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Abstract. Indonesian has experienced high strategic food prices in recent years. This paper examines the welfare impact of rising strategic food groups' prices on Indonesian poor households using Linear Approximate Almost Ideal Demand System (LA-AIDS) approach. The elasticity coefficients derived from LA-AIDS are used to estimate Compensated Variation (CV) and Equivalent Variation (EV). The study uses SUSENAS (Indonesian National Socioeconomic Survey) raw data. Based on our estimates, the strategic food groups of rice, corn, and shallot are necessary goods, as their budget elasticity is positive and below one at the same time. Beef, chili, and sugar are luxury goods, with income elasticity above one. We find that, overall, higher strategic food price raised the average poor household's welfare. Higher food prices make most households worse off.

1. Introduction

During 2010 to 2015 there was a change in Indonesia's strategic food prices (table 1). Some of the factors that cause changes in strategic food prices include the transmission of international price situations and conditions, the problems of production and distribution, the moment of national religious holidays, local supply and imports, demand, and public expectations. Changes in food prices affect the high and low inflation that occurs, and in turn have an impact on people's purchasing power, especially for low-income / poor people [1]. Furthermore the development of food commodity prices greatly influences the welfare of the households at large, so that the development of food prices can be used as a partial indicator of the development of households welfare [2-5].

Table 1. Indonesia Strategic Food Price Data for 2010-2015

Commodity	Year					
	2010	2011	2012	2013	2014	2015
Rice	6,755.00	7,379.00	7,198.00	8,409.00	8,922.00	10,044.00
Corn	4,615.81	4,885.00	5,501.00	5,727.00	5,786.00	5,845.00
Soybean	8,912.00	9,779.00	10,316.00	11,049.00	10,120.00	9,881.00
Beef	66,329.00	69,732.00	76,925.00	90,055.00	94,210.00	104,328.00
Chilli	22,746.00	22,995.00	22,502.00	29,884.00	34,884.00	37,857.00
Shallot	18,894.00	25,928.00	21,949.00	30,751.00	26,511.00	34,000.00
Sugar	10,740.00	10,665.00	12,007.00	12,227.00	12,012.00	12,714.00

Source: [6-10]

Several studies on the impact changes in food prices on welfare have been carried out. [11-13,5] has conducted research on the impact of rising food prices on poverty and welfare in India, Vietnam, Mexico and Ghana by using compensating Variation (CV) as a measure. The results of the study explain that the increase in food prices will reduce the welfare of households, especially households that have low income.

This research is different from several existing studies. This research focuses on the impact of changes in Indonesia's strategic commodity prices on welfare by using Computing variation (CV) and equivalent variation (EV). The study used two measuring instruments at the same time in the hope that the results of the research implications would be in the form of alternative food pricing policies that are most suitable. Furthermore, the purpose of this study is to analyze the impact of the increase in strategic food prices on poor households in Indonesia.

2. Materials and Methods

2.1. Data

Indonesian data on households incomes and expenditures was obtained from SUSENAS (Indonesian National Socioeconomic Survey). This data is cross-sectional and it is published by The Central Statistic Agency of Indonesia. The data is collected from each household for one week by performing direct interview. The data used is 2016 data. Data is limited to poor households totaling 28.652.

. Model Selection

The Almost Ideal Demand System (AIDS) has several advanced of this demand system. Furthermore, there has enjoyed great popularity in applied demand analysis. First, AIDS derived from specific cost function and thus corresponds to a well defined preference structure. Second, a property of AIDS is a consistent aggregation from micro to market level. Third, nonlinear Engel curves are possible [14,15].

The explanatory power of the AIDS model has been recognized in demand studies conducted for both developed and developing countries. The approach has been used demand studies of Turkey [16], Demand for Food in Myanmar [17].

$$w_i = \alpha_i + \sum_j \gamma_{ij} \log p_j + \beta_i \log(x/P) + \mu_i \quad (1)$$

Where w_i, is expenditure share of good i, y is a total expenditure, and μ_i denotes the disturbance term. P is a price index defines as

$$\log P = \alpha_0 + \sum_k \alpha_k \log p_k + \frac{1}{2} \sum_k \sum_j \gamma_{ij}^* \log p_i p_j^* \quad (2)$$

The intercept α_i represent the estimated budget share of commodity i (rice, corn, beef, shallot, chili, and sugar) when all logarithmic prices and real expenditures are zero, interpreted the subsistence consumption of commodity i. The $\beta_i's$ are real expenditure coefficients and represent the change in commodity i's expenditure share with respect to change in total outlay, ceteris paribus.

To be consistent with consumer demand theory, we must ensure that the demand system satisfies adding-up, homogeneity in prices and income and Slutsky simmetry conditions hold as follows:

$\sum \alpha_k = 1$, $\sum_k \gamma_{kj} = 0$, and $\sum_k \beta_k = 0$ (adding-up property)

$\sum_j \gamma_{kj} = 0$ (homogeneity property), and
$\gamma_{kj} = \gamma_{jk}$ (symmetry property)

The LA-AIDS model was then developed by including the variable of household size this was also done by [18,19]:

$$w_i = \alpha_i + \sum_j \gamma_{ij} \log p_j + \beta_i \log(x/p*) + \beta_i \log ART_j + \mu_i \quad (3)$$

The Household survey reported by the SUSENAS report provides some zero expenditure in given type strategic food commodity. Zero expenditures imply that the demand system is the limited dependen variables or censored model and leads to bias estimation (Heien & Wesseils, 1990). The bias estimation for a system of equations with limited dependent variables in the demand system can be solved by using the consistent two-step estimation procedure for rice, corn, beef, shallot, chili, and sugar.

The IMR value is obtained from the following equation:

$$IMR_{ih} = \frac{\phi(x_i\beta)}{\theta(x_i\beta)} \; for \; y_{ih} = 1$$
$$IMR_{ih} = \frac{\phi(x_i\beta)}{\theta(x_i\beta)} \; for \; y_{ih} = 0$$

Where x is a social demographic factor, β is a commodity price log. y_{ih} is a dummy variable, $y_{ih} = 1$ if the household consumes commodities and $y_{ih} = 0$ if the household does not consume commodities.

IMR calculation is the first step. Calculation using a nonlinear seemingly unrelated regression (SUR). and linear seemingly unrelated regression (SUR) is used in the scond step. Adding up, homogeineity, and symmetry restrictions are imposed in the second stage. Heien and & Wesseils [20] used Heckman's two-step estimation by entering IMR in observation. So that the LA-AIDS equation is obtained as follows.

$$w_i = \alpha_i + \sum_j \gamma_{ij} \log p_j + \beta_i \log(x/p*) + \beta_i \log ART_j + IMR_j + \mu_i \quad (4)$$

The results of the estimation model with LA-AIDS are used to calculate demand elasticity.

The value of compensated own price elasticity: $\epsilon_{ii}^M = -1 + \frac{\gamma_i}{w_i} + w_i$ (5)

The value of compensated cross-price elasticity: $\epsilon_{ij}^M = \frac{\gamma ij}{w_i} + w_j$ (6)

The value of uncompensated own price elasticity: $\epsilon_{ii}^M = -1 + \frac{\gamma_i}{w_i} - \beta_i$ (7)

The value of uncompensated cross-price elasticity: $\epsilon_{ij}^M = \frac{\gamma ij}{w_i} - \beta_i \frac{w_j}{w_i}$ (8)

The value of Expenditure elasticity : $\eta_i = 1 + \frac{\beta_i}{w_i}$ (9)

Marginal Expenditure share: $m_i = \eta_i . w_i$ (10)

where ϵ_{ii}^M is the value of uncompensated own price elasticity, ϵ_{ij}^M is the value of uncompensated cross-price elasticity, ϵ_{ii}^H is the value of compensated own price elasticity, ϵ_{ij}^H is the value of uncompensated cross price elasticity, η_i is the value of Expenditure elasticity, m_i is marginal Expenditure share.

In this study the impact of price changes on welfare was analyzed using the Compensating

Variation (CV) concept approach [22-24,5] which uses observations of the household budget share after price changes and price elasticity are estimated as derivatives of the AIDS model. Compensated Variation is the amount of money needed to compensate a household after a price change and to restore the utility level after a change.

$$CV = \left[m^0 lnp_1 \left(\alpha_1 + \sum_{j=2}^{n} \gamma_{ij}\, lnP_j + \beta_1 lnm^0 + \frac{1}{2}\gamma_{ij} lnp_i\right) - \beta_1 m^0 lnp_i \left(\frac{1}{2}\alpha_i lnp_i + \sum_{j=2}^{n} \alpha_j lnp_j + \frac{1}{6}\gamma_{ij}(lnp_i)^2 + \frac{1}{2}\sum_{ji=2}^{n}\sum_{j=2}^{n} \gamma_{ij}\, lnp_i lnp_j\right)\right]_{p_1^0}^{p_1'} \quad (11)$$

The equivalent variation of a reform project transforming (p,m) into (p',m') is a change in income that the consumer would be indifferent about accepting in lieu of the price and income change induced by the project. In other words, the equivalent variation is the unique amount of money, denoted by EV, such that not having the reform project and instead of receiving the transfer payment EV results in the same utility for the consumer as not having this transfer payment but having the project being implemented. Of course, if EV is negative this means that taking away the amount from the consumer results in the same utility for the consumer as not having this transfer payment but having the project being implemented.

$$EV(p,p',m,m') = e(p,v(p',m')) - m \quad (12)$$

3. Results and Discussion

3.1. Estimation of Strategic Food Demand for Poor Households

Poor households are households that have the highest income of IDR 335,124 / month. The number of poor households is 28,652 households. The results of the analysis show that the corresponding price parameter coefficients in beef commodities are negative, which means that the increase in beef prices will reduce the share of demand for beef. This is in accordance with Downward Slopping's demand curve theory and supports the results of the study [25, 26].

Variable coefficient values for other commodity prices vary, some are positive and some are negative. Share of expenditure on rice commodities will decline due to the increase in prices of corn, meat, shallots and chillies (Table 2).

Table 2. Estimation of Parameters for Strategic Food Demand for Poor Households

Variable	Rice	Corn	Beef	Shallot	Chilli	Sugar
Intercept	7.745	-6.628	-2.055	1.203	-1.369	0.844
Price of Rice	-0.541	0.279	0.177	-0.005	-0.035	0.004
Price of Corn	0.279	-0.116	-0.139	-0.001	-0.001	-0.003
Price of Beef	0.177	-0.139	-0.047	0.004	-0.019	0.006
Price of Shallot	0.006	0.007	-0.006	0.002	0.001	-0.002
Price of Chilli	0.028	0.002	0.007	0.001	0.055	-0.001
Price of Sugar	0.051	-0.033	0.008	-0.002	-0.001	0.001
Expenditure	-0.87	0.481	0.316	0.001	0.016	-0.003
Household Size	0.798	-0.466	-0.281	-0.001	-0.030	0.006
Invers Mill's ratio	3.618	1.437	-1.242	-1.201	1.563	-0.967
	0.021	0.062	-0.053	-0.005	0.008	-0.007
R^2	0.998	0.999	0.999	0.999	0.999	0.999

Source: Primary data and calculations

The coefficients of household size for rice and sugar are positive and significant for poor

households. This means that when there is an increase the number of household members, the share of expenditure for rice and sugar increases. On the other hand the coefficient of the number of household members for corn, beef, shallots, and chilies is negative and significant, meaning that when an increase in the number of household members will cause a decrease in expenditure for corn, beef, and shallots.

The inverse mill's ratio variable was found to be significant for rice, corn, beef, shallot, chili, and sugar consumption in terms of the products studied.the fact that the inverse mills ratios were found to be meaningful for other products indicates the need to include this variable in the model. The IMR variable is a variable used to avoid estimation results that are biased due to zero consumption.

3.2. Expenditure Elasticity and Marginal Expenditure Share

The value of expenditure elasticity and marginal expenditure share for poor household presented in Table 3. All expenditure elasticity values are positive, meaning that the increase in income will increase consumption of all strategic foods (rice, corn, beef, shallots, chilies and sugar). this condition illustrates that Indonesia's strategic food is a normal good. This finding is in accordance with the findings [18,21]. The beef had the highest expenditure elasticity (14.86), followed by sugar (1.47), Chili (1.031), shallot (0.974), corn (0.934), and rice (0. 283). Rice, corn, and shallots are commodities of necessities because the value of elasticity is less than one. Beef, chili, and sugar are elastic/ luxury goods because the value of expenditure elasticity is greater than one.While luxury goods are products that are not essential but are highly desired, the demand for necessity goods does not decrease although the price increases. The expenditure elasticity of rice for poor households in Indonesia is lower when compared to the expenditure elasticity of rice in Mali, Africa [28, 29]. This shows that in Indonesia poor households allocate less expenditure on rice consumption than in Mali and Bamako.

The marginal expenditure share measures the future allocation of any increases in income [30]. Table 3 shows that in the long run, as income increases, poor households will increase the expenditure share on Indonesia's 6 strategic foods.

Table 3. Expenditure Elasticity and Marginal Expenditure

Food Group	Expenditure Elasticity	Marginal Expenditure Share
Rice	0.283	0.218
Corn	0.934	0.353
Beef	14.836	0.190
Shallot	0.974	0.050
Chili	1.031	0.073
Sugar	1.473	0.117

Sumber: Primary data and calculations

3.3. Own and Cross Price Elasticity for Poor Household

Table 4 shows that all price elasticities, both uncompensated and compensated, are negative, according to the demand theory. According to the theory of commodity, price demand has a negative relationship with the number of demands. This supports the findings from Ghahremanzadeh and Ziaei [30]. The value of beef price elasticity is greater than one both compensated and uncompensated. This shows that beef is a luxury commodity for poor households

Compensated price elasticity provides a more accurate picture of cross-price substitution between strategic food groups because it describes the size of the substitution effect after

reducing the effect of income. So the value of compensated elasticity is smaller than the value of uncompensated elasticity.

Uncompensated cross elasticity shows that rice is a commodity that has a complementary relationship with corn, beef, chili, and sugar, and has a substitution relationship with shallots. Meanwhile, when viewed from the value of compensated cross elasticity, rice has a complementary relationship with maize, and beef, and has a substitution relationship with shallot, chili, and sugar.

Table 4. Uncompensated and Compensated Price Elasticities Results

Commodity	Rice	Corn	Beef	Shallot	Chilli	Sugar
			Uncompensated			
Rice	**-0.6062**	-0.5867	-0.6053	-0.5698	-0.5554	-0.5494
Corn	-11.2406	**-0.0466**	-2.0628	-2.6528	-2.8923	-2.9926
Beef	-154.9461	-51.7711	**-47.9831**	-55.0357	-57.8217	-58.9882
Shallot	0.1127	0.0935	0.0929	**-0.0928**	0.0960	0.0949
Chilli	-0.0563	-0.0332	-0.0324	-0.0339	**-0.0323**	-0.0348
Sugar	-0.2823	0.0693	0.0816	0.0582	0.0487	**-0.0822**
			Compensated			
Rice	**-0.8358**	-0.5790	-0.6049	-0.5554	-0.5354	-0.5270
Corn	-1.2762	**-0.0193**	-2.0453	-1.9958	-1.9757	-1.9673
Beef	-47.2127	-47.9558	**-48.9817**	-47.9323	-47.9122	-47.9038
Shallot	0.8632	0.1201	0.0942	**-0.8564**	0.1637	0.1721
Chilli	0.7572	0.0140	-0.0119	0.0375	**-0.9424**	0.0660
Sugar	0.3787	0.1066	0.0806	0.1301	0.1501	**-1.3124**

Source: Primary data and calculations

3.4. Food Price and Household Welfare

The Value of The impact of changes in prices on welfare can be seen from the value of CV. Table 5 shows that rural poor households will have a greater impact than urban households due to rising prices. The positive value of CV in the village and in the city shows that the increase in the price of 6 strategic commodities causes the household to go worse off.

Table 6 shows the equivalent variation values. Equivalent variation is the amount of money that, paid for a person, a group, or a whole economy, would make them as well as a specified change in the economy. Providing a monetary measure of change that is similar to, but not, in general, the same as compensating variation. The EV value of 65.6% means that the price increase of 6 strategic commodities will have an impact on reducing household welfare by 65.6 % .

Table 5. Compensating Variation for Poor Household

Food & Non_food Items	W/O Subst	Subst Only	W/ Subst
URBAN			
ALL Items	**-24,834**	**1,932**	**-22,902**
Rice	-13,059	309	-12,750
Corn	-49	0	-49
Beef	-336	119	-218
Shallot	-4,454	627	-3,828
Chilli	-6,216	870	-5,345
Sugar	-720	7	-712
Other foods	0	0	0
Non-food	0	0	0
TOTAL (RUTA)	**-24,834**	**1,932**	**-22,902**
% to AVERAGE HH			**56.3%**
RURAL			
ALL Items	**-28,494**	**2,053**	**-26,442**
Rice	-15,494	331	-15,162
Corn	-181	0	-180
Beef	-315	106	-209
Shallot	-4,993	694	-4,299
Chilli	-6,621	913	-5,708
Sugar	-891	8	-883
Other foods	0	0	0
Non-food	0	0	0
TOTAL (RUTA)	**-28,494**	**2,053**	**-26,442**
% to AVERAGE HH			**74.1%**

Source: Primary data and calculations

Table 6. The Value of Equivalent Variation for Poor Households

Food & Non_food Items	W/O Subst	Subst Only	W/ Subst
ALL Items	**-27,032**	**2,628**	**-24,404**
Rice	-14,521	633	-13,888
Corn	-128	3	-125
Beef	-324	135	-189
Shallot	-4,778	776	-4,001
Chilli	-6,459	1,056	-5,403
Sugar	-822	25	-798
Makanan Lainnya	0	0	0
Bukan-Makanan	0	0	0
TOTAL (RUTA)	**-27,032**	**2,628**	**-24,404**
% to AVERAGE HH			**65.6%**

Source: Primary data and calculations

4. Conclusion

Based on our estimates, the strategic food groups of rice, corn, and shallot are necessary goods, as their budget elasticity is positive and below one at the same time. Beef, chili, and sugar are

luxury goods, with income elasticity above one. The results of the analysis using CV and EV obtained the value of CV for poor households in rural areas with the highest value, thus implying that the income policy will have a greater impact than the price policy.

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