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# Analysis of household income impact on packaged palm cooking oil consumption in Sumatra, Indonesia

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## *ABSTRACT*

This study aims to quantitatively analyze the impact of increasing packaged palm cooking oil prices on different income levels. Cooking oil is a fundamental necessity in Indonesia. The factors influencing the demand for packaged palm cooking oil are analyzed using a multiple linear regression tool and demand elasticity. This study emphasizes the growing demand for packaged palm cooking oil among various income groups of households. In principle, a substantial increase in the price of a product can result in a decrease in elastic demand. The study revealed that the increase in packaged palm cooking oil prices in the Sumatra region primarily impacted low-income households. The demand elasticity indicates that all income levels exhibit in elasticity. The study suggests that an increase in the price of packaged palm cooking oil can negatively impact the welfare of communities, particularly those with lower medium incomes. This is because the demand for packaged palm cooking oil often falls short of household needs. Therefore, a government policy is required to stabilize the price of packaged palm cooking oil. One way to achieve this is to increase the amount of CPO supply in the domestic market.

**Contribution/ Originality:** This study has identified the impact of packaged palm cooking oil price increases on consumer demand based on household income levels. These findings can serve as a reference for government decision-makers tasked with determining an appropriate base price for packaged palm cooking oils, with consideration of income level in Sumatra.

## 1. INTRODUCTION

All segments of society, both rural and urban, across all socio-economic strata, consume cooking oil as a basic necessity in Indonesia. Cooking oil is a basic necessity in Indonesia and is consumed by all segments of society, rural and urban, across all socioeconomic strata. Consequently, it can be classified as a strategic commodity. Numerous studies have demonstrated that the scarcity of cooking oil exerts considerable economic and political influences on the national economy, as evidenced by historical precedent (Irmanelly, Afrizal, Hierdawati, Amrizal, & Dani, 2023; Purbawa et al., 2023; Savarese, Castellini, Paleologo, & Graffigna, 2022; Shigetomi, Ishimura, & Yamamoto, 2020). In Indonesia, the use of palm oil as a source of cooking oil is pervasive. Cooking oils can be classified into two principal categories: those derived from animals and those derived from plants. Plants, such as coconut, palm oil, and soybeans, are the source of vegetable cooking oils. While other plants are capable of producing cooking oil, it is estimated that

approximately 90% of the cooking oil consumed by the global population is derived from palm oil (Mba, Dumont, & Ngadi, 2015). Nevertheless, this potential does not necessarily ensure the stability of palm cooking oil prices. This is particularly the case with regard to one of the downstream palm oil products in Indonesia, notably on the island of Sumatra, which is one of the main centres of palm oil production in Indonesia.

A number of studies have shown that the price movement of Indonesian palm cooking oil has been on the rise over the past two years. However, these studies only examined price changes across the product lifecycle. This study, on the other hand, discusses the impact of price changes on a product on the basis of the income group of the consumer.

The rise in international crude palm oil (CPO) prices has led to a corresponding increase in domestic CPO prices (Chandrarin, Sohag, Cahyaningsih, Yuniawan, & Herdhayinta, 2022). As the majority of palm cooking oil consumed domestically is derived from CPO, the price of palm cooking oil has also increased. The considerable increase in the price of palm cooking oil at the beginning of 2022 has impacted changes in household consumption patterns. In early January, the price of palm cooking oil, particularly packaged varieties, increased from its typical price of IDR 15,000 per litre to a range of IDR 19,000 to IDR 24,000 per litre, depending on the packaging. Reports indicate that the majority of the households in Sumatra use packaged palm cooking oil, which is particularly expensive.

Nevertheless, the existing literature has yet to investigate the impact of rising palm oil prices on different income groups in Sumatra. Concurrently, this price fluctuation will have a considerable effect on public demand in Sumatra. It seems reasonable to posit that the impact of increased prices for packaged palm cooking oil on different levels of income within the community will also differ. The study aims to establish a foundation for government policy that maintains stable palm oil prices, avoiding disadvantages for farmers, industry players, or the community.

## 2. LITERATURE REVIEW

The marketing literature has periodically studied the fluctuating effect of price on product purchase. However, these studies have been limited to price changes throughout the product lifecycle. On the other hand, this study discusses the effect of price changes on a product based on the income group of consumers.

Consumers' willingness to purchase goods or services at varying price points over a specified time frame is known as 'demand.' The demand for basic necessities is subject to influence from the income level of the household, which in turn affects the overall welfare of the household. This research showed that household income is therefore indicative of the economic position of a family within the wider social context. Household income is employed as a means of categorising families according to three distinct income levels: low, middle, and high. This classification is based on the sum of family income and wealth.

Income, which is a dominant variable in both the short and long term, can influence the demand for basic necessities (Diener, Sandvik, Seidlitz, & Diener, 1993). This is in line with research by Mawardati (2017) which states that as one of the basic necessities, the demand for cooking oil is also influenced by income levels. The elasticity calculation of palm cooking oil can be classified as a normal good because an increase in per capita income results in a rise in demand, albeit with a lower percentage increase than the income (Rambe & Kusnadi, 2018).

Consumer behavior is the decision-making process a customer goes through when searching for, buying, using, and consuming goods and services. It includes actions taken before and after the purchase. In response to increasing prices, consumers may alter the frequency and quantity of their purchases (Engel, Blackwell, & Miniard, 1995). Basic necessities are goods that affect many aspects of people's lives and are necessary for the well-being of the community. These goods have inelastic demand ($E<1$), which means that changes in price do not significantly affect demand but do affect consumer behavior. Differences in income levels also lead to variations in how people meet their basic needs. An increase in the cost of basic necessities will affect households' consumption patterns of these products. The article investigates the peculiarities of consumer behavior in modern market conditions. Income level influences the behavior of consumers from various socio-economic backgrounds.

Lesmana (2023) analysed the impact of increased cooking oil on the community economy in Rokanhulu Regency.

This study employs a qualitative approach to uncover and comprehend the ground-level reality. This research showed that the reason for the increase in the price of packaged palm cooking oil is that some distributors and wholesalers in Rokanhulu are still short of supply due to the shortage of cooking oil from North Sumatra. The increase in the price of cooking oil in Rokan Hulu Regency has affected the community's economy, particularly the lower middle class.

Various studies have shown that the price movement of Indonesian palm cooking oil has continued to increase in the last two years. This increase is attributed to the increase in international crude palm oil (CPO) prices, which has led to a corresponding increase in domestic CPO prices (Chandrarin et al., 2022). Changes in the price of cooking oil affect consumer demand. This is because cooking oil is considered one of the basic necessities. However, not all consumers decrease their demand in the event of an increase in cooking oil prices. Instead, the majority tend to substitute it by purchasing lower-quality cooking oil or reducing their consumption of other essentials (Akbay, 2007; Mawardati, Jullimursyida, Azhar, Iga, & Eva, 2023).

The price of coconut cooking oil and consumer preference factors have an insignificant impact on demand for packaged palm cooking oil. This is due to consumer behavior. Personal values, product attributes, social contexts, peer groups, self-image, and situational factors such as the availability of alternatives at competitive prices influence the dynamic process of consumer behavior (Kimmel, 2018). Some studies also stated that demand refers to the willingness of consumers to purchase goods or services at different price points over a specific time period (Huang, Dawes, Lockshin, & Greenacre, 2017). New demand may arise when consumers require these products and possess the financial ability to acquire them (Savarese et al., 2022).

This study uses a survey method to analyze the consumption of packaged palm cooking oil among household consumers in Sumatra, Indonesia. Previous studies Goretzki, Perekhozhuk, Glauben, and Loy (2019); Onegina, Megits, Kravchenko, and Kravchenko (2022) and Sanusi, Safi, Adeeko, and Tabash (2022) broadly categorize current price forecasting methods in the agriculture sector into two categories: qualitative and quantitative. Due to the vast area of Sumatra, two provinces were purposefully selected as the sample location, namely Riau Province and North Sumatra Province, considering that these two provinces are the centers of oil palm production on Sumatra Island. This decision was based on the fact that oil palm production, specifically in the form of crude palm oil (CPO), serves as the primary raw material for packaged palm cooking oil. Additionally, each province selected 300 respondents as the research sample. Therefore, the total sample in this study was 600 household consumers. To determine the sample unit in this study, a convenience sampling technique with predetermined sample criteria, which were married, was used, and the respondents verbally stated that they were willing to complete the questionnaire and be interviewed.

## 3. RESEARCH METHODS

This study analyzes the consumption of packaged palm cooking oil among household consumers in Sumatra, Indonesia, using a survey method. This is consistent with findings from previous studies indicating that the current methods of price forecasting in the agriculture sector can be broadly classified into two categories: qualitative and quantitative (Goretzki, Perekhozhuk, Glauben, & Loy, 2019; Onegina, Megits, Kravchenko, & Kravchenko, 2022; Sanusi, Safi, Adeeko, & Tabash, 2022) Due to the vast area of Sumatra, two provinces were purposefully selected as the sample location, namely Riau Province and North Sumatra Province, considering that these two provinces are the centers of oil palm production in Sumatra Island. This is very reasonable because oil palm production in the form of crude palm oil (CPO) is the main raw material for packaged palm cooking oil. In addition, 300 respondents were selected as the research sample for each province. Therefore, the total sample in this study was 600 household consumers. To determine the sample unit in this study, a 'convenience sampling technique' was used with predetermined sample criteria, which were married, and respondents verbally stated that they were willing to fill out the questionnaire and be interviewed (asked when submitting the questionnaire).

### *3.1. Data Collection Technique*

Both primary and secondary sources provided the data for this study. The primary data gathered for analytical purposes in this study encompass both quantitative data and qualitative data. The quantitative data set comprises the volume of demand for packaged palm cooking oil, the price of such products, the cost of coconut cooking oil, the per capita disposable income of households, and the number of dependents. This data set is drawn from both the pre- and post-price increase periods. In contrast, the qualitative data pertain to consumer preferences. These data are obtained by filling out a questionnaire. The respondents were selected according to predetermined criteria. The interview method was also used to obtain additional information from respondents in addition to the questionnaire. The data were also tabulated and grouped according to the needs of the analysis. Secondary data are data on the average price of packaged palm cooking oil before and after the price increase and only as additional data. These data were obtained from BPS-Statistics Indonesia (2022) in https://www.bps.go.id/id.

### *3.2. Data Analysis Methods*

#### *3.2.1. Quantitative Descriptive Method*

Quantitative descriptive method was employed to analyse consumer behaviour in response to the increased demand for packaged palm cooking oil resulting from price rises across various household income levels. The following criteria were used: The participants were divided into three income groups: low, middle, and high.

#### *3.2.2. Regression Analysis*

The objective of the regression analysis is to examine the influence of various factors on the demand for packaged palm cooking oil in Sumatra. These factors, represented as dummy variables, include the price of packaged palm cooking oil, the price of coconut cooking oil, the number of family dependents, income levels, and consumer preferences. In order to analyse the effect, a demand function model is employed in the form of multiple linear regression analysis utilising the Ordinary Least Squares (OLS) method. The following is the mathematical representation of multiple linear analysis:

$$Qdx = \alpha + \beta_1 P_x + \beta_2 P_y + \beta_3 T_{gg} + \beta_4 I + \beta_5 D_1 + \varepsilon$$

Description: Qdx = Demand for packaged palm cooking oil (liter/month), Px = Price of packaged palm cooking oil (IDR/liter), Py = Price of coconut cooking oil (IDR/liter), Tgg = The number of dependents of the family (people), I = consumer income (IDR/month), D1 = Dummy variable (customer preferences: Packaged palm cooking oil (1); coconut cooking oil (0), $\varepsilon$ = Error term, and $\alpha$, $\beta 1$, $\beta 2$, $\beta 3$, $\beta 4$ and $\beta 5$ = Parameters of interest.

Descriptive analysis compares the average demand for packaged palm cooking oil before and after the price increase at different income levels of consumer households. The Statistical Program for Social Sciences (SPSS) software will process primary data for demand analysis in the form of multiple linear regression analysis. Before further analysis of the collected data, classical assumptions are first tested to generate a regression model that meets the BLUE (Best Linear Unbiased Estimator) criteria.

The classic assumption test is as follows:

a) The objective of the normality test is to ascertain whether the dependent variable data and the independent variables employed in the regression model are normally distributed. The test is conducted by examining whether the data distribution is aligned with the diagonal line on either the normal Q-Q plot graph or the regression standardised residual graph.

b) The multicolinearity test is employed to ascertain whether there is a correlation between the independent variables (IVs) in a regression model. The test is conducted with the objective of ensuring that the tolerance value is $\geq 0.10$ and that the Variance Inflation Factor (VIF) value is $\leq 10$.

c) The heteroscedasticity test is employed to ascertain whether the variance of residuals across observations is consistent within a regression model. If a regression model displays homoscedasticity or lacks

heteroscedasticity, it considered of good quality. The presence or absence of heteroscedasticity can be identified by examining the scatterplot graph between SRESID and ZPRED for the patterns.

If the data are free from violations of the classical assumptions, the data analysis process continues with the decision criteria:

a. If F ≤ sig (α = 0.05), then all independent variables have a significant effect on the dependent variable (demand for packaged palm cooking oil).
b. If the F value > sig value (α = 0.05), then all independent variables simultaneously have an insignificant effect on the dependent variable (demand for packaged palm cooking oil).

In part, it can be seen from the t-value of each independent variable analyzed with the following criteria:

a. If the t value ≤ sig value (α = 0.05), then the independent variable has a significant effect on the dependent variable (demand for packaged palm cooking oil), ceteris paribus.
b. If the t value > sig value (α = 0.05), then the independent variable has an insignificant effect on the dependent variable (demand for packaged palm cooking oil), ceteris paribus.

### *3.2.3. Demand Elasticity*

Demand elasticity measures the responsiveness of the quantity demanded for a good or service to changes in the influencing variable. It is calculated as a percentage change in the quantity demanded divided by the percentage of the variable that affects the variable. Elasticity can be interpreted as the magnitude of the change in a variable. The size of the change is expressed in the elasticity coefficient or elasticity number, which is abbreviated as $E_d$, and is calculated using the following formula:

$$Ed_i = \frac{\Delta Qi \; x \; Pi}{\Delta Pi \; x \; Qi} \text{ or } Ed_i = \frac{\%\Delta Qi}{\%\Delta Pi}$$

Description: ΔQ = The change in quantity demanded, ΔP = The change in the price of a good, P = The baseline price, Q = Baseline quantity demanded, Ed = Demand elasticity.

Furthermore, based on the results of the calculation of demand elasticity, the decision-making criteria are as follows:

a. If the demand elasticity value is greater than 1 (Ed > 1), then it is said to be elastic.
b. If the demand elasticity value is less than 1 (Ed < 1), then it is said to be inelastic.
c. If the demand value of the elasticity is equal to 1 (Ed = 1), then it is said to be unitary.

This study is aligned with the research conducted by Engel et al. (1995) which indicated that a multitude of factors can influence the price elasticity of demand, including the cost of substitutes and the durability of the product in question. Additionally, this study assesses the impact of price increases on the price elasticity of demand. The time-dependent variation in the quantity demanded reflects the repercussions of these alterations, ultimately giving rise to price elasticity dynamics.

## 4. RESULTS

The findings indicate that, on average, a household in Sumatra with five members consumes 57.9 liters of packaged palm cooking oil per year, or 4.82 liters per month. Field data show that the price of packaged palm cooking oil affects its consumption in the region. Before the increase in the price of packaged palm cooking oil, Sumatra households consumed 4.4 liters/month of product per family consisting of five members for IDR 14,400 per liter. However, after the price increase, with packaged palm cooking oil averaging IDR 23,800 per liter, the community has reduced its consumption to 3.9 liters/month per household with the same number of family members. They allocate the earned income to other needs, keeping their income unchanged. Price increases occurred simultaneously in all Indonesian provinces. The national average price of packaged palm oil for cooking purposes in the year 2022 is

IDR 17,772.3529. The lowest price is in the provinces of Jambi and Banten, which is Rp. 15,240 and the highest price is in Maluku province, which is Rp. 23,870 (Ministry of Trade of the Republic of Indonesia, 2022).

Regarding general characteristics, there is no discernible difference between the various income levels within respondents' households, regardless of whether the household income is classified as high, medium, or low. The average age of the respondents is 51 years, with an average level of education at the senior high school and an average number of dependents of 4 people.

### *4.1. Impact Analysis of Packaged Palm Cooking Oil Prices Increases in Demand for Various Levels of Income of Consumers*

Palm oil is a versatile and crucial commodity for the Indonesian economy. An increase in palm oil prices can directly affect consumer behavior, particularly among small- and medium-scale food processing industries and household and industrial consumers. Some studies only consider the overall impact of price increases on consumer behavior. However, this study discusses how the increase in the price of palm oil packaging oil will have a different impact depending on the income group of the community. As revealed by the data, most consumers in the study area have a medium income. Figure 1 provides more information on the number of clients by their income bracket. Furthermore, 57% of the 90 participants were classified as having a medium income ranging from IDR. 2.5 million to IDR. 5 million. This finding aligns with the widespread livelihood of the traditional farming and fishing community. Individuals earning less than IDR. 2.5 million, representing 28% of consumers., followed the trend. On average, their means of livelihood are labor-intensive, with jobs such as farm or market laborers. Conversely, 15% of individuals with an average income exceeding IDR. 5 million are primarily employed as civil servants.

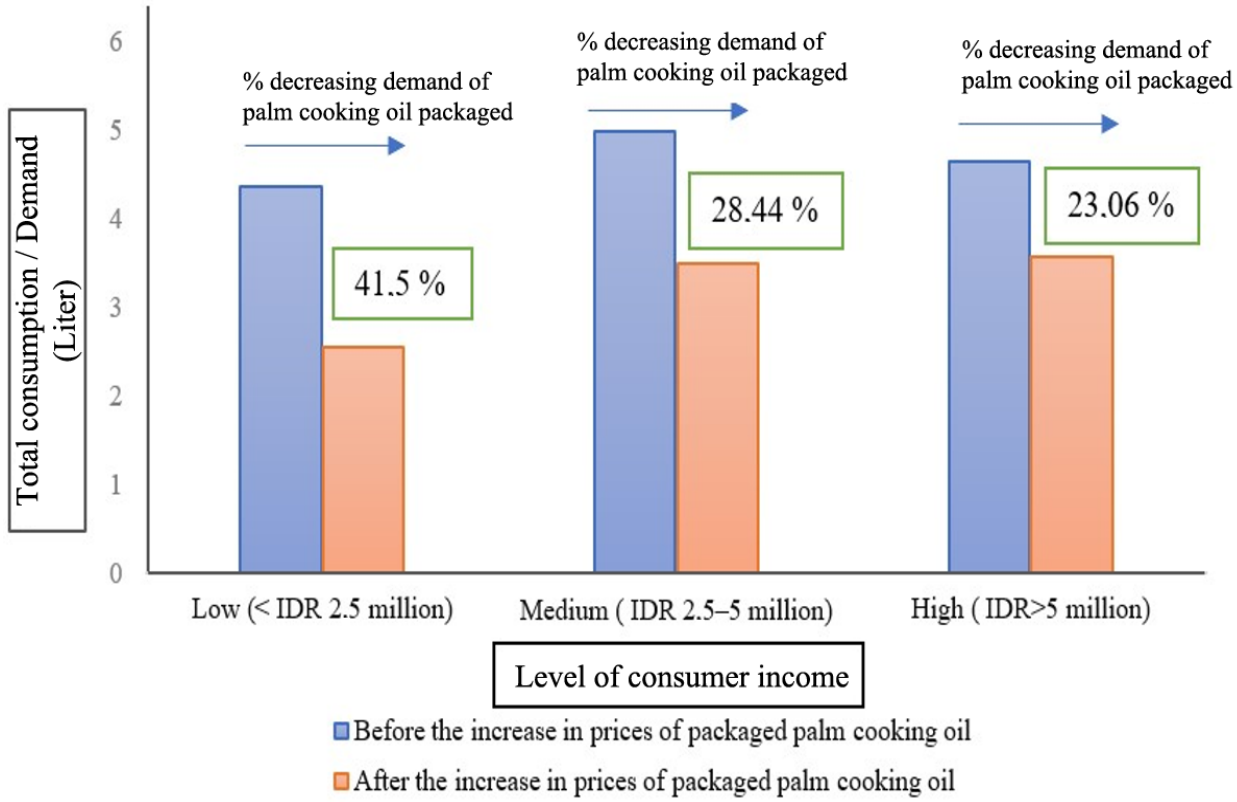


**Figure 1**. Decreasing packaged palm cooking oil demand before and after price increases based on income level.

### *4.2. Consumers of Packaged Palm Cooking Oil with Low Average Income (< IDR 2.5 million)*

The increase in the price of packaged palm cooking oil affected all income levels. The study found that people with lower incomes coped by cutting down on their monthly consumption of packaged palm cooking oil in response to the increase in prices, which was not offset by an increase in income. Figure 1 shows that the increase in packaged

palm cooking oil prices caused a reduction in the use of packaged palm cooking oil among low-income households, from 4.36 liters to 2.56 liters per month. Furthermore, these same households also adapted their use of other essential items.

### *4.3. Packaged Palm Cooking Oil Demand in The Medium-Income Consumer (IDR 2.5 million-5 million)*

Like low-income households, the increase in packaged palm cooking oil prices also affected those in the medium income bracket. The study reveals that the average consumption of packaged palm cooking oil decreased in this group. Figure 1 shows that households in the medium income bracket also felt the impact of the increase in the price of packaged palm oil. Average consumption before the price increase was 4.98 liters per month, which decreased to 3.51 liters per month. This trend can be attributed to the stagnant income of these households.

### *4.4. Packaging Palm Cooking Oil Demand in High Income Consumers (>IDR 5 million)*

The study indicates that the increase in the price of packaged palm cooking oil affected affluent households. Although their consumption reductions were lower compared to those of medium- and low-income households, they were still significant. Furthermore, Figure 1 shows the change in demand for packaged palm cooking oil resulting from the increase in price among households classified as high-income. In general, variations in income levels are impacted by the demand for packaged palm oil. Although the total quantity demanded decreased, the reduction was less pronounced than in the low- and moderate-income brackets. The mean and percentage fluctuations in the consumption of packaged palm cooking oil by household consumers in different income categories, before and after the price increase. However, high-income households only reduced their allocation by 14.52%, as follows:

**Table 1.** Average allocation of budgets for essential items other than packaged palm cooking oil among various income levels.

| Consumer income levels (IDR) | Budget allocation for other basic necessities, except packaged palm cooking oil (IDR). | | Percentage of changes (%) |
|---|---|---|---|
| | Before the increase in prices | After the increase in prices | |
| Low (< 2.5 million) | 1.239.933,33 | 920.083,33 | 25.80 |
| Medium (2.5–5 million) | 1.826.600,00 | 1.281.501,00 | 29.84 |
| High (>5 million) | 1.859.600,00 | 1.589.600,00 | 14.52 |

The increase in packaged palm cooking oil prices caused a reduction in demand at all income levels of consumer households. The low-income household bracket experienced the most significant impact, with a decrease of 41.51 percent. These findings imply that the increase in price curtailed the consumption of packaged palm cooking oil by 1.80 liters per month. Meanwhile, households earning a medium income experienced a 29.44% reduction, which is equivalent to a decrease of 1.47 liters per month, while households with high incomes had a smaller impact of only 23%, or 1.07 liters per month.

Furthermore, a higher cost of packaged palm cooking oil not only affects the decline in demand for packaged palm oil but also changes the economic behaviour of households. Particularly, households adjusted their demand for other basic commodities, especially food. Although none of the households reduced the amount of rice they consumed, middle-income households reduced the quality of the rice they consumed. Conversely, low-income households remained unchanged, likely due to their prior consumption of rice at lower price. Similarly, high-income households continued to consume high-quality rice, as they had done before the price of packaged palm oil for cooking increased. Table 1 shows the decrease in the allocation of household budgets to basic necessities other than packaged palm oil as a result of the increase in the price of packaged palm oil.

The consumption patterns of households in basic necessities in response to the increased prices of packaged palm cooking oil differ according to the income level. Those with a moderate income level made the most significant percentage of adjustments at 29.84%, followed by low-income households at 25.80%.

### *4.5. The Classical Assumptions Test*

The objective of the classical assumption testing is to determine the accuracy of the model used to analyse the factors influencing the demand for cooking oil in the Sumatra region of Indonesia. Table 2 presents the results of the classical assumption testing.

**Table 2.** Classical assumption test results.

| Demand function | Normality | Variable | Heteroscedasticity | Multicollinearity | |
|---|---|---|---|---|---|
| | | | *p-value* | Tolerance | VIF |
| Multiple linear regression function | Kolmogorov-Smirnov showed Asymp.sig = 0.172 | Px | 0.062 | 0.916 | 1.091 |
| | | Py | 0.081 | 0.971 | 1.03 |
| | | I | 0.072 | 0.920 | 1.087 |
| | | Tgg | 0.082 | 0.955 | 1.047 |
| | | D | 0.063 | 0.959 | 1.043 |

a. The results of the Kolmogorov-Smirnov normality test indicate that Asymp. sig = 0.172 is greater than the value of α = 0.05 (5%). Asymp. Sig. implies a normal distribution of the data. This indicates that the standardized residual values of this model are normally distributed, with a significance value greater than the alpha value (α = 0.05).

b. b. The results of the heteroskedasticity test show that the significance value of all independent variables in Table 2 is greater than the alpha value (α = 0.05). This indicates that the regression model does not show any symptoms of heteroskedasticity.

c. c. The results of the multicollinearity test indicate that the tolerance values for all independent variables are greater than 0.10, and the VIF values are less than 10, as shown in Table 2. This suggests that there is no correlation between independent variables or multicollinearity.

### *4.6. Analysis of Various Factors Affecting the Demand for Packaged Palm Cooking Oil*

The analysis of various factors affecting the demand for packaged palm cooking oil can be found in Table 3.

**Table 3.** Estimated values of factors that affect the demand for packaged palm oil.

| Traits | B | Sig. |
|---|---|---|
| (Constant) | 0.809 | 0.846 |
| Price of packaged palm cooking oil (Px) | -0.0000637 | 0.002 |
| Price of coconut cooking oil (Py) | 0.0004874 | 0.598 |
| Income (I) | 0.0007010 | 0.000 |
| Number of the family (Tgg) | 0.065 | 0.036 |
| Customer preferences (D) | 0.748 | 0.191 |

**Note:** R-square = 0.823, Fchange = 7.084, F-sig. = 0.000.

Table 3 presents the coefficient of determination (R2) of 0.823. This indicates that 82.30% of the variation in the price of packaged palm cooking oil, the price of coconut cooking oil, consumer income, the number of dependents, and customer preferences can explain the variation in the demand for packaged palm oil. Other variables not considered in this investigation account for the remaining 17.70%. This study also showed that the demand for packaged palm cooking oil in Sumatra is greatly affected by variables of packaged palm cooking oil price, coconut cooking oil price, consumer income, number of dependents in the family, and customer preferences when considered simultaneously. This was indicated by the probability value of F-sig = 000, which was found to be lower than the confidence level (α) of 0.01. The partial results indicate that at the study location, the demand for packaged palm cooking oil is significantly influenced only by the price of packaged palm oil, income, and the number of dependents in the family. Among the three significant variables, the number of households dependent represents the most influential variable

affecting the demand for packaged palm cooking oil, indicated by the regression coefficient value that is larger than other variables (unstandardized 0.065).

The F-statistic value of 0.000 indicates that the independent variables collectively (price of packaged palm cooking oil, price of coconut cooking oil, income, number of dependents, and consumer preferences) have a highly significant effect on the demand for packaged palm cooking oil. The partial sig value indicates that the price of packaged palm oil is 0.002, while the income variable is. The value of 0.000 for the variable number of dependents is less than the value of $\alpha = 0.05$. This indicates that the three variables have a significant impact on the demand for cooking oil. Among the three variables that most significantly influence the demand for packaged palm cooking oil is the variable number of dependents. The regression coefficient value of 0.065, which is greater than the variable price of packaged palm cooking oil and consumer income, demonstrates this.

Despite the fluctuating price of packaged palm cooking oil, the variable of consumer income significantly affects its demand. The probability value of the income variable is less than $\alpha = 0.00$, indicating its importance. If consumer income increases by IDR. 100,000, the demand for packaged palm cooking oil will increase by 0.70 liters, as revealed by the regression coefficient of the income variable. This implies that packaged palm oil, particularly derived from palm trees, is essential for all households. Therefore, if consumer income increases, there will be an increase in demand for packaged palm cooking oil as one of the products.

The price of packaged palm cooking oil exerts a substantial impact on demand, as evidenced by a probability value of 0.002, less than $\alpha = 0.05$. Furthermore, the regression coefficient reveals that the effect of this pricing variable is -0.0000637, indicating that a 10,000 IDR increase in the price of packaged palm cooking oil reduces 0.637 liters in the demand for the product. These findings have significant implications for the marketing and pricing strategies of packaged palm oil. The finding suggests that despite the nearly double price of packaged palm cooking oil (from IDR. 14,000 to IDR. 23,000), consumers only reduced their demand by 0.637 liters (compared to an average of 3.5 liters before the price increase). Packaged palm cooking oil is a staple commodity, making alternatives difficult to find.

The variable for the number of dependents in the household also has a significant effect on the demand for packaged palm oil.

This is indicated by the probability value of this variable, which is 0.036, less than $\alpha = 0.05$. The regression coefficient of the variable number of family members is 0.065, which means that an increase in the number of family members by one person results in an increase in demand for packaged palm oil of 0.65 liters. This finding suggests that an increase in the number of family dependents leads to an increase in the demand for packaged palm oil, which is an essential commodity. Under these circumstances, the level of social welfare of the community may decline due to the decrease in real income.

The price of coconut cooking oil has an insignificant effect on the demand for packaged palm cooking oil. This can be seen in a probability value of 0.598, which is greater than $\alpha = 0.05$. This is because the price of coconut cooking oil is similar to that of packaged palm cooking oil. So, the customer may believe that the price of coconut cooking oil does not affect their decision to purchase packaged palm cooking oil.

### *4.7. Demand Elasticity*

The elasticity of demand is defined as the percentage change in the amount of packaged cooking oil demanded as a result of a percentage change in the price of packaged cooking oil. Figure 2 presents the results of the elasticity calculation.

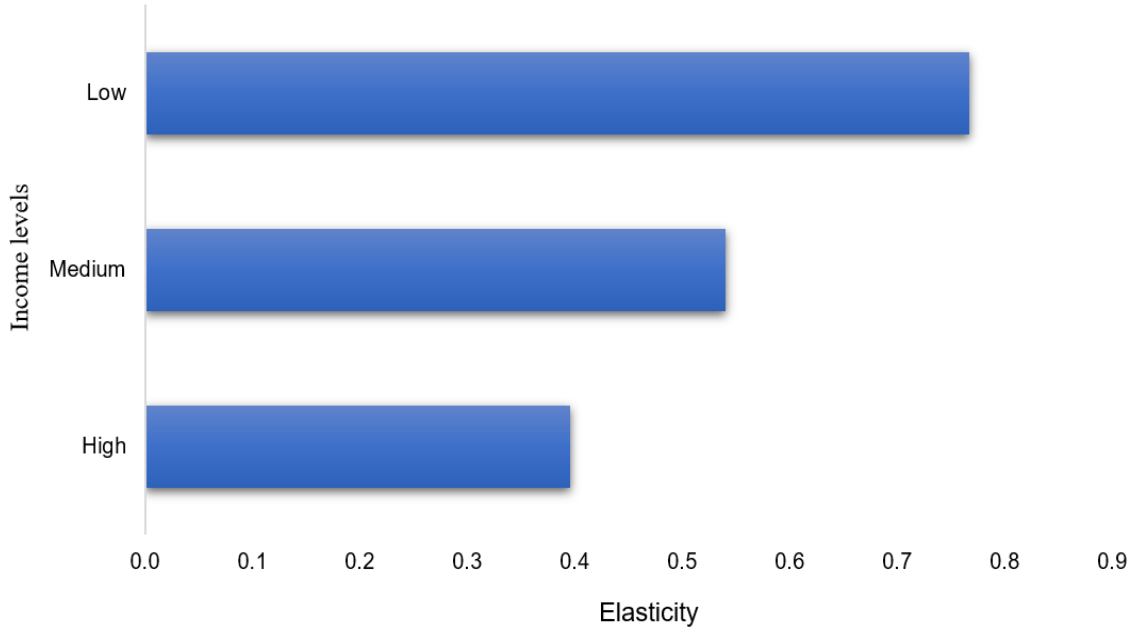


**Figure 2**. The demand elasticity of packaged palm cooking oil is based on income levels.

Demand elasticity for packaged palm cooking oil in the low-income group shows the highest value, followed by the medium-income group and the high-income group. The results of the calculations using the demand elasticity formula yielded the following elasticity values for the respective income groups: 0.77 for households with low income, 0.54 for those in the medium income group, and 0.40 for those in the high income group. In other words, the elasticity of demand for packaged palm cooking oil is less than 1 (Ed < 1) for various households on the island of Sumatra, Indonesia. It proves that the elasticity for packaged palm cooking oil in all levels of income is inelastic because the demand elasticity value is less than 1 (Ed < 1).

## 5. DISCUSSION

The National Socio-Economic Survey conducted by BPS-Statistics Indonesia (2022) showed a steady annual increase in the consumption of packaged palm cooking oil, especially in households, from 2015 to 2020. The consumption of packaged palm cooking oil increased from 10.33 liters/capita/year in 2015 to 11.58 liters/capita/year in 2020, and the average use of packaged palm cooking oil in Indonesian households increased by 2.32% from 2015 to 2020 (BPS-Statistics Indonesia, 2022).

Sumatra is one of the most densely populated regions in Indonesia after Java. Sumatra's population currently represents 21.68% of Indonesia's total population, with a wide range of livelihoods and incomes. Most people in the region have a medium income (57%), 15% are classified as having a lower medium income, and only 28% have an upper medium income. With relatively low incomes, people must be able to meet their basic needs, especially those of their families. Cooking oil is a fundamental necessity along with rice, fish, vegetables, meat, eggs, sugar, milk, and other essentials. Although rice cannot replace the main staple in Sumatra and Indonesia, cooking oil is also an important complement to fish, meat, and vegetables.

Based on the sum of the family income, this study classified household income levels into three categories: low, medium, and high, based on the sum of family income. The results showed that higher income levels are less affected by rising prices. However, people on lower to medium income levels are struggling to meet their basic needs (Heerink & Folmer, 1994). People of low-income levels will spend most of their income on basic necessities; in contrast, high-income households will spend only a small portion of their total expenditure on basic necessities (Sundaraja, Hine, & Lykins, 2021). Based on their fluctuating income, they will reduce their consumption of packaged palm cooking oil, rice, fish, and vegetables. They rarely consumed eggs or meat.

However, individuals with a medium income level did not reduce the amount of rice they consumed, but only the quality. It is important to prioritize basic needs, such as food and shelter, for people to maintain their well-being. Therefore, it is concerning that items such as eggs and milk may not be prioritized. This could potentially lead to a decrease in quality of life and even contribute to an increase in criminal activity over time. In some studies, income, which is a dominant variable in both the short and long term, can influence the demand for basic necessities (Cummins, 2000; Wakefield & Inman, 2003). In relation, the demand for cooking oil is also influenced by income levels (Mawardati, 2017). Calculating the elasticity of palm cooking oil can be classified as a normal good because an increase in per capita income results in higher demand, although with a lower percentage increase than income (Khatiwada, Palmén, & Silveira, 2021).

In terms of demand for packaged palm oil for cooking, it is clear that price, income, and number of dependents have a significant impact. Despite being a basic necessity, an increase in price will lead to a decrease in the quantity of goods the company purchases. Furthermore, various studies have shown that changes in the price of cooking oil have an impact on consumer demand. This is because cooking oil is considered a basic necessity. But not all consumers reduce their demand when the price of cooking oil increases. Instead, most tend to substitute by buying lower-quality cooking oil or reducing their consumption of other essential goods (Akbay, 2007; Akbay & Jones, 2005).

The consumer preference factor is divided into two categories: those who choose packaged palm cooking oil and those who choose coconut oil. The results show that this factor does not have a significant effect, as the price difference between the two products is not significant. This can be seen by the probability value of 0.191, which is greater than $\alpha = 0.05$. Additionally, these respondents demonstrated a similar level of preference for the two products. However, if the price of packaged palm cooking oil rises, coconut cooking oil may be a viable alternative due to its availability from other sources. Sumatra has also become a major centre for coconut production in recent years. The government should encourage this practice to stabilise the price of palm oil and create employment opportunities.

The findings indicate that the price elasticity of demand for packaged palm cooking oil is inelastic across all household income levels, as the price elasticity of demand falls below 1 (i.e., $Ed < 1$). Furthermore, the study revealed that the consumption patterns of low-income households differ from those of non-poor households. Households with low incomes allocate less of their expenditure towards food items deemed essential for good health, such as vegetables, meat, and fish. It can be inferred that any support provided by the government for low-income households must be accompanied by education on healthy consumption patterns.

This is consistent with the research carried out, which shows that food consumption is relatively inelastic to varying incomes. Significant elasticity only occurs in a few cases. These include the consumption of meat, fish, fruit, spices, and processed foods. At the macro level, poverty does not have a significant impact on consumption patterns, but at the micro level of household data, the level of income has a significant impact on all types of household consumption, both food and non-food.

Research by Mawardati et al. (2023) also demonstrated that an increase in the price of cooking oil induces changes in the behavior of consumer households. The quantity of rice consumed has not been reduced, but the quality of rice consumed has decreased, particularly among medium- and low-income levels. Furthermore, the consumption of other goods, such as meat, milk, and other nonessential items, has been reduced in quantity and, in some cases, has been eliminated, particularly among low-income households. In the long term, this will undoubtedly have an impact on the decline in health and the quality of human resources unless immediate action is taken to address the situation.

The study suggests that an increase in the price of packaged palm cooking oil can negatively impact the welfare of the community, particularly those with lower medium incomes. This is because the demand for packaged palm cooking oil often falls short of households needs. Therefore, a government policy is required to stabilize the price of packaged palm cooking oil. One way to achieve this is to increase the amount of CPO supply in the domestic market. The Domestic supply of CPO has an inverse relationship with the price of the cooking oil. A decrease in the supply of CPO leads to a reduction in the production of packaged palm cooking oil, which in turn leads to a decrease in the

availability of packaged palm cooking oil on the market and, in turn, leads to an increase in the price of packaged palm cooking oil and a decrease in household demand. The high price of packaged palm cooking oil in the domestic market is also indirectly related to its high consumption in several countries, including India, China, Pakistan, the European Union, and others. Indonesia, one of the world's largest palm oil producers with production centers in Sumatra, aims to increase CPO exports. To achieve this, the government must balance export demand and domestic needs to protect households with lower medium incomes.

From a policy perspective, the Indonesian government's approach to promoting the expansion of oil palm plantations throughout the country is commendable, given the natural advantages that Indonesia has for this particular agricultural commodity. Moreover, not all countries have optimal natural conditions for oil palm cultivation, and the production of semi-finished products in the form of CPO is essential as a feedstock for various industries, including the palm cooking oil industry. On the contrary, this policy has the unintended consequence of contributing to the gradual decline of other commodities, such as coconut, which is also used as a raw material for palm cooking oil. Ultimately, households depend on palm oil for their daily needs. It is difficult to find a viable substitute.

## 6. CONCLUSIONS

This research concluded that the impact of the reduced demand for packaged palm cooking oil due to the increase in prices is highest among low-income households, followed by medium- and high-income households. Various factors, including the price of packaged palm cooking oil and coconut cooking oil, consumer income, the number of dependents in the family, and customer preferences, greatly influence the demand for packaged palm cooking oil in Sumatra. Furthermore, in part, the price of packaged palm oil, income, and the number of family members significantly affect the demand for packaged palm oil. However, the price of coconut cooking oil and consumer preferences have an insignificant impact. The rise in packaged palm cooking oil costs is an excessive burden for the Sumatra community, especially those with lower-medium incomes. Furthermore, given that cooking oil is a basic necessity, a significant increase in the price of cooking oil results in a relatively inelastic decrease in demand across various income groups. Although the impact is inelastic, it still has a significant effect on the demand for packaged cooking oil among low-income groups. This is because it is challenging to find substitutes for packaged cooking oil in the Sumatra region. Implementing government policies that address the costs of basic amenities, including packaged palm oil, is imperative. In this way, the product can be accessible to people of moderate to low income levels.

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