors influencing egg demand and the price response to egg demand in Riau. The research method used is the literature review method. The data used is secondary data, specifically time series data from 1999 to 2014. The data was collected from the BPS and BKP of Riau Province. The data analysis employed is econometric analysis using a single equation model with the Ordinary Least Squares (OLS) estimation method. The study results indicate that: (1) the price of eggs and household income significantly and negatively affect egg demand at confidence levels of 5% and 10%, respectively. Last year's wheat flour price significantly and positively affected egg demand at a 5% confidence level. Beef prices, rice prices, and population size do not substantially affect egg demand; (2) egg prices and wheat flour prices are responsive to egg demand. This means that changes in egg prices and wheat flour prices significantly impact changes in egg demand. In contrast, household income is not responsive to egg demand. This means that changes in household income have a small impact on changes in egg demand.

1. Introduction

Eggs are a food commodity high in protein and easily accessible to the public. This is because eggs are widely sold and distributed throughout Riau Province and Indonesia. Additionally, eggs are relatively inexpensive compared to chicken or beef, which contain the same amount of protein.

In household food consumption, eggs are a primary necessity after rice. Eggs are a popular source of animal protein due to their delicious taste and affordable price. Eggs also contain essential minerals the body requires, such as potassium, magnesium, calcium, phosphorus, zinc, iron, and vitamins. By consuming eggs, the public fulfills their animal protein needs, contributing to the nutritional requirements of household members. Chicken eggs are a practical food choice for households, allowing for easy meal preparation in various forms of presentation. [I]. The public is becoming increasingly aware of the importance of nutritional intake, including through eggs, which has led to a tendency for increased egg demand by households. The development of egg demand in Riau Province is presented in Figure 1.

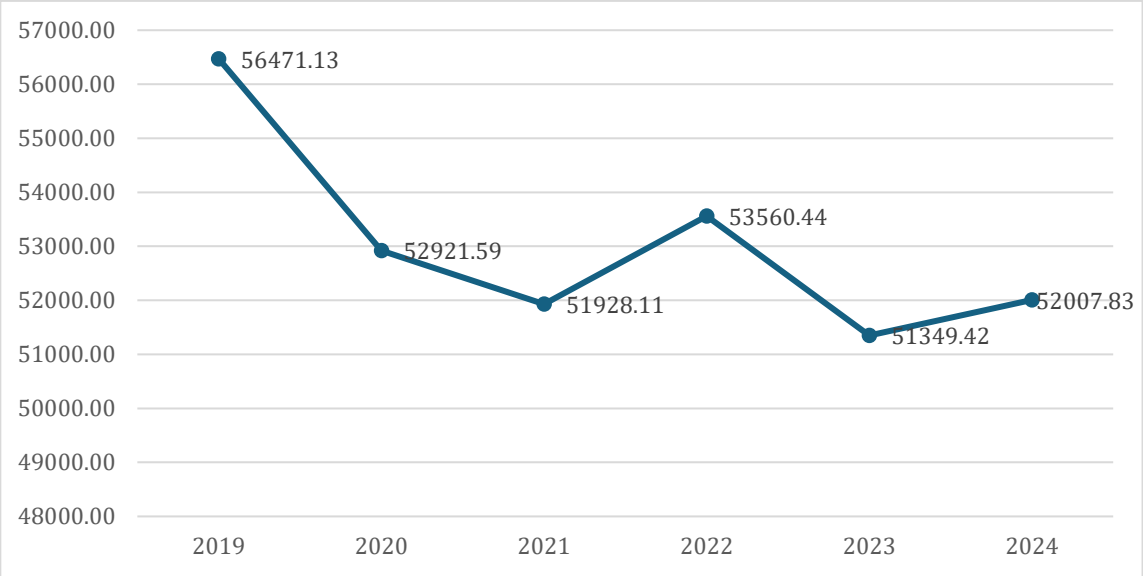

Figure 1. Development of Egg Demand in Riau from 2019 to 2025 (Kg/Capita/Year)

Figure 1 shows that the development of egg demand in the Riau community tends to decline from 2019 to 2024. The average decrease in egg consumption in the year was 1.92%. The decline in egg demand is due to egg prices that tend to increase. The increase in egg prices causes people's purchasing power to decrease, so that people reduce egg consumption and make other more affordable consumption alternatives.

The fulfillment of egg consumption must certainly be balanced with egg production. Egg production in Riau has decreased almost every year. The development of egg production and demand over the past five years is presented in Table 1.

Table 1. Egg Production and Demand in Riau Province in 2019-2020

Year	Production (Tons)	Demand (Tons)	Difference (Tons)	Information
2019	12224.04	56471.13	-44247.09	Defisit
2020	7000.82	52921.59	-45920.77	Defisit
2021	4132.63	51928.11	-47795.48	Defisit
2022	6077.41	53560.44	-47483.03	Defisit
2023	3306.55	51349.42	-48042.86	Defisit
2024	3337.73	52007.83	-48670.10	Defisit

Table 1 shows that egg production tends to increase in 2022-2023 with a growth of 0.94%. Egg demand has decreased yearly, with an average growth of 1.92 percent. Although the demand for eggs has reduced, production is insufficient, so there is an egg deficit yearly. The egg deficit averages 9.78 percent per year. This egg deficit will cause an economic imbalance in the market, namely, a market imbalance, as demand is higher than the supply of eggs.

This market imbalance will drive up egg prices. The increase in egg prices will cause the Riau people's egg consumption to decrease. Reduced egg consumption in households will cause low protein intake, so the community's nutrition will be low. The low nutrition of the people of Riau causes low community productivity, so Riau's human resources will also be low in the long term.

In theory, the concept of egg demand is the same as the concept of demand for an item. The demand for a good is determined by its price, the price of other goods, community income, the population, people's tastes and expectations of the goods ([2] and [3] Sugiarto dkk, 2007; Pindyck and Rubinfeld,2013). Some of the results of research on egg demand analysis show that egg prices determine egg demand, the cost of other egg-related goods, whether substitution or complementary, community income, and population ([4], [5], [6], and [7]).

Based on the above thoughts, I am very interested in examining what factors affect the demand for eggs and how to respond to the demand for eggs in Riau. Based on this, this study aims to analyze the dominant factors that affect the demand for chicken eggs and the response of these factors to the demand for chicken eggs in Riau Province.

2. Research Methods

This research is a literature review because the data or materials needed to complete the research come from libraries, books, published documents, journals, and other sources. The data used are secondary data and time series data from 1999 to 2024, Riau Province, which includes egg production, consumption, demand, population, GDP of Riau Province, egg prices, chicken prices, beef prices, and rice prices. Data was collected from the National Resilience Agency, the Agricultural Information Data Center of the Ministry of Agriculture, the Riau Central Statistics Agency, journals, and books/documents.

The data analysis used was econometric analysis with multiple linear regression. To answer the goal, specifications for the egg demand model must be made. The egg demand model in Riau is built on theory and previous research. The model of egg demand in Riau can be stated as follows:

$$QTt = \beta_0 + \beta_1 HTRt + \beta_2 HDAt + \beta_3 HDSt + \beta_4 HBSt + \beta_5 IPt + \beta_6 PDKt + \beta_7 Lag\ Demand + \varepsilon \ldots (1)$$

dimana:

QTt = Egg demand (tons)
HTRt = Egg Price (Rp/Item)
HADt = Chicken meat price (Rp/ kg)
HTGt = Beef price (Rp/kg)
HBSt = Rice price (Rp/ kg)
IPt = Income (Rp/yr)
PDK = Total population (Population/yrs)
LD = Lag in egg demand (tons)
Expected expected parameters: $\beta_0, \beta_2, \beta_5, \beta_6 > 0$ dan $\beta_1, \beta_3, \beta_4 < 0$, and $0<\beta_7<1$

Based on equation (1), the values of β0 to β7 are estimated to answer the research objectives. The estimation method used is Ordinary Least Squares (OLS) with the help of the SPSS Version 27 program.

The study also analyzed the response of independent variables to egg demand. Elastic analysis was used to answer the variable response. The calculated elasticity is the demand or price elasticity, cross-elasticity, and income elasticity. The elasticity formula used is:

$\varepsilon p = \partial QT/\partial HTR * HTR/QT = \beta_1 * HTR/QT$ ..... (2)
$\varepsilon C_{HDA} = \partial QT/\partial HDA * HDA/QT = \beta_3 * HDA/QT$ ..... (3)
$\varepsilon IP = \partial QT/\partial IP * IP/QT = \beta_5 * IP/QT$ ..... (4)
$\varepsilon PDK = \partial QT/\partial PDK * PDK/Qt = \beta_5 * PDRB/QT$ ..... (4)

Where:

εp = Demand elasticity
εC_{HDS} = Cross-elasticity of beef prices
εC_{HTG} = Cross-elasticity of wheat flour price
εC_{HB} = Cross-elasticity of rice prices
εI = Income elasticity
εPDK = Population elasticity
$\beta_1 - \beta_5$ = Parameters of Independent Variables

To provide econometrically valid results, it is necessary to test several classical assumptions, including the approach to normality, multicollinearity, and heteroscedasticity of the equation. Normality detection using the Shapiro-Wilk test. Multicollinearity detection using Variance Inflating Factor (VIF) and heteroscedasticity detection using White's test [8] and [9].

3. Results and Discussion

3.1. Descriptive Independent Variables Affect Demand for Chicken Eggs in Riau Province

The development of variables that affect egg demand provides an overview of the factors influencing egg demand in Riau Province. These variables are egg prices, chicken meat prices, beef prices, rice prices, gross regional domestic product (GDP), and the population of Riau Province. Descriptions of these variables are presented in Table 2.

Table 2. Descriptive Variables Affecting Egg Demand in Riau Province

Variable Name	Growth (%)	Maximum Value	Minimum Value	Average
Egg Price	18,51	1221,00	135.25	624.53
Chicken meat price	7.23	29841.00	11058.00	18946.67
Beef price	9.59	107544.00	28500.00	58067.00
Rice price	11.15	10552.00	2356.80	5884.14
Income	23.89	436989740.46	18674680.74	16.2087.766.14
Total population	3.59	6188442.00	3655616.00	4919655.38

The development shows an increasing tendency. Table 2 shows that the average growth rate of egg, chicken, beef, and rice prices from 1999 to 2024 has increased. The price growth rate from the highest to the lowest is the price of eggs, rice, beef, and chicken. The high growth rate of egg prices can reach a maximum price of IDR 1221.00/grain and a minimum price of IDR 13525.00/item. The highest price of rice is Rp 10552.00/Kg, and the lowest is Rp 2356.80/kg. Likewise, the highest price of beef reaches Rp 107544/kilogram and the lowest price is Rp 28500/Kg, while the highest price of chicken meat is Rp 29841.00/Kg and the lowest price is Rp 11058.00/Kg.

In addition to the price of eggs, chicken, beef, and rice, other variables affect the demand for eggs, namely, the variables of community income and population. The income variable of the people of Riau Province is proxied by the GDP value. The value of Riau's GDP shows an increasing trend with an average annual growth of 23.89 percent. Riau residents increase with an average growth rate of 3.59 people. Of all the variables that affect egg demand, the trend is rising.

3.2. Dominant Factors Affecting Egg Demand in Riau Province

The dominant factors that affect egg demand in Riau Province are manifested in the egg demand model in Riau and in making a model of egg demand in Riau, based on the concept and theory of demand for a commodity and previous research. The results of the estimation of the egg demand model in Riau Province show the influence of free variables on egg demand. The results of estimating the egg demand model in Riau are shown in Table 3.

Table 3. Estimated Results of the Egg Demand Model in Riau Province in 2024

Variabel	Parameter Estimasi	T Value	Pr > |t|	Elasticity
Intercept	80336.56	-3.155	0.006	-
Egg Price	-309.89	-1.929	0.071**	-0.05
Chicken meat price	-192.58	-0.80	0.434	-
Beef price	-0.55	-1.184	0.253	-
Rice price	122.05	0.784	0.444	-
Income	0.09	2.699	0.015*	11.54
Total population	0.03	4.136	0.001*	1,906.23
Lag in egg demand (LD)	-0.31	-1.391	0.182	-
R^2 = 91,56 % F value = 14,46	Prob. F = 0,0007		DW = 1,926	

Information: * significant at the 5% level
** significant at the 10% level

Table 2 shows that the price of eggs, income, and the number of people are significant to the demand for chicken eggs at the confidence level of 10% and 5%, respectively. The price of chicken eggs hurts the demand for chicken eggs. Meanwhile, income and population positively

affect the demand for chicken eggs. This is by demand theory, which states that the price of goods themselves, income, and population affect the demand for goods and services ([2], [3], [10]).

The variables of chicken meat prices, beef prices, and rice prices, as well as the lag in chicken egg demand, did not significantly affect the demand for chicken eggs at a confidence level of 95% or 90% (Table 2). This is because the prices of chicken, beef, and rice have a low variation in the demand for chicken eggs. Demand theory of goods and services ([2], [3], [10]) states that the variable affects the demand for goods. However, some studies, such as research [11] and [12], show these variables are insignificant.

The results of the static test F showed that the price of chicken eggs, the price of chicken meat, the price of beef, the price of rice, income and the number of population together significantly affected the demand for chicken eggs at a confidence level of 1% or indigo probability F greater than α=5% (0.001>0.05). This means that the demand model for chicken eggs is statistically good.

The model suitability test shows whether a model is good, statistically or econometrically. The model criteria are good or not, as measured by the determination coefficient (R2) value. A high R2 value indicates that the model is good, whereas a low R2 value indicates that the model is statistically and econometrically poor. Table 2 shows an R2 value of 82.00%. This value means that the variation in the variables of chicken egg prices, chicken meat prices, beef prices, rice prices, income, and population can explain the variation in egg demand by 82%, the remaining 18% is explained by other variables that are not included in the model, represented by errors. Based on this, the demand model for chicken eggs in Riau Province is either statistically or econometrically, because the R2 value is more than 50%. The higher the R2 value of the model, the better the model ([13], [14]).

Based on Table 3, the results of this study can be used to form an equation for chicken egg demand in Riau Province. The equation assumes the error is zero, namely: QTt =80336.56 - 309.89HTRt -192.58HDAt -0.55HDSt + 122.05HBSt + 0.09IPt + 0.03PDKt - 0.31LD**.** The explanation of significant independent variables can be found in the section below.

1. Chicken egg price

The price of chicken eggs is an important variable that affects the demand for eggs. The results showed that egg prices significantly affected the demand for chicken eggs at a confidence level of 90% (α=10%). The price of chicken eggs is negatively related to the demand for chicken eggs. This means that if chicken egg prices increase, the demand will decrease. This is because of the theory of demand, which states that prices themselves are negatively related to the demand for goods and services ([2], [3], and [10]).

Table 3 shows the value of the estimated chicken egg price parameter of -309.89. This figure means that if the price of eggs increases by Rp 1, the demand for eggs will decrease by 309.89 tons. This value includes the magnitude of its influence on the demand for chicken eggs. Some research conducted [15],[16] and [17], P. Astaman et al., 2024; Salsabila et al., 2024; Z. Maulana, 2023, found that the price of chicken eggs significantly affects the demand for chicken eggs. Egg prices hurt egg demand; the higher the egg price, the lower the egg demand.

The price of eggs has an impact on egg consumption. Ref. [18] states that 57.5% of consumers decide to reduce their egg purchases when there is an increase in egg prices, and 52.5% decide to buy eggs in a fixed quantity. The purchase of eggs at the time of the price increase is significantly different from when the price is normal. At regular prices, consumers will buy more eggs.

2. Income

Population income is one of the factors that determines the demand for chicken eggs. In theory, the microeconomic income of the population affects the demand for eggs; the higher the income of the population, the greater the demand for eggs. The results of this study show that the income of the population significantly affects the demand for chicken eggs in Riau Province at a confidence level of 95%, which is positively related. The results of this study are in accordance with the hypothesis. The value of the estimated population income parameter is 0.09. This value

means that if the income of the population increases by Rp 1, the demand for chicken eggs increases by 0.09 tons. The increase in income will increase the demand for eggs, showing that chicken eggs for the people of Riau as a normal item.

This research is in line with the research [19], [16], [20]. The results of their study show that household or population income significantly affects egg demand and is positively related. The value of the estimation parameter is not more than 1. The results of their research show that chicken eggs are normal items.

3. Population

The number of inhabitants affects the demand for eggs. Another variable used as a substitute for the population is the number of family members. In theory, the number of people positively affects the demand for eggs; the more population or family members, the greater the demand for eggs.

Table 3 shows that the population is significant and has a positive effect on the demand for chicken eggs at a confidence level of 95% (P< 5%). The research results are in accordance with the theory and hypothesis of proven research. The estimated parameter of the population is 0.03. This figure means that if the population increases by one person, the demand for chicken eggs increases by 0.03 tons. The population has little effect on the demand for chicken eggs.

In line with this research conducted by [21]. The population is significant and has a positive effect on the demand for eggs. The estimated parameter value is 11,146, which means that if the population increases by one person, the demand for eggs will increase by 11.15 tons. This value shows the influence of population size on the demand for large eggs.

3.3. Response of Dominant Factors Influencing Egg Demand

The dominant factors that significantly affect the demand for eggs in Riau are the price of eggs, population income, and population. The response of factors affecting egg demand was measured using elasticity analysis. Elasticity is the change of a variable caused by the change of other variables in percent units. The response of egg demand to price changes is called price elasticity. The response of egg demand to changes in income is called income elasticity, and the response of egg demand to changes in population is called population elasticity. The response of egg demand to significant factors affecting it is presented in Table 3.

Table 3 explains the elasticity of egg prices to egg demand of -0.05. This value means that if the price of eggs increases by 1%, the demand for eggs will decrease by 0.05%. The price elasticity value of eggs is not responsive to egg demand because the value is small 1. This means that changes in egg prices have little impact on changes in egg demand. This research is in line with the research [22] It shows the elasticity of egg prices to egg demand is inelastic and negative. Changes in egg prices have had little impact on egg demand in Saudi Arabia. The same is true of the elasticity of egg prices to the demand for inelastic eggs in Lithuania and Ukraine ([23]).

Income elasticity measures the response to changes in demand for goods due to changes in population income. This elasticity benefits egg product business owners in considering managing egg sales to consumers, as money can produce the right strategy for their business.

Table 3 shows that the income elasticity of the population is responsive to the demand for eggs (ƐIP=11.54>1) and positive properties. This value means that if the population of Riau increases by 1%, the demand for chicken eggs will increase by 11.54%. Value has a big impact on changes in demand. With growing demand, chicken egg businesses must be able to meet the demand of egg consumers. The same is true of the elasticity of income to egg demand in Lithuania and Ukraine, which is responsive and negative [23].

The population positively impacts the demand for chicken eggs, because the greater the population, the greater the demand for chicken eggs. The response to this change is measured in population elasticity. Population elasticity measures the response to changes in egg demand due to changes in population by a percentage of the population. Table 3 shows the population elasticity of 184.47. This value means that if the population increases by 1%, the egg demand increases by 184.47%. This indicates that the population is responsive to changes in the demand for chicken eggs. The population change has a significant impact on the demand for chicken eggs.

Sustained population growth stimulates producers and distributors to increase their production, or new businesses will arise that substitute chicken eggs to meet market needs.

4. Conclusions

The dominant and significant factors that affect the demand for chicken eggs in Riau Province are the price, population income, and the number of people in Riau. The price of chicken eggs hurts the demand for chicken eggs. The income of the population of Riau has a positive effect on the demand for chicken eggs. Changes in chicken prices, beef prices, and rice prices do not significantly affect the demand for chicken eggs.

The response of chicken egg prices to the demand for chicken eggs is unresponsive. This means that the price of chicken eggs has little impact on the demand for chicken eggs. Riau's income and population are responsive to the demand for chicken eggs. This indicates that changes in Riau's income and population significantly impact the change in demand for Riau chicken eggs.

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