Determinants of household beef consumption in Indonesia: a binary logistic analysis

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Abstract. Consumption of high-value food such as beef tends to be responsive to the changes of price, income, and consumer’s characteristics. Household expenditure data were used in this study. Binary logistic regression model analysis was used to investigate the selected socioeconomic and demographic characteristics of consumer/household regarding beef consumption. Household size, working participation of wives, region, level of education, income, and price factors are influencing the household’s decision on beef consumption. This study reveals households in Indonesia sensitive to the change of beef price. Marginal effect value from binary logistic regression analysis showed that households tend to increase consuming beef varies from 0.5 to 1.6 times associated to socioeconomic factors of the households. Furthermore, potential increasing of beef consumption require availability of its foods by enhancing its production. Price intervention should be introduced in order to stabilize the fluctuation in beef prices

1. Introduction

The food consumption patterns are changing for eating more livestock products including beef and dairy products [1]. Food consumption is influenced by several factors, namely the level of income, food availability, public food availability for nutrition, and socio-cultural factors [2]. Income factor is one of the important factors that determine household consumption patterns. Higher income indicates increased purchasing power, and increasing selection of better quality food. Food consumption is more in the form of grains at low income levels, while when income increases, generally food consumption becomes more nutritious, such as animal protein food [3]. The demand for high value food items (e.g., meat, milk, and egg) increases with income. Consumer preferences on the other hand, shape the decision of consumer what to consume or not. This decision could be determined by income level, price, and socioeconomic factor [4]. Therefore, this study intends to breakdown through empirical analysis of beef consumption in relation to various socioeconomic variables in Indonesia.

2. Material and methods

Data used in this analysis were based on household cross-sectional data through National Household Expenditure Survey (SUSENAS). Data on socioeconomic characteristics of the households, and food and non-food expenditure were recorded in the 2016 SUSENAS in two areas (urban and rural area). The decision of food consumption being a dichotomous variable, binary-logit regression provides an appropriate tool when the dependent variable has more than two categories and such categories have no natural ordering [5]. The dependent variable used for binary logistic models in this study is the...
preference of beef consumption. Binary logistic regression analysis was employed to explore the key determinants of its consumption, as follows:

\[ Z_i = \ln \frac{P_i}{1-P_i} = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \cdots + \beta_n X_{ni} + \varepsilon \quad \ldots \ldots \quad (1) \]

where \( Z_i \) is the log-odds of household \( i \), \( \alpha \) is a constant, \( \beta_1, \beta_2, \beta_3, \beta_n \) is the coefficient of households’ socio-economic variables \( (X_1, X_2, X_3, X_n) \) and \( \varepsilon \) is the error term. The coefficient in the logit model suggests a change in the logit as a result of a unit change in the independent variable. Proper interpretation for the coefficients of course depends on the ability to put the significance of the difference between the two logit. Therefore, in the logit model, developed measurement known as the odds ratio.

\[ \text{Odds ratio} = \frac{P_i}{1-P_i} = e^{\alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \cdots + \beta_n X_{ni} + \varepsilon} \quad \ldots \ldots \quad (2) \]

3. Results and discussion

Average share of beef and other foods expenditure from total food expenditure are presented in Figure 1. Food expenditures covered all food items included in the survey such as rice, pulses, eggs and milk products, vegetables, fruits and nuts, fish and meat, and beverages. Food expenditure of households in rural areas represented 53.39% of total expenditure and 44.63% for households in urban areas.

Although rural areas are the main producers of livestock products, the level of consumption was less than that of urban areas. Household in urban is the most dominating in consuming and expending livestock products. The expenditure term, beef, chicken, processed meat, and egg expenses significantly higher in urban, more economically advanced. Compare to urban area, rural households have lower expenditure and higher expenditure share. The livestock product share of food expenditure is lower in the urban areas (31.28%) but consume more (4.92 kg/week).

![Figure 1. Expenditure share of household food consumption](image)

Determinant of household expenditure on beef with different socioeconomic variables of the household sample are compared in Table 1. It showed that null hypothesis is rejected since there is significant difference in the consumption of beef among some socioeconomic characteristics of household. Income is important determinant factor on consuming beef. This study showed that higher household income tends to consume more beef, as well as consumption of chicken meat (not available). There are significant differences in consuming beef at different income levels. This phenomenon occurs in both types of regions both in urban and rural areas. As [6] mentioned that income raise and the expansion of western style fast food restaurant associated with situation is leading to lifestyle changes that are influencing consumer purchases and food choices. Price is one of the considerations for nature to consume beef. Consumption of beef less than that of its chicken while it’s spend more. The increase in beef prices leads consumers to consume cheaper meat, namely chicken [7].

Binary-logic analysis revealed that characteristics of the household affected in the household decision on beef. Households sample in this study were household in urban and rural area. The results obtained with an econometric analysis of household expenditure on beef as a function of household size,
urban or rural region, education level of household head, price, household income level, and working participation dummy show that these characteristics are statistically significant.

**Table 1.** Average beef consumption with various socioeconomic factors (kg/week)

| Attributes                          | Beef  | Processed meat |
|-------------------------------------|-------|----------------|
| Household Size (adult equivalent)   |       |                |
| Less than or equal 4               | 2.29  | 0.11           |
| More than 4                        | 5.15  | 0.24           |
| t-test (22.33)***                  | (7.54)|               |
| Occupation of HHH                  |       |                |
| Agriculture                        | 0.89  | 0.02           |
| Non-Agriculture                    | 4.03  | 0.20           |
| t-test statistics (40.91) ***      | (17.55)*** |            |
| Education of HHH                   |       |                |
| Basic Education                    | 4.35  | 0.01           |
| Higher Education                   | 15.64 | 0.92           |
| F test 2.028***                    | 332.04*** |              |
| Income Level                       |       |                |
| Low                                | 0.14  | 0.00           |
| Middle                             | 1.66  | 0.06           |
| High                               | 14.26 | 0.75           |
| F test 5,304,67***                 | 647.80*** |              |
| Region                             |       |                |
| Urban                              | 4.92  | 0.26           |
| Rural                              | 1.18  | 0.03           |
| t-test 41.52***                    | 17.59*** |              |

Note: * Meat floss, canned meat, etc.; HH: household; HHH: household head; **, * indicate significant at 1% and 5% level of significance respectively.

The model predicts that a one percent increase in household income would yield a 0.9 percent increase in beef expenditure; as the household size grows by one percent, beef expenditure will decrease. The household size in this study used standard equivalence scales as adult equivalent method by taking age and sex of its members into account [8-10]. In this analysis, households were categorized in three income level.

**Table 2.** Estimation of binary-logit regression

| Variables               | B     | SE    | Sig.  | Exp (B) |
|-------------------------|-------|-------|-------|---------|
| HH size (adult equivalent) | -1.76 | 0.53  | 0.001*** | 0.17 |
| Region                  | 0.043 | 0.00  | 0.00*** | 1.04 |
| Education               | 0.47  | 0.21  | 0.027** | 1.6  |
| Working participation   | -1.77 | 0.46  | 0.00*** | 0.51 |
| Age of HHH              | -.004 | .206  | .650  | .996  |
| Food Expenditure        | .0000097 | 2.151 | .142  | 1.000 |
| Beef price              | -.000231 | 15.463 | .000*** | 1.000 |
| Income level            | .0000090 | 3.190 | .074* | 1.000 |
| Constant                | 17.174 | 6.152 | .013  | 28753352.103 |

Note: * significant at 10%, ** significant at 5%, and *** significant at 1%; HH: household; HHH: household head head
Household socioeconomic status showed that region, household size, school and work participation of household head, age, food expenditure and the prices forced the household to make decision on beef. Beef price showed significant to the decision of beef consumption (p<0.00) while it didn’t significant impact for high income household because they have good knowledge (education) on the beneficiary of beef consumption [10]. Coefficients of household size is negatively associated with the odds of beef consumption, i.e., the households having less member is 0.17 (p-value<0.01) times less likely to consume beef. Therefore, we can say that the probability of households to consume beef decreases significantly as adding household member. Level of education, wives participation on working sector, and income are positively associated with the probability of household beef consumption. The binary-dependent-variable analysis was resulting marginal-effect value. The marginal effect of each factor showed that household decision on beef consumption was varied between 0.5 and 1.6 times compare to other foods. Household income has a significant positive effect on the trust level of 90%. The results of the analysis revealed that an increase in income level would increase consumption of beef. The results also indicate that low income households also recognize that consumption of beef is important, the limitations of the consumption are due to limited income so that if income increases, consumption will also increase. The increase in income will result in the tendency of households to increase the consumption of beef by 1.000 times.

4. Conclusion
Discrete choice model is used to explain household decisions in consuming beef. Household’s member, working participation, level of education, region, and income of the household influence household decisions in consuming beef. Better-off households and urban households consume more beef. Potential increasing of livestock products such as beef requires availability of its foods by enhancing the production. Price intervention in order to stabilize the fluctuation of the price enhancing the supply

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