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Examining the Impact of Price and Income on Local Food Choices in Papua, Eastern Indonesia

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In Indonesia, carbohydrate consumption traditionally revolves around rice, overshadowing the rich diversity of tuber-based foods. Papua Province, in Eastern Indonesia, stands out as a region where non-rice staples hold prominence. Despite this, studies on food choice in Papua Province predominantly relied on qualitative methodologies, limited geographical coverage, and small sample sizes. This paper delves into the effects of price and income on the consumption patterns of staple food in Papua Province. It introduces an innovative approach, employing the Quadratic Almost Ideal Demand System (QUAIDS) to account for non-linear relationships between income and consumption. It utilizes the Iterated Linear Least Squares (ILLS) estimator to address endogeneity issues likely to arise from price heterogeneity faced by consumers within the same district. Utilizing data from the 2019 National Socio-Economic Survey (SUSENAS), the paper calculates food price and expenditure-income elasticities.

The findings reveal that rice is a normal good across most income groups, while local tubers are considered a luxury good for wealthier and urban populations. Contrary to previous studies, the paper challenges the notion that local food is inferior, demonstrating that it holds significant value among higher-income groups. Additionally, local tuber consumption is highly price-elastic, indicating that price stability is crucial for its continued consumption. The paper also explores the shift towards ready-to-eat foods, which may impact health and household budgets. Policy implications suggest promoting local tuber foods by stabilizing prices, improving income distribution, and enhancing market access to tuber foods. These efforts can reduce reliance on imported rice, contributing to food sustainability and self-sufficiency in Papua.

Keywords: Local food, Papua, price, income, QUAIDS-ILLS

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1. Introduction

In Indonesia, food consumption is largely dominated by high-carbohydrate foods, especially rice, which accounts for 96.89 per cent of total consumption (Statistics Indonesia 2019). Ariani (2010), Ito et al. (1991) and Wijayati et al. (2019) confirmed that rice is the dominant food, making the country's food consumption less diverse. Though carbohydrate consumption in Indonesia traditionally revolves around rice, overshadowing the rich diversity of tuber-based foods such as sweet potatoes, cassava, taro and sago, Papua Province (in Eastern Indonesia) stands out as a region where non-rice staples like sweet potatoes and sago hold prominence.

In Papua Province, local food patterns remain heavily reliant on tubers, accounting for 14.24 per cent of consumption (Statistics Indonesia 2019). The production of tubers—such as sweet potatoes—is sufficient to meet local consumption needs, with 446,000 tons produced in 2015 and an annual growth rate of 19 per cent (Statistics Indonesia 2015). However, research (Hardono 2016) shows a significant decline in local tuber consumption from 1996 to 2012, with a shift towards rice. From 2015 to 2019, the consumption of tubers has steadily decreased—with sweet potato consumption falling by 16 per cent and sago by 19 per cent—while rice consumption has remained stable. There has been a contrast in local food consumption between rural and urban areas in Papua Province, where urban areas favour rice while rural areas still predominantly consume tubers. On the other hand, the demand for rice in Papua Province consistently surpasses local production, resulting in significant shortfalls of 147,000 tons in 2018 and 73,000 tons in 2019. Furthermore, despite the availability of local carbohydrate-rich foods like sweet potatoes, taro, cassava and sago which could enhance food diversity as well as a food diversification programme starting in 1960, the shift towards rice consumption has continued. The high consumption of rice relative to local production has led to increased imports. The World Trade Organization highlights that while food imports may address short-term hunger, they can negatively affect welfare if prices rise quickly (Onyeneke et al. 2020). In the long term, this impacts foreign exchange reserves and neglects local resources (Suyastiri 2008). A policy alternative to this problem is to accelerate the diversification of food consumption based on local resources.

Numerous studies have delved into consumption trends across Indonesia. Yet, none have specifically examined consumption patterns in Papua Province through the lens of price and income elasticities, as well as the influence of socio-demographic factors representing taste on local food. Research indicates that shifting consumption patterns are influenced by various factors, including price, income and socio-demographic characteristics such as lifestyle, urbanization, occupation, educational background, household composition, gender and age (Bopape and Myers 2007; Goldscheider 1987; Pangaribowo and Tsegai, 2011; Mottaleb et al., 2018; Onyeneke et al. 2020; Widarjono 2012). Despite this, studies on food habits in Papua Province have predominantly relied on qualitative methodologies—with limited geographical coverage and small sample sizes—often focusing on local food availability rather than consumption patterns (Akzar et al. 2020; Wasaraka et al. 2011). However, understanding the extent of elasticity regarding price and income in local food consumption is crucial for informed policymaking. Therefore, assessing the magnitude of elasticity in response to price and income fluctuations is imperative to inform policy decisions effectively.

Methodologically, previous research on food consumption patterns in Indonesia has predominantly utilized the Almost Ideal Demand System (AIDS) model (Moeis 2003; Teklu and Johnson 1987; Wijayati et al. 2019). While this model offers several advantages, including the ability to estimate consumption equations for multiple related commodities and its consistency with consumption expenditure data, it assumes a linear relationship between income and the consumption expenditure of a particular good. To address this limitation, employing the Quadratic Almost Ideal Demand System (QUAIDS) model is essential, as it accounts for the non-linear relationship between income and consumption expenditure, as observed in various studies (Banks et al. 1997; Bopape and Myers 2007; Poi, 2012; Widarjono 2012; Mottaleb et al. 2018). Additionally, many studies continue to rely on Ordinary Least Squares (OLS) and Seemingly Unrelated Regressions (SUR) estimators, which fail to address the endogeneity issue arising from differing quality effects among households, in particular in the possible price heterogeneity faced by the consumers within the same district (Lecocq and Robin 2015). Therefore, building on Majumder et al. (2012), this paper employs an instrumental variable approach to address endogeneity between price and consumption, arising from the varying calculated prices faced by individuals within the same district.

This paper bridges existing research gaps by examining the interplay between prices, income and socio-demographic factors in shaping food consumption patterns in Papua Province. Employing the QUAIDS model with the ILLS estimator, this paper seeks to provide a more nuanced understanding of how changes in prices and income influence local tuber food consumption patterns, thereby facilitating informed policy interventions through expenditure-income and price elasticity analysis.

2. Conceptual Framework

As elaborated in Nicholson and Snyder (2008), consumer demand for specific foods is influenced by factors such as income, the price of the food itself, prices of other foods and consumer preferences. Therefore, households aim to make optimal choices within the constraints of their income and the prices of available foods to maximize their utility. Changes in the quantity demanded in response to price changes have two effects: the substitution effect and the income effect. The substitution effect refers to the change in quantity demanded resulting from consumers substituting one good for another while keeping utility constant and real income as well as purchasing power unchanged. This is often called the "compensated" price effect, in contrast to the "uncompensated" price effect, where real income is allowed to change. On the other hand, the income effect signifies the shift in quantity demanded resulting from changes in consumers' real income or purchasing power.

Furthermore, the quantity demanded may also be influenced by changes in nominal income without changes in prices. In this regard, the effect of income changes on consumption can be examined. While income and expenditure are not necessarily identical, the QUAIDS model applied in this paper assumes a positive relationship between them, reflecting the general tendency for higher income to be associated with greater spending. Therefore, changes in prices and income can significantly impact both the quality and quantity of food consumption, a phenomenon analysed through price elasticity and expenditure/income elasticity. Conversely, household preferences (taste) are inherently linked to the social and demographic characteristics of the households. Furthermore, the consumption dynamics of households are also influenced by the prices of complementary and substitute goods.

Various studies, employing price and income elasticities framework, underscore regional disparities in elasticity within Indonesia, such as rice expenditure elasticity being higher in Java compared to the Maluku and Sulawesi regions. For instance, when income rises, rice consumption in Java typically increases across all income groups, while in the Maluku and Sulawesi regions, there is a shift towards higher consumption of sago and cassava (Alderman and Timmer 1980). In the eastern regions like Maluku, there has been a discernible shift from sago towards rice and wheat consumption (Pusposari 2012). In Maluku, sago is considered an inferior good because its expenditure elasticity is negative. This implies that as people's incomes increase, they spend less on sago. Additionally, sago is more sensitive to price changes than rice and wheat, meaning that changes in the price of sago have a greater impact on its consumption compared to the impact of price changes on the consumption of rice and wheat. However, the Papua region remains understudied within this context. Moreover, Widarjono (2012) suggests that the role of price and expenditure elasticities differ between rural and urban areas, with both elasticities being larger in rural settings. Additionally, findings on carbohydrate foods in Indonesia (Wijayati et al. 2019) indicate that rice and tuber carbohydrates tend to be price inelastic, with rice exhibiting the lowest expenditure elasticity, indicating its status as a staple food. However, detailed analysis of price elasticity, expenditure-income elasticity and the influence of social demographics specific to Papua Province remains scarce.

3. Method

A demand system model is imperative to analyse the interplay of price, income, and taste. Over time, economists have refined demand system models to address inherent limitations. The linear expenditure system, introduced by Stone (1954), had drawbacks such as assuming additive preferences, limiting substitution possibilities and yielding inconsistent results in income elasticity. Subsequent models like the Rotterdam model and trans-log model aimed to rectify these limitations but faced challenges related to constant marginal budget shares.

To overcome these issues, the QUAIDS model was developed, accommodating non-linear relationships between total income and consumption expenditure (Banks et al. 1997; Poi 2012). It also considers the three standard restrictions in consumer theory: adding-up, homogeneity and symmetry. The restriction of "adding-up" ensures that consumers allocate their entire budget which is reflected in the sum of the intercept coefficients across the equations equaling one. Homogeneity guarantees that if all prices and income change in the same proportion, the quantity demanded for each commodity remains unchanged. Symmetry makes sure that, holding real income constant, the substitution effect of a price change in commodity j on commodity i is identical to the substitution effect of a price change in commodity i on commodity j. This model, coupled with the ILLS estimator, proposed by Lecocq and Robin (2015), ensures consistent estimation results by addressing endogeneity caused by price heterogeneity faced by individuals living in the same district.

There are four steps in estimating QUAIDS-ILLS demand. The first step involves creating the dependent variable (wi), which compares the expenditure share of each food group in a month to the overall food expenditure share. Using twelve food groups, this paper first categorizes them based on specific commodity codes. Once the food groups are established, it computes the consumption value per group using data from column 10 of the National Socio-Economic Survey (SUSENAS) KP questionnaire. Subsequently, it calculates the total consumption value across all food groups. The dependent variable (wi) is then formulated by dividing the consumption value of each food group by the total value of all food groups, yielding the share of consumption expenditure for each group.

The second step involves constructing an independent variable, specifically the price variable. As the SUSENAS does not have data on price, the unit value is utilized instead. This entails dividing expenditure by the quantity of commodities consumed. Yet, substituting unit value for price presents endogeneity issues within the demand system equation, stemming from quality effects—price heterogeneity faced by the individuals. To mitigate this price heterogeneity, the unit value is corrected using price differentials, following Majumder et al. (2012). The corrected adjusted unit value accounts for the median unit value and the median residual. This residual is derived by regressing disparities in median unit values across districts or cities against socio-demographic factors, including household size, head of household's education, residential location, age, gender, occupation and income group. This approach ensures that households within the same district encounter equivalent commodity prices. The corrected unit value can be calculated through the following procedure (Lecocq and Robin 2015).

The unit value is first defined as the expenditure per unit of quantity, such as the price per kilogram of rice. Using the household survey data, the median unit value is calculated for each district to establish a representative benchmark for local price variations. Next, a regression analysis is conducted to examine the difference between the median unit value of each district and the overall median unit value across all regions. The independent variables used in this regression include various sociodemographic factors that may influence price variations. These factors encompass household size, the education level of the household head, residential location (urban or rural), the age and gender of the household head, occupation type and income group. Once the regression is performed, the next step is to obtain the residuals. These residuals capture the portion of price variation that cannot be explained by the selected sociodemographic factors, representing unexplained differences in unit values across districts or cities. Subsequently, the median of these residuals is calculated for each district. This median residual serves as an adjustment factor to account for the unexplained variation in the unit values. The corrected unit value for each district is then derived by adding the median residual and the median unit value. This corrected unit value is then used as the instrumental variable to address endogeneity by neutralizing regional differences driven by socio-demographic factors.

The third step in employing the QUAIDS-ILLS model is to form control variables, namely education, age of the head of the household, location of residence, number of household members, gender of the head of the household, occupation of the head of the household, and household income group. These household characteristics are supposed to represent “taste” as one factor that may affect the demand for food. The model specifications used in this paper are:

> $w_i = f$ (price of own goods, price of other goods, household food consumption expenditure, education of head of household, location of residence, household size, gender of head of household, type of occupation of the head of the household, age of the head of household, income group and instrumental variables)

Mathematically, it can be written as follows:

$$w_i^h = \propto_i + \gamma'_{ij} p^h + \beta_i \left[m^h - (a(p^h)\right] + \lambda_i \frac{\left[m^h - a(p^h)\right]^2}{b(p^h, \theta)} + \propto_1 educ + \propto_2 dloc + \propto_3 dhsize_{i1} + \propto_4 dhsize_{i2} + \propto_5 dgen + \propto_6 djob_{i2} + \propto_7 djob_{i3} + \propto_8 dage_{i2} + \propto_9 dage_{i3} + \propto_{10} income_{q2} + \propto_{11} income_{q3} + \propto_{12} income_{q4} + \propto_{13} income_{q5} + iv + \varepsilon_i^h$$

(Equation 1)

where:

- h = households;
- i = food group (i = 1,2,3,…, 12);
- w_i^h= share of food expenditure from food group i;
- $\propto_1$ = constant;
- $\gamma_{ij}, \beta_1, \lambda_i, \alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6, \alpha_7, \alpha_8, \alpha_9, \alpha_{10}, \alpha_{11}, \alpha_{12}, \alpha_{13}$ = coefficients;
- a = coefficient of own price;
- b = coefficient of price of another commodity;
- p^h = commodity price;
- m^h = household food consumption expenditure;
- $\left[m^h - (a(p^h)\right] + \lambda_i \frac{\left[m^h - a(p^h)\right]^2}{b(p^h, \theta)}$ refers to price-adjusted expenditure and its quadratic form;
- iv = instrumental variable;
- $dloc$ = dummy location of residence (1 = urban and 0 = rural);
- $dhsize$ = dummy for number of family members (1 = small; 2 = medium; 3 = large);
- $dgen$ = dummy of head household gender (1 = male and 0 = female);

- *educ* = dummy of head household education (0: < Junior High School; 1: > = Junior High School);
- *djob* = dummy of head household job (1 = no=work; 2 = other sectors; 3 = agriculture sector);
- *dage* = dummy of head household age (1: <25 years old; 2: 25–49 years old; 3: ≥50 years old);
- *dincome* = dummy group income of household (1 = <20; Q2 = 20–40; Q3 = 40–60; Q4 = 60–80; Q5 = 80+);
- ε_i^h error term

The fourth step involves estimating the regression results of the QUAIDS-ILLS demand system as seen in Equation 1, yielding coefficients for income (proxied by total expenditure), price, instrumental variables and social demographics. These coefficients are then used to calculate the elasticity of expenditure and price, with the following steps. The first step is to take the first derivative of Equation 1 with respect to *m* (expenditure):

$$\mu_i \equiv \frac{\partial w_i}{\partial m} = \beta_i + 2\tau_i \frac{\{m - a(p,\theta)\}}{b(p,\theta)} \quad \text{(Equation 2)}$$

where θ = social-demographic parameter

The second step is to take the first derivative of Equation 1 with respect to *p* (price):

$$\mu_{ij} \equiv \frac{\partial w_i}{\partial p} = \gamma_{ij} - \mu_i(\propto_j + \gamma_j p) - \lambda_i \beta_j \frac{(m - a(p,\theta)^2}{b(p,\theta)} \quad \text{(Equation 3)}$$

The third, using the result in Equation 2, is to calculate the expenditure elasticity:

$$e_i = \frac{\mu_i}{w_i} + 1 \quad \text{(Equation 4)}$$

The fourth, using the result in Equation 3, is to calculate the uncompensated price elasticity:

$$\varepsilon_{ij}^u = \frac{\mu_{ij}}{w_i} - \delta_{ij} \quad \text{(Equation 5)}$$

where σ_{ij} is equal to zero for own price (i=j) and one for the cross-price (i≠j)

The fifth, using the result in equation (3), is to calculate the compensated price elasticity

$$\varepsilon_{ij}^c = \varepsilon_{ij}^u + w_j e_i \quad \text{(Equation 6)}$$

3.1 Data

The paper utilizes data from the 2019 SUSENAS, encompassing twenty-eight districts within Papua Province, covering a total of 13,151 households gathered by the Central Statistics Agency. Conducted biannually in March and August, this paper opts for the March dataset due to its larger sample size.

The SUSENAS data collection employs two questionnaires: the CORE questionnaire gathers household socio-demographic details like age, relationship with the household head, gender, marital status and educational background. The VSEN KP (consumption expenditure questionnaire), on the other hand, captures information on the quantity, value and household expenditure on food, encompassing purchases and gifts over the past week. This paper focuses on twelve food groups, including rice, local tuber foods, fish, meat, eggs, milk, vegetables, nuts, fruit, spices, coconut oil, beverage ingredients and miscellaneous food items. The food groups are shown in Table 1.

TABLE 1
Group of Foods

No.	*Type of Good*	*Code of Commodities in SUSENAS-2019 Questionnaire*
(1)	*(2)*	*(3)*
1	Rice	Grains group (code 2–7)
2	Local Food	Tubers group (code 9–15)
3	Fish	Fish/shrimp/squid/shellfish group (code 17–51)
4	Meat	Meats group (code 53–61)
5	Egg	Egg group (code 63–66)
6	Milk	Milk group (code 67–71)
7	Vegetables	Vegetables group (code 73–97)
8	Peanuts	Peanuts group (code 99–105)
9	Fruits	Fruits group (code 107–119)
10	Spices, oil, and coconut	Spices, oil and coconut (code 121–124 and code 134–145)
11	Beverage ingredients	Beverage ingredients (code 126–132)
12	Ready-to-eat food	All types of food other than the food mentioned above, such as ready-to-eat food and drinks as well as tobacco and betel. (code 147–150 and code 152–188)

Source: 2019 SUSENAS.

4. Results and Discussion

Table A1 in the Appendix provides detailed results from the regression on Equation 1. It shows the significance of the coefficient of quadradtic expenditure (lambda_lnx2) for all food consumption shares. Therefore, it justifies the need to employ the QUAIDS-ILLS (Widarjono 2012). Additionally, the resulting model incorporates an instrumental variable to address the endogeneity issue and satisfies the constraints of additivity, homogeneity and symmetry. Therefore, the resulting model is consistent. As Equation 1 controls the influence of taste in shaping food consumption patterns in Papua Province, the analysis can focus on the impact of price and expenditure-income.

Once the estimated parameters of the QUAIDS-ILLS model (Table 2) are obtained, changes in prices and expenditure-income can be analysed through demand elasticity values. These values include expenditure-income elasticity and price elasticity which account for both own-price and cross-price effects. Expenditure elasticity is calculated using Equation 4, while own-price and cross-price elasticities are derived from both Equations 5 and 6. Equation 5 refers to uncompensated elasticity while Equation 6 represents the compensated elasticity.

4.1 Expenditure-Income Elasticity

Table 2 provides the calculated expenditure-income elasticity. It reveals that rice is a normal good with positive expenditure elasticity between 0 and 1 in Papua Province as a whole, both the rural and urban population, as well as the three highest income groups. Rice is a luxury good among the two lowest income groups, though their elasticities are not much higher than 1. They are reported at 1.055 in the lowest income group and 1.024 in the second lowest income group. On the other hand, the expenditure elasticity for local food among those who live in urban areas and those with the highest income is positive and much higher than 1. They are 2.419 in the urban areas and 2.956 in the highest income group. In

TABLE 2
Expenditure Elasticity of Proportion of Food Consumption based on Residence and Income Group in Papua Province, 2019

Food Consumption Proportion	*Expenditure Elasticity*							
	Papua	*Residence*		*Group of Income*				
		Rural	*Urban*	*q1*	*q2*	*q3*	*q4*	*q5*
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*
Rice	0.964***	0.999***	0.745***	1.055***	1.024***	0.953***	0.921***	0.857***
Local food	–0.654	–0.278	2.419***	–0.122	–0.354	0.003	–0.514	2.956***
Fish	1.169***	1.193***	1.062***	1.232***	1.200***	1.166***	1.143***	1.109***
Meats	1.185***	1.209***	0.989***	1.312***	1.273***	1.176***	1.127***	1.072***
Eggs	1.093***	1.132***	0.875***	1.241***	1.171***	1.082***	1.036***	0.979***
Milk	1.336***	1.383***	1.166***	1.497***	1.440***	1.343***	1.260***	1.221***
Vegetables	0.368***	0.330***	0.636***	0.315***	0.467***	0.340***	0.293***	0.454***
Peanuts	1.139***	1.178***	0.921***	1.310***	1.216***	1.124***	1.078***	1.019***
Fruits	1.128***	1.125***	1.138***	1.109***	1.113***	1.140***	1.148***	1.128***
Spices, oil and coconuts	0.702***	0.681***	0.805***	0.674***	0.724***	0.710***	0.682***	0.727***
Beverage ingredients	0.924***	0.947***	0.747***	0.978***	0.957***	0.917***	0.897***	0.865***
Ready-to-eat food	1.286***	1.302***	1.247***	1.254***	1.280***	1.302***	1.308***	1.270***

NOTE: $*p < 0.05$, $**p < 0.01$, $***p < 0.001$.
SOURCE: Calculated by the authors.

contrast, the expenditure elasticity on local food is not significant in Papua Province as a whole, rural areas and the fourth-lowest income groups. This finding implies that local food is not inferior food. It becomes luxury food for people in urban areas and those in the highest income group.

Notably, our findings derived using a more refined methodology, challenge the earlier conclusions of Pusposari (2012), who identified tuber foods as inferior goods (with negative expenditure elasticity) and rice as a luxury good (with expenditure elasticity greater than 1) in Maluku—Papua's neighbouring province in Eastern Indonesia. For the Papua province as a whole, among those who live in rural areas and among those in the fourth-lowest income groups, expenditure elasticity for local food is not significant. This refutes the narration that local food in Papua Province is an inferior food.

Our findings also challenge prior research in Indonesia (Wijayati et al. 2019) and in Sumatra, Western Indonesia (Faharuddin et al., 2015), which reported lower expenditure elasticity for rice compared to tubers. In contrast, our analysis reveals that rice has a higher expenditure-income elasticity than local tuber foods, indicating a stronger increase in demand for rice as income rises. An exception is observed in urban areas and among the highest income group where expenditure elasticity is lower for rice than local food. This may imply that a rise in people's income may worsen or reduce the deficit of rice, depending on which effect is stronger: between people in urban areas and the highest income group on one hand and other groups on the other hand. If the impact from people in urban areas and the highest income groups is stronger, the proportion of local food consumed will increase and reduce rice deficit.

4.2 Own Price Elasticity

As discussed earlier, own price elasticity encompasses two effects: substitution effect (also known as compensated price elasticity) and income effect. The sum of these two effects is the total effect or uncompensated price elasticity. Table 3 shows both compensated (column 3) and uncompensated (column

TABLE 3
Own Price Elasticity of Food Commodities in Papua Province, 2019

Commodities	*Own Price Elasticity*		
	Uncompensated	*Compensated*	*Income Effect*
(1)	*(2)*	*(3)*	*(4)*
Rice	–0.349***	–0.206***	–0.143
Local food	–1.111***	–1.139***	0.028
Fish	–0.966***	–0.790***	–0.176
Meats	–0.676***	–0.519***	–0.157
Eggs	–0.909***	–0.864***	–0.045
Milk	–1.004***	–0.964***	–0.04
Vegetables	–0.297***	–0.270***	–0.027
Peanuts	–1.088***	–1.054***	–0.034
Fruits	–1.689***	–1.654***	–0.035
Spices, oil and coconuts	–1.736***	–1.707***	–0.029
Beverage ingredients	–1.365***	–1.322***	–0.043
Ready-to-eat food	*–0.777****	*–0.480****	*–0.297*

NOTES: *$p < 0.05$, ** $p < 0.01$, ***$p < 0.001$.
SOURCE: Calculated by the authors.

2) own price elasticities for the twelve food commodities in Papua Province. The negative value indicates consistency with demand theory which posits that as food prices rise, the proportion of food consumption tends to decrease, and vice versa, assuming other variables remain constant. However, the magnitude of this response varies across commodities. In particular, the price elasticity of local food is elastic (elasticity >1); on the other hand, the price elasticity for rice is inelastic (elasticity <1). As shown in Table 4, this result for rice holds in both urban and rural areas as well as all income groups. On the other hand, local food is price elastic in rural areas and among the two lowest income groups. This means that local food consumption is more sensitive to price increases. An exception is that local food is price-inelastic in urban areas. Local food is close to unitary price elastic in the two highest income groups. This result implies that the stabilization of local food prices has contributed more to promoting local food consumption among the rural population and low-income groups.

Table 3 also shows that income effect is negative for all commodities, except local food. However, all of them are not significant, suggesting the much more important role of substitution effect than income effect. They switch to or away from the commodities based on relative price differences rather than feeling richer or poorer.

Our findings confirm previous studies (Ariani 2010; Kencana et al. 2014; Pusposari 2012) which suggest that tuber foods are more price-elastic than rice. Specifically, these studies found that in Eastern Indonesia (e.g., Maluku), price changes have a strong effect on reducing tuber food consumption, whereas rice consumption remains relatively stable despite price fluctuations. This pattern contrasts with national-level findings for Indonesia where both tubers and rice exhibit inelastic price elasticity (Wijayati et al. 2019).

Our findings highlight the need to stabilize the prices of local tuber foods to promote their consumption and enhance food sustainability in Papua. Ensuring price stability can support local food systems, reduce reliance on rice sourced from other regions or countries and contribute to long-term food sustainability in the area.

4.3 Cross-Price Elasticity

The uncompensated cross-price elasticity between commodities is shown in Table 5. As a similar pattern emerges in both uncompensated and compensated cross-price elasticity, the compensated cross-price elasticities are shown in Table A2 in the Appendix. A negative impact of one commodity price on another indicates complementarity while a positive relationship suggests they are substitutes. If the relationship is not significant, the commodities are independent of each other. Tables 4 and 5 show that the elasticity of the price of local food on rice consumption is not significant. Likewise, the price elasticity of rice on local food is not significant. This means that rice and local food are independent where their respective prices have no bearing on each other's consumption proportions. On the other hand, the cross-price relationships between rice and local food and ready-to-eat food are significant. We find that the impact of the price of rice on ready-to-eat food is negative, exhibiting a complementary relationship. The impact of the price of local food is positive, suggesting that local food and ready-to-eat food are substitutes. This implies that local food can be substituted by more upscale ready-to-eat options.

It is insightful to further examine the relationship between local food and ready-to-eat food. It indicates that the cross-price elasticity between the price of ready-to-eat food and local food consumption is 1.724, indicating a substitution relationship. This suggests that a 10 per cent increase in the price of ready-to-eat food leads to a 17.24 per cent increase in local food consumption. Conversely, a lower price of ready-to-eat food discourages local food consumption.

Meanwhile, the cross-price elasticity of local food and ready-to-eat food is 0.231, implying that a 10 per cent increase in the price of local food results in a 2.31 per cent increase in the consumption of ready-to-eat food. This finding suggests that as local food becomes more expensive, consumers increasingly turn to ready-to-eat food, reinforcing the notion that ready-to-eat food has partially replaced

TABLE 4
Own Price Elasticity of Uncompensated and Compensated Food Commodities based on Location and Income Group in Papua Province, 2019

Location/ Income Group	Own Price Elasticity											
	Rice	*Local Food*	*Fish*	*Meats*	*Eggs*	*Milk*	*Vegetables*	*Peanuts*	*Fruits*	*Spices, Oil and Coconuts*	*Beverage Ingredients*	*Ready-to-eat Food*
Uncompensated												
Location												
Urban	–0.130***	–0.708*	–0.949***	–0.400***	–0.876***	–1.000***	–0.310***	–1.090***	–1.557***	–1.681***	–1.525***	–0.887***
Rural	–0.376***	–1.048***	–0.968***	–0.705***	–0.913***	–1.004***	–0.309***	–1.088***	–1.725***	–1.745***	–1.344***	–0.735***
Income Group												
q1	–0.435***	–1.194***	–0.992***	–0.713***	–0.913***	–1.015***	–0.432***	–1.122***	–1.722***	–1.696***	–1.368***	–0.746***
q2	–0.327***	–1.116***	–0.978***	–0.669***	–0.911***	–1.007***	–0.478***	–1.096***	–1.689***	–1.619***	–1.366***	–0.743***
q3	–0.319***	–0.987***	–0.959***	–0.658***	–0.905***	–1.001***	–0.231**	–1.083***	–1.742***	–1.727***	–1.371***	–0.764***
q4	–0.342***	–0.935***	–0.951***	–0.664***	–0.907***	–0.999***	–0.082	–1.075***	–1.729***	–1.853***	–1.365***	–0.776***
q5	–0.257***	–0.998***	–0.945***	–0.644***	–0.899***	–0.998***	–0.166	–1.073***	–1.579***	–1.809***	–1.367***	–0.836***
Compensated												
Location												
Urban	–0.041	–0.765*	–0.785***	–0.320***	–0.845***	–0.960***	–0.263***	–1.066***	–1.512***	–1.644***	–1.502***	–0.409***
Rural	–0.224***	–1.065***	–0.792***	–0.534***	–0.865***	–0.964***	–0.283***	–1.052***	–1.692***	–1.716***	–1.298***	–0.475***
Income Group												
q1	–0.267***	–1.204***	–0.810***	–0.550***	–0.869***	–0.977***	–0.405***	–1.090***	–1.689***	–1.666***	–1.322***	–0.499***
q2	–0.185***	–1.137***	–0.793***	–0.514***	–0.865***	–0.969***	–0.431***	–1.061***	–1.654***	–1.583***	–1.321***	–0.486***
q3	–0.182***	–0.987***	–0.788***	–0.505***	–0.860***	–0.962***	–0.208**	–1.048***	–1.708***	–1.697***	–1.329***	–0.472***
q4	–0.202***	–0.955***	–0.782***	–0.507***	–0.861***	–0.956***	–0.065	–1.041***	–1.695***	–1.828***	–1.324***	–0.463***
q5	–0.138***	–1.072***	–0.780***	–0.497***	–0.857***	–0.956***	–0.136	–1.041***	–1.537***	–1.781***	–1.328***	–0.448***

NOTES: *$p < 0.05$, ** $p < 0.01$, ***$p < 0.001$.
SOURCE: Calculated by the authors.

TABLE 5
QUAIDS-ILLS Own and Cross-Price Uncompensated Estimation Results

Proportion of Food Consumption	*Rice*	*Local Food*	*Fish*	*Meats*	*Eggs*	*Milk*	*Vegetables*	*Peanuts*	*Fruits*	*Spices, Oil and Coconuts*	*Beverage Ingredients*	*Ready-to-eat Food*
	b/se	*b/se*	*b/se*	*b/se*	*b/se*	*b/se*	*b/se*	*b/se*	*b/se*	*b/se*	*b/se*	*b/se*
Rice	–0.349***	–0.003	–0.199***	0.145***	0.059	0.065***	–0.133***	0.014	–0.095***	0.084**	–0.143***	–0.409***
	(0.030)	(0.027)	(0.016)	(0.023)	(0.033)	(0.012)	(0.023)	(0.018)	(0.019)	(0.031)	(0.024)	(0.015)
Local food	0.229	–1.111***	–0.070	–0.479*	–0.064	0.023	–0.343*	0.040	0.945***	0.276	–0.515**	1.724***
	(0.176)	(0.153)	(0.098)	(0.223)	(0.225)	(0.078)	(0.154)	(0.124)	(0.213)	(0.215)	(0.198)	(0.408)
Fish	–0.227***	–0.096**	–0.966***	0.004	0.028	–0.048**	0.154***	0.055*	0.024	0.065	0.025	–0.186***
	(0.040)	(0.034)	(0.021)	(0.035)	(0.047)	(0.017)	(0.038)	(0.026)	(0.025)	(0.044)	(0.033)	(0.021)
Meats	0.130**	–0.229***	0.002	–0.676***	0.037	–0.031	–0.302***	0.075**	–0.288***	0.041	0.184***	–0.129***
	(0.042)	(0.035)	(0.022)	(0.034)	(0.052)	(0.018)	(0.035)	(0.029)	(0.029)	(0.049)	(0.037)	(0.024)
Eggs	0.192***	–0.139***	0.113***	0.130***	–0.909***	–0.072***	–0.244***	–0.051	0.063*	–0.077	0.166***	–0.264***
	(0.037)	(0.034)	(0.021)	(0.033)	(0.047)	(0.017)	(0.032)	(0.026)	(0.026)	(0.044)	(0.033)	(0.021)
Milk	0.264***	–0.052	–0.265***	–0.156*	–0.109	–1.004***	–0.069	–0.069	0.150**	–0.233**	0.082	0.124**
	(0.069)	(0.066)	(0.035)	(0.067)	(0.089)	(0.031)	(0.063)	(0.050)	(0.048)	(0.083)	(0.062)	(0.045)
Vegetables	–0.174**	–0.235***	0.428***	–0.425***	–0.104	0.002	–0.297***	–0.101**	0.102**	0.178**	–0.151**	0.410***
	(0.060)	(0.043)	(0.034)	(0.062)	(0.066)	(0.023)	(0.071)	(0.039)	(0.035)	(0.062)	(0.048)	(0.049)
Peanuts	0.044	–0.019	0.279***	0.338***	–0.073	–0.063**	–0.310***	–1.088***	0.228***	–0.708***	0.635***	–0.403***
	(0.048)	(0.045)	(0.029)	(0.040)	(0.060)	(0.021)	(0.041)	(0.033)	(0.033)	(0.063)	(0.046)	(0.027)
Fruits	–0.474***	1.188***	0.120**	–1.207***	0.082	0.150***	0.187*	0.218***	–1.689***	0.100	0.688***	–0.492***
	(0.088)	(0.124)	(0.043)	(0.111)	(0.093)	(0.032)	(0.076)	(0.051)	(0.061)	(0.087)	(0.073)	(0.046)
Spices, oil	0.334***	0.216***	0.300***	0.192***	–0.059	–0.146***	0.291***	–0.489***	0.088**	–1.736***	0.285***	0.022
and coconuts	(0.042)	(0.047)	(0.027)	(0.037)	(0.055)	(0.020)	(0.046)	(0.037)	(0.029)	(0.056)	(0.039)	(0.027)
Beverage	–0.452***	–0.531***	0.117***	0.560***	0.154**	0.065***	–0.286***	0.417***	0.472***	0.251***	–1.365***	–0.326***
ingredients	(0.047)	(0.032)	(0.023)	(0.035)	(0.050)	(0.017)	(0.035)	(0.029)	(0.032)	(0.048)	(0.039)	(0.024)
Ready-to-eat	–0.310***	0.231***	–0.138***	–0.087*	–0.055	0.018	0.064	–0.057	–0.072*	–0.021	–0.082*	–0.777***
food	(0.051)	(0.048)	(0.024)	(0.041)	(0.056)	(0.019)	(0.041)	(0.031)	(0.030)	(0.052)	(0.040)	(0.038)

local food consumption due to rising local food prices. In addition to ready-to-eat food, the reduction in local food consumption is also replaced by an increase in fruit consumption and oil-coconut consumption.

The paper also finds that consumption of ready-to-eat food is inelastic (–0.777) with respect to its own price but the consumption of local food is elastic (1.724) with respect to the price of ready-to-eat food. In other words, a reduction in the price of ready-to-eat food will reduce the consumption of local food while increasing the consumption of ready-to-eat food, albeit marginally. This means that a price change in ready-to-eat food has a greater impact on the consumption of local food than on the consumption of ready-to-eat food itself. It should be noted that the consumption of ready-to-eat food may reveal their prestige. As noted by Rauf and Wahid (2009), the shift in consumption patterns is not solely reflected in commodity preferences but also in practical accessibility, with the proliferation of food stalls and restaurants facilitating easier access to ready-to-eat food. Therefore, if the price of ready-to-eat food decreases while the price of local food increases, it may become challenging for local food to regain its position as the main staple in Papua Province. This contrasts with the elasticity of rice consumption which is negatively inelastic with respect to its own price and the price of ready-to-eat food. An increase in both prices will reduce rice consumption, though not by much.

This paper also finds that rising prices of meat, vegetables and beverage ingredients significantly reduce local food consumption. Hence, these foods are complementary to local food consumption. It is therefore also important to stabilize the price of these foods to encourage local tuber food consumption. On the other hand, cross-price elasticities of fish, egg, milk, peanut, oil and coconut on local food are not significant, suggesting that these foods are independent of local food. Price changes in these foods do not affect local food consumption.

5. Conclusion

This paper evaluates the pattern of food choice, especially between local food and rice, using price and expenditure-income elasticities analysis in Papua Province. Located in Eastern Indonesia, tuber food has been traditionally the stable food in this province. It is in contrast with the majority of Indonesians who consume rice as their staple food. However, the rising pattern of shifting consumption from local food to rice may harm food sustainability in Papua Province, as this province relies heavily on rice from outside Papua, both within Indonesia and other countries. Furthermore, the expenditure share is predominantly allocated to food in this province.

Focusing on Papua Province and using a more rigorous statistical model, this paper provides a more precise understanding of household food choices in Papua Province. The finding of this paper challenges previous studies that local tuber food is an inferior good and rice is a luxury good. Rather, from the expenditure-income elasticity, this paper concludes that rice is a normal good in Papua Province overall, including both rural and urban areas and the three highest income groups. It becomes a luxury good only for the two lowest income groups, though the elasticities are only slightly above 1.

On the other hand, while the expenditure elasticity of local food is not significant in Papua Province as a whole, rural areas, and the fourth-lowest income group, it is a luxury good for urban residents and the highest income group, with elasticities of 2.419 and 2.956, respectively. These findings suggest that local food is not an inferior good and is even highly valued by wealthier and urban populations.

This paper also challenges previous research that argued expenditure elasticity is higher for local food than for rice. Our findings support this claim only for urban residents and the highest income group, where local food is a luxury good. In contrast, expenditure elasticity is higher for rice than for local food across other income groups, in rural areas and in the province as a whole. This means that as income rises in Papua Province, the shift from local food to rice as a staple will continue—unless the influence of people in cities and the highest income group, who favour local food, outweighs that of rural residents and lower-income groups. However, this paper supports earlier findings that tuber food is price elastic, meaning its consumption is highly influenced by price changes. Furthermore, the substitution effect is much stronger than the income effect as consumers switch to or away from the local food based on relative price differences rather than feeling richer or poorer. Therefore, maintaining stable prices is crucial to promoting local tuber food consumption.

While not discussed in earlier research, the paper contributes to exploring the relationships between rice, local tuber foods, and ready-to-eat foods through cross-price elasticities. As incomes rise, people increasingly substitute traditional staples like rice and local foods with convenient, ready-to-eat options. Understanding this shift is crucial for food policy as ready-to-eat food may differ in nutrition and cost, affecting health and household expenses.

This paper concludes that rice and local tubers are independent in terms of price elasticity but local tubers are substituted by ready-to-eat foods as the price of local food increases, reflecting a shift towards more convenient food options. On the other hand, ready-to-eat foods are more resistant to price changes, suggesting they are becoming a more stable part of the diet. These findings underscore the complex interplay between income, price sensitivity and food preferences, highlighting rice's enduring role as a staple while also revealing emerging dietary trends. In short, as local food is not an inferior good but a luxury good for the urban residents and those with the highest income, there is a window of opportunity to create a sustainable staple food consumption based on local tuber foods. Policies to continue raising per capita income and improving income distribution will be accompanied by a rising proportion of tuber food consumption. This policy should be accompanied by stabilization of tuber food prices as tuber food consumption is price elastic.

Moreover, given the growing shift towards ready-to-eat foods which may not offer the same nutritional benefits as traditional staples, there is a need for nutrition-oriented policies that encourage balanced, sustainable food choices. This effort should be accompanied by an efficient distribution system and market access for selling local food products. Consequently, local food can become more accessible across all regions and be developed in alignment with the food diversification programme, ultimately reducing rice imports (from other regions in Indonesia and other countries) and achieving food self-sufficiency. These policy interventions can ensure that local foods remain a central part of Papua's food culture while safeguarding both economic and nutritional sustainability for future generations.

Suggestions for further research include examining the influence of migration on consumption patterns, exploring individual-level preferences, analysing marginal expenditure share and compensating variation to gauge long-term demand changes and household welfare impacts in Papua Province.

APPENDIX

TABLE A1

Parameter Estimation Results of the QUAIDS-ILLS Model for Food Demand in Papua Province, 2019

Coefficients of Independent Variables	*Dependent Variables*							
	Rice		*Local Food*		*Fish*		*Meats*	
	Coef	*SE*	*Coef*	*SE*	*Coef*	*SE*	*Coef*	*SE*
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
Rice	.06329***	.00480	.06566***	.00935	–.05819***	.00612	–.01972**	.00653
Local food	.06566***	.00494	–.15814***	.01014	.04935***	.00525	. .05961***	.00644
Fish	–.05819***	.00405	.04935***	.00816	–.01719**	.00615	–.03320***	.00560
Meats	–.01972***	.00500	.05961***	.00938	–.03320***	.00547	–.00692	.00666
Eggs	–.00367	.00491	.02037*	.00961	–.00563	.00717	–.00974	.00713
Milk	.00084	.00197	.01853***	.00391	–.01463***	.00258	–.01492***	.00272
Vegetables	.01963***	.00384	–.11081***	.00740	.06293***	.00486	.01547**	.00524
Peanuts	–.00747**	.00278	.01992***	.00543	.00051	.00396	–.00150	.00395
Fruits	–.01347***	.00293	.03651***	.00580	.00476	.00405	–.03659***	.00412
Spices, oil and coconuts	.02045***	.00472	–.01070	.00909	.01878**	.00676	.01770**	.00681
Beverage ingredients	–.02658***	.00361	–.01482*	.00711	.00068	.00519	.01929***	.00520
Other food	–.04076***	.00619	.02450*	.01203	–.00816	.00591	.01051	.00778
All food shares	.11854***	.00619	–.24615***	.01036	.10344***	.00862	.14983***	.00938
Quadratic expression of all food shares	–.02166***	.00122	.03094***	.00181	–.01366***	.00151	–.02192***	.00188
Consumption	–.04886***	.00295	.01614**	.00575	–.04155***	.00429	–.01308**	.00416
Higher than junior high school	.00745***	.00131	–.01197***	.00263	.00163	.00198	–.00433*	.00196
Urban	.00314*	.00190	–.04814***	.00370	–.00366	.00282	–.01042***	.00273
Small family	–.00853**	.00296	–.07281***	.00603	.00805*	.00445	.01062*	.00446
Medium family	–.00204	.00169	–.03425***	.00341	.00260	.00255	.00656**	.00253
Male	–.00580**	.00202	–.00266	.00404	–.01422***	.00305	–.00466	.00306
Other sectors	–.00545*	.00292	.00064	.00573	–.00372	.00440	–.01624***	.00433
Agriculture sector	–.01368***	.00311	. .07680***	.00613	–.04540***	.00469	.00654	.00464
Head household age: 25–49 yrs old	.00019	.00299	.02242***	.00614	–.00470	.00455	.00176	.00458

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TABLE A1 — *cont'd*

Coefficients of Independent Variables	*Dependent Variables*							
	Rice		*Local Food*		*Fish*		*Meats*	
	Coef	*SE*	*Coef*	*SE*	*Coef*	*SE*	*Coef*	*SE*
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
Head household age: >=50 yrs old	.00254	.00315	.01985**	.00644	.01107*	.00479	–.01428**	.00482
Group income: 20–40	–.03805***	.00208	.01761***	.00420	–.00214	.00314	–.02083***	.00316
Group income: 40–60	–.04386***	.00266	.06440***	.00540	–.01433***	.00400	–.02362***	.00401
Group income: 60–80	–.03695***	.00322	.06114***	.00651	–.01804***	.00480	–.01886***	.00483
Group Income: 80+	–.03712***	.00394	.03042***	.00800	–.02900***	.00590	–.00963	.00593
Constant	–.06715***	.01647	.54183***	.03167	–.02402	.02093	–.12048***	.02076
F-statistics	**167.40*** **		**801.99*** **		**273.85*** **		**68.90*** **	
R2	**0.2562**		**0.6226**		**0.3604**		**0.1242**	

Coefficients of Independent Variables	*Dependent Variables*							
	Eggs		*Milk*		*Vegetables*		*Peanuts*	
	Coef	*SE*	*Coef*	*SE*	*Coef*	*SE*	*Coef*	*SE*
1	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*
Rice	–.00367*	.00183	.00085	.00220	.01963***	.00485	–.00748***	.00160
Local food	.02037***	.00184	.01855***	.00193	–.11081***	.00521	.01992***	.00155
Fish	–.00563***	.00154	–.01463***	.00180	.06294***	.00467	.00052	.00133
Meats	–.00974***	.00190	–.01492***	.00203	.01547**	.00543	–.00150	.00160
Eggs	–.00071	.00194	–.00622*	.00266	.00581	.00478	–.00560**	.00178
Milk	–.00622***	.00077	–.00238*	.00094	.01063***	.00211	–.00440***	.00068
Vegetables	.00581***	.00145	.01063***	.00180	–.00625	.00423	.00324*	.00130
Peanuts	–.00560***	.00110	–.00440**	.00147	.00324	.00423	–.00531***	.00098
Fruits	.00298**	.00114	.00492**	.00146	.00568*	.00423	.00714***	.00102
Spices, oil and coconuts	.00022	.00186	–.00402	.00254	–.00042	.00423	–.01850***	.00170

Beverage ingredients	.00513***	.00142	.00164	.00191	–.00762*	.00423	.01778***	.00130
Other food	–.00293	.00229	.00998***	.001945	.00168	.00423	–.00580**	.00183
All food shares	.04465***	.00247	.03188***	.00341	–.14765***	.00423	.03465***	.00228
Quadratic expression of all food shares	–.00714***	.00044	–.00381***	.00056	.01754***	.00424	–.00533***	.00040
Consumption	–.02002***	.00117	–.023467***	.00161	–.05064***	.00424	–.01411***	.00108
Higher than junior high school	.00175**	.00052	.00473***	.00072	.00097	.00424	.00228***	.00048
Urban	.00589***	.00075	.00036	.00105	.00503**	.00424	.00544***	.00069
Small family	.00586***	.00117	.00017	.00163	–.00228	.00424	.00524***	.00108
Medium family	.00396***	.00067	.00290**	.00093	–.00416*	.00424	.00269***	.00062
Male	–.00390***	.00080	–.00321**	.00111	.00005	.00424	–.00272***	.00074
Other sectors	.00058	.00116	–.00063	.00163	–7.08e–06	.00424	–.00351**	.00107
Agriculture sector	.00316*	.00123	.00413*	.00173	.00319	.00424	.00334**	.00114
Head household age: 25–49 yrs old	–.00142	.00118	–.00618***	.00164	.00715*	.00424	.00194*	.00109
Head household age: >=50 yrs old	–.00305*	.00125	–.01205***	.00173	.01416***	.00424	.00057	.00115
Group income: 20–40	–.00295***	.00082	–.00342**	.00114	.03416***	.00424	.00020	.00076
Group income: 40–60	–.00455***	.00105	–.00680***	.00147	.03197***	.00424	–.00106	.00097
Group income: 60–80	–.00282*	.00127	–.00381*	.00177	.03450***	.00424	–.00151	.00117
Group income: 80+	–.00224	.00156	–.00473*	.00217	.03951***	.00424	–.00087	.00144
Constant	–.02981***	.00659	–.00232	.00800	.34077***	.00424	–.0339947***	.00569
F-statistics	**127.56*** **		**50.36*** **		**254.31*** **		**88.02*** **	
R2	**0.2079**		**0.0939**		**0.3435**		**0.1533**	

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TABLE A1 — *cont'd*

Coefficients of Independent Variables	*Dependent Variables*							
	Fruits		*Spices, Oil and Coconuts*		*Beverage Ingredients*		*Ready-to-eat Food*	
	Coef	*SE*	*Coef*	*SE*	*Coef*	*SE*	*Coef*	*SE*
1	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*
Rice	–.01348***	.00229	.02045***	.00187	–.02658***	.00189	–.04076***	.00960
Local food	.03651***	.00182	–.01069***	.00163	–.01482***	.00159	.02450**	.00788
Fish	.00476**	.00174	.01878***	.00154	.00068	.00144	–.00816	.00802
Meats	–.03659***	.00201	.01770***	.00179	.01929***	.00173	.01051	.00872
Eggs	.00298	.00291	.00022	.00225	.00513*	.00233	–.00293	.01186
Milk	.00492***	.00099	–.00402***	.00082	.00164*	.00081	.00998*	.00406
Vegetables	.00568**	.00186	–.00042	.00156	–.00762***	.00153	.00168	.00768
Peanuts	.00714***	.00161	–.01850***	.00127	.01778***	.00129	–.00580	.00648
Fruits	–.02152***	.00156	.00324**	.00123	.02190***	.00127	–.01556*	.00646
Spices, oil and coconuts	.00324	.00277	–.03415***	.00218	.01268***	.00222	–.00529	.01133
Beverage ingredients	.02190***	.00208	.01268***	.00162	–.01788***	.00166	–.01220	.00846
Other food	–.01556***	.00141	–.00529**	.00172	–.01219***	.00146	.04402***	.00795
All food shares	–.00270	.00371	–.03053***	.00286	.01852***	.00298	–.07448***	.01620
Quadratic expression of all food shares	.00117*	.00056	.00314**	.00044	–.00386***	.00047	.02460***	.00307
Consumption	–.01587***	.00181	–.03697***	.00138	–.01275***	.00144	.26117***	.00739
Higher than junior high school	.00111	.00079	.00140*	.00060	–.00094	.00063	–.00408	.00300
Urban	–.00010	.00116	.00741***	.00090	.00141	.00093	.03365***	.00428
Small family	.00458*	.00177	.00532***	.00134	.00398**	.00141	.03980***	.00671
Medium family	.00236*	.00102	.00375***	.00077	.00248**	.00081	.01317**	.00384
Male	–.00644***	.00120	–.00360***	.00092	.00224*	.00096	.04493***	.00464
Other sectors	–.00260	.00178	.00230*	.00137	–.00252*	.00142	.03121***	.00673
Agriculture sector	–.00114	.00188	.00179	.00144	.00222	.00150	–.04095***	.00716
Head household age: 25–49 yrs old	–.00116	.00176	.00046	.00133	–.00538***	.00140	–.01508*	.00683
Head household age: >=50 yrs old	.00093	.00186	.00065	.00141	–.00767***	.00148	–.01271*	.00721

Group income: 20–40	.00249*	.00123	.00871***	.00094	–.00306**	.00098	.00730	.00475
Group income: 40–60	–.00079	.00159	.00587***	.00121	–.00215*	.00127	–.00509	.00603
Group income: 60–80	–.00241	.00192	.00154	.00146	–.00125	.00153	–.01152	.00726
Group income: 80+	.00141	.00235	.00329*	.00179	.00115	.00188	.00776	.00891
Constant	.11908***	.00893	.10331***	.00730	–.07319***	.00722	.24597***	.03427
F-statistics	**88.05*****		**188.45*****		**81.42*****		**452.10*****	
R2	**0.1534**		**0.2794**		**0.1435**		**0.4819**	

NOTE: $*p < 0.05$, $**p < 0.01$, $***p < 0.001$.

TABLE A2
QUAIDS-ILLS Own and Cross-Price Compensated Estimation Results

Proportion of Food Consumption	*Rice*	*Local Food*	*Fish*	*Meats*	*Eggs*
	b/se	*b/se*	*b/se*	*b/se*	*b/se*
Rice	–0.206***	0.037	–0.054**	0.273***	0.098**
	(0.028)	(0.030)	(0.017)	(0.024)	(0.033)
Local food	0.132	–1.139***	–0.168	–0.566*	–0.091
	(0.146)	(0.146)	(0.120)	(0.259)	(0.228)
Fish	–0.053	–0.047	–0.790***	0.158***	0.076
	(0.041)	(0.035)	(0.020)	(0.035)	(0.047)
Meats	0.306***	–0.179***	0.180***	–0.519***	0.086
	(0.042)	(0.036)	(0.023)	(0.035)	(0.052)
Eggs	0.354***	–0.093*	0.277***	0.275***	–0.864***
	(0.038)	(0.037)	(0.021)	(0.033)	(0.047)
Milk	0.463***	0.004	–0.065	0.021	–0.054
	(0.070)	(0.068)	(0.036)	(0.067)	(0.089)
Vegetables	–0.120	–0.219***	0.484***	–0.376***	–0.089
	(0.064)	(0.041)	(0.031)	(0.066)	(0.066)
Peanuts	0.213***	0.029	0.450***	0.489***	–0.026
	(0.049)	(0.047)	(0.029)	(0.040)	(0.060)
Fruits	–0.307***	1.235***	0.289***	–1.057***	0.129
	(0.089)	(0.124)	(0.042)	(0.112)	(0.093)
Spices, oil and coconuts	0.439***	0.246***	0.405***	0.285***	–0.030
	(0.043)	(0.046)	(0.026)	(0.038)	(0.055)
Beverage ingredients	–0.315***	–0.492***	0.255***	0.682***	0.192***
	(0.049)	(0.033)	(0.023)	(0.035)	(0.050)
Ready-to-eat food	–0.119*	0.285***	0.055*	0.083*	–0.002
	(0.050)	(0.053)	(0.025)	(0.041)	(0.056)

NOTE: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.
SOURCE: Calculated by the authors.

Milk	*Vegetables*	*Peanuts*	*Fruits*	*Spices, Oil and Coconuts*	*Beverage Ingredients*	*Ready-to-eat Food*
b/se	*b/se*	*b/se*	*b/se*	*b/se*	*b/se*	*b/se*
0.094***	–0.061**	0.043*	–0.065***	0.125***	–0.098***	–0.186***
(0.012)	(0.023)	(0.018)	(0.019)	(0.031)	(0.024)	(0.018)
0.003	–0.392*	0.021	0.925***	0.248	–0.545**	1.573***
(0.080)	(0.155)	(0.126)	(0.204)	(0.212)	(0.207)	(0.329)
–0.013	0.242***	0.090***	0.060*	0.114**	0.079*	0.084**
(0.017)	(0.038)	(0.026)	(0.025)	(0.044)	(0.033)	(0.026)
0.005	–0.213***	0.111***	–0.250***	0.091	0.239***	0.145***
(0.018)	(0.035)	(0.029)	(0.029)	(0.049)	(0.037)	(0.029)
–0.039*	–0.162***	–0.019	0.098***	–0.031	0.216***	–0.011
(0.018)	(0.032)	(0.027)	(0.026)	(0.044)	(0.033)	(0.025)
–0.964***	0.031	–0.029	0.192***	–0.176*	0.143*	0.433***
(0.031)	(0.063)	(0.050)	(0.048)	(0.083)	(0.062)	(0.049)
0.013	–0.270***	–0.090*	0.114**	0.193**	–0.134**	0.495***
(0.023)	(0.067)	(0.040)	(0.035)	(0.062)	(0.049)	(0.044)
–0.029	–0.225***	–1.054***	0.264***	–0.660***	0.687***	–0.139***
(0.022)	(0.041)	(0.034)	(0.033)	(0.063)	(0.046)	(0.030)
0.184***	0.272***	0.252***	–1.654***	0.148	0.740***	–0.231***
(0.031)	(0.076)	(0.051)	(0.063)	(0.087)	(0.072)	(0.049)
–0.125***	0.343***	–0.468***	0.110***	–1.707***	0.318***	0.185***
(0.020)	(0.045)	(0.037)	(0.029)	(0.056)	(0.038)	(0.028)
0.093***	–0.217***	0.445***	0.501***	0.290***	–1.322***	–0.112***
(0.017)	(0.035)	(0.029)	(0.031)	(0.048)	(0.040)	(0.027)
0.056**	0.161***	–0.018	–0.031	0.034	–0.022	–0.480***
(0.019)	(0.042)	(0.031)	(0.030)	(0.052)	(0.039)	(0.030)

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