Analysis of Household Demand for Chicken Meat in Yogyakarta

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Abstract. One of the important food commodities in Indonesia is chicken meat. Approximately 79% of the entire Indonesian population consumes chicken meat for their daily consumption. This study was conducted in Yogyakarta which is a mini of Indonesia, where the population is heterogeneous, many migrants from all over Indonesia live there. An Almost Ideal Demand System (AIDS) model is used to examine household behaviour in Yogyakarta using household social and economy survey data for the period of 2017. The empirical results indicate that estimated elasticity of chicken meat is found to be price inelastic. The study revealed that there is an inverse relationship between the household expenditure and the budget share of chicken meat, a direct relationship between the price of chicken meat and its budget share. The result can have important implications for maintaining the stability of price and availability of chicken meat in meeting the demand for chicken meat.

1. Introduction
Livestock and their products are source of protein which is very important to improve the quality of human resources in Indonesia. One of the livestock products which highly consumed by many people is chicken meat. This type of meat contains the nutrients needed by the human body. Chicken meat is consumed a lot because the price is relatively affordable. Communities can easily obtain chicken meat both in traditional markets and modern markets at prices that are more affordable than beef prices.

The level of income will influence decision making of household whether to consume more protein or carbohydrate sources, which will affect the level of quality consumption in accordance with nutritional requirements. The level of consumption will determine the quality of human resources which is influenced by the level of availability of meat / other livestock products and the level of household income. Around 60% of national meat consumption is in the provinces of West Java, DKI Jakarta, Central Java, Yogyakarta and East Java. The highest level of meat consumption per capita is in the regions of DKI Jakarta, Bali and East Kalimantan, which are above 10 kg/capita/year. While the lowest level of meat consumption per capita is in North Maluku, Maluku and Papua. Thus, the level of animal protein consumption in Indonesia is still much lower than in other countries. The average level of animal protein consumption in Indonesia only reaches 4.7 grams/capita/day. Whereas in Malaysia, Thailand and Philippines, the average level of animal protein consumption has been above 10 grams/capita/day. Then in developed countries such as Japan, Australia, and New Zealand, the average consumption has reached above 20 grams/capita/day [1].

The faster population growth rate, namely 1.40%/year in the period of 1990-2000 to 1.49%/year in the period of 2000-2010, indicates that future needs of food will increase even faster. Increased income, education and the proportion of the urban population can change the consumption patterns which increasingly lead to higher quality, safer, more prestigious, and more “fast food” products [2].
In the daily consumption, the household will maximize their utility with limited income to allocate among available goods and services, including chicken meat. The preference of the two-good case can be represented by an indifference curve whose level sets are non-intersecting, strictly convex away from the origin, and increasing north-easterly (Figure 1). Figure 2 illustrates the household behaviour in maximizing satisfaction with income constraints. The household is in equilibrium when given their income and price constraints, they maximize the total utility or satisfaction from their expenditure [3;4;5]. Therefore, this study will observe the share of expenditure for chicken meat consumption and total household expenditure for food consumption.

![Figure 1. Indifference Curve [4]](image)

![Figure 2. Consumer Equilibrium [4]](image)

By using a budget line and an indifference curve, it can be known the consumer equilibrium. Consumer behaviour is always willing to maximize utility with income constraints. The tangent point between the budget line and the indifference curve is called the consumer balance point (Consumer Equilibrium).

In the economic system in which transactions between agents are mediated by markets. There is a market for each commodity, including chicken meat, and in these markets, a price $p_i$ prevails for each commodity $i$. This study supposes that prices are strictly positive, so $p_i > 0$, $i = 1, \ldots, n$. Moreover, it is assumed that the individual consumer is an insignificant force on every market. The consumer is
endowed with a fixed money income \( y \geq 0 \). Because the purchase of \( x_i \) units of commodity \( i \) at price \( p_i \) per unit requires an expenditure of \( p_i x_i \) dollars, the requirement that expenditure not exceed income can be stated as \( \sum_{i=1}^{n} p_i x_i \leq y \) or, as \( p \cdot x \leq y \). These assumptions on theory of the consumer by specifying the following structure on the feasible set, \( B \), called the budget set as depicted in equation \( (1) \) [6].

\[
B = \{x|x \in \mathbb{R}^n+, p \cdot x \leq y \}
\]  

One of the appropriate models to investigate the budget share and chicken meat demand of the household is Almost Ideal Demand System (AIDS) model [7]. Motallebi and Pendell [8] used the AIDS model to estimate the demand for red meat, chicken and fish in Iran, stating that there was a negative relationship between chicken meat prices and consumer spending. Red meat and fish are complementary ingredients and substitutes for chicken meat. The chicken meat error value of -0.93 indicates that consumers will adjust the consumption of chicken meat in long-term balance faster than red meat. Dynamics AIDS analysis showed that Marshallian's own price elasticity was negative for red meat and fish, and positive for chicken meat. Hicsian's own price elasticity was negative for all types of meat.

Mawaddah, et al [9] conducted a study using the multiple linear regression method, stating that there was a negative relationship between price and demand for broiler chicken meat in Medan City. There was a positive relationship between per capita income of Medan City and demand for broiler chicken meat. The increasing income will cause the demand for broiler chicken meat in Medan City to increase as well.

Previous study of Yogi [10] showed that during the period 1983 - 2013, the consumption of broiler meat in Indonesian tended to increase by an average of 13.2 percent annually. In general, the increase and decrease in consumption of broiler meat is almost the same as the increase and decrease in production. This is because the focus of chicken meat production in Indonesia is to meet domestic needs, and the government is trying to maintain the self-sufficiency of chicken meat. Consumption of broiler meat continues to increase from year to year in which the largest increase was occurred in 2000 and 2011, which amounted to 119 thousand tons and 98 thousand tons respectively. The increase in per capita income has led to the tendency of people to consume more chicken meat.

This study aims to analyse the relationship between household expenditure and the demand of chicken meat in Yogyakarta. This study also analysed the price elasticity of chicken meat in Yogyakarta Province. An Almost Ideal Demand System (AIDS) model is used to examine household behaviour in Yogyakarta using household social and economy survey data for the period of 2017.

2. Research Methods

This study used data from National Economic Survey (SUSENAS) in 2017 which consists of food and non-food expenditure as well as revenue/income of households. The number of households in SUSENAS 2017 that taken from Yogyakarta Province are 3723 households. Beside the chicken meat as focused commodity, this study also observes rice and egg to represent the complementary and substituted commodities. The data is analysed by using Almost Ideal Demand System (AIDS). AIDS gives an arbitrary first-order approximation to any demand system, satisfies the axioms of choice exactly, aggregates perfectly over consumers without invoking parallel linear Engel curves, and has a functional form which is consistent with known household-budget data. It is simple to estimate, largely avoiding the need for non-linear estimation, and it can be used to test the restrictions of homogeneity and symmetry through linear restrictions on fixed parameters [11].

The model can be derived from second order approximation of any cost function, which means that it has a flexible functional form. That is extremely useful for estimating a demand system with many properties [12]. The model automatically and exactly satisfies the axioms of choice. Also homogeneity and symmetry can be imposed with simple parametric and aggregation restrictions. It is consistent with known household-budget data and can be easily estimated, but the fact that the price index is not linear in terms of parameter estimated can make it more complicated. Therefore the linear approximation of the price index is often used, the model is then called AIDS, and it restricts Engel curves to be linear. In recent years, AIDS family models have been very popular especially in food demand modelling and of course in the models of demand for chicken meat.
This study follows Deaton and Muellbauer [11] that started from a specific class of preferences, which leaves exact aggregation to consumers. The market demands representation that is like the outcome of the representative consumer decision, called the PIGLOG (Polynomial Price-Independent Generalized Linearity) class. The cost of expenditure function that represents them defines the minimum expenditure necessary to reach a specific level of utility at given prices. The PIGLOG cost function is defined in equation (2).

\[ In \ c \ (u, p) = \alpha_1 + (1 - u) \ln a(p) + u \ln b(p) \]  

(2)

Where a(p) and b(p) are homogenous function of degree 1 in p and u is the utility with the range from 0 to 1. Specific functional forms for \( \ln a(p) \) and \( \ln b(p) \) as in equation (3).

\[ In \ a(p) = \alpha_0 + \sum_{i=1}^{N} \alpha_i \ln(p_i) + \frac{1}{2} \sum_{i=1}^{N} \sum_{j=1}^{N} \gamma_{ij} \ln(p_i) \ln(p_j) \]  

(3)

\[ In \ b(p) = In \ a(p) + \beta_0 \prod_{i=1}^{N} p_i^{\beta_i} \]  

(4)

Then, the cost function can then be transferred to equation (5).

\[ In \ c(u, p) = \alpha_0 + \sum_{i=1}^{N} \alpha_i + \ln(p_i) + \frac{1}{2} \sum_{i=1}^{N} \sum_{j=1}^{N} \gamma_{ij} \ln(p_i) \ln(p_j) + u \beta_0 \prod_{i=1}^{N} p_i^{\beta_i} \]  

(5)

In here, \( \alpha_i, \beta_i, \) and \( \gamma_{ij} \) are parameters, the homogeneity in p is fulfilled, as can be seen from the equation, if those restrictions are possessed as defined in equation (6) - (8).

\[ \sum_{i=1}^{N} \alpha_i = 1, \sum_{i=1}^{N} \beta_i = 0, \sum_{i=1}^{N} \gamma_{ij} = 0 \]  

(adding-up)

(6)

\[ \sum_{j=1}^{N} \gamma_{ij} = 0 \]  

(homogeneity)

(7)

\[ \gamma_{ij} = \gamma_{ji} \]  

(symmetry)

(8)

If we use the logarithmic differentiation on the equation (5) we get the function of prices and utility expressed by the budget shares as in equation (9).

\[ w_i = \alpha_i + \sum_{j=1}^{N} \gamma_{ij} \ln(p_j) + \beta_i u \beta_0 \prod_{i=1}^{N} p_i^{\beta_i} \]  

(9)

Where :

\[ \gamma_{ij} = \frac{1}{2} (\gamma_{ij} + \gamma_{ji}) \]  

(10)

The budget shares equation (equation 11) in the basic form that can be used for estimation of the model.

\[ w_i = \alpha_i + \sum_{j=1}^{N} \gamma_{ij} \ln(p_j) + \beta_i \ln \left( \frac{X_i}{p} \right) + \epsilon_i, f or all \ i = 1, ..., N \]  

(11)

From the AIDS result, the elasticity can be calculated following the procedure of Sadoulet and Janvry [7], Deaton and Muellbauer [11], Teklu and Johnson [13], and Green and Atson [14].

3. Result and Discussion

The behaviour of urban and rural households is not much different in term of amount (kg). However, in term of expenditure value (IDR), the living cost in rural area is lower than that in urban area. The difference of prices would imply the different of budget share. Table 1 illustrates the characteristics
between urban and rural households. It is very interesting that the household size in urban area larger than rural area. Usually the number of family members in rural area is larger than urban area since the rural household needs family labour to work in agricultural sector. The consumption of rice in rural area describe that people prefer to consume more carbohydrates. There are no difference on chicken meat and rice consumption.

**Table 1.** Household Consumption Characteristics in the Urban and Rural Area of Yogyakarta Province (SUSENAS, 2017).

|                     | Urban          | Rural          |
|---------------------|----------------|----------------|
| Household size (people) | 4              | 3              |
| Food expenditure (IDR/week) | 1,535,980     | 1,339,885     |
| Non-food expenditure (IDR/week) | 1,980,136     | 1,249,863     |
| Per capita expenditure (IDR) | 1,080,342     | 807,353       |
| Rice purchasing (kg/week)    | 3              | 3              |
| Rice consumption (kg/week)   | 5              | 6              |
| Chicken meat purchasing (kg/week) | 1             | 1             |
| Chicken meat consumption (kg/week) | 1             | 1             |
| Egg purchasing (kg/week)     | 9              | 9              |
| Egg consumption (kg/week)    | 9              | 9              |

Source: Owned Calculation from SUSENAS 2017
Note: Exchange rate in 2017 of USD 1 = IDR 13,542

**Table 2.** Parameter for AIDS Model Based on the 2017 SUSENAS Micro Data of Yogyakarta Province.

| Commodity          | Intercept | Price Chicken Meat | Price Rice | Price Egg |
|--------------------|-----------|--------------------|------------|-----------|
| Chicken Meat       | 0.016398*** | 0.008156***       | -0.004710* | 0.002009*** |
| Rice               | 0.066114*** | -0.005696**       | 0.005034*** | 0.011305**  |
| Egg                | 0.018346*** | 0.006179***       | 0.001510*  | 0.008755*** |

| Commodity          | Per capita Expenditure | Household size Urban |
|--------------------|------------------------|----------------------|
| Chicken Meat       | -0.004287***           | -0.007108***         | -0.00461***
| Rice               | -0.019713***           | -0.032319***         | -0.00120*  |
| Egg                | -0.004672***           | -0.007473***         | -0.00060  |

Per capita expenditure elasticity of chicken meat = 0.7936
Own price elasticity of chicken meat = -0.6030
Cross price elasticity of rice and chicken meat = 0.000039
Cross price elasticity of egg and chicken meat = -0.00000427
Household size elasticity of chicken meat = -0.1358

Note: *Significant at 10% level; **Significant at 5% level; ***Significant at 1% level
Source: Analysis of SUSENAS Data, 2017

Table 2 shows the estimation result of AIDS model based on the SUSENAS 2017 micro data of Yogyakarta Province. The demand systems that specified and estimated take the form of budget share of three commodities as being independent on the own price and two prices of other food groups in this system, the per capita expenditure, household size and location dummy (urban or rural area) where the household belongs. However, this study focuses on chicken meat demand. Rice has the highest share of total food expenditure (Figure 3). This indicates that households in both areas take priority on staple food. The estimated parameter of chicken meat and egg prices is positively significant, while negatively significant for rice price. When the per capita expenditure increases, the household would reduce the demand of chicken meat. Household size has negative effects on chicken meat, rice and egg. Thus, food consumption for households of with big family member consumes merely carbohydrate and protein.
diets. According to Ani and Antriyandarti [15], the estimated parameters of income that conducted in Cilacap and Grobogan is significantly negative to the rice self-consumption. This result indicates that an increase in income lead a decrease in rice self-consumption. The rice farmers prefer to sell their product to the market rather than to keep for their consumption when they have larger income.

4. Conclusion
The empirical results indicate that estimated elasticity of chicken meat is found to be price inelastic. The study revealed that there is an inverse relationship between the household expenditure and the budget share of chicken meat, a direct relationship between the price of chicken meat and its budget share. The result can have important implications for maintaining the stability of price and availability of chicken meat in meeting the demand for chicken meat.

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