

Animal Products Consumption Pattern of Beef Cattle Farmer Households in Donggala Regency, Indonesia

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Abstract

The research on consumption of animal products of beef cattle farmer households was conducted for eight months from January to August 2013 in Damsol District, Donggala, Indonesia. A total of 92 beef cattle farmer households were purposively chosen as respondents of the present research, which applied Linear Approximation-Almost Ideal Demand System (LA-AIDS). The result of the study indicates that among the group of animal products consumed, fish is the most frequently consumed with the amount of 21.65 kg/capita/year. It is correspondingly followed by egg, milk, chicken, and red meat in a row (5.840, 3.80, 1.467 and 0.945 kg/capita/year) with the biggest fish expenditure segment about 53.03% from the total household expenditure on animal products. Total household spending affect the demand for fish, chicken and milk, while the number of household members does not affect the level of consumption of animal products. Based on the price elasticity, livestock products is a necessity which is less a response to changes in price and have a substitution and complementarity relationship between one another in the composition of household food. Based on the income elasticity, the Fish is considered as basic needs, while red meat, chicken, eggs and milk are considered as non basic needs for beef cattle farmer Households.

Keywords: demand, household expenditure, price and income elasticities, LA-AIDS

1. Introduction

Beef cattle farmer household have a major contribution in terms of fulfill the availability of meat, ranging from the household level to the national level. Although the small-scale ownership, the number of cattle that are scattered in rural areas contribute significantly to food security aspects of animal food availability. On the other hand, household farmers who also act as consumers, need animal food to improve quality of life for members of the household. Shortage of quality food, namely food containing enough energy and protein, and both can cause health and growth, especially for children.

Food and Nutrition of Widya Karya requires the minimum amount of protein consumption for 52 gram/capita/day. The average of protein consumption in the rural area of Central Sulawesi in 2014 is 49.1 gram/capita/day. The biggest composition of this protein consumption comes from cereals with 24.1 gram/capita/day. The consumption of the animal products consists of fish 10.9 gram/capita/day, meat 0.66 gram/capita/day, and milk and egg 1.47 gram/capita/day (BPS, 2015). This amount is still far below the animal protein consumption of Asian countries in 2005, which reached 16.6 gram/capita/day consisting of 9.2 gram of meat, 4.7 gram of low-fat milk and 2.7 gram of egg (FAO 2011).

Animal foods such as meat, egg, milk, and fish have a significant role in individual's nutrition fulfilment. Meat, egg, and milk contain high-quality protein as they consist of essential amino acids needed by human body. Animal products are also the source of important micro-nutrition, such as iron, zinc, Vitamin A, Vitamin B12, and calcium, required for growth and development of children, pregnant women, and nursing mothers (WHO 2003, Catelo 2006). There was a significant correlation between hemoglobin concentration and consumption of animal protein. Animal protein as well as sources of heme iron hemoglobin formation (Andarina and Sumarmi 2006). Micronutrient deficiency will increase the vulnerability of body against chronic diseases, which were encountered in the segment of society suffering from malnutrition (FAO 2011).

The level of animal food consumption by each individual is highly determined by the ability of households in accessing these commodities. Household ability to access these animal foods is determined by various factors. In addition to the physical access, such as the availability of infrastructure like roads and markets facilitating people to get the commodities and financial access, such as households income (Amao 2013) is considered as determinant as well. Almost 64 % of poor people in Indonesia live in rural areas and work as farmer and breeder. Poverty in rural area leads to the low consumption of animal products compared to the urban areas (Saliem 2002). Poverty causes the households have a low purchasing power towards high-quality animal products whose prices are relatively higher than vegetable products.

Beef cattle farmer households have advantages in terms of beef supply. The role of farmers as producers in the fulfilment of animal food availability should not be disregarded. As consumers, farmers are faced with the

decision to consume or sell the products. The decision to sell the products depends on the cash needs and the access to markets. If the farmers do not consume the products, they are supposed to be able to fulfil their needs, including animal product needs, through the increase of households' purchasing power by selling their products.

Based on the role of farmers as producers, suppliers, and consumers of animal products, this research aims at determining the consumption level and expenditure on animal products as well as how beef cattle farmer households respond to the demand for animal products in case of a change of price and income occurs. This research is expected to provide an overview for all interested stakeholders in determining the development and increasing both the quantity and the quality of animal product consumption for households and individuals.

2. Research Methods

2.1 Location

The research was conducted in two villages (Malonas and Lembah Mukti villages) in sub district Damsol, Donggala district since January to August 2013. The location was determined gradually by using multistage sampling method, ranging from district to the village level. Determination of locations in each stage was done by using purposive sampling method based on the highest number of cattle population and the number of cattle farmer households.

Sub district Damsol is one of 16 districts in Donggala district, has total land area of 733 km² located between 0°25'08 "-0°05'27" North Latitude and 119°46'16 "-120°06'03" East Longitude. The topography of Damsol district consists of plains at 22.4%, 18.6% hills and mountains of 59.01%. Geographically, settlements are spread in both coastal areas and non-coastal areas. 9 villages are located in the coastal areas and 4 villages are in non-coastal areas (Badan Pusat Statistik, 2016).

2.2 Data collection

Population in this research is the whole of cattle farmer households in Donggala district. Respondent determination was done using a purposive sampling technique, based on ownership of beef cattle by household, at least one animal unit. As the result, there are 92 beef cattle farmer households selected, while respondents in each household are the head of family and his wife. The observed data covering characteristics of respondents and variety of animal products demand, including food prices, the amount of consumption and the amount of expenditures on farmer households. Animal products consumed by households can be classified into five groups 1) beef and pork classified as red meat, 2) native chicken and broiler meat as chicken, 3) egg, 4) fish, 5) milk.

2.3 Data Analysis

Consumer demands for animal products are analyzed using a demand model of LA-AIDS (Linear Approximation - Almost Ideal Demand System), with the tool named SAS 9.1 program. Demand behavior analyzed includes the impact of the price of each animal product on the animal product expenditure segment. The determination of price elasticity value on demand includes some approaches of household income: own-price elasticity, cross-price elasticity and expenditure elasticity.

AIDS model is chosen because it has several advantages appropriate for analyzing household demands, especially food products, some types of which are consumed at the same time. Hence, the analysis of demand on food products must also be carried out simultaneously.

Deaton and Muelbauer (1980) stated that the advantages of LA-AIDS are: 1) giving the first approximation to any demand systems; 2) satisfying the axiom of choice correctly; 3) aggregating the consumer perfectly; 4) having a pattern which is consistent with the budget for households; 5) simple to use (in the form of linear approximation); and 6) useful to test the homogeneity and symmetry constraints. Several researchers conducting research on the demand for food products by applying this model include Saliem (2002), Ariningsih (2004), Taljaard et al (2004), Wadud (2006), Nur et al (2012), Tash et al (2012) and Basarir (2013).

The model of Almost Ideal Demand System (AIDS) for animal product demands follows the mathematical pattern as follows:

$$w_i = \alpha_i + \sum_{j=1}^n \gamma_{ij} \log p_j + \beta_i \ln \left(\frac{x}{P} \right)$$

w_i = budget share for animal product i

$\alpha_i, \gamma_i, \beta_i$ = coefficient parameter to intercept, price and expenditure of each group of animal products $i, j= 1, 2, \dots, 5$ (the group of animal product consisting of red meat, chicken, fish, eggs and milk)

p = the aggregate price of each group of animal product

x = total expenditure on animal products which is an approximation of income

P = the price index defined by:

$$\log P = \alpha_0 + \sum_{j=1}^n \alpha_j \log P_j + \frac{1}{2} \sum_{i=1}^n \sum_{j=1}^n \gamma_{ij} \log P_i \log P_j$$

This price index is not linear, which is then linearized with the stone price index below:

$$\ln p^* = \sum_i w_i \log P_i, \text{ thus AIDS turns into Linear Approximation AIDS (LA-AIDS):}$$

$$w_i = \alpha_i + \sum_{j=1}^n \gamma_{ij} \log p_j + \beta_i \log \left(\frac{x}{p^*} \right) + u_i$$

Based on the theory of demand, a good model of demand must fulfill some basic requirements such as adding up, homogeneity and symmetry. The requirements are as follows:

Adding up : $\sum_{i=1}^n \alpha_i = 1, \sum_{i=1}^n \beta_i = 0, \sum_{i=1}^n \gamma_{ij} = \sum_{j=1}^n \gamma_{ij} = 0$

Homogeneity : $\sum_i \gamma_{ij} = 0$ for all i

Symetry : $\gamma_{ij} = \gamma_{ji}$

Based on the estimated parameters of AIDS model, uncompensated (Marshallian) and compensated (Hicksian) own and cross price elasticities and expenditure elasticities can be calculated by following the pattern (Jung 2000 in Taljaard et al 2004).

The Marshallian own and cross price elasticity of product i consumption relative to price of product j can be calculated as follows:

$$e_{ij} = \frac{\gamma_{ij} - \beta_i w_j}{w_i} - \delta_{ij}$$

Hicksian own and cross price elasticities can be calculated as follows:

$$e_{ij} = \frac{\gamma_{ij}}{w_i} + w_j - \delta_{ij}$$

Where δ_{ij} is the Kronecker delta term (that is 1 when $i = j$ or 0 when $i \neq j$)

$$E_i = 1 + \frac{\beta_i}{w_i}$$

For the expenditure (income) elasticity:

3. Result and Discussion

3.1 THE CONSUMPTION OF ANIMAL PRODUCTS

The consumption and expenditure on animal products in beef cattle farmer households is shown in Table 1. The consumption of animal foods per capita reached 33.7 kg/ year or 93.6 grams/day. This amount is still below the average of national consumption of animal products reported 102.6 g/cap/day from the total 91.22% of total national consumption (Food Security Agency 2015). Overall, it can be seen that the beef cattle farmer households are able to fulfill their household needs (animal products).

Table 1: Consumption, price, and expenditure on animal products in farmer households.

	Fish	Red Meat	Chicken	Egg	Milk
Household consumption, kg/year	87.53	3.48	5.81	20.6	14.87
Consumption per capita, kg/year	21.65	0.945	1.467	5,840	3.80
Price, Rp.(000)/kg	18.64	73.72	32.49	21.58	25.19
expenditure, Rp.(10,000)/year	164.45	24.16	18.39	44.15	41.46

Considering the consumption of each commodity, the consumption of fish is the highest, followed by eggs, milk, chicken and red meat. It is presented that red meat consumption is considered as the lowest. The consumption of some livestock products per capita per year reported in Indonesia were 0.417 kg of ruminant meat and pork, 4.48 kg of chicken, 6.44 kg of eggs, 4.54 kg of sweetened condensed milk and milk powder— in 2014 (Ministry of Agriculture 2015).

Fish consumption which is adequate high compared to other animal products indicates that fish become the main source of animal protein for beef cattle farmer households. Fish were often found in this area at a relatively cheaper price than the price of meat, milk and eggs per kilogram. The living area which is dominated by coastal areas triggers society to choose fish as their daily food consumption. The result of research conducted by Saliem

(2002) showed that the areas in eastern Indonesia based marine areas consume more fish than the population in the area of dry land. Fabiosa (2005) also found that fish is a source of animal protein which is the most consumed by Indonesian, followed by dairy products and poultry, while the lowest consumption are beef and pork.

Households were accustomed to eating beef, lamb and pork only during religious holidays or during the celebration of certain events such as weddings, *aqiqah* (religious ritual in Islam for celebrating the birth) and others. Similarly, chicken is only served at a party or at the time of the household serves food to honor guests. Accordingly, the consumption of red meat and chicken in beef cattle farmer households is lower than eggs, milk and fish. Although the amount of red meat consumption was lower compared to the other animal product consumption, but it was still higher, being 43.8% when it is compared to the national average of fresh meat consumption which was 0.417 kg / capita / year. This fact is particularly interesting to notice because in fact the farmer households as one of the supplier of meat, especially beef and prok (which are mostly maintained by farmers), have a bit much contribution to the availability of meat for the surrounding communities where the farmers live. Although there are not slaughterhouses, people could easily obtain meat for both large parties and the purposes of religious festivities. The difficulty of obtaining beef for households due to the high price of meat can be handled by a system of 'social gathering' where the beef cattle farmer household and the surrounding communities collect money regularly every month during 10-12 months to buy beef for the feast. The total average of consumption for each household was 3.5 kg annually. Fast foods or processed foods which are beef-based or chicken-based were still rare.

Based on Table 1 also shows that households choose to consume animal food is cheaper. Consumption will be reduced in line with the high food prices. The highest food prices are for red meat, followed by chicken meat, milk, eggs and fish. in terms of total household expenditures, the highest annually household expenditure was for fish which was Rp 1,644,500, equivalent to USA \$ 123.6, followed by milk, eggs, red meat and chicken. Although the price of fish (per kilogram) was the lowest, due to the high consumption of fish, it causes the household expenditures for this commodity become much more than others. The access of farmer households to animal products was highly determined by the purchasing power against such products.

3.2 ESTIMATION RESULTS OF ANIMAL PRODUCTS DEMAND MODEL

Results of animal food demand estimation models using LA-AIDS-demand model is shown in Table 2. The LA-AIDS model estimated a system of five equation by SUR (Seemingly Unrelated Regression) method. In addition to seeing the influence of price and income, the variable number of household members is also included, which is considered to influence the amount of expenditure share on food animal in beef cattle farmer household.

The coefficient of determination (R^2) in the system is 0.521 indicates that the share of spending for the fifth variation of animal food groups for each equation can be described in the model amounted to 52.1%, while 47.9% is explained by other factors outside the model.

Table 2: Parameter estimates of the LA-AIDS model for animal products demand

	Fish	Red meat	Chicken	Eggs	Milk
Intercept	3.947*** (5.31)	-0.053 (-0.18)	-0.885** (-2.49)	-0.412 (-0.59)	-1.597*** (-2.83)
Fish price	0.235*** (5.34)	-0.039* (-2.60)	-0.062*** (-3.46)	-0.008 (-0.20)	-0.126*** (-4.77)
Red meat price	-0.039** (-2.60)	-0.001 (-0.03)	-0.021* (-1.93)	0.056*** (2.79)	0.004 (0.34)
Chicken price	-0.062*** (-3.46)	-0.021* (-1.93)	0.078*** (4.71)	0.021 (1.00)	-0.016 (-1.11)
Eggs price	-0.008 (-0.20)	0.056*** (2.79)	0.021 (1.00)	0.006 (0.11)	-0.075** (-2.65)
Milk price	-0.126*** (-4.77)	0.004 (0.34)	-0.016 (-1.11)	-0.075*** (-2.65)	0.212*** (7.61)
Number of household member	-0.046 (-1.31)	0.015 (1.25)	0.020 (1.29)	-0.005 (-0.17)	0.016 (0.62)
Log (Expenditure)	-0.406*** (-5.95)	0.034 (1.32)	0.112*** (3.43)	0.080 (1.24)	0.180*** (3.46)
Lnp	0.588*** (9.02)	-0.081*** (-3.36)	-0.156*** (-5.08)	-0.141** (-2.33)	-0.211*** (-4.21)
System weighted R^2	0.521				

Note: * significant at 10% significance level, ** significant at 5% significance level, *** significant at 1% significance level. Numbers in parentheses are the t-ratios.

The demand on fish, chicken and milk was significantly affected by food price itself (Table 2). The coefficient value of own-price which entirely signs positive indicates that the increase in each price of animal food commodities will increase the proportion of spending on food, and vice versa, if the commodity prices decline. The increase in price would theoretically reduce the demand for certain goods. The fact that household expenditure on animal food remains to grow in line with the increase in prices. This shows that households remain in need of animal food for daily consumption. Animal product was the basic needs in the diet list consumed by households. Based on the fact, it can be said that the beef cattle household farmer have listed the animal food as the basic requirement as well as other kinds of food.

Mark a positive coefficient indicates that an increasing in the price of animal products, will increase household expenditures for each commodity. The share of household expenditures for fish, meat, eggs and dairy products are also affected by the cross price of cattle.

Number of household members are expected to affect the amount of the share of animal product expenditure did not give a significant effect on demand for the five groups of commodities of animal products.

The income (expenditure) gave real influence to the share of fish, chicken and milk, with a negative coefficient as well as to the share of chicken and milk expenditure signed with a positive coefficient. It is evident that households would reduce their spending to buy fish while increase their spending to buy chicken and milk if household income increases.

3.3 Uncompensated Own and Cross Price Elasticities

Uncompensated Own and Cross Price Elasticities shown in Table 3. The value of the own price elasticity for fish, chicken and dairy products valued at between -1 and 1 precisely -0.151, -0.034 and 0.306 respectively. This shows that the three commodities of animal products are basic needs that is less a response to price changes. This applies to food commodities in general. On the other hand, red meat and eggs are more responsive to price changes shown by the elasticity of greater than -1. When changes in the price of red meat or eggs, then the demand will change by a greater percentage than the percentage change in the price of each product.

Own price elasticity for fish and livestock products other than milk are negative according to the theory of demand, while the milk is positive, which is not in accordance with the theory. This is due to more milk consumed by toddlers who need milk in the daily menu, so the price changes will be responded in the same direction. for example, an increase in milk prices will continue to increase demand for milk. Some research on food demand also showed results that do not match expectations, including Basarir (2013) and Yuliastuti et al (2014) obtained its own price elasticities for some food commodities is positive.

Table 3. Uncompensated (Marshallian) elasticities for animal products demand of beef cattle farmer households

	Fish	Red meat	Chicken	Eggs	Milk
Fish price	-0.151	-0,623	-1,685	-0,306	-1,549
Red meat	-0,003	-1.041	-0,429	0,294	-0,085
Chicken	-0,062	-0,253	-0.034	0,096	-0,205
Eggs	0,111	0,546	0,043	-1.045	-0,730
Milk	-0,128	-0,006	-0,448	-0,523	0.306

The entire elasticity value between -1 to 1 indicates that the demand for animal foods are “in elastic” to price changes. Animal food was included into the basic needs which less response to the changes in prices. This finding is also discussed by Basarir (2013), Taljaard et al (2004), Ariningsih (2004) and Wadud (2006). In the event of price changes, the demand for each animal food commodities would change with a smaller percentage from the percentage of price change. For example, if there is an increase in fish prices by 10%, the demand for fish will be reduced with a smaller proportion of 1.5%. Based on the magnitude of the value of elasticity, the demand for red meat and eggs was more responsive to the price changes than other commodities.

Marshallian cross price elasticity show that fish and other animal food have a complementary relationship, except with eggs that have a relationship of substitution. The complementary relationship is indicated by the negative coefficient, whereas substitution with a positive coefficient sign. On this basis then egg is a substitute for red meat, chicken and fish. If the price of a commodity increases, the household prefers eggs to fulfill household animal food needs. Whereas other animal food complement each other. Increasing the price of a commodity leads to reduced consumption of other animal products. Cross elasticity value greater than -1 between chicken with fish prices and milk with the price of fish indicates that fish is a source of animal food is more important for households cattle farmers in this area.

3.4 Compensated Own and Cross-price Elasticities

Based on the calculation of Hicksian own price elasticity (Table 4) showed that the five groups of animal product is staple goods that less in response to price changes, characterized by the amount of elasticity between -1 and 1. Comparing the five commodities, the red meat and eggs are more sensitive to price changes. Changes in prices by the same percentage will respond differently by each commodity. Red meat and eggs with the elasticity

of close to 1 is -0.9 and -0.8 respectively for red meat and eggs, are more sensitive to price changes. This is due to the egg is a substitute for other commodities, so the price changes will be responded only slightly bigger by household. As for the demand for red meat were more in response to changes in prices due to high meat prices so that households will be more selective in determining the amount of demand for the household.

Hicksian cross-price elasticity Showed that animal products have a complementary relationship and substitution between one another. From 20th cross price elasticity values, 10 of which have a complementary relationship value and 10 is the substitution. Fish is a substitute for red meat, chicken and eggs, red meat is a substitute for eggs and milk, chicken with eggs, while eggs and milk is a substitute for red meat and chicken.

Table 4. Compensated (Hicksian) elasticities for animal products demand of beef cattle farmer households

	Fish	Red meat	Chicken	Eggs	Milk
Fish	-0.027	-0,498	-1,502	-0,062	-1,225
Red meat	0,120	-0.915	-0,245	0,538	0,238
Chicken	0,061	-0,127	-0.150	0,340	0,118
Eggs	0,234	0,672	0,227	-0.801	-0,407
Milk	-0,005	0,120	-0,265	-0,279	0.629

The most responsive relationship occurred between the demand for eggs with the fish price and the milk price. It is indicated by the elasticity of more than 1 for fish and close to 1 for the price of milk with a negative sign. The increase in prices of fish and milk would reduce the demand for eggs, with almost the same percentage which is even greater than the percentage of the increased price. This indicates that fish and eggs as well as eggs and milk were served together in the daily diet. When the price of fish increased, the household would reduce the consumption of fish and the eggs to be consumed together. The consumption of eggs and milk in a household was more intended for children, especially at school age, while milk was usually served as a mixture in coffee drinks for adult.

The value of cross-price elasticity which is low for animal food commodities other than fish and eggs as well as eggs and milk shows that although the relationship was complementary, they are not served at the same time. Red meat and chicken for example, they are solely served during religious celebrations and parties. Therefore, it requires households to seek the provision, so that the increased price of these commodities will be responded by reducing meat consumption while reducing the consumption of other animal food commodities. This condition is indicated by a negative-signed correlation.

3.5 The Influence of Income Changes towards the Animal Food Demands

The elasticity of expenditure which is the approach of income is presented in Table 5. The value of elasticity is useful to indicate the responsiveness of demand for animal products when there is a change in household income. The values obtained could be used to distinguish whether each animal food commodity was classified as luxury, normal, or inferior goods to the household beef cattle farmer.

Table 5. Expenditure elasticity and expenditure share of animal products

	Expenditure elasticity	Share of expenditure (%)
Fish	0.234	53.03
Red meat	1.404	8.52
Chicken	2.549	7.21
Eggs	1.466	17.09
Milk	2.274	14.15

The value of expenditure elasticity for the overall animal products were positive, indicating that the animal products were classified as normal, in which demand would increase in line with the increase in income. The result is in line with the research conducted by Fabiosa (2005), Akbay (2006) and Basarir (2013). Their research based on household income classification shows that the higher the household income was the higher consumption and spending for animal food the households have.

Based on value of elasticity, fish were classified as staple goods for farmer households, which is characterized by a value less than 1. While red meat, chicken, eggs and milk is still considered a luxury goods for farmer households. Households consume more dominant fish in the daily menu compared to other animal food. Besides the price of fish most cheaper than other animal product commodities (Table 1), the fish can also be found at any time either in the form of fresh or preserved like salted fish. Red meat or chicken is not available on the market at any time except on religious holidays or parties, while eggs and milk more consumed by children, so that the household consumption for these commodities are also quite a bit.

Red meat, chicken, eggs and milk with the value of elasticity greater than 1 indicates that these commodities would change with a greater proportion of the change in income, if there is an increase or a reduction in income. With the limited income, households also have limited access to food price which is relatively high. Therefore, for beef cattle farmer households, these commodities were still classified as luxurious

goods.

At Table 5 also shows that the consumption of livestock products is dominated by fish with spending reaching 53.03 percent share, followed by eggs, milk, red meat and chicken respectively 17.1, 14.2, 8.5 and 7.2 percent. Although the price of fish is the cheapest among other animal food prices, but because fish consumption is high enough, then the household expenditures for these commodities is also high.

4. Conclusion

The consumption of animal products on beef cattle farmer households in Donggala was dominated by fish, in accordance with the condition of the region which is largely a coastal area. The share of household expenditures for fish was reaching 53.03% of total household expenditure for animal products. The number of household members not influenced the demand for the five groups of commodities of animal products.

Fish, red meat, chicken, eggs, and milk were classified as staple goods which were less responsive to the price changes. The overall animal food commodities were substitution in the list of household beef cattle farmers' groceries.

Animal food demand would increase in line with the increase in income. Based on the responsiveness to the changes in income, fish were classified as the basic needs, while red meat, chicken, eggs and milk are considered as a luxurious commodity for household beef cattle farmers.

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