

# New Capital Relocation of Indonesia: Estimating Food Demand in East Kalimantan and Jakarta

Tri Wahyu Cahyono<sup>1,2</sup> & Hiromi Tokuda<sup>1</sup>

<sup>1</sup> Department of Plant Production Sciences, Graduate School of Bioagricultural Sciences, Nagoya University, Nagoya City, Japan

<sup>2</sup> Planning Bureau, Ministry of Agriculture of Indonesia, Jakarta, Indonesia

Correspondence: Tri Wahyu Cahyono, Department of Plant Production Sciences, Graduate School of Bioagricultural Sciences, Nagoya University, Nagoya City 464-860, Japan. E-mail: triwahyu.c@gmail.com

Received: July 3, 2023

Accepted: July 31, 2023

Online Published: August 15, 2023

doi:10.5539/jas.v15n9p26

URL: <https://doi.org/10.5539/jas.v15n9p26>

## Abstract

This research examines the current state of food demand and its influencing factors in East Kalimantan and Jakarta, considering the relocation of Indonesia's capital city. Using the Quadratic Almost Ideal Demand System (QUAIDS) method and 2021 Susenas data, we have analyzed the impact of variations in food prices, income, and demographic variables on seven food categories—rice, grains, tubers, legumes, animal protein, fruit & vegetables, and prepared food. Our findings reveal that increased income increases demand for animal protein and fruit & vegetables in East Kalimantan but decreases in Jakarta. In both regions, as expenditure increases, rice consumption decreases while the demand for prepared food increases. An increase of 1% in rice prices will reduce rice consumption by approximately 0.334-0.487% in East Kalimantan and 0.126-0.202% in Jakarta. Households in East Kalimantan consume more prepared food when prices for other food items increase. In Jakarta, prepared food consumption decreases as rice prices go up. Demographic factors play a crucial role in determining food demand. For example, public sector employees in East Kalimantan consume more rice and less prepared food, while in Jakarta, they prefer prepared food and consume less rice. It is essential to pay adequate attention to the demand for food for public workers who will move to East Kalimantan and the demographic factors that influence it. This consideration will ensure that the residents of East Kalimantan and those who relocate to the new capital receive the necessary food provisions.

**Keywords:** food demand, QUAIDS, elasticity, New Capital, East Kalimantan, Jakarta

## 1. Introduction

As per Law No. 3 of 2022, the Indonesian government's decision to relocate the national capital from DKI Jakarta to East Kalimantan is believed to result in a surge of new residents migrating to the province. The capital relocation has been decided due to the significant challenges Jakarta faces, such as traffic congestion, flooding, and land subsidence. Insufficient road infrastructure in Jakarta has resulted in traffic jams, while poor drainage systems and excessive groundwater drilling have led to frequent floods and rapid land subsidence. The government has decided to relocate the capital city to address these issues and alleviate the burden on the already strained infrastructure.

The relocation of Indonesia's capital city aims to drive economic progress in regions beyond Java and Bali. For years, Java and Bali have dominated Indonesia's economic activity and development, resulting in significant development disparities on other islands. However, the move of the capital city presents new opportunities for investment, infrastructure development, and economic growth in East Kalimantan and neighboring areas. East Kalimantan is the eastern part of Kalimantan Island (Figure 1). East Kalimantan covers an area of 120,000 km<sup>2</sup> but has a population of only 3.77 million, with a population density of only 30 people/km<sup>2</sup>. The primary industries of East Kalimantan are mining and quarrying due to its abundance of minerals (BPS Kaltim, 2021). However, these industries have stagnated in recent years. In East Kalimantan, the promotion of new initiatives which will drive the regional economy in the future is required. The relocation of the capital is expected to promote migration to East Kalimantan and trigger the development of new industries. As an archipelago nation, Indonesia boasts diverse demographics and geography. The relocation of the capital city is expected to bridge development gaps by focusing on the eastern part of the country. This policy will promote more equitable

economic growth throughout the nation, creating regional balance, reducing pressure on Java, and ensuring fair access to opportunities for all.



Figure 1. Map of Indonesia, moving the nation's capital from Jakarta to East Kalimantan (Maulia, 2019)

Relocating the capital city to East Kalimantan has various challenges, such as establishing new government institutions and ensuring a diverse food supply. Notably, as a large population inflow is expected, a sufficient food supply to meet them is essential. According to Pratama, Sudrajat, and Harini (2019), East Kalimantan suffers from a rice deficiency, while Jakarta is Indonesia's largest rice importer, resulting in a surplus.

When considering food demand, it is necessary to consider not only the population change but also changes in food consumption patterns. In Indonesia, there are differences in food consumption patterns among the islands. Moreover, household income has risen owing to the enhanced economic growth in Indonesia. An increase in income is expected to change food consumption patterns (BPS Kaltim, 2021). The capital relocation is expected to change the food consumption pattern in East Kalimantan due to population migration from other regions and economic growth. The studies conducted by Handani, Kusnadi, and Rachmina (2021) and Deshaliman and Gantina (2019) suggest that the demand for rice in the region exceeds its production capacity. According to the latter research, the government's decision to move the capital will require 498 thousand tons of rice for household consumption due to the population increase. These studies do not consider changes in food consumption patterns. When considering the food supply issues related to the capital relocation, it is also necessary to consider the changes in food consumption patterns brought by the relocation.

In this study, the food price elasticity and expenditure elasticity, which are useful information for examining changes in food consumption patterns in East Kalimantan due to capital relocation, are measured by mainly using the Quadratic Almost Ideal Demand System (QUAIDS) model. We also measure the price and income elasticity of food in Jakarta and compare the results in both areas.

## 2. Literature Review

Deshaliman and Gantina (2019) studied desired dietary patterns and food supply planning in East Kalimantan for 2024. They used Susenas data from the BPS Province of East Kalimantan and DKI Jakarta Province 2018 for an explanatory cross-sectional design study. They processed the data descriptively using the Harmonized Analysis of Expected Food Patterns Application based on the Expected Food Pattern (PPH) approach. The study revealed the necessary food data that must be available cumulatively based on the ideal needs of each person's food consumption. However, the research did not consider the economic factor of each person or household's ability to access food sources.

Adi, Rachmina, and Krisnamurthi (2021) have also studied the rice supply shortage in East Kalimantan caused by migration from Jakarta. They employed the system dynamic method to estimate the demand and supply of rice as the population of East Kalimantan increased. Their study involved analyzing population size and average rice consumption to predict future consumption needs. However, their research did not consider the impact of economic factors on rice demand, as it solely focused on population growth.

Furthermore, analyzing actual household consumption, this study considers economic and demographic factors that can influence food demand. Using the QUAIDS method, the effect of changes in prices and income on household food demand can be calculated by determining price and expenditure elasticity. Demographic factors

are also considered as variables, allowing for observations of differences and similarities in food demand patterns between households in East Kalimantan and those planning to move from Jakarta to the area. The QUAIDS method has gained popularity for its ability to demonstrate how economic factors such as prices and income affect food consumption. This model highlights Engel's law, which suggests that as income increases, the proportion of income spent on food decreases. The QUAIDS approach offers insights into how household food demand is affected by demographic factors. Numerous studies have examined the food demand system through the QUAIDS method, such as those conducted in Thailand (Wongmonta, 2022), Nigeria (Obayelu, Wintola, Olufunmilayo, & Oluwalana, 2022), Vietnam (Hoang, 2018), Senegal (N. F. Faye, A. Faye, Sy, Lee, & McPeak, 2022), China (Zheng & Henneberry, 2010), and the Philippines (Valera, Mayorga, Pede, & Mishra, 2022). Research has also investigated food consumption's price and income elasticity in Indonesia among different demographics. For instance, a recent study found that price increases significantly impact the welfare of households and increase the number of poor households (Faharuddin, Yamin, Mulyana, & Yunita, 2022). Another study revealed that social assistance could increase the consumption of rice and staple foods among low-income individuals, indicating increased income (Rasyid, 2022). Research conducted by Ermansyah, Daryanto, and Syaikat (2020) examines the effects of changes in own prices, cross prices, and income on the consumption of animal protein in Indonesia. Preferences influence the demand for animal-based foods in Indonesia and react to animal food prices and income changes. Other researchers, including Nikmatul, Ratya, Nuhfil, and Wahib (2020) and Iriany, Sui, Anindita, Khoiriyah, and Sa'diyah (2022), have also studied animal protein in Indonesia and discovered that animal-based food is elastic in Indonesia.

Research on food patterns at the regional level has been utilizing the demand model, as seen in the work of Faharuddin et al. (2015) in South Sumatra. However, further studies are required to examine the demand for food at the regional level in Indonesia, considering economic and sociodemographic factors. A recent analysis of Susenas data from 2010-2017 on the island of Java revealed that rice consumption was not income elastic, with a shift towards prepared food and beverages (Devi & Purnomosidi, 2019). In addition, research on food demand with demographic variables was also carried out in Indonesia. For example, sociodemographic factors, such as household size, gender, location, occupation, and education, significantly impact household food consumption patterns (Hafizah, Hakim, Harianto, & Nurmawati, 2020). A study in Bengkulu, Indonesia, revealed that age, education, place of residence, and occupation influence rice consumption behavior. Household income and location also play a significant role in determining food consumption habits. Occupation is an important sociodemographic factor influencing the demand for essential food items. Studies have also examined the effect of higher food prices on farming households, revealing that increased income is linked to higher rice consumption (Suryanti & Matsuda, 2022). It is important to note that income elasticity, own-price, and cross-price items affect food consumption patterns depending on the household's demographics, socioeconomic conditions, and geographical location (Allo, Satriawan, & Arsyad, 2018).

### 3. Method

#### 3.1 Data

The data for this study comes from the March 2021 National Socioeconomic Survey (Susenas) conducted by BPS-Statistics Indonesia. The survey includes 5,919 households in East Kalimantan and 5,757 in Jakarta. We add the amount spent on each food group in rupiah units to calculate food expenditure. BPS-Statistics Indonesia collects detailed data in three categories: Household Consumption/Expenditure and Income Module, Socio-Cultural and Education Module, and Health and Housing Module. This study utilizes these data sources for its calculations.

Our analysis focused on household consumption data for food commodities, grouped into seven categories in Table 1. The QUAIDS model includes a summary of food variables, encompassing the price of different food categories and the number of expenses per capita incurred in the East Kalimantan and Jakarta regions. Interestingly, rice in East Kalimantan is more expensive (IDR 11,945) than Jakarta (IDR 10,447). Pratama et al. (2019) state that Jakarta has a more excellent rice supply due to its rice warehouses and imports, whereas East Kalimantan is not an agricultural center. As a result, other commodities like grains, legumes, and prepared food are more expensive in East Kalimantan. Table 1 shows that the daily consumption of rice, grains, tubers, legumes, animal protein, and fruits & vegetables per capita is relatively the same in East Kalimantan and Jakarta. However, East Kalimantan consumes less prepared food (0.312 portions purchased/cap/day) than Jakarta (0.707 portions purchased/cap/day).

Table 1. Description of Food Groups from Susenas, 2021

| No. | Type of Food         | Details   | East Kalimantan          |                   |                  | Jakarta                  |                   |                  |
|-----|----------------------|---|--------------------------|-------------------|------------------|--------------------------|-------------------|------------------|
|     |                      |   | Quantity<br>(kg/cap/day) | Price<br>(IDR/kg) | S.D. of<br>Price | Quantity<br>(kg/cap/day) | Price<br>(IDR/kg) | S.D. of<br>Price |
| 1   | Rice                 | rice  | 0.175                    | 11495             | 1992             | 0.176                    | 10447             | 2323             |
| 2   | Grain                | maize, wheat  | 0.015                    | 10404             | 1785             | 0.012                    | 9891              | 1701             |
| 3   | Tuber                | cassava, sweet potato, sago, potato   | 0.018                    | 10762             | 3722             | 0.025                    | 11359             | 3302             |
| 4   | Legume               | peanuts, soybeans, tofu, tempeh   | 0.042                    | 12090             | 3580             | 0.043                    | 10548             | 3303             |
| 5   | Animal Protein       | fish, beef, lamb, chicken meat, egg, milk   | 0.420                    | 10710             | 9968             | 0.433                    | 10257             | 7899             |
| 6   | Fruit &<br>Vegetable | spinach, kale, cabbage, mustard greens,<br>beans, tomatoes, carrots, cucumbers,<br>eggplants, onions, chilies, oranges, mangoes,<br>apples, rambutan, bananas, watermelon | 0.255                    | 9106              | 4930             | 0.244                    | 11931             | 4568             |
| 7   | Prepared Food*       | ready food/eaten away from home   | 0.312                    | 10338             | 4518             | 0.704                    | 9111              | 3138             |

*Note.* \* The prepared food quantity unit uses the portion purchased per capita per day, and the price unit is IDR per food portion. The data is an average of 5,919 households in East Kalimantan and 5,757 in Jakarta.

In microdata analysis, missing data is often found because some households do not consume certain goods. An imputation approach that utilizes the average value of communal units is applied to overcome this problem. In addition, since price data was not collected in this survey, a substitute for market prices is calculated by dividing expenditure by the amount consumed, as described by Deaton (1987). This method of imputing price data in missing data was also utilized by Hoang (2009) and Faharuddin et al. (2022) to address variations in food prices.

### 3.2 Analysis Method

This research utilizes the QUAIDS method to describe consumer behavior and estimate demand for goods. The QUAIDS model approximates demand systems based on the budget share, a linear component of total log revenue. It considers consumer choices in determining a group of goods, enabling it to identify the cross-relationships between consumed goods. The demand system, which employs a quadratic, logarithmic function, aligns with the Engel curve and utility theory, demonstrating how demand for numerous goods can be specified. Additionally, this analytical approach integrates household preferences and heterogeneity by incorporating demographic variables (Banks, Blundell, & Lewbel, 1997).

The QUAIDS analysis, which was first introduced by Banks et al. (1997), is a method that evaluates the impact of sociodemographic characteristics, income, and prices on household consumption demand. One significant finding of this analysis was the discovery of a non-linear Engel curve that was not previously considered in the Almost Ideal Demand System (AIDS). The QUAIDS and AIDS models, which were popularized by Deaton and Muellbauer (1980), are commonly used to study the Engel curve and explain how household spending on a particular good change with household income. The QUAIDS model is instrumental in handling the nonlinearity of the Engel curve. In addition, Nicol (2001) demonstrated that sociodemographic variables play a crucial role in determining household demand patterns. As a result, many researchers use the QUAIDS model to investigate changes in consumer demand. Poi (2012) has developed STATA program commands that can readily compute QUAIDS to estimate system demand. Overall, the QUAIDS function is a valuable tool for analyzing household consumption demand and understanding the factors that influence it. The definition of QUAIDS function can be stated as follows:

$$\omega_x = \alpha_y + \sum_{y=1}^n \gamma_{xy} \ln P_y + (\beta_x + \eta'_x Z) \ln \left[ \frac{k}{\bar{k}_0(Z)a(p)} \right] + \frac{\lambda_x}{b(p)c(p,Z)} \left\{ \ln \left[ \frac{k}{\bar{k}_0(Z)a(p)} \right] \right\}^2 + u_x \quad (1)$$

The calculation involves several variables, such as  $\omega_x$ , which is the expenditure share of the x-th food group,  $P_y$ , which is the price of the y-th food group;  $k$  pertains to the total expenditure on food,  $Z$ , which is the demographic variable; and  $p$ , the price vector. Another variable,  $\bar{k}_0(Z)$  is  $\rho'Z$ , where  $\rho$  is a vector of parameters to be estimated. For  $\ln a(p)$  is the transcendental logarithm function,

$$\ln a(p) = \alpha_0 + \sum_{x=1}^n \ln P_x + \frac{1}{2} \sum_{x=1}^n \sum_{y=1}^n \gamma_{xy} \ln P_x \ln P_y \quad (2)$$

$$c(p, Z) = \prod_{y=1}^n P_y^{\eta_y Z} \quad (3)$$

where,  $b(p)$  is a cobb-Douglas price aggregator,

$$b(p) = \prod_{x=1}^n P_x^{\beta_x} \quad (4)$$

The parameters to be estimated in this scenario are  $\alpha_x, \gamma_{xy}, \beta_x, \eta_x$ . However, adding these constraints can lead to a singularity in the covariance matrix of the error term  $u_x$ . To estimate the QUAIDS model in Equation (1), we use a seemingly unrelated regression technique due to the nonlinearity in the parameters and cross-equation constraints of the demand system. To obtain more efficient parameter estimates, QUAIDS needs restrictions to be consistent with utility maximization, namely:

Adding up,

$$\sum_{x=1}^n \alpha_x = 1, \sum_{x=1}^n \beta_x = 0, \sum_{x=1}^n \gamma_{xy} = 0 \quad (5)$$

Homogeneity,

$$\sum_{y=1}^n \gamma_{xy} = 0 \quad (6)$$

and Symmetry

$$\gamma_{xy} = \gamma_{yx} \quad (7)$$

Based on Equation (5), we can conclude that the budget constraint remains constant. It has also been demonstrated that not all food products are low-quality. Equation (6) is known as the homogeneity constraint as it ensures that demand functions are uniform in their level of homogeneity regarding overall expenditure and prices. This state implies that demand will not alter if there is a proportional change in expenditure and all prices. Equation (7) emphasizes that complementarity and substitutability among food groups are uniform when using compensated demand functions. In order to assess the impact and variations in the pricing of products and expenditures, the elasticity value is utilized. The QUAIDS model provides three categories of demand elasticity, which include:

(1) Income elasticity,

$$\epsilon_x = 1 + \frac{1}{\omega_x} \left[ \beta_x + \eta_x' Z + \frac{2\lambda_x}{b(p)c(p, Z)} \ln \left\{ \frac{k}{\bar{k}_0(Z)a(p)} \right\} \right] \quad (8)$$

(2) Uncompensated price elasticity, and

$$\epsilon_{xy} = \frac{1}{\omega_x} \left\{ \gamma_{xy} - \left( \beta_x + \eta_x' Z + \frac{2\lambda_x}{b(p)c(p, Z)} \left[ \ln \left( \frac{k}{\bar{k}_0(Z)a(p)} \right) \right] \right) \times \left( \alpha_y + \sum_l \gamma_{yl} \ln P_l \right) - \frac{(\beta_y + \eta_y' Z) \lambda_x}{b(p)c(p, Z)} \left( \ln \left[ \frac{k}{\bar{k}_0(Z)a(p)} \right] \right)^2 \right\} - \delta_{xy} \quad (9)$$

(3) Compensated price elasticity is derived from the Slutsky equation:

$$\epsilon_{xy}^C = \epsilon_{xy} + \epsilon_x \omega_y \quad (10)$$

In Equations (9) and (10), the price elasticities are calculated using two demand functions: the Marshallian and Hicksian demand functions. The Marshallian demand function provides uncompensated elasticities, while the Hicksian demand function provides compensated elasticities. These demand functions model consumer behavior and determines the demand for goods at different prices. The Marshallian function shows how the quantity demanded changes with price while other factors remain constant. It is obtained by maximizing utility subject to a budget constraint. The Hicksian demand function shows how much a consumer will demand at different prices while keeping utility constant. It is derived by determining the amount of income needed to compensate for changes in price so that utility remains constant. This approach allows for a more precise analysis of the substitution and income effects of price changes. The Marshallian demand function explains how the demand for a product changes with its price, while the Hicksian demand function determines the quantity of a product a consumer will purchase at various prices without affecting their utility. The Slutsky equation is used to convert Marshallian elasticity into Hicksian elasticity (Nicholson & Snyder, 2012; Poi, 2012).

The QUAIDS model also incorporates household demographic variables to account for differences in preference structure among households due to their demographic characteristics. The study used seven food group variables and six demographic variables. The QUAIDS model helps accommodate the nonlinearity of the Engel curve. Statistical programs such as STATA can quickly calculate the QUAIDS model through specific commands (Poi, 2012).

Table 2. Demographic Variables Description, Susenas 2021

| No. | Variable       | Definition  | 2021            |         | Unit      |
|-----|----------------|---|-----------------|---------|-----------|
|     |                |   | East Kalimantan | Jakarta |           |
| 1   | Occupation     | The proportion of public administration households (1: public administration; 0: Other sectors) | 6.8             | 5.4     | %         |
| 2   | Age            | Age of family head  | 46.7            | 48.1    | years old |
| 3   | Gender         | The proportion of head household gender (1: male; 0: female)                                    | 87.6            | 81.6    | %         |
| 4   | Education      | The proportion of middle-high education (1: middle-high education; 0: lower than middle school) | 89.4            | 78.1    | %         |
| 5   | Family size    | Household size  | 3.8             | 3.4     | member    |
| 6   | Marital status | The proportion of married (1: Married; 0: No Married)   | 82.4            | 74.5    | %         |

*Note.* The descriptive statistics for a sample of 5,919 households in East Kalimantan and 5,757 households in Jakarta.

In 2021, Table 2 provides an overview of the research variables for East Kalimantan and Jakarta, including age, gender, education level, number of families, and marital status of the household head. For our analysis, we have filtered the occupational variables only to include individuals working in public administration, as per the capital relocation plan to move residents from Jakarta to East Kalimantan for public administration work. Our study focuses on the socioeconomic profiles of households in both regions. The average age of the household head in East Kalimantan is 46.7 years, slightly younger than Jakarta's average of 48.1 years. Most household heads are male, with a higher percentage of 87.6% in East Kalimantan than 81.6% in Jakarta. Education-wise, 89.4% of household heads in East Kalimantan have attended middle-high education, while 78.1% in Jakarta. The average number of household members is higher in East Kalimantan, with 3.8 members, compared to 3.4 in Jakarta. Additionally, the percentage of married household heads is higher in East Kalimantan at 82.4% than in Jakarta at 74.5%.

#### 4. Results and Discussion

##### 4.1 Parameter Estimation

According to the model's estimations, the percentage of household food commodity budgets for East Kalimantan and Jakarta can be determined. Appendix A displays the estimated food demand for East Kalimantan, while Appendix B contains Jakarta's data. The results indicate that in East Kalimantan, the coefficient of income/expenditure is significant at a 1% level for rice (-0.407), grain (-0.012), animal protein (0.123), fruit & vegetables (0.140), and prepared food (0.157). Conversely, in Jakarta, all food commodities except grains have a significant consumption expenditure coefficient. The expenditure-consumption coefficients for Jakarta are rice (-0.084), tuber (-0.007), legumes (-0.031), animal protein (-0.015), fruit & vegetables (-0.074), and prepared food (0.344). There are notable differences in household reactions to food consumption expenditure in East Kalimantan and Jakarta. Increased income leads to increased demand for animal protein and fruit & vegetables in East Kalimantan but a decrease in Jakarta. Meanwhile, the demand for rice decreases with a consumption coefficient of -0.407 in East Kalimantan and -0.084 in Jakarta for every expenditure increase. Finally, demand for prepared food increases by a coefficient of 0.157 in East Kalimantan and 0.344 in Jakarta.

Based on Appendix A, it has been found that the estimated squared expenditure coefficient impacts all food groups in East Kalimantan, except tubers. However, in Jakarta, all squared expenditure coefficients for food groups are significant at 1% (refer to Appendix B). The results indicate that the demand function for this food group is not linearly related to total expenditure. To model a nonlinear Engel curve, the QUAIDS model can be used (Gostkowski, 2018). This discovery implies that the Engel curve for this demand function is nonlinear. The Engel curve is a valuable tool used to determine the effect of income changes on the demand for a good, commonly applied to food demand. It can also reveal whether a good is inferior, normal, or luxurious. The curve's shape can vary significantly based on the specific good, ranging from linear to highly nonlinear. As a household's income increases, the percentage spent on food decreases while the percentage spent on non-food items increases.

Besides income, the demand for food is also affected by price and demographic factors, as outlined in Appendix A and B. The discussion of price elasticity will further explain the influence of price on demand. In East Kalimantan and Jakarta, various demographic factors such as type of work, age, gender, education level,

household size, and marital status significantly impact the estimation of food demand. The following section will provide more details on the effects of demographics on food demand.

#### 4.2 Income/Expenditure Elasticities

Understanding elasticity is crucial in economics when analyzing fluctuations in food demand due to changes in income factors. By examining the demand function for food in East Kalimantan, we can see how income affects the quantity demanded. The elasticity of expenditure refers to the percentage change in consumption that results from a one percent increase in expenditure. Table 3 reports the expenditure elasticity of demand for the seven food groups in East Kalimantan and Jakarta. The elasticity of demand for rice expenditure is 0.584 in Jakarta, which is the lowest elasticity compared to other foods, while in East Kalimantan, the elasticity is 0.749, the second lowest after legumes (0.582). The spending elasticity for rice in Jakarta aligns with the elasticity figure discovered by Hafizah et al. (2020) for rice in Indonesia, which is 0.532, mirroring the findings of Rasyid's study (2022), Devi et al. (2019) and Sugiyanto (2006).

Table 3. Expenditure Elasticities and Budget Share of Food Groups in East Kalimantan and Jakarta

| Food Groups         | East Kalimantan  |              | Jakarta          |              |
|---------------------|------------------|--------------|------------------|--------------|
|                     | Elasticity       | Budget Share | Elasticity       | Budget Share |
| Rice                | 0.749<br>(0.017) | 20.39%       | 0.584<br>(0.018) | 13.11%       |
| Grain               | 0.913<br>(0.048) | 1.38%        | 1.115<br>(0.049) | 0.70%        |
| Tuber               | 1.292<br>(0.046) | 1.28%        | 0.970<br>(0.039) | 1.59%        |
| Legumes             | 0.582<br>(0.027) | 5.15%        | 0.643<br>(0.027) | 2.95%        |
| Animal Protein      | 1.046<br>(0.011) | 29.97%       | 1.061<br>(0.014) | 23.62%       |
| Fruits & vegetables | 0.821<br>(0.012) | 21.51%       | 0.776<br>(0.016) | 18.28%       |
| Prepared food       | 1.467<br>(0.020) | 20.31%       | 1.229<br>(0.016) | 39.74%       |

Note. The standard errors are in parentheses.

In East Kalimantan, when there is an increase in income, people tend to increase spending on prepared food, tubers, and animal protein because they have a higher expenditure elasticity. Conversely, rice and legumes have the lowest expenditure elasticity, with values of 0.7 and 0.5, respectively. Grains and fruits and vegetables have an elasticity of expenditure close to 1. On the other hand, in Jakarta, grain, animal protein, and prepared food are considered elastic goods. According to Nikmatul et al. (2020), the demand for animal protein in Indonesia is influenced by changes in household income, making it an elastic good.

Income changes significantly impact the consumption of animal protein and prepared food in both regions, as shown in Table 3. With every 1% increase in expenditure, there was a notable increase in the consumption of prepared food and animal protein. In East Kalimantan, the consumption of prepared food increased by 1.467%, while animal protein consumption increased by 1.046%. In Jakarta, there was a 1.229% increase in prepared food consumption and a 1.061% increase in animal protein consumption. These two groups constitute a significant percentage of the food budget share. In Jakarta, prepared food expenditure dominates the household budget with 39.7%, while in East Kalimantan, animal protein expenditure accounts for 29.9%. An analysis of income elasticity revealed a decrease in the demand for rice but an increase in the demand for animal protein and prepared food due to the increased income in East Kalimantan, a new capital city.

#### 4.3 Price Elasticities

The elasticity of own price refers to the percentage change in quantity consumed resulting from a one percent change in price. Own price elasticity is a way to measure the responsiveness of household demand to changes in food commodity prices. Table 4 shows the elasticity of each food group and reflects that if there is a price increase, the quantity of food commodities demanded will decrease. In East Kalimantan and Jakarta, grains and

tubers are the most price-sensitive food commodities because their price elasticity is more than 1 (refer to Table 4). Consumers tend to reduce the quantity demanded for these products as their prices increase.

In contrast, rice has the lowest elasticity value in both regions, and even if its price increases significantly, the demand for it tends to remain stable. Moreover, the relocation of the capital city to East Kalimantan means that changes in rice prices do not significantly affect household demand for this staple food. The compensated price elasticity is lower than the uncompensated one, which suggests that compensation can mitigate the impact of rising commodity prices on consumption. When households receive compensation for price increases, they are less responsive to changes in consumption. The Uncompensated Price Elasticity measures the responsiveness of quantity demanded to price changes without considering income adjustments. Compensation Price Elasticity factors in income adjustments to counteract the effect of price changes on purchasing power.

Based on the data, both regions show similar elasticities for animal protein and fruits & vegetables, ranging from 0.4-0.7. However, in East Kalimantan, the demand for rice, grain, tuber, legumes, and prepared food is more affected by price increases, as indicated in Table 4.

Table 4. Own Price Elasticities of Food Groups in East Kalimantan and Jakarta

| Food Groups         | East Kalimantan |               | Jakarta     |               |
|---------------------|-----------------|---------------|-------------|---------------|
|                     | Compensated     | Uncompensated | Compensated | Uncompensated |
| Rice                | -0.334          | -0.487        | -0.126      | -0.202        |
| Grain               | -1.342          | -1.354        | -1.031      | -1.039        |
| Tuber               | -1.462          | -1.479        | -1.232      | -1.247        |
| Legumes             | -0.892          | -0.922        | -0.745      | -0.764        |
| Animal Protein      | -0.436          | -0.750        | -0.437      | -0.687        |
| Fruits & Vegetables | -0.429          | -0.606        | -0.599      | -0.741        |
| Prepared Food       | -0.668          | -0.966        | -0.320      | -0.808        |

Cross-price elasticity refers to the percentage change in the quantity demanded of one product resulting from a one percent increase in the price of other products. A negative cross-price elasticity suggests that the products are complementary, whereas a positive cross-price elasticity indicates that they are substitutes. If the cross-price elasticity value is close to zero, it means that the products are independent, and changes in the price of one product do not affect the demand for other products (Gotkowski, 2018). By examining the results of self-price and expenditure elasticity, cross-price elasticity provides valuable insights into additional or alternative food options. For example, if the price of rice changes, consumers may opt for substitute products.

Table 5. Cross-Price Elasticities Uncompensated (Marshallian) in East Kalimantan and Jakarta

| Quantity Demanded      | Price Change |        |        |         |                |                     |               |
|------------------------|--------------|--------|--------|---------|----------------|---------------------|---------------|
|                        | Rice         | Grain  | Tuber  | Legumes | Animal Protein | Fruits & Vegetables | Prepared Food |
| <i>East Kalimantan</i> |              |        |        |         |                |                     |               |
| Rice                   |              | 0.023  | 0.022  | 0.062   | -0.168         | -0.190              | -0.012        |
| Grain                  | 0.310        |        | -0.040 | 0.313   | -0.042         | -0.092              | -0.008        |
| Tuber                  | 0.240        | -0.049 |        | 0.043   | 0.049          | -0.015              | -0.081        |
| Legumes                | 0.285        | 0.089  | 0.020  |         | -0.063         | -0.007              | 0.016         |
| Animal Protein         | -0.175       | -0.004 | 0.005  | -0.034  |                | -0.066              | -0.023        |
| Fruits & Vegetables    | -0.190       | -0.005 | 0.005  | -0.013  | -0.025         |                     | 0.013         |
| Prepared Food          | -0.165       | -0.008 | -0.007 | -0.041  | -0.159         | -0.121              |               |
| <i>Jakarta</i>         |              |        |        |         |                |                     |               |
| Rice                   |              | 0.001  | 0.009  | 0.020   | -0.101         | -0.042              | -0.270        |
| Grain                  | -0.051       |        | -0.075 | 0.583   | 0.022          | -0.280              | -0.274        |
| Tuber                  | 0.021        | -0.032 |        | 0.263   | 0.103          | -0.127              | 0.049         |
| Legumes                | 0.077        | 0.142  | 0.15   |         | -0.086         | -0.212              | 0.052         |
| Animal Protein         | -0.122       | 0.001  | 0.01   | -0.024  |                | -0.029              | -0.206        |
| Fruits & Vegetables    | -0.055       | -0.008 | -0.01  | -0.038  | 0.034          |                     | 0.040         |
| Prepared Food          | -0.171       | -0.006 | -0.002 | -0.013  | -0.166         | -0.063              |               |



When we examine Table 5, it becomes clear that most East Kalimantan and Jakarta food groups have low cross-price elasticity. This implies that the prices of other food items do not significantly impact the consumption of these food items. However, in East Kalimantan, the highest uncompensated cross-price elasticities were observed for rice and legumes on grain consumption, with elasticities of 0.310 and 0.313, respectively. In Jakarta, legumes have the highest cross-price elasticity of 0.583 for grain consumption. If the prices of rice and legumes increase by 1%, grain consumption will increase by 0.3% in East Kalimantan, while in Jakarta, grain consumption will increase by 0.5% if the price of legumes increases by 1% (as shown in Table 5).

According to the data provided in Table 5, rice consumption in East Kalimantan and Jakarta seems to follow a similar pattern in relation to the prices of other food items. Out of the seven food groups studied, grains, tubers, and legumes display a positive cross-price elasticity concerning the quantity of rice demanded. This essentially means that when the prices of these food items go up, so does rice consumption. However, the elasticity values of these three food groups range from 0.001 to 0.062, indicating that rice is an independent commodity and not significantly impacted by changes in the prices of these foods.

In contrast, animal protein, fruits and vegetables, and prepared foods exhibit cross-price elasticity values of -0.167, -0.189, and -0.012 in East Kalimantan and -0.101, -0.042, and -0.270 in Jakarta. This implies that rice complements these three food groups. In East Kalimantan and Jakarta, a rise in prices of grains, tubers, and legumes leads to an increase in rice consumption, while an increase in prices of animal protein, fruits and vegetables, and prepared foods results in a decrease in rice consumption (refer to Table 5 for details).

Table 6. Cross-Price Elasticities Compensated (Hicksian) in East Kalimantan and Jakarta

| Quantity Demanded      | Price Change |        |        |         |                |                     |               |
|------------------------|--------------|--------|--------|---------|----------------|---------------------|---------------|
|                        | Rice         | Grain  | Tuber  | Legumes | Animal Protein | Fruits & Vegetables | Prepared Food |
| <i>East Kalimantan</i> |              |        |        |         |                |                     |               |
| Rice                   |              | 0.034  | 0.032  | 0.100   | 0.057          | -0.029              | 0.140         |
| Grain                  | 0.496        |        | -0.029 | 0.360   | 0.231          | 0.105               | 0.178         |
| Tuber                  | 0.503        | -0.031 |        | 0.110   | 0.436          | 0.263               | 0.182         |
| Legumes                | 0.404        | 0.097  | 0.027  |         | 0.112          | 0.119               | 0.134         |
| Animal Protein         | 0.039        | 0.011  | 0.019  | 0.020   |                | 0.160               | 0.189         |
| Fruits & Vegetables    | -0.023       | 0.007  | 0.016  | 0.029   | 0.221          |                     | 0.180         |
| Prepared Food          | 0.135        | 0.012  | 0.011  | 0.034   | 0.281          | 0.194               |               |
| <i>Jakarta</i>         |              |        |        |         |                |                     |               |
| Rice                   |              | 0.005  | 0.018  | 0.037   | 0.038          | 0.065               | -0.038        |
| Grain                  | 0.095        |        | -0.058 | 0.616   | 0.285          | -0.076              | 0.169         |
| Tuber                  | 0.148        | -0.025 |        | 0.292   | 0.332          | 0.05                | 0.435         |
| Legumes                | 0.161        | 0.146  | 0.157  |         | 0.066          | -0.094              | 0.308         |
| Animal Protein         | 0.017        | 0.009  | 0.022  | 0.007   |                | 0.165               | 0.216         |
| Fruits & Vegetables    | 0.047        | -0.003 | 0.005  | -0.015  | 0.217          |                     | 0.349         |
| Prepared Food          | -0.010       | 0.003  | 0.017  | 0.023   | 0.124          | 0.162               |               |

When analyzing price elasticity, we can consider both income and substitution effects in Marshallian elasticity, while Hicksian elasticity (compensation) only focuses on price changes. Table 6 displays the Hicksian cross-price elasticity, which reveals that only substitution effects are present. In East Kalimantan, a substitution relationship was observed between rice and tubers, with a value of 0.503. This elasticity indicates that if the price of rice increases by 1%, households tend to increase their consumption of tuber by 0.503%. On the other hand, in Jakarta, the substitution relationship between legumes and grains is the highest at 0.616. This elasticity implies that if there is a 1% increase in legume prices, the consumption of grains increases by 0.616%.

The findings of Table 6 reveal that when prices of rice, grains, tubers, legumes, animal protein, and fruit & vegetables rise, households in East Kalimantan tend to switch to prepared food. Conversely, if prepared food price increases, consumers may substitute it with other food groups. This state aligns with Sari's research (2016), indicating that households prefer prepared food when staple food prices rise. However, in Jakarta, the consumption of prepared food decreases as the price of rice increases, and vice versa. Suryanti and Matsuda (2022) demonstrate that prepared food and staple food are complementary. Grain and tubers, the two food

commodity groups with the lowest budget portion (as shown in Table 3) in East Kalimantan and Jakarta, serve as substitutes for other food groups. Based on this data, if the capital city were to move to East Kalimantan, an increase in the price of tubers could lead to an increase in rice consumption, while an increase in the price of grains could lead to an increase in legume consumption.

#### *4.4 Effect of Demographic*

The study of demographic factors in East Kalimantan and Jakarta indicates that these factors play a crucial role in determining household food demand. The analysis (Table 7) shows that 61% of the demographic variable coefficients are statistically significant at the 1% level, with 23% being insignificant and the remaining 5% and 10% being appropriate. The results show that several demographic coefficient parameters significantly impact household food demand, such as the demand for rice in both regions. In Jakarta, all the coefficients of demographic variables for rice demand are significant at the 1% level, while in East Kalimantan, not all demographic variables have a significant effect.

The study also shows that the variable occupation (public administration) significantly impacts the two regions' demographic differences in rice consumption. In East Kalimantan, households employed in the public sector tend to consume more rice than other industries, while in Jakarta, the public sector workers consume less rice than other industries but prefer prepared food. Interestingly, the coefficient of prepared food in East Kalimantan is negative (-0.006), indicating that public administration workers consume less prepared food than other sector workers. In contrast, Jakarta's public administration workforce shows the opposite trend. The substantial value of each coefficient explains the food consumers' behavior in East Kalimantan connected to the population movement policy from Jakarta. It is clear from the QUAIDS model with the chosen demographic data. Public administration employees' purchasing habits differ structurally in Jakarta and East Kalimantan.

Studies have demonstrated that the age of the head of the household is a vital factor in determining the household's food consumption. In East Kalimantan, rice, and fruit & vegetable consumption declines as the head ages. Similarly, in Jakarta, the demand for rice, tubers, animal protein, and fruits & vegetables decreases with the head of the household's age. However, research indicates that the demand for food, except for prepared food, declines as the head of the household ages, which shows an upward trend in both East Kalimantan and Jakarta. Furthermore, research conducted in Jakarta and East Kalimantan indicates that the gender of the head of the household has a significant impact on food demand. Male heads of households in Jakarta have a higher demand for all seven food groups, except for prepared food, than women. Similarly, in East Kalimantan, the demand for animal protein is insignificant, but the demand for other food groups follows a similar pattern to that of households in Jakarta.

Moreover, Table 7 shows that the consumption of rice, legumes, animal protein, and prepared food in East Kalimantan and Jakarta is significantly influenced by education levels. However, it has little effect on consuming grains, tubers, and fruits & vegetables. Household size also plays a crucial role in demand. The demand for prepared food in East Kalimantan and Jakarta differs based on family size. In East Kalimantan, the demand for prepared food decreases with increased household members, while in Jakarta, it increases. Regarding marital status, there are similarities in demand for animal protein, fruits & vegetables, and prepared food among heads of households in East Kalimantan and Jakarta. Married heads of households tend to reduce their consumption of animal protein and fruits & vegetables and increase their consumption of prepared food compared to unmarried heads.

From the results of the QUAIDS analysis, it is known that the estimation of food demand in East Kalimantan and Jakarta is affected by changes in expenditure, prices, and sociodemographics. The similarities and differences in food demand patterns between East Kalimantan and Jakarta provide information on consumer behavior that can be used as a reference in the food supply. For example, the rice consumption pattern of Jakarta households moving to East Kalimantan has lower rice demand than East Kalimantan households. Still, Jakarta households prefer to increase their demand for prepared food. Likewise, East Kalimantan households increased their demand for animal protein when their expenditure increased. When households move from Jakarta to East Kalimantan, their consumption patterns may shift, with increased animal protein and prepared food consumption as income rises. Additionally, boosting income could serve as a potential solution for decreasing rice consumption in East Kalimantan if that is the government's goal.

Table 7. Demographic Variables Estimation by QUAIDS in East Kalimantan and Jakarta

| Parameter              | Expenditure Share (w) |            |            |            |                |                     |               |
|------------------------|-----------------------|------------|------------|------------|----------------|---------------------|---------------|
|                        | Rice                  | Grain      | Tuber      | Legumes    | Animal Protein | Fruits & Vegetables | Prepared Food |
| (1)                    | (2)                   | (3)        | (4)        | (5)        | (6)            | (7)                 | (8)           |
| <i>East Kalimantan</i> |                       |            |            |            |                |                     |               |
| Z1 (occupation)        | 0.0077***             | 0.0008***  | -0.0007**  | 0.0023***  | -0.0055***     | 0.0019              | -0.0066**     |
| Z2 (age)               | -0.0001**             | 0.0000     | 0.0000***  | 0.0000***  | 0.0000         | -0.0001***          | 0.0002***     |
| Z3 (gender)            | 0.0000***             | 0.0012***  | 0.0007**   | 0.0021**   | 0.0021         | 0.0106***           | -0.0168***    |
| Z4 (education)         | 0.0020***             | 0.0000     | 0.0000     | -0.0001    | -0.0002        | 0.0003              | -0.0020***    |
| Z5 (HH size)           | -0.0031               | -0.0001    | 0.0000     | 0.0007*    | -0.0016*       | 0.0062***           | -0.0021*      |
| Z6 (Marital Status)    | -0.0013               | -0.0013    | -0.0004    | -0.0017    | -0.0054***     | -0.0094***          | 0.0195***     |
| <i>Jakarta</i>         |                       |            |            |            |                |                     |               |
| Z1 (work)              | -0.0083***            | 0.0001     | 0.0002     | -0.0013    | -0.0087***     | -0.0119***          | 0.0300***     |
| Z2 (age)               | -0.0003***            | 0.0000     | -0.0001*** | -0.0001*** | -0.0003***     | -0.0005***          | 0.0013***     |
| Z3 (gender)            | 0.0093***             | 0.0007***  | 0.0014***  | 0.0034***  | 0.0188***      | 0.0213***           | -0.0549***    |
| Z4 (education)         | 0.0043***             | 0.0000     | 0.0000     | 0.0003***  | -0.0016***     | 0.0003              | -0.0033***    |
| Z5 (HH size)           | -0.0166***            | -0.0001*** | 0.0000***  | -0.0020*** | -0.0057***     | -0.0004***          | 0.0249***     |
| Z6 (Marital Status)    | -0.0219***            | -0.0011*** | -0.0017*** | -0.0055*** | -0.0216***     | -0.0274***          | 0.0793***     |

Note. \*, \*\*, and \*\*\* signify significance at 10, 5, and 1%, respectively.

## 5. Conclusion and Policy Implications

### 5.1 Conclusion

This study analyzes food demand in East Kalimantan, considering the relocation of the Indonesian capital city, Jakarta, as a point of comparison. We use the 2021 Susenas data and the QUAIDS method to analyze the effect of changes in food prices, income, and demographic variables on seven food groups: rice, grains, tubers, legumes, animal protein, fruit & vegetables, and prepared food.

This study reveals that increased expenditure in both regions leads to decreased rice consumption. The demand for prepared food has witnessed a surge in both areas. While the demand for most food items in East Kalimantan shows a non-linear relationship with income, except for tubers, all food demand functions in Jakarta display a nonlinear Engel curve, with all squared food expenditure coefficients being significantly significant at the 1% level. Both regions have experienced a considerable rise in the consumption of prepared food and animal protein, with East Kalimantan households spending the most on animal protein while Jakarta households spending the most on prepared food. With the capital's relocation and an increase in income, households in East Kalimantan are expected to have less demand for rice and more demand for animal protein and prepared food.

In East Kalimantan and Jakarta, grains and legumes are found to be highly sensitive to their prices based on own-price elasticity analysis, with an elasticity of over 1. Conversely, rice has the lowest elasticity in these regions. If the price of rice increases by 1%, the demand for rice will decrease by approximately 0.334-0.487% in East Kalimantan and 0.126-0.202% in Jakarta. Additionally, with the capital city being relocated to East Kalimantan, changes in rice prices do not significantly affect household demand for rice.

Rice and legumes have the highest uncompensated cross-price elasticity for grain consumption in East Kalimantan, with elasticities of 0.310 and 0.313, respectively. In Jakarta, legumes have the highest uncompensated cross-price elasticity of 0.583 for grain consumption. Consumption of rice follows a similar pattern concerning the prices of other food groups. Increasing the prices of grains, tubers, and legumes led to increased rice consumption. In contrast, increased animal protein prices, fruit & vegetables, and prepared foods reduced rice consumption in East Kalimantan and Jakarta. According to the compensated cross-price elasticity analysis, in East Kalimantan, a 1% increase in rice prices leads to a 0.503% increase in tuber consumption. In Jakarta, a 1% increase in grain prices leads to a 0.616% increase in legume consumption. This research also reveals that when the prices of rice, grains, tubers, legumes, animal protein, and fruit & vegetables rise, households in East Kalimantan tend to increase prepared food consumption. However, in Jakarta, consumption of prepared food has decreased along with rising rice prices, and vice versa. Based on these data, if the capital city moves to East Kalimantan, an increase in the price of tubers can lead to an increase in rice consumption, while an increase in the price of grain can increase the consumption of legumes.

The occupation of public administration affects rice consumption in East Kalimantan and Jakarta. Public sector workers in East Kalimantan consume more rice and less prepared food; in Jakarta, they consume less rice and prefer prepared food. Demographic factors such as age and gender also impact food demand. As the household head ages, demand for rice, tuber, legume, animal protein, and fruit & vegetables decreases. Male heads of households in Jakarta have higher demands for all food groups except prepared food. Demand for prepared food differs based on household size, decreasing in East Kalimantan and increasing in Jakarta.

### 5.2 Policy Implications

The demand for food in households in East Kalimantan and Jakarta shows similarities and differences, influenced by factors such as income, prices, and demographics. The relocation of the capital to East Kalimantan and an increase in household income are expected to decrease rice consumption and increase animal protein and prepared food consumption. Therefore, the new capital city needs a rise in the production and distribution of animal protein products. Moreover, the prepared food industry in the new capital city needs to be ready to cater to the growing demand. It is crucial to prioritize the supply of animal protein and prepared food to meet the surging demand resulting from the migration from Jakarta.

Demand for rice and other staple foods decreases as income rises in East Kalimantan and Jakarta. However, the demand for rice remains unchanged even if its prices increase. Therefore, it is essential to maintain a stable price for rice in East Kalimantan. Based on the cross-price elasticity, an increase in the price of tubers will result in a higher demand for rice, whereas an increase in grain prices will lead to a surge in legume demand. Hence, it is crucial to keep the price of tubers and grain stable in East Kalimantan to avoid any impact on rice and legume demand in the new capital.

According to research, public administration workers relocating from Jakarta to East Kalimantan tend to consume less rice but have a higher demand for prepared food than other sectors, which differs from the pattern observed in East Kalimantan. Therefore, the provision of food should consider the specific demand patterns of households working in the public sector.

### Acknowledgments

We want to thank JICA, the Ministry of Agriculture of Indonesia, and the food economics laboratory at the Graduate School of Bioagricultural Science, Nagoya University for their support. Additionally, we would like to thank our colleagues and BPS-Statistics Indonesia for providing crucial statistical data for our study.

### References

- Adi, A., Rachmina, D., & Krisnamurthi, Y. B. (2021). Neraca ketersediaan beras di Kalimantan Timur sebagai calon Ibukota baru Indonesia dengan pendekatan sistem dinamik. *Analisis Kebijakan Pertanian*, 19(2), 207. <https://doi.org/10.21082/akp.v19n2.2021.207-218>
- Allo, A. G., Satriawan, E., & Arsyad, L. (2018). The impact of rising food prices on farmers' welfare in Indonesia. *Journal of Indonesian Economy and Business*, 33(3), 193-215. <https://doi.org/10.22146/jieb.17303>
- Banks, J., Blundell, R., & Lewbel, A. (1997). Quadratic Engel Curves and Consumer Demand. *The Review of Economics and Statistics*, 79(4), 527-539. <https://doi.org/10.1162/003465397557015>
- BPS Kaltim. (2021). *Indikator kesejahteraan rakyat Provinsi Kalimantan Timur 2021*. Badan Pusat Statistik, Kaltim.
- Deaton, A. (1987). Estimation of own-and cross-price elasticities from household survey data. *Journal of Econometrics*, 36, 7-30. [https://doi.org/10.1016/0304-4076\(87\)90041-8](https://doi.org/10.1016/0304-4076(87)90041-8)
- Deaton, A., & Muellbauer, J. (1980). An Almost Ideal Demand System. *The American Economic Review*, 70(3), 312-326. Retrieved from <http://www.jstor.org/stable/1805222>
- Deshaliman, & Gantina, A. (2019). Perencanaan penyediaan pangan penduduk ibukota negara di Provinsi Kalimantan Timur Tahun 2024 telaahan berbasis pola pangan harapan. *Jurnal Pilar Ketahanan Pangan*, 01(01).
- Devi, L. Y., & Purnomosidi, R. Y. K. H. (2019). Estimation of demand elasticity for food commodities in Java Island. *Jurnal Ekonomi Dan Kebijakan*, 12(1), 54-67. <https://doi.org/10.15294/jejak.v12i1.18824>
- Ermansyah, L., Daryanto, A., & Syaikat, Y. (2020). Pola permintaan pangan hewani di Indonesia. *Jurnal Ekonomi Pertanian dan Agribisnis*, 4(1), 176-190. <https://doi.org/10.21776/ub.jepa.2020.004.01.16>

- Faharuddin, F., Yamin, M., Mulyana, A., & Yunita, Y. (2022). Impact of food price increases on poverty in Indonesia: Empirical evidence from cross-sectional data. *Journal of Asian Business and Economic Studies*. <https://doi.org/10.1108/jabes-06-2021-0066>
- Faharuddin, Mulyana, A., Yamin, M., & dan Yunita. (2015). Analisis pola konsumsi pangan di Sumatera Selatan 2013: Pendekatan quadratic almost ideal demand system. *Jurnal Agro Ekonomi*, 33(2), 123-140. <https://doi.org/10.21082/jae.v33n2.2015.121-140>
- Faye, N. F., Faye, A., Sy, M. R., Lee, S., & McPeak, J. (2022). *Domestic or imported? An analysis of rice demand in Senegal*. Innovation Lab for Food Security Policy Research, Capacity and Influence. Retrieved from <http://ageconsearch.umn.edu>
- Gostkowski, M. (2018). Elasticity of consumer demand: Estimation using a quadratic almost ideal demand system. *Econometrics*, 22(1), 68-78. <https://doi.org/10.15611/eada.2018.1.05>
- Hafizah, D., Hakim, D. B., Harianto, H., & Nurmawati, R. (2020). The role of rice's price in the household consumption in Indonesia. *AGRIEKONOMIKA*, 9(1), 38-47. <https://doi.org/10.21107/agriekonomika.v9i1.6962>
- Handani, W. M., Kusnadi, N., & Rachmina, D. (2021). Prospek swasembada beras di Provinsi Kalimantan Timur. *Jurnal Agribisnis Indonesia*, 9(1), 67-78. <https://doi.org/10.29244/jai.2021.9.1.67-78>
- Hoang, H. K. (2018). Analysis of food demand in Vietnam and short-term impacts of market shocks on quantity and calorie consumption. *Agricultural Economics (United Kingdom)*, 49(1), 83-95. <https://doi.org/10.1111/agec.12397>
- Hoang, L. V. (2009). *Estimation of food demand from household survey data in Vietnam* (Working Paper 12). Development and Policies Research Center (DEPOCEN), Vietnam. Retrieved from <https://ideas.repec.org/p/dpc/wpaper/1209.html>
- Iriany, A., Sui, J., Anindita, R., Khoiriyah, N., & Sa'diyah, A. (2022). Implementation of demand system restrictions and accuracy of QUAIDS model estimator on animal food demand in Indonesia. *Eastern-European Journal of Enterprise Technologies*, 4(118), 27-37. <https://doi.org/10.15587/1729-4061.2022.263626>
- Maulia, E. (2019). *Five things to know about Indonesia's \$33bn capital relocation plan*. Retrieved from <https://asia.nikkei.com/Politics/Five-things-to-know-about-Indonesia-s-33bn-capital-relocation-plan>
- Nicholson, W., & Snyder, C. (2012). *Microeconomic theory: Basic principles and extensions* (11th ed.). South-Western, Cengage Learning, USA.
- Nicol, C. J. (2001). The rank and model specification of demand systems: An empirical analysis using United States microdata. *The Canadian Journal of Economics*, 34(1), 259-289. <https://doi.org/10.1111/0008-4085.00074>
- Nikmatul, K., Ratya, A., Nuhfil, H., & Wahib, M. A. (2020). The analysis demand for animal source food in Indonesia: Using quadratic almost ideal demand system. *Business: Theory and Practice*, 21(1), 427-439. <https://doi.org/10.3846/BTP.2020.10563>
- Obayelu, A. E., Wintola, A. O., Olufunmilayo, E., & Oluwalana, A. (2022). Households' rice demand response to changes in price, income, and coping strategies during food inflation in Nigeria: Evidence from Oyo State. *Italian Review of Agricultural Economics*, 77(2), 61-75. <https://doi.org/10.36253/rea-13602>
- Poi, B. P. (2012). Easy demand-system estimation with QUAIDS. *The Stata Journal*, 12(3), 433-446. <https://doi.org/10.1177/1536867X1201200306>
- Pratama, A. R., Sudrajat, S., & Harini, R. (2019). Analisis ketersediaan dan kebutuhan beras di Indonesia tahun 2018. *Media Komunikasi Geografi*, 20(2), 101. <https://doi.org/10.23887/mkg.v20i2.19256>
- Rasyid, M. (2022). Can unconditional cash assistance improve household welfare? QUAIDS model for food commodities in Indonesia. *Development Studies Research*, 9(1), 1-11. <https://doi.org/10.1080/21665095.2022.2027258>
- Sari, N. A. (2016). Analisis pola konsumsi pangan daerah perkotaan dan pedesaan serta keterkaitannya dengan karakteristik sosial ekonomi di Provinsi Kalimantan Timur. *Jurnal Ekonomi Dan Manajemen Indonesia*, 16. <https://doi.org/10.53640/jemi.v16i2.347>

- Sugiyanto, C. (2006). Permintaan beras di Indonesia: Revisited. *Jurnal Ekonomi dan Bisnis Indonesia*, 21(2), 138-155. Retrieved from <https://core.ac.uk/download/pdf/297708549.pdf>
- Suryanti, M. S. N., & Matsuda, T. (2022). Rural household food consumption in Bengkulu, Indonesia: Estimating a demand system based on SUSENAS microdata. *Journal of Agricultural Science*, 14(12), 15. <https://doi.org/10.5539/jas.v14n12p15>
- Valera, H. G., Mayorga, J., Pedraza, V. O., & Mishra, A. K. (2022). Estimating food demand and the impact of market shocks on food expenditures: The case for the Philippines and missing price data. *Q Open*, 2(2). <https://doi.org/10.1093/qopen/qoac030>
- Wongmonta, S. (2022). An assessment of household food consumption patterns in Thailand. *Journal of the Asia Pacific Economy*, 27(2), 289-309. <https://doi.org/10.1080/13547860.2020.1811191>
- Zheng, Z., & Henneberry, S. R. (2010). An Analysis of food grain consumption in urban Jiangsu Province of China. *Journal of Agricultural and Applied Economics*, 42(2), 337-355. <https://doi.org/10.1017/s1074070800003497>

## Appendix A

### Summary of Share Equation Estimated Coefficients from QUAIDS in East Kalimantan

| Parameter               | Expenditure Share |                 |             |              |                |                     |               |
|-------------------------|-------------------|-----------------|-------------|--------------|----------------|---------------------|---------------|
|                         | Rice              | Grain (no rice) | Tuber       | Legume       | Animal Protein | Fruits & vegetables | Prepared Food |
| (1)                     | (2)               | (3)             | (4)         | (5)          | (6)            | (7)                 | (8)           |
| Constant ( $\alpha$ )   | -0.8808***        | -0.0167**       | 0.0251***   | -0.0100      | 0.6229***      | 0.4880***           | 0.7716***     |
| Expenditure ( $\beta$ ) | -0.4072***        | -0.0115***      | 0.0026      | -0.0035      | 0.1228***      | 0.1404***           | 0.1565***     |
| Price ( $\gamma$ )      |                   |                 |             |              |                |                     |               |
| (1) Rice                | 0.4440***         | 0.0138***       | 0.0019      | 0.0158**     | -0.1497***     | -0.1702***          | -0.1557***    |
| (2) Grain (no rice)     |                   | -0.0046***      | -0.0006***  | 0.0044***    | -0.0038***     | -0.0049***          | -0.0043***    |
| (3) Tuber               |                   |                 | -0.0060***  | 0.0006       | 0.0023***      | 0.0009              | 0.0011        |
| (4) Legumes             |                   |                 |             | 0.0039       | -0.0112***     | -0.0044**           | -0.0091***    |
| (5) Animal Protein      |                   |                 |             |              | 0.1078***      | 0.0179***           | 0.0366***     |
| (6) Fruits & vegetables |                   |                 |             |              |                | 0.1252***           | 0.0355***     |
| (7) Prepared food       |                   |                 |             |              |                |                     | 0.0960***     |
| Lambda ( $\lambda$ )    | -0.0380***        | -0.0011***      | -0.0002     | 0.0018***    | 0.0110***      | 0.0198***           | 0.0066***     |
| Z1 (occupation)         | 0.0077***         | 0.0008***       | -0.0007**   | 0.0023***    | -0.0055***     | 0.0019              | -0.0066**     |
| Z2 (age)                | -0.0001**         | 0.0000          | 0.0000***   | 0.0000***    | 0.0000         | -0.0001***          | 0.0002***     |
| Z3 (gender)             | 0.0000***         | 0.0012***       | 0.0007**    | 0.0021**     | 0.0021         | 0.0106***           | -0.0168***    |
| Z4 (education)          | 0.0020***         | 0.0000          | 0.0000      | -0.0001      | -0.0002        | 0.0003              | -0.0020***    |
| Z5 (HH size)            | -0.0031           | -0.0001         | 0.0000      | 0.0007*      | -0.0016*       | 0.0062***           | -0.0021*      |
| Z6 (Marital Status)     | -0.0013           | -0.0013         | -0.0004     | -0.0017      | -0.0054***     | -0.0094***          | 0.0195***     |
| Rho ( $\rho$ )          | Z1=0.758***       | Z2=-0.002       | Z3=-0.255** | Z4=-0.179*** | Z5=0.956***    | Z6=0.773***         |               |

Note. The symbols \*, \*\*, and \*\*\* signify significance at 10, 5, and 1%, respectively. Due to symmetry restrictions, the empty cells are not stated.

## Appendix B

### Summary of Share Equation Estimated Coefficients from QUAIDS in Jakarta

| Parameter               | Expenditure Share |              |             |           |                |                     |               |
|-------------------------|-------------------|--------------|-------------|-----------|----------------|---------------------|---------------|
|                         | Rice              | Grain        | Tuber       | Legumes   | Animal Protein | Fruits & Vegetables | Prepared Food |
| (1)                     | (2)               | (3)          | (4)         | (5)       | (6)            | (7)                 | (8)           |
| Constant ( $\alpha$ )   | -0.130***         | 0.004**      | 0.002       | -0.043*** | 0.021          | -0.026              | 1.172***      |
| Expenditure ( $\beta$ ) | -0.084***         | -0.002       | -0.007***   | -0.031*** | -0.145***      | -0.074***           | 0.344***      |
| Price ( $\gamma$ )      |                   |              |             |           |                |                     |               |
| Rice                    | 0.120***          | 0.000        | 0.002       | 0.008***  | 0.000          | 0.003               | -0.133***     |
| Grain (no rice)         |                   | 0.000        | 0.000       | 0.004***  | 0.001***       | -0.001***           | -0.003***     |
| Tuber                   |                   |              | -0.004***   | 0.005***  | 0.004***       | -0.001              | -0.006***     |
| Legumes                 |                   |              |             | 0.009***  | 0.004          | -0.002              | -0.027***     |
| Animal Protein          |                   |              |             |           | 0.120***       | 0.019***            | -0.147***     |
| Fruits & vegetables     |                   |              |             |           |                | 0.056***            | -0.073***     |
| Prepared food           |                   |              |             |           |                |                     | 0.390***      |
| Lambda ( $\lambda$ )    | -0.009***         | -0.001***    | -0.002***   | -0.004*** | -0.030***      | -0.009***           | 0.054***      |
| Z1 (work)               | -0.008***         | 0.000        | 0.000       | -0.001    | -0.009***      | -0.012***           | 0.030***      |
| Z2 (age)                | 0.000***          | 0.000        | 0.000***    | 0.000***  | 0.000***       | 0.000***            | 0.001***      |
| Z3 (gender)             | 0.009***          | 0.001***     | 0.001***    | 0.003***  | 0.019***       | 0.021***            | -0.055***     |
| Z4 (education)          | 0.004***          | 0.000        | 0.000       | 0.000***  | -0.002***      | 0.000               | -0.003***     |
| Z5 (HH size)            | -0.017***         | 0.000***     | 0.000***    | -0.002*** | -0.006***      | 0.000***            | 0.025***      |
| Z6 (Marital Status)     | -0.022***         | -0.001***    | -0.002***   | -0.006*** | -0.022***      | -0.027***           | 0.079***      |
| Rho ( $\rho$ )          | Z1=-0.151***      | Z2=-0.007*** | Z3=0.243*** | Z4=0.023  | Z5=0.029**     | Z6=-0.369           |               |

*Note.* The symbols \*, \*\*, and \*\*\* signify significance at 10, 5, and 1%, respectively. Due to symmetry restrictions, the empty cells are not stated.

### Acknowledgments

We want to thank JICA, the Ministry of Agriculture of Indonesia, and the food economics laboratory at the Graduate School of Bioagricultural Sciences, Nagoya University, for their support. Additionally, we would like to thank our colleagues and the Central Bureau of Statistics for providing crucial statistical data for our study.

### Authors contributions

Not applicable.

### Funding

Not applicable.

### Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### Informed consent

Obtained.

### Ethics approval

The Publication Ethics Committee of the Canadian Center of Science and Education.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

### Provenance and peer review

Not commissioned; externally double-blind peer reviewed.

### Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

**Data sharing statement**

No additional data are available.

**Open access**

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).

**Copyrights**

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.