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## Research Article

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## Does Price Fluctuations Decrease Purchasing Power? An Almost Ideal Demand System Model

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**Abstract:** This study aims to analyze the influence prices of gasoline, LPG, electricity and water as well as the influence of the family size and education on the purchasing power of rural communities in Aceh Province by looking at changes in price elasticity, income, and elasticity of control variables, family size and education. The data used is cross-section data collected from the National Socio-Economic Survey (Susenas) in March 2018, covering 975 rural households in Aceh Province with an analysis model Almost Ideal Demand System (AIDS) by using estimates in the form of Multinomially Unrelated Regression (SUR). The results showed that prices and incomes could significantly influence the purchasing power of rural communities in Aceh Province with the effect of own-prices and cross prices is positive, but income is negative. Besides, the control variables, family size and education, those have a positive and significant influence on the purchasing power of rural communities on 4 administered prices. Furthermore, the results of elasticity calculation showed that the purchasing power of rural communities in Aceh Province on electricity, water and LPG commodities are inelastic and gasoline commodities is elastic and has a positive value on the own-price and cross prices. Then, the income elasticity of electricity and water commodities is positive. In contrast, the income elasticity for gasoline and LPG is negative. For the elasticity of control variables, family size and education, have positive elasticity values in the commodities of electricity, LPG, gasoline, and water. Therefore, the government needs to maintain the price stability in rural areas.

**Keywords:** Price fluctuations, purchasing power, elasticity, AIDS model.

### INTRODUCTION

Purchasing power is the ability to pay to obtain the desired item. Indicator of purchasing power can be seen from the increase in people's real income. The increasing of income will cause the increasing the demand of goods and services. It will trigger an increase in prices of goods and cause inflation. Inflation brings positive and negative impacts on the economy sectors. Low and stable inflation will increase real people's income and encourage the economy to be better, conversely high and unstable inflation will reduce the real income of the community, so that the purchasing power of the community also decrease, especially for workers who have fixed income.

The increase of inflation is closely related to people's purchasing power (low-income purchasing power). Kaplan & Wohl (2017) stated that high

inflation occurs in low-income households. More deeply, Bosch and Koch (2009) argued that inflation can reduce people's purchasing power because people will spend more income to get the desired goods.

Aceh is one of contributor of high inflation at the national level. Aceh's inflation rate was above the national inflation about 3.95 percent in 2016 and increased about 4.25 percent in 2017 due to an increase in electricity tariffs which contributed 0.81 percent (BPS, 2018). The increasing of Aceh's inflation rate beyond the national level is influenced by the price policy set by the government.

To control inflation, Bank Indonesia Aceh representative and Aceh's government have formed the Aceh Provincial Regional Inflation Control Team (TPID). The decline of pressure on Aceh's inflation rate

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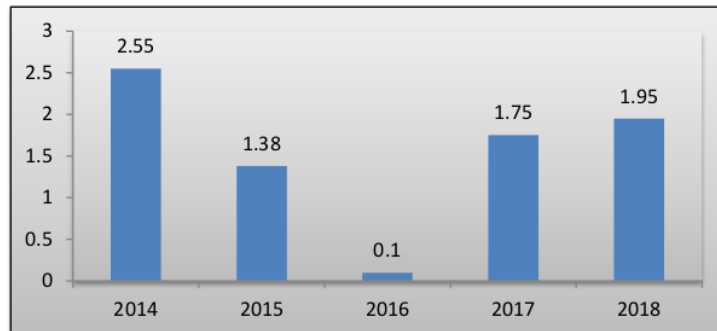
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occurs because the more stable volatile food commodity prices in the community. Meanwhile, administered price commodities are a factor driving inflation in Aceh due to the policy of rising fuel prices and goods and

services demand and community mobility at the end of the year (www.bi.go.id, 2019). The development of Aceh's inflation rate contribution from administered prices commodities can be seen in Figure 1.



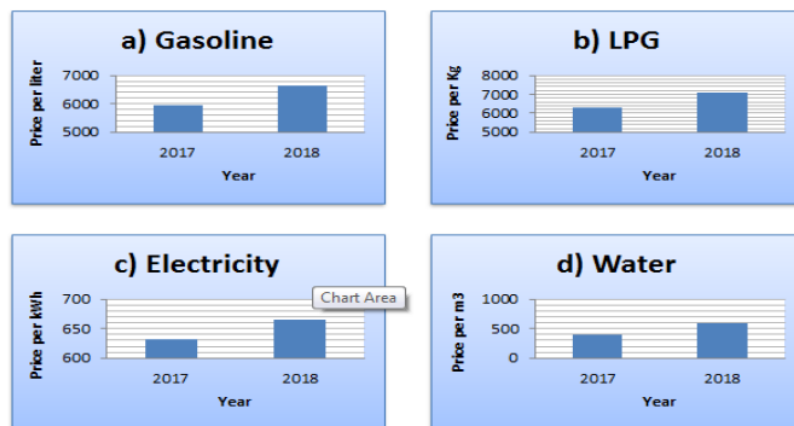
**Figure 1 Inflation Administered Prices Commodities in Aceh (percent), 2014-2018**  
 Source: BPS, 2014-2018 (data processed).

In the period 2014-2018, administered prices commodity inflation remained to fluctuate depending on local government policy. The highest inflation occurred in 2014 about 2.55 percent caused by the increase of fuel prices and the rupiah exchange rate. Then, in 2015, the inflation declined along with the decline in fuel prices. The lowest inflation occurred in 2016 by 0.1 percent, where inflation this year was more due to rising prices of food and processed foods (volatile food). Then, in 2017 inflation experienced an increase to 1.75 percent which was largely due to an increase in electricity tariffs.

The increase or decrease in prices on administered prices will affect the coefficient of elasticity of each item. This elasticity is related to the level of people's purchasing power. Price elasticity can

measure how much price changes can affect people's purchasing power. The elasticity of prices which tends to be elastic means that an increase in price will reduce people's purchasing power. The more elastic it is, so the purchasing power of the people will decrease. Conversely, the more inelastic it is, the price increase does not affect people's purchasing power.

Figure 2. showed the average price per commodity administered prices, namely (a) gasoline, (b) LPG, (c), electricity and (d) water obtained from the National Socio-Economic Survey (Susenas) in rural households in Aceh Province. Average administered prices of commodity prices during the 2017-2018 period have an upward trend, these price increases can affect changes in people's purchasing power.



**Figure 2 Average Prices for Administered Prices Commodity In Aceh, 2017-2018**

Source: Susenas, 2017-2018 (processed).

Besides the price and income, control variables such as the level of education and the number of family members also have a bearing on people's purchasing power. The higher level of education, the value of income elasticity is inelastic, because additional income is more used to consume other goods (besides the main staple goods). While low-income households (heads of households with secondary education) showed that an increase in the family size will reduce the allocation of income to the education sector (Kahar, 2010).

Research related to price fluctuations and purchasing power has been studied by other researchers. But, by case studies in different countries, different variables, as well as with data samples in different periods. There are also studies with case studies in Aceh but only two variables are the same as this research, but the researchers do not see intertemporal changes. The research has been done by Sefarita (2015) who see demand for commodities contributing to poverty in Aceh Province. Analysis of urban households using the analysis model Almost Ideal Demand System (AIDS).

The sample of this study is rural households and cross-section data of March 2018. Given the differences from previous studies, this study tries to fill the gap of previous studies aimed at analyzing the effects of fluctuations in the prices of gasoline, LPG, electricity and water supply and the influence of education levels and family members on the purchasing power of rural communities. This case conducts by looking at change on price elasticities, income elasticity, and control variable elasticity, family size and education level.

#### Literature Study

There are several previous studies that found the final results of the relationship of variables used in research. Deaton and Muellbauer (1980) see welfare from the magnitude of price and income elasticities. This research was carried out in British in 1954-1974 and this research the first writing that uses AIDS model. The results showed that the price did not have a big impact on people's welfare. This can be seen from the elasticity of price inelasticity and even in some commodities looks perfectly inelastic. Viewed from the income elasticity, welfare in the UK is improving as seen from the increase in demand for commodities outside of primary needs.

Guta (2012), using the AIDS model, he sees households that use energy in rural Ethiopia. The results showed that households with low incomes will have an impact on the elasticity of expensive expenditure on fuel. Expenditures on fuels are elastic, so the use of fuel will reduce consumption of other commodities.

Sahinli (2013), looked at welfare in Turkey over the period 2002-2011. This study uses the AIDS model to see the effect of price and income changes on

the welfare of urban and rural areas in all provinces in Turkey. Food and beverage commodities, alcoholic beverages and cigarettes, communication, education services, as well as housing and energy (water, electricity, gas, and fuel) are inelastic. The inelastic nature of the commodity shows that rising prices will not significantly influence the decline in demand.

Irfan, *et al* (2018), looked at the elasticity of household fuel prices in Pakistan. Using the Linear Approximate Almost Ideal Demand System (LA-AIDS) model, the results of the research showed that all types of fuel except natural gas are inelastic in urban households. Whereas, in rural areas, natural gas and LPG have price elasticities that are elastic.

Brockwell (2013), also analyzes price and income elasticities using the AIDS model in Sweden, Denmark and the United Kingdom. The commodities used are cigarettes, wine, electricity, household appliances, clothing (clothing and shoes), alcoholic beverages, gas, gasoline, beer, meat, fish and seafood, as well as dairy products and non-alcoholic beverages. The results showed that the price of staple food commodities and fuels such as gas and gasoline did not really affect demand as seen from its inelastic nature. While the price of household equipment is large enough to affect demand, this can be seen from its elastic nature.

Sun and Ouyang (2016), looked at the price elasticity and expenditure of household energy demand during urbanization in China using data from the China Occupancy Energy Consumption Survey (CRECS) which includes households at different income levels and applies the Linear Approximate Almost Ideal Demand System model (LA-AIDS). The results showed that the demand for electricity, natural gas and transportation fuels is inelastic to household demand.

Jansky, *et al.*, (2013), analyzed ready-to-eat / restaurant commodities, household equipment, transportation and recreation services, other services, food, clothing, energy, and other goods, by looking at price and income elasticities using the Quadratic Almost Ideal Demand System (Quadratic Almost model) Ideal Demand System. The results of the study showed that the readiness of fast food / restaurants and household equipment has a price elasticity value that is elastic, while the prices of basic necessities such as food, clothing, energy, and other goods appear to be inelastic, then the income elasticity of food, energy, and other basic needs are inelastic.

#### METHODOLOGY

This study uses secondary data in the form of cross section in March 2018. Data was obtained from the National Socio-Economic Survey (Susenas) conducted by the Central Statistics Agency of Aceh Province. The data used in this study were taken randomly from a sample of rural households used by

Susenas in the household survey in the Province which consisted of 975 households in March 2018 which consumed four commodity administered prices, namely; gasoline, LPG, electricity, water, and control variables (family size and education level).

The model used in this study is Almost Ideal Demand System (AIDS) model, introduced by Deaton and Muellbauer in 1980. Estimating the AIDS model uses Seemingly Unrelated Regression (SUR). The general form of the AIDS model request function is as follows:

$$W_i = \alpha_i + \sum_j \gamma_{ij} \log P_j + \beta_i \log (x/p) \dots\dots\dots(1)$$

Where P is the price index specified by:

$$\log P = \alpha_0 + \sum_i \alpha_i \log P_i + \frac{1}{2} \sum_j \sum_i \gamma_{ij} + \log P_i P_j \dots\dots\dots(2)$$

Because equation (2) is non-linear and difficult to estimate, a linear approximation of the price index called the Stone Index, namely:

$$\log p^* = \sum w_i \log p_i \dots\dots\dots(3)$$

By using the Stone price index equation (3), it becomes linear and easy to estimate. The general model was then modified by prior research by adding control variables, namely the level of education and family member. So, the AIDS model uses in this study.

$$W_i = \alpha_i + \sum_j \gamma_{ij} \log P_j + \beta_i \log (x/p^*) + \rho_i \log ART + \sigma_i \log PDD + \mu_i \dots\dots\dots(4)$$

Where:

- $W_i$  : The proportion of expenditure for commodity i to total commodity expenditure j (budget share)
- $P_j$  : commodity group prices to j
- $(x/p^*)$  : total expenditure deflated by the Stone index
- PDD : household education of the sample
- ART : family size of the sample
- $\mu_i$  : error term

To ensure the maximum assumption of satisfaction is not violated, there three restrictions that must be included in the model are additivity, homogeneity, and symmetry.

$\sum \alpha_i = 1 ; \sum \beta_i = 0 ; \sum \gamma_{ij} = 0$	Additivity
$\sum \gamma_{ij} = 0$	Homogeneity
$\gamma_{ij} = \gamma_{ji}$	Symmetry

The AIDS Model regression coefficient in equation (4) is then used in order to calculate elasticity as a proxy for measuring the purchasing power of rural communities. The following elasticity calculation formula is based on the results of the AIDS model estimation (Aliasuddin, 2003 & Kahar, 2010):

Income  $\eta_i = 1 + \frac{\beta_i}{W_i} \dots\dots\dots(5)$

Price (Marshallian)  $\epsilon_{ii} = -1 + \frac{\gamma_{ii}}{W_i} - \beta_i \dots\dots\dots(6)$

Price (Hicksian)  $\delta_{ii} = -1 + \frac{\gamma_{ii}}{W_i} + W_i \dots\dots\dots(7)$

Cross (Marshallian)  $\epsilon_{ij} = \frac{\gamma_{ij}}{W_i} - \beta_i \left(\frac{W_j}{W_i}\right) \dots\dots\dots(8)$

Cross (Hicksian)  $\delta_{ij} = \frac{\gamma_{ij}}{W_i} + W_j \dots\dots\dots(9)$

Family Size  $\epsilon_{ART} = \frac{\rho_i}{W_i} \dots\dots\dots(10)$

Education  $\epsilon_{PDD} = \frac{\sigma_i}{W_i} \dots\dots\dots(11)$

**RESULT AND DISCUSSION**

Table 1 shows the estimation results of the Almost Ideal Demand System (AIDS) model. Estimation is carried out using the Seemingly Unrelated Regression (SUR) model, where the model is used to

estimate the demand model with restrictions such as adding up, homogeneity, and symmetrically. In general, the estimation results of the 2018 AIDS model are sufficient to meet econometric criteria to proceed to test the elasticity of the AIDS model. This condition can be

seen from the significant coefficient values based on the t-test at a confidence level of 99 percent and 95 percent. This is consistent with the relationship between price and demand theory. Adjusted R-squared value (coefficient of determination) also looks quite large,

above 50 percent, so that together all dependent variables can be explained by independent variables. The Durbin Watson (DW) value also looks quite large in that the average is above 1 or even exceeds 2, this indicates no autocorrelation.

**Table 1 Estimated AIDS Model Results, March 2018**

Variables	w_Electricity	w_Gasoline	w_LPG	w_Water
Constanta	0.183858*	0.241823*	0.061688*	0.076129*
LP_Electricity	0.010341*	0.016623*	0.001760*	0.003147*
LP_Gasoline	0.001968	0.035756*	0.001999	0.005225**
LP_LPG	0.014539*	0.030179*	0.016606*	0.002613
LP_Water	0.004144*	0.004791**	0.000486	0.000172
Lw	-0.035837*	-0.073095*	-0.016715*	-0.001357*
Family Size	0.002054*	0.004451*	0.000852*	0.000806*
Education	0.000559*	0.000909*	9.86E-05*	0.000158*
Adjusted R-squared	0.593905	0.571712	0.740601	0.629493
Durbin-Watson stat	2.022163	0.646578	2.031450	2.082930

\*: Significant at a 99 percent confidence level

\*\* : Significant at 95 percent confidence level

From the estimation results of the AIDS model in equation 3.4, we get the value ( $\beta$ ), namely the coefficient of expenditure (income), value ( $\gamma$ ), which is the coefficient of the price of the goods themselves and the price of other goods, and the value of  $w$  obtained from the average proportion of administered prices. The

values of  $\beta$ ,  $\gamma$  and  $w$  are then entered into equations 3.5 through equation 3.10, so we get the income elasticity value, own-price elasticity (using Marshallian) cross-price elasticity value (using Marshallian), and the elasticity value of the control variables.

**Table 2. Value of Own Price Elasticity, Cross Prices, Income and Control Variables According to Commodities of Rural Communities in Aceh Province, March 2018**

Administered Prices commodities	Price Elasticity ( $E_{ii}$ dan $E_{ij}$ )				Income Elasticity ( $E_{iy}$ )	Elasticity of Control Variables ( $E_{ve}$ )	
	Electricity	Gasoline	LPG	Water		Family size	Education
Electricity	<b>-0.50398</b>	0.10260	0.69455	0.19870	0.82919	0.09781	0.02662
Gasoline	0.34919	<b>-0.23929</b>	0.59864	0.10338	-0.40567	0.08560	0.01748
LPG	0.16239	0.22063	<b>0.29410</b>	0.04767	-0.28577	0.06554	0.00758
Water	2.26724	3.78061	1.87612	<b>-0.87579</b>	0.03071	0.57571	0.11286

Source: AIDS Model Regression Results, 2019 (processed).

The elasticity of administered prices of commodity prices in rural communities in Aceh Province can be seen in Table 4, it has a negative value ranging from -0.23929 to -0.87579 and is inelastic especially in electricity and water commodities, which means that an increase in price of one percent will cause the number of commodities purchased to decrease by 0.23929 percent to 0.87579 percent (assuming ceteris paribus). This is following the expected results (according to theory). Meanwhile, gasoline and LPG commodities have a positive value, which means that an increase in price will not reduce the amount of commodity demanded because the commodity is a basic need of the community. So that when there is a change in price the quantity of a commodity demanded remains. LPG commodities are inelastic with their elasticity value of 0.36843 and gasoline commodities are elastic which are characterized by the elasticity of more than one (0.29410) which means that price changes will not reduce the demand for commodities in

large quantities. This is in line with the research of Akpalu (2011) where the elasticity of demand prices in Ghana is not elastic on charcoal, firewood, and LPG, while kerosene is elastic. Next, they found that LPG was the most preferred fuel, followed by charcoal, firewood, and kerosene.

The increase in the price of a commodity in addition to affecting the demand for the commodity will also affect the demand for other commodities (seen in cross-price elasticities). The table above shows that in general the value of cross-price elasticity between one administered price commodity and another administered price commodity has a positive sign indicating the relationship of substitution and that commodity is equally important for rural communities. This is in line with research conducted by Sefarita (2015) wherein general the value of price elasticity has a negative influence and tends to be inelastic, while the LPG and electricity commodities have a positive cross-

price elasticity value. The negative and positive cross-price elasticity of various commodities cannot only be interpreted as supplementary goods or substitute goods. The value of positive cross-price elasticity shows that both commodities are equally important for households. The increase in prices of other goods will not affect the demand for the commodity under study. Conversely, when the value of cross elasticity is negative, an increase in the price of other goods will reduce the demand for the commodity under study.

Looking at the income elasticity value, in general, the income elasticity is positive and not elastic. Electricity commodity has the highest income with a positive elasticity value of 0.82919 and followed by water commodity 0.03071 which shows that this commodity is a normal item, where an increase in income will increase demand for the commodity. While gasoline and LPG commodities have a negative elasticity value and inelastic which shows that these commodities are inferior goods. This means that an increase in income will not increase demand for this commodity, but an increase in income will ask for other types of higher quality. Besides, in general Table 4 shows the elasticity value of the control variable is positive, which means that the higher level and increase in the number of family members will result in an increase in expenditure levels for these commodities.

#### CONCLUSIONS AND SUGGESTIONS

Overall the result of the study indicates that price and income can significantly influence the purchasing power of rural communities in Aceh Province with the effect of own-prices is positive, positive cross prices and negative income. Besides, the control variable, namely the number of household members and the level of education has a positive and significant influence on the purchasing power of rural communities on 4 administered prices.

The result of elasticity calculation shows that the purchasing power of rural communities in Aceh Province on electricity, water and LPG commodities are inelastic and gasoline commodities are elastic. Those have a positive value on the own-price and cross prices. Then the income elasticity is positive for electricity and water commodities, while the elasticity of revenue for gasoline and LPG is negative. For the elasticity of control variables (family size and education) have positive elasticity values in the commodities of electricity, LPG, gasoline, and water.

Therefore, the government needs to maintain price stability in rural areas and further research on this issue is expected to incorporate more variables and areas and make comparisons between time into the analysis to provide more comprehensive and robust findings so that they can be used as references by policy

makers in designing policies to further enhance people's purchasing power.

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