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## Analysis of Influencing Factors and Volatility of Broiler Meat Prices in Pasuruan Regency, East Java Province

Hariadi Subagja\* and Durrotun Nikmah

Department of Poultry Agribusiness, Department of Animal Science, Politenik Negeri Jember, Jember, 68121, Indonesia

### ABSTRACT

The research was aimed to analyze of broiler meat price fluctuation, identify the factors competitor foodstuffs price that influence of broiler meat price, and identify alternative foodstuffs of broiler meat at consumer level in Pasuruan. The determination of location was did deliberately with consideration that in 2013, the production of broiler meat in Pasuruan was fourth highest production after Malang, Sidoarjo and Jombang , it was 8,842 million kg. This research was used secondary data from January 2010 until November 2015. The analytical method used is the price volatilitass analysis and multiple linear regression. The results showed that the value of broiler meat price volatility in Pasuruan tend to be small (low volatility) and happen quickly. Factors competitor foodstuffs price that influence the price of broiler meat in Pasuruan simultaneously influenced by the price of local chicken meat, beef prices, the price of eggs, and prices of salted anchovies fish. While partially, broiler meat prices at the consumer level in Pasuruan influenced by the price of beef and the price of eggs. The relation between the both showed that: broiler meat is alternative foodstuffs for beef, eggs are alternative foodstuffs for meat broiler, salted anchovies fish is complements for broiler meat.

Keywords: Alternative foodstuffs, Broiler meat, Volatility price

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\* Corresponding author:

Telp. +62 8328076375

E-mail: hariadisubagja@gmail.com

### Introduction

The case of rising food prices originating from livestock meat is still a problem in society. Considering the level of livestock meat consumption of Indonesian people is still low compared to several countries in Asia, namely in 2013 the consumption of Indonesian people's livestock meat was 6 kg/capita/year while Malaysia reached 36 kg/capita/year. One of the reasons for the increase in livestock meat prices is the high level of demand and not an adequate supply of meat. This can be seen from the 2013 BPS data which states, the total national livestock production of 2,880,274 tons has increased by 7.7% from the previous year. Poultry, especially broiler chickens, is a meat-producing resource that has a role as a provider of national animal protein which is relatively cheap compared to other livestock commodities.

Pasuruan Regency is one of the areas with the fourth largest broiler meat production in East Java in 2013 after Malang, Sidoarjo and Jombang, which amounted to 8,842,000 kg (BPS Jatim, 2013). The demand for broiler meat consumption in Pasuruan Regency is the highest compared to other livestock commodities, amounting to 9,666

quintals/year in 2014. The increase in broiler meat production in Pasuruan Regency is followed by beef cattle and domestic chickens as the second and third largest production. This reflects that the demand for broiler meat in the people of Pasuruan Regency is competing with beef cattle and native chickens. Hadini *et al.* (2011) stated that the amount of demand for broiler meat is not only influenced by the price of broiler meat itself, but is influenced by the prices of other goods such as beef prices, domestic chicken meat prices, fish prices and other animal foodstuffs. Animal food ingredients that have a high level of production in Pasuruan include eggs and sea fish. Chicken eggs have an increasing production of 10,094,621 kg in 2014, an increase of 50% from 2010. The fish often consumed by the people of Pasuruan Regency is anchovies because there are many anchovy salted fish traders and fishermen in Pasuruan Regency. The high production of some animal food ingredients causes price competition among these goods.

The price of broiler meat at the consumer level tends to be high and fluctuating, but the cost of broiler meat production tends to increase, especially the cost of feed, besides that the demand for broiler meat in Pasuruan is seasonal, meaning that in certain conditions the demand for

broiler meat is high, especially on religious holidays and the holiday season, thus impacting on an increase in the price of these goods. The results of Iham's research (2009) show that the price of poultry products and inputs is more volatile than the price of beef products, besides that the poultry business is dominated by large commercial businesses while the people's poultry business only follows this pattern, thus this business is relatively high speculative. A significant increase in price can cause the demand for broiler meat to decline and cause consumers to switch to cheaper foodstuffs, thus producers must pay attention to this phenomenon. Based on the things stated above, a research was conducted on the analysis of volatility and the factors that influence the price of broiler meat in Pasuruan Regency.

This study aims to 1) analyze the price fluctuation of broiler meat in Pasuruan Regency, 2) identify the factors of competitor food prices that affect the price of broiler meat in Pasuruan Regency, and 3) identify alternative foodstuffs for broiler meat in Pasuruan Regency. This research is useful as information to anticipate the future if there is an increase or decrease in the price of broiler meat, so that breeders and traders can determine the right decision-making action.

## Materials and Methods

This research was conducted in Pasuruan Regency, East Java. The location was determined purposively (purposive sampling) with the consideration that broiler meat production in Pasuruan Regency was the fourth largest in East Java in 2013 after Malang, Sidoarjo and Jombang. This research was conducted from December 2015 to January 2016.

The data used in this study are secondary data (time series) monthly for the period January 2010 to November 2015, including: broiler meat price (IDR/kg), local chicken meat price (IDR/kg), beef price (IDR/kg), the price of eggs (IDR/kg) and the price of anchovies (IDR /kg). The data were obtained from the Livestock Service Office and the Industry and Trade Office of Pasuruan Regency.

The data analysis method used in estimating the value of volatility and the factors that influence the price of broiler meat in Pasuruan Regency is by using price volatility analysis and multiple linear regression analysis which are analyzed using Microsoft Excel and Eviews 4.0 programs.

### Stationarity test

To avoid the occurrence of "spurious regression", the analyzed data must be stationary, that is, it does not contain a unit root (Diebold and Killian, 2000 cit. Sumaryanto, 2009). Analysis of price volatility using the ARCH/GARCH model, beforehand, it is necessary to ascertain whether the data used is stationary or not. The stationary test is carried out first in the form of a level and then if the data is not stationary it is followed by a

non-stationary difference process. This stationary test used ADF (Augmented Dickey Fuller) with the intercept model and included the independent variable time (t). The testing criterion is if the ADF probability value >5% significance level ( $\alpha = 0.05$ ) then accept  $H_0$ , which means that the data has a unit root or the data is not stationary, and vice versa.

The statistical test is carried out after the stationary test using the ARIMA (Box-Jenkins) model with the order that has been obtained from the stationary test. This statistical test can determine the ability and feasibility of the model (Wijaya *et al.*, 2014).

### Price volatility analysis

Price volatility analysis is used to determine the level of price volatility of broiler meat in Pasuruan Regency. Price volatility is analyzed using the ARCH/GARCH model with the following equation:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \dots + \alpha_p \varepsilon_{t-p}^2 + \beta_1 \sigma_{t-1}^2 + \dots + \beta_q \sigma_{t-q}^2$$

It is known that  $\sigma_{2t}$  is the conditional variance,  $\alpha_0$  (0) is the constant term,  $\alpha_1 \varepsilon_{2t-1}$  and  $\alpha_p \varepsilon_{2t-p}$  are the residual coefficient estimates for the previous period (called ARCH), while  $\beta_1 \sigma_{2t-1}$  and  $\beta_q \sigma_{2t-q}$  estimate the variance coefficient for the previous period (called GARCH) where represents the ARCH element and q the GARCH element.

### Multiple linear regression analysis

Linear regression analysis aims to determine the effect of the independent variable (X) on the dependent variable (Y). The general form of this multiple linear regression equation is:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + e$$

Information:

Y = Price of broiler meat

b = constant change in variable X against Y

a = constant coefficient

$X_1$  = Average price of native chicken (IDR Kg/month)

$X_2$  = Average price of beef (IDR Kg/month)

$X_3$  = average price of eggs (IDR Kg/month)

$X_4$  = average price of anchovies (IDR Kg/month)

e = Error (error rate).

## Result and Discussion

Broiler meat price volatility in Pasuruan Regency. The results of the stationary test show the t-statistical value of ADF (-2.154613) > critical test value (-2.9042) and the probability value (0.035) < significance value (0.05). The data shows that  $H_0$  is accepted, meaning that the data has a unit root or is not stationary. The stationary test was continued at the first difference level to obtain stationary data. The results of the stationary test for the first difference level show

that the t-statistic value of ADF (-6.829841) < critical test value (-2.9048) and the probability value (0.000) < significance value (0.05). The data shows reject H<sub>0</sub>, which means that the data does not experience unit root or stationary data. The data shows that it is not stationary at the level or in the order I (0), which indicates that if the data is regressed it will cause pseudo regression. The data shows stationary at the level of first difference or in order I (1), which illustrates that if the data is regressed it will not cause false regression.

The broiler meat price forecasting model was carried out to get the right model to calculate the price risk of consumer-level boiler meat in Pasuruan Regency using ARCH-GARCH analysis. After obtaining stationary data in order I (1), then proceed with the ARIMA model statistical test to determine the ability and feasibility of the model used. The best ARIMA model obtained is the autoregressive model with AR (1), AR (5) and AR (12). The model has met the criteria required in the evaluation of the Box-Jenkins model, which is free from autocorrelation problems which is indicated by the value of the Q-statistic probability on the correlogram is greater than the significance value (5%), and the data residual is random (white noise). The error is around 0, which is indicated by a bar graph on the correlogram that is all inside the Bartlett line.

The ARCH-GARCH analysis results on broiler meat prices produce the best model for estimating the price volatility of broiler meat at the consumer level in Pasuruan Regency, namely the GARCH model (1,1). The variance model equation (var-e) of broiler meat prices obtained is:

$$\sigma_t^2 = 7380112 + 0,078369e^2_{t-1} - 1,043486\sigma_{t-1}^2$$

The model equation shows that broiler meat price movements are influenced by the volatility of the previous period and the price variants of the previous period. The ARCH coefficient value in the model shows the high and low price volatility of broiler meat. The ARCH coefficient value in this model is 0.078369. This value is relatively small (not close to number one), thus indicating that the price volatility of broiler meat at the consumer level in Pasuruan Regency shows low volatility. The value of the GARCH coefficient is -1.043486. This value is relatively small (not close to number one), thus indicating that the residual variant of the broiler meat price does not last long. Based on the GARCH model (1,1), it is known that the price volatility of broiler meat at the consumer level in Pasuruan Regency tends to be low (low volatility) and takes place in a fast time.

Based on the time series plot, it shows that the price of broiler meat at the consumer level in Pasuruan Regency ranges from IDR 18,000/kg to IDR 33,860/kg. The average price of broiler meat was IDR 26,202.76/kg, with the lowest price of broiler meat of IDR 18,000/kg which occurred in January 2010 and 2011. The highest price of

broiler meat at the consumer level was IDR 33,860/kg. occurred in August 2015. Every year the price of broiler meat at consumer level in Pasuruan Regency has increased in July, August and October. This condition is because this month is the month of Ramadan and there have been various celebrations for the independence of the Indonesian nation as well as Eid al-Fitr and Eid al-Adha, so that the demand for boiler meat is quite high which causes the price of broiler meat to tend to rise.

The increase in the price of corn will affect the increase in the price of poultry feed, because 48-55% of commercial poultry feed is mainly corn. Poultry business actors are dominated by large commercial businesses, while the people's poultry business only follows this pattern, thus this business has a relatively high speculative nature. A significant increase in the price of broiler meat can cause demand to decline, thus producers are very concerned about this price.

#### **Competitor food price factors that affect broiler meat prices in Pasuruan Regency**

The results of the regression analysis showed that the R<sup>2</sup> value was 0.773. This shows that 77.3% of the price of broiler meat at the consumer level (Y) in Pasuruan Regency is influenced by the variables in the study, namely the price of native chicken (X<sub>1</sub>), the price of beef (X<sub>2</sub>), the price of eggs (X<sub>3</sub>), and the price of anchovies (X<sub>4</sub>). The remaining 22.7% is influenced by factors outside the factors (variables) studied.

The results of the analysis show that the F-count value of 35.683 is greater than the F-table value (5%), which is 5.644, so it can be interpreted that the independent variables (domestic chicken meat price, beef price, broiler egg price, and fish price) salted anchovies) as a whole has a significant effect on the variable price of broiler meat at the consumer level in Pasuruan Regency. The regression equation for consumer-level broiler meat prices in Pasuruan Regency is:

$$Y = 4603,167 + 0,019 X_1 + 0,101 X_2 + 0,797 X_3 + 0,014 X_4$$

This equation is obtained by a constant value of 4603.167, this value indicates that the price of broiler meat at the consumer level in Pasuruan is IDR 4,603,167/kg, if it is not influenced by the price of native chicken meat (X<sub>1</sub>), beef price (X<sub>2</sub>), price purebred chicken eggs (X<sub>3</sub>), and the price of anchovies (X<sub>4</sub>).

**Price of local chicken meat.** The coefficient of the variable price of native chicken meat shows a positive value of 0.019, meaning that if the price of native chicken meat increases by 1% while other factors are considered constant, the price of broiler meat at the consumer level in Pasuruan Regency will increase by 0.019%.

The t-count value of the variable price of native chicken meat was 0.243, while the t-table

value (5%) was 1.970 (t-count < t table 5%). This shows that the price of native chicken meat does not show a significant effect on the price of broiler meat, which means that the ups and downs of local chicken meat prices do not affect the price of broiler meat. This is because in the people of Pasuruan, native chicken meat is consumed only at certain times, namely during religious holidays or during religious celebrations. Domestic chicken meat has a tough texture, making it less practical in terms of processing and the price of native chicken is relatively expensive compared to broiler meat. This is in accordance with Mawaddah *et al.* (2012) research in the city of Medan which concluded that the price of broiler chicken, the price of native chicken, the price of broiler chicken eggs and the income per capita of Medan City influenced the demand for broiler meat.

**Price of beef.** The variable coefficient of local chicken meat prices shows a positive value of 0.101, meaning that if the price of beef increases by 1% while other factors are considered constant, the price of broiler meat at the consumer level in Pasuruan Regency will increase by 0.101%. beef was 2,747, while the value of t table (5%) was 1,970 (t-count > t table 5%). This suggests that changes in beef prices affect broiler prices. The increase in beef prices causes the demand for beef to decline, so that consumers will switch to other alternative foodstuffs that are cheaper. This condition shows that broiler meat is one of the alternatives for choosing substitute side dishes that can be consumed when the price of beef has increased. This is because the choice of broiler meat prices is relatively lower than beef prices. Bilas (1992) states that if the price of beef rises, then the price of other lower priced beef will replace beef. In line with the research results of Hadini, *et al.* (2011) show that if the price of beef increases, the beef can be replaced by broiler meat. This can happen because these two commodities are included in the animal food group and their use depends on the income of the community.

**Price of eggs.** The coefficient of the variable price of native chicken meat shows a positive value of 0.797, meaning that if the price of eggs of broilers has increased by 1% while other factors are considered constant, the price of broiler meat at the consumer level in Pasuruan Regency will increase by 0.797%. The price of eggs for broilers was 4.588, while the value of t table (5%) was 1.970 (t count > t table 5%). This shows that changes in the price of eggs affect broiler meat prices. The high and low price of eggs will affect the consumption of broiler meat. The decline in the price of eggs caused a decrease in the price of broiler meat, so that consumers switched to choosing eggs from broiler meat. This condition indicates that the consumption of purebred chicken eggs is an alternative choice of side dishes when the price of broiler meat occurs. This is in accordance with the opinion of Wahyuningsih *et al.* (2008) that the price of chicken eggs has an effect and has a

negative relationship with chicken demand, which means that chicken eggs and broiler chickens are food ingredients as a mutual substitute (competitors).

The price of anchovies: The coefficient of the variable price for native chicken meat shows a positive value of 0.014. This means that if the price of anchovies has increased by 1% while other factors are considered constant, then the price of broiler meat at the consumer level in Pasuruan will increase by 0.014%.

The t-count value of the anchovy salted fish price is 0.357, while the t-table value (5%) is 1.970 (t-count < t table 5%). This shows that changes in the price of anchovies do not affect the price of broiler meat. Anchovies salted fish is one of the most consumed foods both when broiler meat prices are high and low, this is because there are many anchovy salted fish traders and fishermen in Pasuruan, so that salted anchovy fish becomes a side dish for households in the Pasuruan Regency. The fish price variable does not have an effect on the demand for chicken meat, fish will still be available whether there is or no demand for chicken meat, because fish has become a side dish (minded) for the community's household.

## Conclusions

Broiler meat price volatility in Pasuruan Regency tends to be low (low volatility) and lasts a fast time. The price of broiler meat at the consumer level in Pasuruan Regency is influenced by the price of beef ( $X_2$ ) and the price of eggs ( $X_3$ ). Broiler meat is an alternative choice for side dishes when the price of beef has increased. Chicken eggs are an alternative choice for side dishes when the price of broiler meat has increased. Meanwhile, anchovies salted fish is one of the complementary side dishes for broiler meat.

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