



## Estimating Food Elasticities for Urban and Rural Households in Indonesia

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### ABSTRACT

This study aimed to analyze changes in household consumption patterns in rural and urban areas due to price changes in the rice commodity. The data sources used were the 2016 National Socio-Economic Survey (SUSENAS). Household food consumption data were grouped into ten food groups, while respondent households were grouped into four household groups, i.e., rich urban, poor urban, rich rural, and poor rural groups. The research methodology used was QUAIDS and Elasticity. The results showed that the characteristics of the four household groups on the variable number of household members and the age of the household head had almost the same average. However, the household heads were different in the variable of education length. The longest education was in the rich urban group, while the least was in the poor rural group. Likewise, the highest average income was the rich urban group, and the lowest was the poor rural group. As for commodities, the poor areas share that were greater than the rich ones are rice, other carbohydrates, fat, fruits, spices, and other ingredients. In contrast, the larger commodities in rich areas than in poor areas were meat, eggs-milk-and beans, vegetables, cigarettes, and prepared foods. Of the four commodity groups, the highest share was cigarettes and prepared foods, greater in rich areas than in poor areas, both for urban and rural areas. For the rice commodity, the household group with the highest share was the poor rural group of 0.23, while the smallest was the rich urban group of 0.1033.

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### INTRODUCTION

Differences in consumption patterns among households are due to changes in food preferences. This change is dynamic following the changes in the level of education, income, number of household members, and age. Generally, the public response to rising prices will reduce demand and vice versa, following the law of demand. In addition, another factor that influences preferences is income. Households that have high incomes will have more choices in the consumption of food that they will consume compared to households that have lower incomes (Wijayati et al., 2019).

Referring to Engel's law, when the average income per capita increases, the proportion of household consumption expenditure for food will decrease, so it can be said that income will affect household expenditure. Furthermore, the sensitivity of changes in household consumption can be measured using elasticity. The elasticity can provide a picture of consumer preferences on several different attributes. Low-income elasticity values indicate consumer choices based on income, preferences, prices, and information about the goods.

The income received by poor households and rich households will also influence the choice of

commodities to be consumed. Kumar et al. (2011) stated that the improvement of the economy and the increase in household income has led to changes in household consumption patterns from staple foods (carbohydrate sources) to consuming more high-value foods such as milk, meat, fruit, fish, and prepared foods. In other words, it can be interpreted that people with lower incomes have limited access to consuming high-value commodities and are more focused on consuming more sources of carbohydrates. In addition, the variety of food commodities they choose is also limited.

According to Amanatullohim and Widodo (2016), there are differences in consumption patterns based on the domicile area of the household. The level of consumption of the rural population is higher than that of the urban population, and the rural population performs this to maintain their subsistence level of living for a better life.

As for Pontoh et al. (2016), the differences in household commodities consumed are influenced by the community's regional potential and cultural structure, including residences, customs that apply in an area, and socio-demographic factors that differ from one region to another.

One important food commodity that has become the government's concern is rice. This commodity gets a lot of intervention regarding prices always being kept stable and the distribution and availability that must always be available. In the portion of the household food group (basket of goods), the portion of rice is 18 %. The rest is occupied by other commodities.

The role of rice is very important in households, so changes in prices and the amount of rice in household consumption also cause changes in demand and consumption of other commodities. The effect of price changes and the amount of rice on the consumption of other commodities can be observed through elasticity.

Research on consumption patterns is important because consumer preferences change from time to time, in which consumer preferences adjust to changes in an economic capacity and public knowledge about the benefits of food to be able to live better. According to Wijayanti et al. (2019), an analysis of public consumption patterns is important to provide information in formulating policies related to changes in public consumption patterns. Kumar et al. (2011) also

stated that research on changes in consumption patterns through demand elasticity would help to predict future demand for food products when prices and incomes rise and help the government to make the necessary policies.

The research that has been carried out related to the consumption patterns of rice and other food commodities was conducted in Nigeria (Erhabor and Ojogho 2011), which found that rice is a staple food source whose availability must be maintained in the community. Research on rice consumption patterns was also reported in Philliphina (Lantican et al. 2013) and other countries (Setiawan et al. 2016; Bett et al. 2012)

Therefore, the research question was the role of rice in food consumption in urban and rural areas. This study aimed to analyze changes in household consumption patterns in rural and urban areas due to changes in rice commodities.

## METHODS

### *Data Source*

The data used in this study was the 2016 National Socio-Economic Survey (SUSENAS) data. This data contains information on food consumption from 291,415 households throughout Indonesia, covering 126 food commodities surveyed. For the research purpose, out of 126 food commodities, household consumption was simplified by classifying 126 food commodities into ten food groups using weighted averages. The respondents were divided into three groups based on income groups owned by households to answer the research question. Around 20 % highest-income households were included in the rich household group, while 30 % of the lowest-income were classified as poor.

After obtaining the number of rich households, this group was divided again based on the domicile of the household, whether living in urban or rural areas. The same method was also applied to poor households. In this treatment, the final results were obtained from 4 groups of households that were analyzed, i.e., the group of poor urban households, rich urban households, poor rural households, and rich rural households.

### *Analytical Method*

Furthermore, these four household groups were analyzed for consumption patterns using the Quadratic

Almost Ideal Demand System (QUAIDS) discovered by Deaton and Muellberer (1980) and improved by Banks et al. (2007). This method had also been tested by Gostkowski (2018), where the results stated that QUAIDS was suitable for use in the research of consumption patterns. QUAIDS was used for research studies that accommodate expenditures as non-linear variables, as explained by Arivelarsan and Sekar (2019) related to their research in India.

An elasticity of demand approach was used, both for the cross-demand elasticity and income demand elasticity, to examine how demand responds from one food group to another. The elasticity in the QUAIDS model can be derived by deriving the share of expenditure equations to  $\ln X$  and  $\ln P_j$ . The resulting derivative is as follows.

$$\mu_i = \frac{\partial w_i}{\partial \ln X_i} = \beta_i + \frac{2\lambda_i}{b(P)} \left( \ln \left[ \frac{X}{\alpha(P)} \right] \right)$$

$$\mu_j = \frac{\partial w_i}{\partial \ln P_j} = \gamma_j - \mu_i \left\{ \alpha_j + \sum_x \gamma_x \ln p_x \right\} - \frac{\lambda_i \beta_i}{b(P)} \left( \ln \left[ \frac{X}{\alpha(P)} \right] \right)$$

Non- compensated price elasticity (Marshallian) can also be derived from the QUAIDS Equation model as follows :

$$\varepsilon_{ij} = \frac{1}{w_i} [\mu_{ij}] - \delta_{ij}$$

$$\varepsilon_{ij} = \frac{1}{w_i} \left\{ \gamma_j - \left( \beta_i + \frac{2\lambda_i}{b(P)} \left[ \ln \left( \frac{X}{\alpha(P)} \right) \right] \right) \left( \alpha_j + \sum_x \gamma_x \ln p_x \right) - \frac{\lambda_i \beta_i}{b(P)} \left( \ln \left[ \frac{X}{\alpha(P)} \right] \right)^2 \right\} - \delta_{ij}$$

Where  $\delta_{ij}$  is Kronecker delta with value 1 if  $i=j$  and 0 if vice versa

The elasticity of total food expenditure against total expenditure spent by households was calculated using the following equation:

$$\ln \text{Food} = a + b \ln \text{expend} + \varepsilon$$

**RESULTS AND DISCUSSION**

**Household Characteristics**

Based on the data obtained from the National Socio-Economic Survey (SUSENAS), the number of households in rural areas with the highest 20 % income was 30,931, and the number of households in rural areas with income in the range of 40 % lowest income was

62,732 households. Meanwhile, the number of households in urban areas with the highest 20 % income was 27,353, while the number of households in urban areas with the lowest 40 % income was 53,832. Characteristics of household groups in detail are presented in Table 1.

The variable number of household members, age of the household head, length of education of the household head, and household income are the variables chosen in the QUAIDS model. This variable was selected based on a review of previous research conducted by Nugroho and Wardhani (2016) and Yuliana (2018). Table 1 shows that the average number of household members among the four groups was not significantly different, i.e., in the range of 4.1 to 5.5 people. However, when viewed in more depth, the number of household members in poor areas was greater than the number of household members in rich areas. This classification was applied to both rural and urban areas.

**Table 1.** Household characteristics based on the data group

Variable	Rich Rural	Poor Rural	Rich Urban	Poor Urban
Number of household members	4.5	5	4.1	5.5
Age of the household head	45.85	47.22	46.74	46.64
Education length of the household head	9.68	7.28	12.17	8.28
Household income (IDR)	7,101,916	1,757,842	8,417,301	1,868,261

The average age of household heads for the four groups was 45 to 47 years. In terms of age, the average age of household heads in Indonesia for the four groups was at a productive age and assumed to have a job and the ability to finance household expenses.

Regarding the education length of the household head, the range was from 7.28 years to 12.17 years. It reveals that the education received by the household head in the rich group was longer than the education received by the household head in the poor group. It was applied to rural and urban areas, where the education of the household heads in urban areas is longer than that of the household heads in rural areas. It could be due to the facilities available in urban areas being more completely

compared to rural areas and the ability of high-income people to access education better than people with low incomes.

In terms of household income, there was a significant difference between rich and poor groups. The lowest average income was in poor rural areas of IDR 1,757,842/household, while the highest average was in the household group that lives in urban areas of IDR 8,177,301/household.

#### ***Differences in the Share of Food Commodities in each Group***

Based on the differences in food commodities, each household group had differences in filling their basket of goods. Food commodities consumed by households in the four groups (rich rural, poor rural, rich urban, and poor urban areas) were divided into ten main groups, which are adjusted to the similarity of content and type of food. The ten commodities studied were rice, other carbohydrates, fish, meat, eggs-milk-and beans, fat, vegetables, fruit, spicy beverage, cigarettes, and prepared foods. Table 2 shows the share of 10 commodities consumed by households in each group. Table 2 shows the share of 10 commodities consumed by households in each group.

Table 2 shows the difference in the amount of expenditure used to buy certain food commodities compared to the total expenditure. In the case of rice commodity, the group with the highest share was the poor rural at 0.23, while the smallest was the rich urban at 0.1033. It confirms that in poor areas (both urban and rural), households spend more on rice than households in rich areas. This result is consistent with the previous study by Malian et al. (2016), who reported that poor people allocate more of their expenses to buying rice. The same tendency also occurs in other carbohydrate commodities, fat, fruit, spicy-beverage ingredients, and others. The same finding was reported in Yuliana's study that the share of rice in poor areas had a higher value than in rich areas.

In the case of meat commodities, the highest share was found in a rich rural group of 0.056, and the lowest share was found in a poor rural of 0.0204. When compared within the four groups, it can be observed that the expenditure used to buy meat was higher in rich areas compared to poor areas. This trend indicates that in rich areas, meat is included as a component that is

mostly purchased compared to poor areas, both in urban and rural areas. Other groups behave the same way as meat, eggs-milk-beans, vegetables, cigarettes, and prepared food.

**Table 2.** Share of ten food commodities based on four research groups of household

Food Type	Rich	Poor	Rich	Poor
	Rural	Rural	Urban	Urban
Rice	0.1093	0.2360	0.1033	0.2105
Other carbohydrates	0.0236	0.0321	0.0341	0.0570
Fish	0.0899	0.0911	0.0900	0.0802
Meat	0.0562	0.0204	0.0553	0.0227
Eggs, milk, and beans	0.0887	0.0639	0.0873	0.0681
Fat	0.0685	0.1028	0.0736	0.1016
Vegetable	0.0542	0.0300	0.0507	0.0297
Fruit	0.0239	0.0410	0.0248	0.0412
Spicy beverages and others	0.0638	0.0982	0.0669	0.0994
Cigarette and prepared food	0.4218	0.2846	0.4139	0.2897

In the case of meat commodities, the highest share was found in a rich rural group of 0.056, and the lowest share was found in a poor rural of 0.0204. When compared within the four groups, it can be observed that the expenditure used to buy meat was higher in rich areas compared to poor areas. This trend indicates that in rich areas, meat is included as a component that is mostly purchased compared to poor areas, both in urban and rural areas. Other groups behave the same way as meat, eggs-milk-beans, vegetables, cigarettes, and prepared food.

In the case of fish commodities, the biggest share was found in the poor rural group, where the share was almost the same as the rich urban group, and the lowest was found in the poor urban group. It reveals that households in poor rural areas prefer to buy fish to fulfill protein than meat. Nevertheless, the high share of fish in rich urban areas can be due to the awareness of rich households to consume fish that have superior and less bad fat than meat as an alternative to the protein needs of the family. It agrees with the results of Virgantari (2012) and the research conducted by Arthatiani et al. (2018), who reported that food sources

from fish have advantages compared to other protein food sources.

Of the four groups above, the commodities with the highest share were cigarettes and prepared food. The share of cigarettes and prepared food in rich areas was greater than in poor areas (both in urban and rural areas). This result means that households prefer to consume cigarettes and prepared food compared to self-processing food, even though poor households still consider spending rice for their total expenditure compared to rich households with higher incomes and are more flexible in managing their expenses. This finding is in line with the previous finding of Miranti et al. (2016), who stated that smoking affects the total expenditure of the family.

In the rich rural group, it can be observed that the highest share was found for a cigarette and prepared food, which was 0.42, while the rice was in second, and the lowest was other carbohydrates. Fish protein consumption occupied the highest position with a share value of 0.0899, followed by eggs-milk-beans with an adjacent share value of 0.0887 and meat of 0.0562.

In the poor rural group, the highest share was occupied by cigarette and prepared food commodities, but the share value was not similar to that of a rich rural group of 0.2846. Then, it was followed by rice with a value that was not significantly different of 0.2360. For protein fulfillment, households in poor rural areas tend to consume fish, eggs-milk-beans, and meat, in which the difference between the highest and lowest shares in the poor rural group was greater than the rich rural group.

The behavior similar to the rich rural group was also shown in rich urban households, in which the highest share was a cigarette and prepared food at 0.4139, and the lowest was the fruit at 0.0248. The second was rice after a cigarette and prepared food. The poor urban group has the same tendency as the poor rural group confirming that the highest share was cigarettes and prepared food at 0.2897, while the lowest was meat at 0.0227. Previous research, which stated that cigarettes and processed foods occupy the largest position in total household expenditure, was also obtained by Astari, who researched in East Java (Miranti et al. 2016).

### ***The Elasticity of Changes in Rice Prices to the Demand of Other Commodities***

The role of rice is very important in society's basket of goods because, as a staple food, the price and quantity of rice will affect the price and demand of other commodities. Research conducted by Oyinbo et al. (2013) stated that rice is important in household expenditure in Nigerian communities. The government is important in keeping prices stable so it does not affect other commodities. Changes in demand for a commodity due to changes in rice prices can be described using cross elasticity. Table 3 illustrates the change in 10 groups of food commodities because of changes in the rice price by one unit in the four household groups examined in this study.

Table 3 shows that all values are below one, meaning that all commodity groups are inelastic. A value closer to one is interpreted as being more elastic (responsive) than other food groups. Therefore, a rich urban group for all commodities was the most responsive in responding to change in one unit price of rice compared to the other three groups. Meanwhile, the poor urban group was the least responsive group due to changes in one unit price of rice.

**Table 3.** Cross elasticity of 10 food groups on rice price changes in four household groups

Food Group	Rich Rural	Poor Rural	Rich Urban	Poor Urban
Rice	-	-	-	-
Other carbohydrates	0.105	0.290	0.694	0.052
Fish	-0.151	-0.352	-0.760	-0.019
Meat	-0.097	-0.346	-0.806	-0.075
Eggs, milk, and beans	0.014	0.233	0.757	-0.038
Fat	-0.064	-0.344	-0.770	-0.009
Vegetable	0.057	0.287	0.763	0.023
Fruit	0.094	0.348	0.780	0.014
Spicy beverages and others	-0.064	-0.344	-0.751	-0.013
Cigarettes and prepared food	0.165	0.336	0.824	0.019

Positive and negative values on the elasticity mean that the food group is a substitution or complementary to rice. A negative value can also be interpreted that when the price of rice rises by one unit, the demand for these

commodities will decrease by the stated value. Therefore, the goods are complementary to rice. Meanwhile, a positive value means that when the price of rice rises by one unit, the demand for food commodities will increase by the stated value (substitution to rice).

Therefore, the results showed that each food group had the same tendency for all household groups, except for the eggs-milk-beans food group. This food group was different within the three household groups (rich rural, poor rural, and rich urban groups) compared to the poor urban group. In the poor urban group, the elasticity value of eggs-milk-beans was negative, so this food group is complementary to rice. The elasticity value in the other three household groups was positive, meaning the eggs-milk beans are a rice substitution.

The results revealed that when rice prices increase, most household groups will reduce meat and fish consumption. At the same time, an increase in the price of rice increased demand for eggs-milk beans in 3 household groups, except in the poor rural group, which reduced all demand for the consumed protein. In addition, the elasticity value of fish and meat in rich areas showed a more elastic value compared to the elasticity value in poor areas. The results agree with the research on chicken meat in East Java (Laili and Anindita 2018)

In rich rural areas, each change in the price of rice by 1 % caused the demand for other carbohydrates to rise by 0.105. This demand indicated that other carbohydrates are a substitute for rice. In addition, the other food groups that substituted rice are eggs-milk-beans, vegetables, fruit and cigarette, and other foods whose demand was increased by 0.014; 0.057; 0.094, and 0.165 for each commodity, respectively. Meanwhile, the negative elasticity value (complimentary) was obtained for fish, meat, fat, spices, beverage ingredients, and other consumption. This finding showed that if the price of rice rises by 1 %, then the demand for fish, meat, fat, spices, beverage ingredients, and other consumption will decrease by 0.151; 0.097; 0.064; 0.064, respectively.

In poor rural areas, every change in the price of rice by 1 % caused the demand for other carbohydrates to increase by 0.290. This value is greater compared to rich rural areas. The difference in value indicated that

households in poor rural areas are more responsive to substituting household rice consumption with other carbohydrates. This result can occur because when rice prices rise, poor households do not have enough money to buy rice. Poor rural households replace carbohydrate sources from rice with other carbohydrates such as sweet potatoes and corn.

Other commodities substituting rice in the poor rural group were eggs-milk beans, vegetables, fruit, cigarettes, and other foods. Every 1 % increase in the price of rice caused the demand for each commodity to increase by 0.233; 0.287; 0.348; and 0.336, respectively. Meanwhile, complementary foods in poor rural household groups are fish with decreasing demand by 0.352, meat by 0.346, fat by 0.344, and spices, beverage ingredients, and other consumption by 0.344. This data means that when rice prices rise, households reduce animal protein consumption, such as fish and meat, fat and spices, and others. It was also observed that when compared to rich rural areas, changes in demand in poor rural areas are greater (more responsive).

In contrast to conditions in rural areas, Table 3 shows that rich areas had more responsive cross-elasticity values in urban areas than in poor areas. The elasticity values that were more elastic in rich urban areas can occur because rich households can access many menus and food choices compared to the other groups. The good access because of the adequacy of income, finance, and various facilities caused rich households to be free to choose and consume various food groups to respond to changes due to rising rice prices. Households cannot access these facilities in poor urban areas because of their limited source of income.

## CONCLUSIONS

This research concluded that the response to changes in household consumption patterns in rural and urban areas because of changes in rice commodities was different depending on the residence domicile of the household and the amount of income obtained by the household used to purchase various food commodities to be consumed. Households in rich areas, both rural and urban, have many choices to consume protein sources such as fish, eggs-milk-beans compared to households in poor areas when there is a change in rice prices. Therefore, the government must create policies that

provide access to the poor to obtain more various food sources at the time of changes in rice prices.

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