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IMPACTS OF RISING ANIMAL FOOD PRICES ON DEMAND AND POVERTY IN INDONESIA

Nikmatul Khoiriyah[1*], Ratya Anindita[2], Nuhfil Hanani[2], Abdul Wahib Muhaimin[2]

[1] Deparment of Agribusiness, Faculty of Agriculture, University of Islam Malang, Indonesia
[2] Deparment of Socio Economic, Faculty of Agriculture, Brawijaya University, Indonesia

*corresponding author: nikmatul@unisma.ac.id

Abstract: Protein deficiency is one of the causes of the poor nutritional status of the Indonesian population, is permanent, and long-term will have an impact on the lower quality of human resources. This study analyzes the impact of price and income changes on animal food consumption patterns and demand on five poverty level in Indonesia. The demand esimation uses Quadratic Almost Ideal Demand Systems, using the National Socio Economic Survey (SUSENAS) data (March 2016) compilation data of 291,414 households. The results showed that there were different interactions between beef and the other four animal protein food sources, namely the Poor, Almost Poor and Vulnerable Poor beef substitution was mainly chicken, followed by fresh fish and eggs. Hicksian's own-price elasticity decreases following the decrease in the level of household poverty. Cases of beef, household own-price elasticity "extremely poor" -11.70% and "not poor" -1.95%. The sensitivity of the decrease in beef consumption is due to an increase in own-prices for "extremely poor" households 5.5 times compared to "non-poor". Beef is a very luxurious and relatively inaccessible source of animal protein food, especially for extremely poor, poor, almost poor, and vulnerable poor households, and this constitutes 40% of Indonesia's population. To increase beef consumption, it is necessary to increase domestic beef production so that the price of beef is affordable not only for non-poor households but also for extremely poor, poor, almost poor and vulnerable poor households in Indonesia

Keywords: *food demand system, protein, poor household, poverty*

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INTRODUCTION

The development of animal protein consumption can be used as a reference to see the quality of protein consumed by the Indonesian population and can be used as a support for research on nutrition. Protein deficiency is one of the causes of the poor nutritional status of the Indonesian population, which in the long run, will have an impact on the lower quality of human resources. According to Kurnia Dewi (2012), lack of protein consumption and dietary changes are one of the causes of malnutrition in Indonesia. This lack of protein consumption is mainly due to the low economic level of Indonesia's population. The low level of the economy causes their lack of access to quality protein because quality sources of animal protein have a relatively higher price compared to sources of vegetable protein.

The behavior of households to consume an item, including food sources of animal protein, can be influenced by many things including the price of goods, household income, and household preferences for the goods to be consumed.

Differences in preferences of each household due to differences in characteristics such as differences in the location of the region, the level of education of family members, the number of household members, habits, culture, and so on. Thus, changes in food prices, especially food sources of animal protein, and differences in household income will be responded to by

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households differently according to each household's characteristics. Research conducted by Wahyuni, Purnastuti, & Mustofa (2016) shows that partially the prices of the three food sources of protein (fish, meat, and chicken meat), household expenditure, the area of residence of the household, and the number of household members have an influence on the share of consumption expenditures of the three food sources of protein (fish, meat) , and chicken).

Several studies on consumption patterns and demand systems for animal protein source foods have been carried out by several previous researchers, including in Saudi Arabia (Al-Shuaibi, 2011), in Kenya (Bett, Musyoka, Peters, & Bokelmann, 2012), in Nigeria (Elijah Obayelu, Okoruwa, & Ajani, 2009), in Swizterland (Abdulai, 2002), (Korir, Rizov, & Ruto, 2018), and also in Indonesia by Pangaribowo (2010). This research using the Quadratic Almost Ideal Demand Systems (QUAIDS) approach. Generally, in Indonesia, studies of household food demand using the QUAIDS approach are at province level and its analysis divided based on settlement type, urban and rural regions only. The additional five level poverty as unit of analysis would explore deeper insight how the household consumption patterns, and behavior are affected price changes as well as by their poverty level. Therefore the study aims to analyze the impact of price and income changes on animal consumption and food demand patterns at five poverty levels in Indonesia. The results of data analysis will obtain price and income elasticity. The results of the study are expected to be valuable information in compiling a policy scenario of protein fulfillment according to the national protein adequacy rate more effectively, efficiently, and more precisely.

RESEARCH METHODS

Model specification: Quadratic Almost Ideal Demand System (QUAIDS)

The QUAIDS model being consistent with demand theory assumptions, it can also allow for non-linear Engel relationships between food group expenditure shares and food expenditure (Banks, Blundell, & Lewbel, 1997). Ignoring such nonlinear relationships could cause parameter estimates to be inconsistent (Banks et al. 1997). The QUAIDS model will be appropriate when the joint significance of the parameter capturing the quadratic term of income on food group share, for all the food group equations is significantly different from zero.

Following Deaton & Muellbauer (1980), food and non-food expenditures are assumed to be weakly separable. The QUAIDS, developed by Banks, Blundell, & Lewbel (1997), which was further augmented with demographic variables by Poi (2013), is used to estimate price and food expenditure elasticities in the second stage. QUAIDS has been widely applied in the literature on food demand analysis. Using the QUAIDS augmented with demographic and other controls to examine the household food demand patterns, and thus availability and access to food, across income groups and types of region.

Demand Estimation

The approach of estimating QUAIDS for Indonesia, using the SUSENAS 2016 household expenditure survey. On the basis of selected commodity groups, which are indexed by i, we estimate a system of demand equations, consisting of total of animal protein consumption expenditure m, expenditure shares $\boldsymbol{w_i}$ and commodity prices $\boldsymbol{p_i}$. The income and price elasticities estimation using settlement type and quintile total expenditure per capita as unit of analysis. The estimation of our system of demand equations following Poi (2012), using non-linear, seemingly unrelated regression.

The QUAIDS model is an AIDS model development. AIDS was discovered by (Deaton, 1980) built on the Rotterdam and Translog models. QUAIDS was developed by (Banks, Blundell & Lewbel, 1997). Based on the non-parametric analysis of consumer spending patterns, it appears that the Engel curve requires a higher order of logarithm expenditure. The QUAIDS model has almost the same features as AIDS and can capture the curvature of Engel. Therefore, QUAIDS has been chosen as the demand model for estimated empirical strategies. As with the general demand system model, the AIDS model is determined by the following food budget shares (wi):

$$w_i \equiv \frac{p_i q_i}{m} \quad (1)$$

where p_i is price of i, q_i is quantity of i, and m is total expenditure, so demand system:

$$w_i = \alpha_i + \sum_{j=1}^{k} \gamma_{ij} inp_j + \beta_i 1n \left[\frac{m}{a(p)}\right] \quad (2)$$

where p_j is price of j and a (p) is index price of total expenditure:

$$ln\alpha(p) \equiv \alpha_0 + \sum_{i=1}^{k} \alpha_i 1np_i + \frac{1}{2}\sum_{i=1}^{k}\sum_{j=1}^{k} \gamma_{ij} 1np_i 1np_j \quad (3)$$

As well as the AIDS Model, the QUAIDS model also needs restrictions to be consistent with utility maximization, i.e.:

Adding up: $\sum_{i=1}^{k} \alpha_1 = 1 \;\; \sum_{i=1}^{k} \beta_i = 0$

$$\sum_{i=1}^{k} \gamma_{ij} = 0 \;\; \forall j \quad (4)$$

Homogeneity: $\sum_{j=1}^{k} \gamma_{ij} = 0 \; \forall j$, and (5)

Slutsky's symmetry: $\gamma_{ij} = \gamma_{ji}$ (6)

Restriction on demand theory (4), (5) and (6) are imposed during estimation and ensure that notation (3) defines α (p) as a linearly homogeneus function af the individual prices. Futher, where notation (4), (5) and (6) hold, notation (2) provides a system of demand function which add up to total expenditure $(\sum w_i = 1)$, is homogen as long as prices and income are zero according to the Slutsky Symmetry theory (Deaton & Meullbauer, 1980). So, that the AIDS model can interpreted: as price (p_j) and real expenditure $\left(\frac{m}{\alpha(p)}\right)$ is not change, so share of expenditure (w_i) is constant (α_i).

A development of the AIDS model, the QUAIDS model was proposed by Banks et. al (1997), namely by adding an element of quadratic logarithm of expenditure. This follows the nature of flexibility the Engel curve share of household expenditure is not linear, and some commodities are staple goods and some commodities are luxury goods (Banks et al, 1997). The QUAIDS model in budget share is:

$$w_i = \alpha_i + \sum_{j=1}^{K} \gamma_{ij} 1np_j + \beta_i 1n\left[\frac{m}{\alpha(p)}\right] + \frac{\lambda_i}{b(p)}\left\{1n\left[\frac{m}{\alpha(p)}\right]\right\}^2 \quad (7)$$

The term equals equation (2) and b (p) is the Cobb-Douglas aggregate price, written as follows:

$$b(p) = \prod_{j=1}^{K} \rho_j^{\beta_i} \quad (8)$$

In the consumer demand theory, adding-up conditions are also needed:

$$\sum_{j=1}^{K} \lambda_j = 0 \quad (9)$$

When entering the household socio-demographic variable, use the Roy method (1983) based on the expenditure function (cost) as follows:

$$e(p,z,u) = m_o(p,z,u) \times e^R(p,u) \quad (10)$$

Where z is a vector of household characteristics, $e^R(p,u)$ is expenditure function, and $m_0(p,z,u)$ scale of the expenditure function that can be obtained from:

$$\overline{m_o}\,(p,z,u) = \overline{m_o(z)\phi(p,z,u)} \quad (11)$$

where m_0 measure the increase in household expenditure as a function of z, and ϕ is a change in the price of goods consumed. So, $\overline{m_o}(z)$ is:

$$\overline{m_o}\,(z) = 1 + \rho z \quad (12)$$

where ρ is a vector estimate parameters, $\emptyset(p,z,u)$ is a parameter of:

$$ln\phi(p,z,u) = \frac{\prod_{j=1}^{K} \rho_j^{\beta_i} (\prod_{j=1}^{K} \rho_j^{n_{iz}} - 1)}{\frac{1}{u} - \sum_{j=1}^{K} \lambda_j 1np_j} \quad (13)$$

Where η_j describes the column to j of the matrix parameter η. To adhere to consumer demand theory, a further adding-up condition is required, given as

$$\sum_{j=1}^{K} \lambda_j 1np_j + (\beta_i + \acute{\eta}_i z) 1n \quad (14)$$

for r= 1 ..., s. The estimation of the QUAIDS animal food model can be written into the formula:

$$w_i = \alpha_i + \sum_{j=1}^{K} \lambda_j 1np_j + \left[\frac{m}{\alpha(p0)\overline{m_0}(z)}\right] + \frac{\lambda_i}{b(p)c(p,z)}\left\{1n\left[\frac{m}{\alpha(p0)\overline{m_0}(z)}\right]\right\}^2 + \varepsilon \quad (15)$$

where

$$c(p,z) = \prod_{j=1}^{K} \rho_j^{n_{iz}} \quad (16)$$

The parameters generated from the QUAIDS model are used to calculate the own-price elasticity of both Hicksian and Marshallian, expenditure elasticity and cross price elasticity. Marshallian price elasticity (Uncompensated) is:

$$\in_{ij}^{u} = -\delta_{ij} + \frac{1}{w_i}\left(\gamma_{ij} - \left[\beta_i + \acute{\eta}_i z + \frac{2\lambda_i}{b(p)c(p,z)} 1n\left\{\frac{m}{\alpha(p0)\overline{m_0}(z)}\right\}\right] \times \left(\alpha_j + \sum_1 \gamma_{j1} 1np_1\right) - \frac{(\beta_i + \acute{\eta}_j z)\lambda_i}{b(p)c(p,z)}\left[1n\left\{\frac{m}{\alpha(p0)\overline{m_0}(z)}\right\}\right]^2\right) \quad (17)$$

Income elasticity is:

$$\mu_i = 1 + \frac{1}{w_i}\left[\beta_i + \acute{\eta}_i z + \frac{2\lambda_i}{b(p)c(p,z)} 1n\left\{\frac{m}{\alpha(p)\overline{m_0}(z)}\right\}\right] \quad (18)$$

Hicksian elasticity (Compensated) is:

$$\in_{ij}^{c} = \in_{ij}^{u} + w_j \mu_i \quad (19)$$

Equation (1) to (6) adopted from Deaton and Muellbauer (1980), equation (7) to (19) adopted from (Poi, 2012) with reference to Banks et al. (1997).

Data

The data used in this research is secondary data of the National Socio-economic Survey (SUSENAS) data (March 2016). The data analyzed were socio-demographic data (household residence status, total household member, household consumption and expenditure, and total expenditure). The animal foods observed in this study were eggs (chicken eggs, local chicken eggs, and duck eggs), chicken meat (local chicken meat and chicken meat), beef, fresh fish (fresh fish and shrimp including fish, shrim, squid, and shellfish) as well as powdered milk (milk powder and infant milk). The sample of this research is 291,414 households.

RESULTS AND DISCUSSION

Households' responsiveness to price and income changes

The results of the QUAIDS analysis show that prices, income, income square, and sociodemographic, namely the number of household members are almost all significant at alpha 1% to 5% (Table 1). The income squared is very significant at alpha 1%. This means that the increase in the square of income is very influential on demand for animal food (Korir et al., 2018), (Mittal, 2010). The QUAIDS coefficient also shows whether animal products is a normal item tend to be luxurious or luxury goods tend to be normal (Pangaribowo, 2010), (Mittal, 2010) . Eggs are luxury goods tend to be normal, indicated by a positive sign on the income variable and the quadratic variable of income. Whereas chicken, beef, fish, and milk are normal items, tend to be luxurious, indicated by the sign that the parameter coefficient is negative. Variable demography is also very significant for the demand for animal foods in Indonesia (L. Bopape & Myers, 2007), (Bellemare, Barrett, & Just, 2013), (Agbola, 2003).

Table 1. QUAIDS Parameter estimates of animal food demand

Parameter (Coeff. and SEM)	Eggs (1)	Chicken meat (2)	Beef (3)	Fresh fish (4)	Powdered milk (5)
Constant	-0.0699*	0.6313*	0.1946**	0.1259**	0.1179**
α	(0.84986)	(0.67323)	(0.036894)	(0.022589)	(0.040134)
Income	0.2476*	-0.0547**	-0.0298***	-0.0052***	-0.1579***
β	(0.064152)	(0.046363)	(0.012681)	(0.006465)	(0.015136)
Price	0.2255**	-0.1841**	-0.0102***	0.0239***	-0.055023
γ_1	(0.044770)	(0.036690)	(0.012160)	(0.007052)	(0.011639)
	-0.1841**	0.1267**	0.0048***	0,0069***	0.045605
γ_2	(0.036690)	(0.033924)	(0.011402)	(0.006590)	(0.011356)
	-0.0102***	0.0048***	-0.0272***	-0.0092***	0.041719
γ_3	(0.012160)	(0.011402)	(0.013498)	(0,005685)	(0.008408)
	0.0239***	0.0069***	-0.0092***	-0.0151***	0,005119
γ _4	(0.007052)	(0.006590)	(0.005685)	(-0.006603)	(0.005501)
	-0.0550***	0.0456***	0.0417***	0.0051***	-0.025698
γ_5	(0.011639)	(0.011356)	(0.008408)	(0.005501)	(0.013065)
Income-squared	0.0129***	-0.0034***	-0.0016***	-0.0003***	-0.0077***
λ	(0.000735)	(0.001092)	(0.000463)	(0.000330)	(0.000684)
Demography	-0.0020***	0.0018***	0.0004***	0.00001***	-0.0002***
η_hhm_tot	(0.000612)	(0.000393)	(0.000197)	(0.000136)	(0.000366)
Demography	0.00006***	0.00006***	0.00006***	0.00006***	0.00006***
	(0.000032)	(0.000032)	(0.000032)	(0.000032)	(0.000032)

Source: March 2016 Susenas, STATA analysis, standart errors in parentheses (* p<0.1, ** p<0.05, *** p<0.01)

Marshallian own-price elasticity (uncompensated)

Uncompensated own-price elasticity (Marshallian) for the five animal protein sources of food at five poverty levels is presented in Table 2, while price elasticity is compensated (Hicksian) own-price in Table 3. The results show that all of own-price elasticity, both Marshallian and Hicksian, marked negative and in line with the theory. This is also in line with the research (Alem, 2011),(Alem & Söderbom, 2010), (Demeke & Rashid, 2012), (Valero- Gil & Valero, 2008). A negative sign on the price elasticity itself means that the demand for the five foodstuffs of animal protein sources derived from eggs, chicken meat, meat (beef), fresh fish, and milk applies to the demand law. This means that an increase in the price of eggs, chicken meat, meat, fresh fish, and milk will cause a decrease in the amount of demand for each of these commodities (Bett et al., 2012), (Burggraf, Kuhn, ZHAO, Teuber, & Glauben, 2015), (L. E. Bopape, 2006) and (Abramovsky, Attanasio, & Phillips, 2012).

Table 2. Marshallian own-price elasticity based on poverty level in Indonesia 2016

Animal food group	Demand for animal foods ↓				
	Eggs	Chicken meat	Beef	Fresh fish	Powdered milk
Poverty level	Marshallian elasticity (uncompensated)				
1.Extremely poor	-0.9200	-3.1514	-11.7289	-2.7674	-2.2011
2.Poor	-0.9057	-2.5609	-9.5588	-3.0666	-2.1659
3.Almost poor	-0.8888	-2.2253	-7.1867	-2.8540	-2.1159
4.Vulnerable poor	-0.8685	-1.9312	-5.5549	-2.7326	-2.0444
5.Not poor	-0.7480	-1.3927	-2.0215	-2.0284	-1.6026

Based on its own-price elasticity, both Marshallian and Hicksian, only egg commodities have an absolute value below one, which means egg commodities have inelastic properties. This means that when there is an increase in egg prices by 1%, the number of egg demand will decrease by less than 1%. For other commodities, namely chicken meat, beef, fresh fish, and powdered milk, are food sources of animal protein sources that are elastic. This means that the total demand for these four animal protein food source commodities is highly influenced by own-price changes. The results in line with the research of (Aftab, Rehman, Abdul, & Faheem, 2015), (Katchova & Chern, 2004), and (Kumar & Joshi, 2016). The comparison of the two Tables (2 and 3) shows that, in general, all absolute Marshallian ownprice elasticity are always higher than Hicksian own-price elasticity. This indicates that besides being influenced by price changes, animal protein is significantly influenced by household income because of the considerable magnitude of the substitution effect between types of animal food, except eggs.

Hicksian own-price elasticity (compensated)

The Hicksian own-price elasticity (compensated) for the five food sources of animal protein at five poverty levels is presented in Table 3. The Hicksian own-elasticity of beef is the most elastic, followed by fresh fish, chicken, and milk powder. The Hicksian own-price elasticity decreases in accordance with the decrease in the level of poverty. It means that the increase in own-prices has a more significant impact on that are not / less prosperous than the more able household. They will reduce consumption significantly if there is an increase in prices. A striking example in the case of beef, the value of the elasticity of the price of the family "extremely poor" -11.70% and families "not poor" -1.95%. This means that the sensitivity of the decline in beef spending is due to an increase in own prices for "extremely poor" households 5.5 times compared to "non-poor".

Table 3. Hicksian own-price elasticity based on poverty levels in Indonesia 2016

Unit Analisys – Animal food groups	Demand for animal foods ↓				
	Egg	Chicken meat	Beef	Fresh fish	Milk powder
Poverty level	Hicksian own-price elasticity (compensated)				
1.Extremely poor	-0.4415	-2.8572	-11.7047	-2.7034	-2.0621
2.Poor	-0.4519	-2.2476	-9.5304	-3.0090	-2.0189
3.Almost poor	-0.4621	-1.8960	-7.1547	-2.7940	-1.9640
4.Vulnerable poor	-0.4790	-1.5778	-5.5184	-2.6715	-1.8849
5.Not poor	-0.4997	-1.0018	-1.9520	-1.9477	-1.3918

Although both are highly elastic, changes in the elasticity of chicken meat's own-price due to changes in poverty status levels are not as drastic as beef. An interesting finding for chicken is that there is a tendency for elastic goods to become inelastic in the non-poor. Own-price elasticity of Hicksian eggs tends to increase from extremely poor to vulnerable poor, then decreases in non-poor. This phenomenon shows the (possibly) shifting patterns of consumption of animal protein sources according to their preferences, especially for households who are well off. The shift from chicken and eggs to beef and possibly also to fresh fish and powdered milk. As indicated by the Hicksian own-price elasticity, the decrease in demand for fresh fish and milk powder is not as large as beef or chicken meat. Little anomaly elasticity of demand for fresh fish occurs in extremely poor; the absolute value of elasticity itself is lower than in poor. However, this trend decreases following the decreasing level of poverty. There is not much research of demand systems on various levels of poverty, but what is often found is urban and rural levels such as research (Ivanic & Martin, 2014), (Majumder, Ray, & Sinha, 2012), and (Cudjoe, Breisinger, & Diao, 2010).

Marshallian cross-price elasticity

The behavior of consumption of protein-source foods, in addition to being seen from changes in prices, must also consider changes in prices of other food-source protein food commodities. The elasticity of cross-prices represents a change in the percentage of the demand quantity of an item consumed as a result of a 1% change in the price of other goods.

Analysis based on the poverty level shows that there are different interaction patterns between beef and the other four animal protein food sources. The difference in this interaction is more pronounced, especially in the very poor, which is also found to have a complementary effect with eggs other than milk powder. Because the price of eggs is lower than milk powder, it indicates a shift in complementation due to limited purchasing power (a proxy of total expenditure per capita). This phenomenon needs to be explored further, taking into account other relevant supporting data. For Poor, Almost Poor and Vulnerable Poor substitution of beef is mainly chicken, followed by fresh fish and eggs. For the Non-Poor, the cross-price elasticity with all substituents is less than one, indicating that although there is a substitution effect due to an increase in the price of the meat prices, this substitution effect may not be/less significant.

Hicksian cross-price elasticity

The cross-price elasticity of both Marshallian and Hickisan is carried out simultaneously on each commodity to see in more detail how the behavior of households in each poor group in consuming animal protein. Tables 4 and 5 are the results of calculations of cross elasticity of animal foods source of protein in five poverty levels in Indonesia.

The cross-price elasticity of eggs

In the aggregate at the national level, based on Hicksian's ow-price elasticity values, egg demand is inelastic. Based on the status of household poverty shows that the substitution of eggs by powder milk, especially in households that are relatively prosperous in non-poor. There is a tendency for egg substitution by chicken meat to decrease with increasing levels of household welfare. Egg substitution by powdered milk applies. The trend of egg substitution by beef and fresh fish is similar to powdered milk, although the percentage is much smaller.

Table 4. The cross-price elasticity of Marshallian based on the poverty levels in Indonesia 2016

Unit Analisys – Animal food groups	Demand for animal foods ↓				
	Egg	Chicken meat	Beef	IFresh fish	Milk powder
1.Extremely poor	Marshallian cross-price elasticity (uncompensated)				
Egg	-0.9200	0.0759	-5.1455	-0.1130	-0.9218
Chicken meat	0.2361	-3.1514	9.5019	0.4838	0.7039
Beef	-0.0039	0.3031	-11.7289	0.4438	-0.1867
Fresh milk	0.0380	0.1208	3.7655	-2.7674	-0.0073
Milk powder	0.0382	0.3419	-2.8191	0.0334	-2.2011
2.Poor					
Egg	-0.9057	-0.0260	-3.2928	-0.1703	-0.7745
Chicken meat	0.2160	-2.5609	6.8812	0.6528	0.6579
Beef	0.0027	0.2306	-9.5588	0.5095	-0.2106
Fresh milk	0.0357	0.1161	2.8414	-3.0666	-0.0088
Milk powder	0.0436	0.2979	-2.7444	0.0412	-2.1659
3.Almost poor					
Egg	-0.8888	-0.0851	-2.0686	-0.1854	-0.7075
Chicken meat	0.2001	-2.2253	4.4033	0.6534	0.5906
Beef	0.0079	0.1792	-7.1867	0.4469	-0.2007
Fresh milk	0.0346	0.1133	2.0172	-2.8540	-0.0123
Milk powder	0.0477	0.2549	-2.0306	0.0333	-2.1159
4.Vulnerable poor					
Egg	-0.8685	-0.1269	-1.2442	-0.2041	-0.6162
Chicken meat	0.1846	-1.9312	2.8212	0.6759	0.5197
Beef	0.0142	0.1369	-5.5549	0.4085	-0.1925
Fresh milk	0.0336	0.1074	1.4460	-2.7326	-0.0145
Milk powder	0.0532	0.2187	-1.5786	0.0293	-2.0444
5.Not poor					
Egg	-0.7480	-0.2515	-0.1082	-0.2025	-0.3423
Chicken meat	0.1079	-1.3927	0.1677	0.5434	0.2041
Beef	0.0419	0.0448	-2.0215	0.2245	-0.0910
Fresh milk	0.0311	0.1105	0.3202	-2.0284	-0.0156
Milk powder	0.0751	0.1417	-0.3143	0.0166	-1.6026

Table 5. The cross-price elasticity of Hicksian based on the poverty levels in Indonesia 2019

Poverty level – Animal food groups	Demand for animal foods ↓				
	Egg	Daging Ayam	Egg	Ikan Segar	Egg
1.Extreamly poor	Hicksian cross-price elasticity (compensated)				
Egg	-0.4415	1.8827	-0.1185	1.3885	1.1223
Chicken meat	0.3140	-2.8572	10.3205	0.7284	1.0368
Beef	-0.0016	0.3118	-11.7047	0.4510	-0.1768
Fresh milk	0.0584	0.1978	3.9798	-2.7034	0.0798
Powdered milk	0.0707	0.4648	-2.4771	0.1355	-2.0621
2.Poor					
Egg	-0.4519	1.4245	1.0935	1.3483	1.0939
Chicken meat	0.3140	-2.2476	7.8283	0.9807	1.0613
Beef	0.0057	0.2399	-9.5304	0.5193	-0.1985
Fresh milk	0.0529	0.1711	3.0079	-3.0090	0.0622
Powdered milk	0.0793	0.4120	-2.3993	0.1607	-2.0189
3.Almost poor					
Egg	-0.4621	1.1720	1.4006	1.1735	1.0364
Chicken meat	0.3119	-1.8960	5.3121	1.0094	1.0475
Beef	0.0118	0.1908	-7.1547	0.4594	-0.1846
Fresh milk	0.0535	0.1688	2.1704	-2.7940	0.0647
Powdered milk	0.0849	0.3644	-1.7284	0.1517	-1.9640
4.Extremely poor					
Egg	-0.4790	0.9388	1.5020	1.0138	0.9524
Chicken meat	0.3137	-1.5778	3.7319	1.0798	1.0399
Beef	0.0193	0.1510	-5.5184	0.4246	-0.1717
Fresh milk	0.0532	0.1609	1.5839	-2.6715	0.0642
Powdered milk	0.0928	0.3271	-1.2994	0.1532	-1.8849
5.Not poor					
Egg	-0.4997	0.4282	0.8786	0.5271	0.5897
Chicken meat	0.2507	-1.0018	0.7353	0.9631	0.7402
Beef	0.0593	0.0927	-1.9520	0.2759	-0.0254
Fresh milk	0.0585	0.1856	0.4293	-1.9477	0.0874
Powdered milk	0.1312	0.2954	-0.0911	0.1816	-1.3918

The cross-price elasticity of chicken meat

Based on Hicksian's own-price elasticity in the food protein sources of animal protein, "chicken meat" at the national food level is a source of an animal protein whose demand is elastic towards the unitary for urban national aggregates and in "non-poor" household groups. Differences in demand elasticity are higher in rural than in urban areas. Chicken meat elasticity tends to decrease with an increasing level of welfare/household economy (Table 5 and Table 6), and demand becomes inelastic in the group of 40% of households with the highest level of welfare/economy (not poor). This means that the more prosperous or improved the household economy, the less responsive to price increases. Nationally, the Hicksian cross elasticity shows that there is no complementary effect on the four other animal protein sources if there is an increase in the price of chicken meat. The same results were obtained in the analysis unit of the status of the poverty level "total household expenditure" for the five food sources of animal protein.

The cross-price elasticity of beef

Nationally, the absolute value of the elasticity of beef prices decreases with increasing household economic status. This means that the less poor the household, the lower the elasticity. For extremely poor households, the substitution of beef is chicken meat, fresh fish, milk powder, and eggs. Whereas in non-poor households, the substitution of beef is eggs, chicken meat, and fish. In addition to the different substitution order, the proportion of substitution is also different, as indicated by the cross-price elasticity. Powdered milk is complementary to beef in all poverty level.

The cross-price elasticity of fresh fish

As with other animal protein sources, the sensitivity of the demand to the increase in own-prices according to the increasing level of the economy/household welfare. Despite its sensitivity, the demand for fresh fish is not as big as beef and chicken meat. The main substitution of fresh fish is beef, followed by chicken meat and milk powder. The contribution of eggs as a substitute for meat is relatively small. Perhaps the role of fresh fish is closer to the role of meat, compared to the case for milk powder.

The cross-price elasticity of powdered milk

Milk powder acts more as a beverage ingredient than an ingredient for food, although in some cases, it can also be used as an ingredient in making food. Sensitivity to the price of milk powder itself decreases with increasing levels of the economy/welfare of the household. The absolute value of own-price elasticity is the smallest compared to chicken, beef, and fresh fish. The complementary level decreases with increasing household economic/welfare. An interesting phenomenon occurs in non-poor households, that beef is no longer complementary to milk powder. The other four sources of animal protein are all substitutive items. This might be interpreted as meaning that the household is not poor; the behavior of consuming animal protein sources is already at the level of diversification, which is more directed at improving nutrition. This is thought to be a consequence of adequate or even excess household income.

Expenditure elasticity

Expenditures elasticities indicate the response to changes in demand for a commodity due to changes in expenditure/income. The expenditure elasticities of the five groups of protein source food commodities are presented in Table 6. Based on the results of income elasticity calculations, all food commodity sources of animal protein originating from eggs, chicken meat, meat, fish, and milk are positive, which means the food sources are classified as normal goods, not inferior. Based on the elasticity value shows that the elasticity of expenditure of chicken meat, beef, fish, and milk powder is more than 1 (elastic) - luxurious. In contrast, for egg commodities the elasticity value is less than 1 (inelastic) - normal/necessity. This indicates that the commodities of beef, chicken, fish, and milk powder are more responsive to changes in expenditure/income, while egg commodities are not responsive to changes in expenditure/income.

Table 6. Income elasticity based on the poverty levels in Indonesia 2016

Unit Analisys – Animal food group	Demand for animal food ↓				
	Eggs	Chicken meat	Beef	Fresh fish	Powdered milk
Poverty level		Income elasticity			
1.Extreamely poor	0.6117	2.3097	6.4261	1.9195	2.6130
2.Poor	0.6076	1.9424	5.8734	2.0334	2.5020
3.Almost poor	0.5985	1.7631	4.8653	1.9058	2.4457
4.Vulnerable poor	0.5830	1.5951	4.1105	1.8230	2.3478
5.Tidak Miskin	0.4921	1.3472	1.9561	1.4464	1.8474

Referring to the value of income elasticity of greater opinion 1 as a luxurious item, beef is the most luxurious food source of animal protein followed by powdered milk, fresh fish, and chicken. In general, the level of "relative luxury" of these four commodities decreases with increasing levels of the economy/household welfare. Chicken meat, fresh fish, and milk powder, although classified as a source of luxury animal protein, but not as luxurious as beef. Beef is the source of animal protein with the widest range of "relative luxuries". This disparity in the level of "relative luxury" becomes wider if an

analysis of poverty status units is used. This means that beef is a very luxurious and relatively inaccessible source of animal protein, especially for extremely poor, poor, almost poor and vulnerable poor households.

CONCLUSION

This study explains the impact of changes in prices and incomes on the behavior of consumption and demand for animal-based protein foods, using the QUAIDS approach. The research data used March 2016 SUSENAS data of 291,414 households. The results showed that there were different interactions between beef and the four other animal protein food sources, namely the extremely poor household group, found to have a complementary effect with eggs other than milk powder. Because the price of eggs is cheaper than milk powder, it indicates a shift in complementation due to limited purchasing power (proxy of total expenditure per capita). Poor household, almost Poor and Vulnerable Poor substitution of beef is mainly chicken, followed by fresh fish and eggs. For the Non-Poor, although there is a substitution effect due to an increase in the price of beef itself, the substitution effect is not/less significant.

The own-price elasticity of Hicksian beef is most elastic, followed by fresh fish, chicken meat, and milk powder. The Hicksian own-price elasticity decreases following the decrease in the level of household poverty. The case of beef, the elasticity of the family's own-price "extremely poor" -11.70% and families "not poor" -1.95%. The sensitivity of the decline in beef shopping due to rising prices for "extremely poor" households 5.5 times compared to "non-poor" family groups.

Beef is the most luxurious food source of animal protein followed by powdered milk, fresh fish, and chicken. In general, the level of "relative luxury" of these four commodities decreases with increasing levels of the economy/household welfare. Chicken meat, fresh fish, and powdered milk, although classified as a source of luxury animal protein, are not as fancy as beef. Beef is a very luxurious and relatively inaccessible source of animal protein food, especially for extremely poor, poor, almost poor, and vulnerable poor households, and this constitutes 40% of Indonesia's population.

Considering that eggs are the most widely consumed animal protein source consumed by households in Indonesia, the government should maintain egg price stability so that protein consumption increases and the national minimum protein adequacy rate is immediately met. To increase beef consumption, it is necessary to increase domestic beef production so that the price of beef is affordable not only for non-poor households but also for extremely poor, poor, almost poor and vulnerable poor households in Indonesia.

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