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Article

Estimating food demand and the impact of market shocks on food expenditures: The case for the Philippines and missing price data

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Abstract

This study uses the Quadratic Almost Ideal Demand System to estimate food demand among Filipino households. Our study uses the recently released 2018 Family Income and Expenditure Survey and the Stone-Lewbel price index in the absence of price data on food groups. Results show that demand for rice with respect to prices and expenditures is relatively inelastic compared with that for other food groups. The income elasticity for rice is inelastic (0.26), slightly higher than the income elasticity for sugar. Demand for rice is generally less elastic for higher-income Filipinos and families residing in urban areas than for their counterparts. The findings reveal that, in the short term, a 15 per cent decrease in income or a 20 per cent increase in rice prices induces families to spend more of their income on rice at the expense of other cereals, meat, fish, and other food groups. Income and rice price shocks have differential impacts on low-income and high-income Filipino families. Policymakers may be able to moderate the food price impacts of market shocks through targeted interventions and programs that improve the accessibility to and availability of quality agri-fishery products.

Keywords: Demand analysis, QUAIDS, Income categories, Stone-Lewbel prices, Expenditure elasticity, Income elasticity

JEL code: D12

1. Introduction

The rice sector plays a significant role in Philippine agriculture and the economy. As of 2018, about 10 million farmers and family members—representing 22 per cent of the rural population—depended on growing rice for their livelihood. Recent data show that annual rice production fell to 114.69 kg per capita (PSA, 2020). The per capita output was slightly lower (2.7 per cent) than the record set in 2018. Rice is the staple food for 109.04 million

Filipinos (PSA, 2021), who consume an average of about 110 kg of rice per capita per year (PSA, 2018). Rice accounts for more than a third of the average calorie intake of Filipinos. In addition, rice is a major food expense, accounting for 13.1 per cent of total household spending and a third of total food consumption. Thus, rice in the Philippines is a highly political crop and a sensitive issue for policymakers regarding food prices and security.

The 2018 Family Income and Expenditure Survey (FIES) revealed that Filipinos' average annual income increased by about 17 per cent, from 268,000 pesos in 2015 to 313,000 pesos in 2018. Average family income also increased in all deciles. On the other hand, the average family expenditures during the same period increased by about 11 per cent, from 216,000 pesos to 239,000 pesos. In 2018, 42.6 per cent of the average Filipino family's spending was on food, an increase of 0.8 percentage points from 2015 (41.8 per cent). Of the above proportion, 33.6 per cent was spent on food consumed at home and only 9.0 per cent was spent on food outside the home. Among the food items consumed at home, bread, and cereals had the highest share of food expenditures (11.0 per cent), followed by meat (5.7 per cent) and fish and seafood (5.0 per cent) (PSA, 2020). A 0.7 per cent share of expenditures was for oils and fat. Unlike the income pattern observed in deciles, for families in the bottom 30 per cent income group, 58.2 per cent of their total expenditures went for food compared with 39.5 per cent for families in the upper 70 per cent income group.

Price and income shocks affect families in various income groups differently regarding food expenditures (or food consumption). For instance, for the early 2000s, Ivanic and Martin (2008) noted that price shocks in low-income countries negatively affected poverty rates. The authors stated that rice prices increased by 25 per cent, leading to higher poverty rates in rice-dependent countries. Other studies have also investigated the causes of higher food prices and their impact on household welfare (Dewbre et al., 2008; Coxhead et al., 2012; Minot and Dewina, 2015). In addition, Valera, Balié, and Magrini (2022) recently noted that rice price shocks have a higher inflationary effect than fuel prices and remittance earnings. Thus, the food security of millions of Filipinos is affected by inflation and the rise in commodity prices. Populations across developing and emerging economies also experience income shocks. These income shocks can arise from natural disasters, for example, flooding, droughts, hurricanes, and typhoons (Samphantharak, 2014; Alano and Lee, 2016). The authors found that droughts and typhoons decrease national income in the short and long term—about a 2.3 per cent decrease in gross domestic product (GDP). Additionally, in their study, Tanaka, Ibrahim, and Lagrine (2021) found that although large-scale natural disasters hurt real GDP, the effect of the shock persists for a more extended period in the Philippines than in China, India, and Thailand. The Organization of Economic Co-operation and Development (OECD) reports used income and price shocks to estimate household food insecurity (OECD, 2015, AAAAAA 2017). A related measure that captures the components of food security is the self-sufficiency ratio (SSR), which is the share of production compared with utilization (Clapp, 2017). The ratio indicates how much a commodity's supply is from domestic production. The higher the SSR, the greater the self-sufficiency.[1] Interestingly, in 2019, the SSR for rice dropped to 79.8 per cent from 86.7 per cent in 2018, implying a rice shortage and thus more imports from world markets (PSA, 2020). In other words, the Philippines imported about 20.2 per cent of its domestic rice supply.

Given rice's budgetary and nutritional importance in the well-being of Filipinos, a further understanding of rice demand behavior would provide valuable information regarding food security, income stabilization, and trade policies. Changes in income or relative prices culminate in shifting purchasing patterns, and changes in these factors can lead to a healthier or more malnourished rural population. Thus, information on food demand behavior is crucial in analyzing the effects of different policies and, in turn, in providing recommendations for planning, designing, and implementing government programs that will help improve Filipinos' food supply and nutritional status.

Our study examines the influence of income, relative prices, and relevant socioeconomic factors on food purchasing behavior, in total and by primary food categories, among Filipino households. The study uses the Quadratic Almost Ideal Demand System (QUAIDS) and recently collected 2018 FIES that collected detailed information on expenditure patterns among Filipino families. In 2019, the Philippines shifted to a liberalized rice trading regime with the Rice Tariffication Law (RTL). Thus, the findings from our study provide a better understanding of the potential effects of future price and income shocks on rice demand. Second, the study offers complementary information to enrich the Philippine Rice Industry Roadmap 2030 (a guide toward achieving rice security—increasing yields, reducing costs, enhancing resiliency, and ensuring safety and nutrition[2]) in estimating the country's rice demand in rural and urban locations and income of consumer types and improving the quality of policy recommendations in food security and nutritional programs. Finally, another crucial contribution of our study is in providing policymakers with an up-to-date analysis to quantify the effects of various market shocks on consumer food expenditures.[3] Although considerable literature explores food demand estimation for the Philippines, we offer a first study that considers a two-stage budgeting process in food demand instead of treating demand for food commodities in a one-step budgeting process. The household determines the share of income devoted to food in the first step. Based on the outcome of this first stage, the second stage determines how to allocate food expenditures across the different food categories.

The article is structured as follows. The following section discusses the literature on food demand estimation for the Philippines. The third section describes the conceptual framework and empirical methodology. The fourth section describes the data and the fifth section presents the results. The final section concludes and elaborates on policy implications.

2. Background

Several studies have investigated food demand in the Philippines. In the late 1980s, Quisumbing et al., (1988) used 1978 and 1982 household surveys collected by the Food and Nutrition Research Institute. The study was the first to estimate the demand elasticities of food and non-food items. The study reported disaggregate demand parameters for food subgroups that accounted for location and occupation when assessing food consumption. In the early 1990s, Bouis (1990) estimated the food demand elasticity for urban and rural Filipinos. The author used 1978 and 1982 household surveys to find that meats have higher own-price and income elasticities. In contrast, Bouis (1990) found that maize had a negative income elasticity for rural and urban families. In addition, the author predicted changes in the consumption levels of food items[4] and overall calorie intakes. The author concluded that lower real wages and rising cereal prices[5] would increase malnutrition.

Two years later, Bouis, Haddad, and Kennedy (1992) compared calorie-income elasticities for Kenya and the Philippines. The authors estimated calorie intake and calorie availability for both countries. For the Philippines, our focus in this study is that the authors found that calorie intake and availability are higher for more affluent families for most food items but not for maize. The authors argue that wealthy families buy extra food for guests and workers. Using household survey data from 1985,1988, and 1991, the FIES, and the Almost Ideal Demand System (AIDS), Balisacan (1994) studied food demand by Filipinos. The authors found that most food items (maize, rice, other cereals, dairy and meat, fruits and vegetables, and other foods) were income-inelastic (about 0.1) and did not change with income levels. Balisacan (1994) concluded that although food price responses vary by income group and household location, the variation was not as large as reported in the media.

In the early 21st century, Mutuc, Pan, and Rejesus (2007), using 2000 FIES data and the QUAIDS, estimated expenditure elasticities for 11 vegetable types[6] in the Philippines. The authors found significant expenditure elasticities between urban and rural residents.

However, the authors did not find significant differences in own-price and cross-price elasticities between urban and rural residents. In a recent study, Fuji (2016) compared food demand in the urban populations of the Philippines and China. Using six rounds of FIES data (1988,1991, 1994, 2000, 2003, and 2006), the author found that, from 1998 to 2006, Filipinos' diet essentially became more westernized. Additionally, urban Filipinos' demand for meat, vegetables, and fruits was similar to that of the Chinese urban population. Using the 2008–2009 Survey of Food Demand for Agricultural Commodities and Linear Approximate Almost Ideal Demand System (LA/AIDS), Sombilla, Lantican, and Quilloy (2011) estimated rice demand for Filipinos. The authors noted that rice demand was inelastic to total food expenditure, income, and own-price, especially for rural poor Filipinos.

Finally, Dizon and Wang (2019) used 2015 FIES data in estimating own-price and cross-price food demand elasticities to simulate the impact of the rice tariffication policy, which has abandoned quantitative restrictions on rice imports since the promulgation of the RTL in February 2019. The authors highlighted that the corresponding expected decline in rice prices following the rice tariffication policy would increase rice consumption and that of other food groups, with potential for increased diet diversity. In a recent study, Balié, Minot, and Valera (2021), using the IRRI Global Rice Model, simulated the RTL on the domestic price of rice. The authors found that the RTL decreased consumer and producer rice prices, thus affecting the production and consumption of rice. Rice farmers who were net sellers were negatively affected, although overall the RTL reduced poverty.

3. Conceptual Model and Empirical Framework

The QUAIDS is an extension of the now-famous AIDS proposed initially by Deaton and Muellbauer (1980). QUAIDS is quadratic in expenditures, more flexible than the AIDS, and allows demand curves to be non-linear in the logarithm of expenditures, thus exhibiting non-linear Engel curves.[7] Specifically, QUAIDS allows a good to be both a luxury item and a necessity good at the two ends of the income distribution (Banks, Blundell, and Lewbel, 1997). Several studies have used the QUAIDS modeling approach (initially proposed by Banks, Blundell, and Lewbel, 1997) to estimate broad food demand in developed and developing countries. Studies in developing countries of interest to us in this study are Hoang (2018) for households in Vietnam; Khanal, Mishra, and Keithly (2016) for rural households in southern India; Boysen (2012) for Uganda; Meenakshi and Ray (1999) for Indian families; and Obayelu et al., (2009) and Fashogbon and Oni (2013) for Nigerian households. Other studies include Ecker and Qaim (2011), who study food and nutrient demand in Malawi. Two studies (Gould and Villarreal, 2006; Zheng and Henneberry, 2010) investigated food demand in urban China. Studies in South and Southeast Asia include, for example, Garcia et al., (2005), Tey et al., (2008), and Pangaribowo and Tsegai (2011), who estimated fish demand in the Philippines, rice demand in Malaysia, and food demand in Indonesia, respectively.

Interestingly, a series of studies estimated food demand projections using QUAIDS for Ethiopia (Tafere et al., 2011), Bangladesh (Ganesh-Kumar et al., 2012b), and India (Ganesh-Kumar et al., 2012a). Food demand studies using QUAIDS also include Vietnam (Hoang, 2018), India (Khanal, Mishra, and Keithly, 2016), and China (Fashogbon and Oni, 2013). The above studies use Ray's (1983) and Poi's (2012) approach to include differences in demographic factors across households when analyzing food and non-food expenditures in a complete demand system. Recent studies using the QUAIDS model are Law, Fraser, and Piracha (2020) and Hussein, Law, and Fraser (2021). For instance, Law, Fraser, and Piracha (2020) used the QUAIDS model to estimate the combined demand elasticities for cereals to assess changes in the food preferences of Indian households. Hussein. Law, and Fraser (2021) used the World Bank's 2018 Somalia High Frequency household survey data to show the effects of income shocks (civil war in Somalia) on food consumption elasticities (expenditure, own- and cross-price elasticities for animal products).

The above studies, in general, support the superiority of the QUAIDS model compared with the AIDS model when estimating food expenditures, by category, in a complete demand system.[8]

Recall that the QUAIDS model accounts for differences in socioeconomic conditions across households by augmenting demographic and household-specific variables (e.g. household size) using the method proposed by Ray (1983) and Poi (2012). Therefore, our study employs the QUAIDS method for estimating food demand among the Filipino population. We assume weak separability in the household's two-stage budgeting process (Boysen, 2012). In the first stage, the family decides the percentage of the total budget allocated to food. In the second stage, the household allocates the food budget among different food categories.[9] Note that elasticities contingent on exogenous total group expenditure in the demand system may be inappropriate when assuming a two-stage allocation process. Our study overcomes the limitation of single-stage and conditional elasticities by computing appropriate unconditional elasticities. The unconditional elasticities from the demand model are derived following Edgerton (1993; 1997) and Carpentier and Guyomard (2001).

3.1. First-stage: expenditure share of food

Following Ecker and Qaim (2011), the first-stage model predicts the share of food expenditure of total household expenditure as a function of socio-demographic variables, quadratic expenditure terms, and a food price index. Specifically, the first-stage model estimates the following equation:

$$S_F = \alpha'_F + \delta_F Z + \beta_F lnM + \lambda_F \left(lnEXP\right)^2 + \gamma_F lnF_{Pf}, \tag{1}$$

where S_F represents the household expenditure share of food. Z is the vector of household and demographic variables consisting of age, education, gender, and marital status of the household head and region dummies. This vector accounts for household-specific demand heterogeneity (Pollak and Wales, 1981).[10] EXP represents total per capita household expenditure. Finally, F_{Pf} represents a household-specific food price index:

$$\ln\left(F_{pf}\right) = \sum_j \overline{w}_i \ln\left(p_i\right), \tag{2}$$

where $\overline{w_i}$ represents food category i's mean share of total food expenditure and p_i is the Stone-Lewbell price of food category i. Ecker and Qaim (2011) use good-level prices to calculate F_{Pf}. A limitation of FIES data is the lack of good-level price information, a necessary variable for calculating the price. Castellón, Boonsaeng, and Carpio (2015) note several methods to compensate for the lack of price data. We apply Lewbel's (1989) approach to impute prices, known as Stone-Lewbel (SL) prices. We calculate SL prices not at the good level but in the food category. An alternative to using SL group-level prices would be to use group-level consumer price indices (CPIs). Indeed, Hoderlein and Mihaleva (2008) and Castellón, Boonsaeng, and Carpio (2015) found that SL price indices performed better (more precisely) in estimating demand systems than did CPIs. Castellón, Boonsaeng, and Carpio (2015) concluded that SL prices could accurately measure demand systems without good-level prices.[11] For a given household, category-level SL prices are defined as

$$p_i = \frac{1}{k_i} \prod_{j=1}^{n_i} \left(\frac{\overline{p_i}}{w_{lij}}\right)^{w_{lij}}, \tag{3a}$$

where k_i is commodity category i's scaling factor, which is a function of the mean budget shares $\overline{w}_{ij}$ of the n_i goods j within the food category i and the mean food expenditure share

$\overline{w}_i$ of category i ($k_i = \prod_{j=1}^{n_i} \overline{w}_{ij}^{-\overline{w}_i}$). $\overline{p_i}$ is the price index of category i. w_{lij} is the household l's budget share of good i within category j.[12] We use the category-level SL prices (see Appendix Table A1) to compute the household-specific food price index in Equation 2.[13] In conjunction with parameters derived from Equation 2 and the Slutsky equation, we estimate the food expenditure elasticity[14] (φ_F) and uncompensated (Marshallian) elasticity (ε_F^M) as

$$\varphi_F = 1 + \frac{\beta_F}{S_F} + \frac{2\lambda_F\, lnEXP}{S_F} \tag{3b}$$

$$\varepsilon_F^M = -1 + \frac{\gamma_F}{S_F} \tag{3c}$$

We estimate Equation 1 with OLS to recover the elasticity of food expenditure with respect to income. Later, we simulate the impact of a 15 per cent reduction in income on the demand for rice, non-rice cereals, and other food categories. In particular, we use the Equation 1 OLS estimates to predict food expenditures in a scenario with 85 per cent of reported income. Then, we combine the predicted food expenditure with the second-stage demand system estimates to recover the counterfactual expenditure shares by food category.

3.2. Second-stage demand system

The QUAIDS method is used to accomplish the second stage of the two-stage budgeting process. Following Banks, Blundell, and Lewbel (1997), the model is derived from the indirect utility function:

$$\ln V\left(p, F_{ex}\right) = \left\{\left[\frac{\ln F_{ex} - \ln a\left(p\right)}{b\left(p\right)}\right]^{-1} + \lambda\left(p\right)\right\}^{-1}, \tag{4}$$

where $a(\boldsymbol{p})$ and $b(\boldsymbol{p})$ are SL price indices, p is the vector of SL prices, and F_{ex}indicates total food or food group expenditure. ln *a(p)* is the translog aggregator function of the following form:

$$\ln a\left(p\right) = \alpha_0 + \sum_{i=1}^{k} \alpha_i \ln p_j + \frac{1}{2}\sum_{i=1}^{k}\sum_{j=1}^{k} \psi_{ij} \ln p_i \ln p_j \tag{5}$$

where the price of food category i for $i = 1,\ldots k$ is represented by p_i. There are k categories of goods in the system. Additionally, $b(\boldsymbol{p})$ is the Cobb-Douglas price aggregator represented as

$$b\left(p\right) = \prod_{i=1}^{k} p_i^{\beta_i} \tag{6}$$

The price aggregator $\lambda(p)$ can be represented as

$$\lambda\left(p\right) = \sum_{i=1}^{k} \lambda_i \ln p_i \; where \; \sum_{i=1}^{k} \lambda_i = 0. \tag{7}$$

Applying Roy's identity to the indirect utility function in Equation 4, the budget shares for the QUAIDS are

$$\omega_i = \alpha_i + \sum_{j\,=\,1}^{k} \psi_{ij} \ln p_j + \beta_i \ln\left(\frac{F_{ex}}{a\left(p\right)}\right) + \frac{\lambda_i}{b\left(p\right)}\left(\ln\left(\frac{F_{ex}}{a\left(p\right)}\right)\right)^2 + \xi_i, \tag{8}$$

where ω_i, p_j, and F_{ex} are the budget share and price of food item i and category j, and total food expenditures, respectively. From this specification, the AIDS model arises as a special case when $\lambda_i = 0$. Additionally, we impose restrictions of adding-up, homogeneity, and Slutsky symmetry to comply with the demand system. Thus, in Equation 9, the following holds:

$$\sum_{i=1}^{k}\alpha_i = 1;\ \sum_{i=1}^{k}\beta_i = 0,\ \sum_{i=1}^{k}\lambda_i = 0\ \ for\ all\ \ j\epsilon\ \text{group}\ i \tag{9}$$

A sufficient condition for the expenditure shares to be homogeneous of degree zero in prices is that $\sum_{i=1}^{k}\psi_{ij} = 0$ for the equation of food group i. Symmetry condition is imposed by $\psi_{ij} = \psi_{ji}$.

In addition to prices and income effects, we are interested in assessing the impact of demographic variables on the food demand system. Poi (2002) derived a procedure from augmenting demographic variables in QUAIDS. Poi (2002) expressed each household's expenditure function of the form specified below with z as a vector of s characteristics and u as the given utility level:

$$e\left(p, Z, u\right) = F_{ex_0}(p, Z, u)^{*}e^{R(p,u)}, \tag{10}$$

where $F_{ex_0}(p, Z, u)$ scales the expenditure function to account for household characteristics and $e^{R(p,u)}$ is the expenditure function of a reference household. Equation 10 can be decomposed as

$$F_{ex_0}\left(p, Z, u\right) = \overline{F_{ex_0}}\left(Z\right) * \phi\left(p, Z, u\right). \tag{11}$$

Following Ray (1983), Poi (2002) defines $\overline{F_{ex_0}}(Z)$ as

$$S\overline{F_{ex_0}}\left(Z\right) \ = \ 1 + \rho'\mathbf{z}$$

where ρ is a vector of parameters. The function $\phi(p, Z, u)$ is parameterized such that

$$\ln\phi\left(\mathbf{p}, \mathbf{z}, u\right) = \frac{\prod_{j=1}^{k} p_j^{\beta_j}\left(\prod_{j=1}^{k} p_j^{\eta_j'\mathbf{z}} - 1\right)}{\frac{1}{u} - \sum_{j=1}^{k}\lambda_j \ln p_j}. \tag{12}$$

where η_j is the j-th column of the $s \times k$ parameter matrix η. The resulting expenditure share of the QUAIDS with a vector of demographic variables Z is given by

$$w_i = \alpha_i + \sum_{j=1}^{k}\gamma_{ij}\ln p_j + \left(\beta_i + \boldsymbol{\eta}_i'\mathbf{z}\right)\ln\left\{\frac{F_{ex}}{\overline{F_{ex_0}}\left(Z\right)a\left(\mathbf{p}\right)}\right\} + \frac{\lambda_i}{b\left(\mathbf{p}\right)c\left(\mathbf{p}, \mathbf{z}\right)}\left[\ln\left\{\frac{F_{ex}}{\overline{F_{ex_0}}\left(Z\right)a\left(\mathbf{p}\right)}\right\}\right]^2 \tag{13}$$

where

$$c\left(\mathbf{p}, \mathbf{z}\right) = \prod_{j=1}^{k} p_j^{\eta_j'\mathbf{z}} \tag{14}$$

The adding-up condition imposes $\sum_{j=1}^{k}\eta_{rj} = 0$. The elasticity of category i with respect to the price of category j is

$$\begin{aligned}\epsilon_{ij} = -\delta_{ij} + \tfrac{1}{w_i}(\gamma_{ij} - \left[\beta_i + \eta_i'\mathrm{z} + \tfrac{2\lambda_i}{b(\mathrm{p})c(\mathrm{p},\mathrm{z})}\ln\left\{\tfrac{F_{ex}}{\overline{m}_0(\mathrm{z})a(\mathrm{p})}\right\}\right] \\ \times\left(\alpha_j + \sum_{l}\gamma_{jl}\ln p_l\right) - \tfrac{\left(\beta_j + \eta_j'\mathrm{z}\right)\lambda_i}{b(\mathrm{p})c(\mathrm{p},\mathrm{z})}\left[\ln\left\{\tfrac{F_{ex}}{\overline{F_{ex_0}}(Z)a(\mathrm{p})}\right\}\right]^2\Bigg)\end{aligned} \tag{15}$$

The expenditure elasticity of category i is

$$\mu_i = 1 + \frac{1}{w_i}\left[\beta_i + \eta_i'\mathrm{z} + \frac{2\lambda_i}{b\left(\mathrm{p}\right)c\left(\mathrm{p}, \mathrm{z}\right)}\ln\left\{\frac{F_{ex}}{\overline{m}_0\left(\mathrm{z}\right)a\left(\mathrm{p}\right)}\right\}\right] \tag{16}$$

From the Slutsky equation, the compensated price elasticities are

$$\epsilon_{ij}^{C} = \epsilon_{ij} + \mu_i w_j \tag{17}$$

4. Data

Our study uses the 2018 FIES.[15] The FIES is a nationwide survey of households in the Philippines. The first FIES was conducted in 1957. The Philippine Statistics Authority (PSA) gathers family income and expenditure data. The 2018 FIES was the first to use and interview a sample of 170,917 households, which was deemed sufficient to provide reliable estimates of income and expenditure at the national, regional, provincial, and highly urbanized cities (HUC) levels. The 2018 FIES used the 2013 Master Sample sampling design. A total of 2,695 data items were included in the 2018 FIES questionnaire.[16] The sample households covered in the survey were interviewed in July 2018.

The survey reports total expenditures on food and non-food items. Unfortunately, the 2018 FIES data released by the PSA lack quantity and unit prices for the goods the families consumed.

Total expenditures are the sum of all consumption expenditures. Data cleaning and missing information resulted in 147,717 families for analysis in our study. Appendix Table A2 shows the average socioeconomic and demographic attributes of the families in the 2018 FIES. The average age of the household head (HH) was 48, 84 per cent reported being married, and 86 per cent were employed. The average family size was 4.6 persons per household and 10 per cent of the sampled households lived in poverty. All food items consumed by families are aggregated into nine categories. These categories are (1) RICE (well-milled, regular, National Food Authority, and other); (2) OTHER CRLS (maize and other cereals—maize, flour, cereal preparation, bread, pasta, and other bakery products); (3) MEAT (beef, chicken, goat, pork, preserved meats); (4) FISH (fresh, dried/smoked, preserved, and seafood); (5) FRUIT (fresh, dried, nuts, preserved, and others); (6) VEGE (vegetables, tubers, preserved, and products of tubers); (7) SUGAR (centrifugal, muscovado, refined brown sugar, and others); (8) DRINKS (soft drinks, mineral, fruit juice, concentrates, and other non-alcoholic beverages); and (9) MISC (milk and others).

We divided the sample into three income terciles (low, middle, and high) and two regional categories (rural and urban). The latter two categories are based on the location of the surveyed households. Table 1 shows the average budget shares and annual income (expenditures) per capita of each selected food group for the sample, income terciles, and urban and rural families. Table 1 reveals that low-income households spent more than 55 per cent of their total income buying food. The average family spent nearly 42 per cent of its total income purchasing food and food items.

On the other hand, urban households spent 38.5 per cent of their income on food. Table 1 shows that affluent households (high-income households) spent 28 per cent of their income on food. The annual per capita income of the average family was about 294,000 pesos and high-income families earned about 3.8 times more than low-income households. Similarly, the average urban household earned about 1.6 times more than the average rural household. The second column of Table 1 shows that nearly all Filipino families in the sample had non-zero consumption. Thus, censoring issues related to our datasets are not valid. Column 3 of Table 1 reveals that the miscellaneous food group makes up the largest share of food expenditures (29.8 per cent), followed by rice (23.1 per cent), fish and seafood (13.1 per cent), meat (12.2 per cent), vegetables (6.8 per cent), other cereals (7.8 per cent), fruit (3.3 per cent), drinks (2.7 per cent), and sugar (1.1 per cent). Table 1, Row 1, shows that low-income families and Filipino households living in rural areas had higher food expenditures on rice than high-income and urban families in the Philippines. We use the method of Hoang (2018), Dharmasena and Capps Jr (2014), and Kyureghian et al., (2011) to address the issue of missing expenditures (i.e. zero consumption). If a consumer reports zero expenditure on a good category, the SL method does not recover SL prices for that good category. To impute

Table 1. Food expenditure share (per cent) by income levels and regions, Philippines, 2018.

Food group	Households with non-zero consumption	Entire sample	Low-income	Middle-income	High-income	Rural	Urban
RICE	99.0	23.11	30.29	23.12	16.05	26.46	19.22
OTHER CRLS	99.9	7.80	9.30	7.49	6.72	8.40	7.17
MEAT	99.5	12.19	9.24	12.77	14.33	11.37	12.99
FISH	99.8	13.11	13.93	13.31	12.14	14.13	11.93
FRUIT	99.9	3.35	3.11	3.18	3.79	3.50	3.19
VEGE	99.7	6.81	7.28	6.84	6.26	7.41	6.05
SUGAR	99.4	1.09	1.49	1.06	0.72	1.33	0.81
DRINKS	98.1	2.71	2.10	2.81	3.22	2.39	3.10
MISC	100.0	29.83	23.24	29.41	36.76	25.01	35.54
Share of food expenditure in total income		41.8	54.88	42.26	28.15	44.52	38.54
Annual income per capita (1,000 Philippines pesos)		294.18	138.66	224.13	523.02	230.64	371.81
Number of households		147,717	47,013	46,800	46,556	76,737	63,632

Source: 2018 FIES. Philippines Statistical Authority. https://psa.gov.ph/tags/family-income-and-expenditure-survey
Exchange rate USD 1 = PHP 52.41 (Philippine pesos). Food groups: RICE = rice (well-milled, regular, National Food Authority (NFA), and other); OTHER CRLS = maize and other cereals (maize, flour, cereal preparation, bread, pasta, and other bakery products); MEAT = beef, chicken, goat, pork, and preserved; FISH = fresh, dried/smoked, preserved, and seafood; FRUIT = fresh, dried, nuts, preserved, and others; VEGE = vegetables, tubers, preserved, and products of tubers; SUGAR = centrifugal, muscovado, refined brown sugar, and others; DRINKS = soft drinks, mineral, fruit juice, concentrates, and other non-alcoholic beverages; MISC = milk and others.

the missing SL prices, we use the following auxiliary OLS regression:

$$p_i^m = \delta_0 + \sum_{n=1}^{N} \delta_l X_n^m + \theta_r + \nu_i^m, \tag{18}$$

where p_i^m is the SL price of category i faced by household m. X is a set of household-level demographic characteristics that may affect SL prices that consist of gender, age, marriage status, and employment status of the household head, as well as the household's poverty index, number of members, share of members less than 5 years of age, share of members between 5 and 17 years of age, number of members employed for pay, and rural/urban status. θ_r is a set of region fixed effects and ν_i^m is the error term. The demographic variables capture differences in tastes and preferences of the household members and family composition.

5. Results and Discussion

Table 2 presents the estimates of uncompensated price elasticity, expenditure, and income elasticity. Table 2 shows that nine food items' estimates of own-price elasticity (the percentage change in the quantity of food items demanded due to a percentage change in price) are negative and statistically significant at the 1 per cent level of significance. On the one hand, Table 2 also shows that demand for other cereals, meat, fish, fruit, vegetables, and miscellaneous food groups is elastic. On the other hand, demand for rice, sugar, and drinks food groups is inelastic (Table 2). Cross-price elasticities are consistent and in both directions. Our finding is consistent with Hoang (2018) in her study of Vietnamese food demand. Table 2 shows that rice, the main food item for Filipinos, complements four other food groups, but rice is a substitute for other cereals, fish, and miscellaneous food groups (milk and others). Similarly, the meat group complements seven other food groups but not other cereals and miscellaneous food. The miscellaneous food group is a substitute for all other food groups. Finally, the fruit food group is substitutable with the other cereals, fish, vegetables, and miscellaneous food groups.

Demand for rice is near unitary elastic (−0.93) to change in rice prices compared with that for other food groups, with own-price elasticity ranging from −1.67 (drinks) to −1.00 (meats) and to −1.67 (miscellaneous food group). Demand is less elastic for the sugar and drinks food groups, with own-price elasticity of −0.71 for sugar and −0.70 for drinks. Our estimate is consistent with Quisumbing (1986), who found an elastic price elasticity of demand for rice in the Philippines. Specifically, our estimates are lower, in absolute terms, than those of Quisumbing (1986), who discovered an own-price elasticity of rice demand from −1.44 to −1.00, depending on the income group. However, our estimate is closer to that of Vu (2009), who, using the Vietnam Household Living Standard Survey (VHLSS), found an own-price elasticity of demand for rice of −0.8 for Vietnamese households. Our estimates are also closer to the own-price elasticity estimates (−0.6) obtained by Gibson and Kim (2013), who analyzed 2010 VHLSS data.

However, our own-price elasticity of demand for rice estimate is about two times larger, in absolute terms, than that obtained by Hoang (2018) using 2010 VHLSS data (−0.47). It should be noted that Hoang's rice food group included white rice, sticky rice, rice noodles, and *bun*. However, several reasons could explain the higher own-price elasticity. First, the higher own-price elasticity for rice could be due to our use of prices at the provincial level. Second, our study's rice group comprises several rice types, including well-milled, regular, National Food Authority, and others. At the provincial level, the price of rice is not differentiated by the type of rice. Third, the elastic response of rice to its own price appears to reflect a slight variation in rice prices. A plausible argument for elastic rice demand could be the westernization of the Filipino diet (Fuji, 2016). Fuji (2016) notes that, from 1988

Table 2. Uncompensated price, expenditure, and income elasticities, Philippines, 2018.

	RICE	OTHER CRLS	MEAT	FISH	FRUIT	VEGE	SUGAR	DRINKS	MISC	Expenditure elasticity	Income elasticity
RICE	−0.927***	0.014***	−0.027***	0.008**	−0.010***	−0.010***	0.001	−0.015***	0.295***	0.671***	0.255
	(−0.003)	(−0.003)	(−0.004	(−0.003)	(−0.003)	(−0.004)	(−0.005)	(−0.003)	(−0.004)	(−0.003)	
OTHER CRLS	−0.018***	−1.478***	0.069***	0.072***	0.048***	0.010	−0.010	0.018***	0.360***	0.927***	0.352
	(−0.005)	(−0.005)	(−0.006)	(−0.006)	(−0.005)	(−0.007)	(−0.008)	(−0.005)	(−0.007)	(−0.005)	
MEAT	−0.169***	0.023***	−1.013***	−0.088***	−0.041***	−0.061***	−0.021***	−0.007**	0.197***	1.180***	0.448
	(−0.004)	(−0.003)	(−0.004)	(−0.004)	(−0.004)	−0.005)	(−0.006)	(−0.003)	(−0.004)	(−0.003)	
FISH	−0.076***	0.031***	−0.067***	−1.221***	0.002	0.025***	0.001	−0.018***	0.266***	1.058***	0.402
	(−0.003)	(−0.003)	(−0.004)	(−0.004)	(−0.003)	(−0.004)	(−0.005)	(−0.003)	(−0.004)	(−0.003)	
FRUIT	−0.149***	0.106***	−0.136***	0.016***	−1.082***	0.083***	−0.016*	−0.042***	0.212***	1.008***	0.383
	(−0.006)	(−0.005)	(−0.007)	(−0.006)	(−0.006)	(−0.007)	(−0.009)	(−0.005)	(−0.007)	(−0.005)	
VEGE	−0.060***	0.023***	−0.063***	0.088***	0.048***	−1.061***	−0.013**	−0.054***	0.318***	0.775***	0.294
	(−0.004)	(−0.004)	(−0.004)	(−0.004)	(−0.004)	(−0.005)	(−0.006)	(−0.003)	(−0.005)	(−0.004)	
SUGAR	0.039***	−0.047***	−0.169***	0.061***	−0.036***	−0.070***	−0.711***	−0.079***	0.452***	0.561***	0.213
	(−0.006)	(−0.006)	(−0.007)	(−0.007)	(−0.006)	(−0.008)	(−0.010)	(−0.005)	(−0.008)	(−0.006)	
DRINKS	−0.192***	0.047***	−0.003	−0.075***	−0.049***	−0.146***	−0.035***	−0.702***	0.183***	0.972***	0.369
	(−0.006)	(−0.005)	(−0.007)	(−0.006)	(−0.006)	(−0.007)	(−0.009)	(−0.005)	(−0.007)	(−0.005)	
MISC	0.101***	0.070***	0.076***	0.097***	0.016***	0.042***	0.009***	0.010***	−1.669***	1.248***	0.474
	(−0.002)	(−0.002)	(−0.003)	(−0.002)	(−0.002)	(−0.003)	(−0.003)	(−0.002)	(−0.003)	(−0.002)	

Source: Authors' computation using FIES 2018 https://psa.gov.ph/tags/family-income-and-expenditure-survey. Numbers in parentheses denote standard errors.
Notes: ***, **, * denote significance at 1 per cent, 5 per cent, and 10 per cent levels, respectively.

to 2006, Filipinos increased their food budget share for dairy, eggs, and meat. The author notes a decline in the expenditure share of cereals, including rice, during the same period.

Column 11 of Table 2 reports the expenditure elasticity of demand for all nine food groups. The expenditure elasticity of demand for rice is 0.67, slightly higher than the expenditure elasticity of demand for the sugar food group (0.56). Our expenditure elasticity estimate for rice is nearly twice as large as the estimates obtained by Vu (2009) and Hoang (2018). In contrast, the expenditure elasticity[17] of demand for other food groups is significantly larger, ranging from 0.76 to 1.25. Finally, the last column of Table 2 reports the income elasticity of each food group. Estimates show that the income elasticity of each food group decreases by 50 per cent or more compared to expenditure elasticity, suggesting that each food group is a necessary good for changes in consumer income. The income elasticity of the rice group is 0.26 (Table 2, last column), suggesting that a 1 per cent increase in household income (expenditures) increases rice demand by 0.26 per cent. The results suggest an inelastic demand for rice with respect to changes in Filipino families' income. Our estimate is lower in absolute terms than the estimates obtained by Abad et al., (2010) and Lantican, Sombilla, and Quilloy (2013). The miscellaneous food group (0.47) and meat food group (about 0.45) have the highest and second-highest income elasticity, followed by drinks (0.37) and other cereals (about 0.35). Interestingly, the sugar food group's income elasticity is the lowest (0.21).

5.1. Income and location disaggregation

Estimates of expenditure and uncompensated price elasticities by income terciles for urban families are provided in Appendix Table A3 and for rural families in Appendix Table A4. Table 3 presents the estimates for three income groups (low, middle, and high) and urban and rural subsamples. The left panel of Table 3 shows the expenditure elasticities and the right panel presents the uncompensated own-price elasticities of each food group. As expected, Table 3 shows that expenditure elasticities are all positive and own-price elasticities are negative for each food group. All estimates are significant at the 1 per cent level of significance. Table 3's left panel shows that demand for food items, especially rice, tends to be more elastic with respect to expenditures for lower-income and rural households. For instance, the expenditure elasticity of demand for the rice food group is higher (0.78) for low-income families and lower (0.66) for high-income families. Similarly, the expenditure elasticity of demand for the rice food group is 0.65 for rural families and 0.68 for urban families. However, the expenditure elasticity of demand for the other cereals food group is higher (0.96) for high-income families and lower (0.89) for low-income families. The expenditure elasticity of demand for the other cereals food group is 0.98 for rural families and 0.92 for urban families.

On the one hand, estimates in Table 3 (left panel) show that, regardless of income strata and location of families (rural and urban), meat, fish, and miscellaneous food groups appear to be luxury goods (elasticity > 1). On the other hand, estimates in Table 3 (left panel) reveal that, regardless of income strata and location of families (rural and urban), vegetables and sugar appear to be normal goods (elasticity < 1). Our finding is consistent with Hoang's (2018) and Vu's (2009) results for Vietnamese households. Lastly, drinks are a luxury good for rural households. Interestingly, estimates from our study show that fruits are normal goods for lower- and middle-income Filipino families and luxury goods for high-income urban and rural families. Demand elasticities with respect to prices reveal a pattern that is consistent with expenditure elasticities. For example, the own-price elasticity of rice group demand is decreasing, in absolute terms, with increasing household income. The elasticity of demand is -0.98 for low-income households compared with -0.91 for high-income households. Our estimates follow a similar pattern and are lower in magnitude, in absolute terms, than those of Quisumbing (1986), who found that the own-price elasticity of demand for

Table 3. Expenditure and uncompensated own-price elasticities for income and regional subsamples, Philippines, 2018.

	Expenditure					Uncompensated				
Food group	Low- income	Middle-income	High-income	Urban	Rural	Low- income	Middle-income	High-income	Urban	Rural
RICE	0.780***	0.731***	0.659***	0.681***	0.650***	−0.975***	−0.949***	−0.913***	−0.907***	−0.930***
	(−0.009)	(−0.005)	(−0.005)	(−0.004)	(−0.004)	(−0.006)	(−0.005)	(−0.004)	(−0.004)	(−0.005)
OTHER	0.888***	0.928***	0.975***	0.921***	0.977***	−1.862***	−1.351***	−1.118***	−1.255***	−1.643***
CRLS	(−0.019)	(−0.009)	(−0.008)	(−0.006)	(−0.007)	(−0.013)	(−0.008)	(−0.007)	(−0.006)	(−0.008)
MEAT	1.105***	1.127***	1.147***	1.124***	1.186***	−0.942***	−1.047***	−1.063***	−0.997***	−0.989***
	(−0.009)	(−0.006)	(−0.007)	(−0.005)	(−0.004)	(−0.007)	(−0.007)	(−0.007)	(−0.006)	(−0.005)
FISH	1.118***	1.065***	1.020***	1.055***	1.129***	−1.296***	−1.241***	−1.115***	−1.140***	−1.284***
	(−0.01)	(−0.006)	(−0.007)	(−0.004)	(−0.004)	(−0.007)	(−0.006)	(−0.006)	(−0.005)	(−0.005)
FRUIT	0.800***	0.874***	1.050***	1.145***	1.100***	−1.111***	−1.079***	−1.067***	−1.017***	−1.175***
	(−0.017)	(−0.01)	(−0.011)	(−0.007)	(−0.007)	(−0.011)	(−0.009)	(−0.009)	(−0.007)	(−0.008)
VEGE	0.815***	0.766***	0.837***	0.897***	0.934***	−1.151***	−1.061***	−0.986***	−1.003***	−1.188***
	(−0.011)	(−0.007)	(−0.007)	(−0.005)	(−0.005)	(−0.009)	(−0.009)	(−0.008)	(−0.007)	(−0.007)
SUGAR	0.698***	0.634***	0.618***	0.663***	0.683***	−0.777***	−0.691***	−0.686***	−0.696***	−0.763***
	(−0.02)	(−0.012)	(−0.011)	(−0.008)	(−0.008)	(−0.022)	(−0.018)	(−0.013)	(−0.013)	(−0.015)
DRINKS	0.989***	0.885***	0.834***	0.929***	1.095***	−0.660***	−0.713***	−0.753***	−0.728***	−0.703***
	(−0.016)	(−0.01)	(−0.01)	(−0.007)	(−0.007)	(−0.009)	(−0.008)	(−0.007)	(−0.007)	(−0.007)
MISC	1.207***	1.236***	1.216***	1.193***	1.178***	−1.580***	−1.655***	−1.705***	−1.663***	−1.693***
	(−0.005)	(−0.004)	(−0.005)	(−0.003)	(−0.003)	(−0.005)	(−0.005)	(−0.005)	(−0.004)	(−0.004)

Source: Authors' computation using FIES 2018 https://psa.gov.ph/tags/family-income-and-expenditure-survey. Numbers in parentheses denote standard errors.
Notes: ***, **, * denote significance at 1 per cent, 5 per cent, and 10 per cent levels, respectively.

rice was −1.45 for lower-income households and about −1.00 for higher-income households.[18] Similarly, the own-price elasticity of rice group demand is higher (−0.93) for rural households than for urban families (−0.91). Our result is consistent with other studies in the literature. For instance, Hoang (2018), Vu (2009), and Canh (2008) found the own-price elasticity of rice demand in urban areas to be less elastic than in rural areas.

5.2. Impact of income and price shocks on budget shares

In our study, we model the impacts of two hypothetical scenarios: a 15 per cent decrease in income and a 20 per cent rise in rice prices in the budget share that Filipino families devote to the various food groups. Specifically, we use Hoang's (2018) procedure to estimate the impacts of income and price shocks on budget shares. T able 5 shows the income and price shock results using 2018 FIES data as the baseline. For reasons of space and brevity, we present only the impact on budget shares and quantities and discuss only low-income and high-income households.

Table 4 shows that a 15 per cent reduction in income increases the budget share for rice by 0.1 percentage points for the entire sample and is compensated for by a decrease in the budget share of other meat (−0.1 percentage points) and miscellaneous (−0.1 percentage points) food groups. Interestingly, the impact of a 15 per cent reduction in income on budget shares differs by income group. For low-income families, a 15 per cent reduction in income decreases the budget share for rice by 1.8 percentage points, for other cereals by −0.1 percentage points, for vegetables by −0.1 percentage points, and for sugar by −0.1 percentage points, and is compensated for by an increase in the budget share of meat by 1.0 percentage points, fish by 0.1 percentage points, drinks by 0.2 percentage points, and miscellaneous by 0.7 percentage points. For high-income families, a 15 per cent decrease in income increases the budget share of rice by 2.8 percentage points, thus increasing rice expenditure and purchased quantity by 6.1 per cent. An income decrease also induces a smaller increase in budget share (0.1 to 0.2 percentage points) for non-rice cereals, fish, and sugar. These budget-share increases are offset by decreases in the budget share of meat (−1.2 percentage points), fruit (−0.3 percentage points), drinks (−0.3 percentage points), and miscellaneous (−1.4 percentage points). Our findings for the entire sample and high-income households are qualitatively consistent with those of Hoang (2018). However, the percentage in the budget share differs because Hoang considered only a 10 per cent reduction in income compared with a 15 per cent reduction in our study of Filipino families.

The last panel of Table 4 shows the impact of a 20 per cent increase in rice prices. The results reveal that a 20 per cent rise in rice prices increases budget shares for rice by 0.1 percentage points and for the miscellaneous food group by 0.9 percentage points for the entire sample. The increase in budget share for rice and the miscellaneous food group is compensated for by a decrease in the meat (−0.4 percentage points), fish (−0.2 percentage points), fruit (−0.1 percentage points), vegetables (−0.2 percentage points), and drinks (−0.1 percentage points) food groups. We also observe that increased rice prices have a differential impact on budget shares by analyzing family income groups. On the one hand, for low-income families, Table 4 shows that a 20 per cent increase in rice prices decreases the budget share allocated to rice by 1.7 percentage points, vegetables by 0.3 percentage points, and other cereals by 0.2 percentage points. However, a 20 per cent increase in rice prices increases the budget share of the miscellaneous food group by 1.5 percentage points and the drinks food group by 0.1 percentage points. On the other hand, for high-income families, a 20 per cent increase in rice prices increases the budget share of rice by 2.8 percentage points, thus increasing the quantity by 17 per cent. The same price increase will decrease budget shares for meat by 1.6 percentage points, fish by 0.3 percentage points, fruit by 0.5 percentage points, and drinks by 0.3 percentage points. Our estimates for the entire sample

Table 4. Impacts of income and price shocks on budget share and per capita quantity, 2018, Philippines.

Food Group	Budget share: Baseline (%)			Budget share: Income decreases by 15% (difference from baseline in pp)			Budget share: Rice price increases by 20% (difference from baseline in pp)			Quantity: Income decreases by 15% (difference from baseline in %)			Quantity: Rice price increases by 20% (difference from baseline in %)		
	Entire sample	Low-income	High-income	Entire sample	Low-income	High-income	Entire sample	Low-income	High-Income	Entire sample	Low-income	High-income	Entire sample	Low-income	High-income
All															
RICE	23.1	30.2	16.0	0.1	−1.8	2.8	0.1	−1.7	2.7	−8.3	−11.3	6.1	0.5	−5.6	17.0
OTHER CRLS	7.8	9.2	6.7	0.0	−0.1	0.1	0.0	−0.2	0.1	−8.4	−6.6	−8.5	−0.4	−2.2	1.1
MEAT	12.2	9.3	14.4	−0.1	1.0	−1.2	−0.4	0.8	−1.6	−9.1	4.6	−17.3	−3.2	8.3	−11.3
FISH	13.1	13.9	12.1	0.0	0.1	0.0	−0.2	−0.1	−0.3	−8.6	−4.8	−9.9	−1.7	−1.0	−2.2
FRUIT	3.3	3.1	3.8	0.0	0.2	−0.3	−0.1	0.1	−0.5	−8.2	−0.3	−18.0	−2.1	3.4	−12.1
VEGE	6.8	7.3	6.3	0.0	−0.1	0.2	−0.2	−0.3	0.0	−8.9	−7.2	−7.4	−2.6	−3.8	−0.1
SUGAR	1.1	1.5	0.7	0.0	−0.1	0.1	0.0	−0.1	0.1	−8.5	−12.2	6.9	−1.5	−6.4	12.5
DRINKS	2.7	2.1	3.2	0.0	0.2	−0.3	−0.1	0.1	−0.4	−8.5	4.1	−16.8	−3.8	7.0	−12.3
MISC	29.8	23.3	36.7	−0.1	0.7	−1.4	0.9	1.4	−0.1	−9.0	−2.7	−13.2	3.0	6.0	−0.4
Urban															
RICE	19.2	28.2	14.4	0.1	−2.6	2.0	0.0	−2.5	1.8	−8.9	−12.4	1.9	0.0	−9.0	12.7
OTHER CRLS	7.2	8.7	6.5	0.0	−0.1	0.1	0.0	−0.2	0.1	−9.1	−4.9	−9.3	−0.4	−2.6	0.9
MEAT	13	9.8	14.2	0.0	1.4	−0.7	−0.4	1.1	−1.2	−9.3	10.2	−14.9	−3.1	11.3	−8.3
FISH	11.9	13.3	11.2	0.0	−0.3	0.1	−0.2	−0.5	−0.2	−9.2	−5.5	−9.8	−2.0	−4.1	−1.5
FRUIT	3.2	2.7	3.6	0.0	0.3	−0.3	−0.1	0.2	−0.4	−8.8	8.1	−17.6	−2.9	9.0	−11.4
VEGE	6.1	6.7	5.7	0.0	−0.3	0.2	−0.2	−0.4	0.0	−9.3	−7.5	−7.6	−2.8	−6.6	0.1
SUGAR	0.8	1.2	0.6	0.0	−0.1	0.1	0.0	−0.1	0.0	−8.4	−13.7	2.2	−4.5	−11.2	4.2
DRINKS	3.1	2.5	3.3	0.0	0.3	−0.1	−0.1	0.2	−0.3	−8.7	8.0	−14.2	−4.0	8.2	−9.3
MISC	35.6	26.9	40.4	−0.1	1.5	−1.3	1.1	2.3	0.1	−9.6	1.9	−13.3	3.1	8.6	0.3
Rural															
RICE	26.3	30.9	18.8	0.2	−1.6	4.5	0.3	−1.4	4.4	−7.8	−11.1	12.8	1.1	−4.5	23.6
OTHER CRLS	8.3	9.4	7.1	0.1	−0.1	0.1	0.0	−0.2	0.1	−7.9	−7.3	−7.1	−0.2	−2.1	1.7
MEAT	11.5	9.1	14.8	−0.1	0.9	−2.1	−0.4	0.7	−2.4	−9.4	2.4	−21.6	−3.3	7.2	−16.4
FISH	14.1	14.2	13.6	0.1	0.3	−0.1	−0.2	0.0	−0.4	−8.1	−4.6	−9.7	−1.4	0.1	−2.8
FRUIT	3.5	3.2	4.1	0.0	0.1	−0.4	−0.1	0.1	−0.5	−7.8	−2.9	−18.5	−1.5	1.8	−12.7
VEGE	7.4	7.5	7.2	0.0	−0.1	0.2	−0.2	−0.2	0.0	−8.6	−7.2	−6.7	−2.3	−2.9	0.1
SUGAR	1.3	1.6	0.9	0.0	−0.1	0.2	0.0	−0.1	0.2	−8.2	−12.0	13.8	0.4	−4.9	23.3
DRINKS	2.4	2	3.1	0.0	0.2	−0.5	−0.1	0.1	−0.6	−8.8	2.5	−22.3	−3.9	6.4	−18.2
MISC	25.2	22.1	30.4	−0.2	0.4	−1.9	0.6	1.1	−0.9	−9.2	−4.6	−14.7	2.5	4.8	−2.9

Source: Authors' computation using FIES 2018 https://psa.gov.ph/tags/family-income-and-expenditure-survey.

and high-income households are consistent, albeit of a different magnitude, with those of Hoang's (2018) study, which considered a 30 per cent increase in rice prices in Vietnam.

Table 4 shows that urban and rural families allocate more of their budgets to rice and reduce expenses on other food items when income shocks occur. For urban families, when income decreases by 15 per cent, the budget share for rice increases by 0.1 percentage points and is primarily compensated for by a decrease in the budget share for miscellaneous food items. In response to decreased income (a 15 per cent reduction), low-income urban Filipino families diminished their budget share for rice by 2.6 percentage points, other cereals by 0.1 percentage points, fish and vegetables by 0.3 percentage points, and sugar by 0.1 percentage points. On the other hand, low-income urban families increased the budget share for meat (1.4 percentage points) and drinks (0.3 percentage points). In response to decreased income, high-income urban families allocated more of their budgets to rice (increasing quantity by 12.7 per cent), other cereals, fish, vegetables, and sugar food items. Perhaps high-income Filipinos have higher saving rates and use savings to buy more food items. For low-income rural families, a 15 per cent reduction in income decreases the budget share for other cereals by 0.1 percentage points. This increases the expenditure share of miscellaneous food items by 0.4 percentage points (Table 4). In response to decreased income, high-income rural families behave similarly to their urban counterparts. Specifically, high-income rural households allocate more of their budgets to rice (by 4.5 percentage points, a 12.8 per cent increase in quantity) and vegetables and sugar (by 0.2 percentage points), and increase the budget share to other cereals by 0.1 percentage points.

In the case of a 20 per cent increase in rice prices, the response is quite different for urban and rural Filipino families. Low-income urban and rural families allocate less of their budgets to rice (a 2.5 percentage points reduction for low-income urban families versus a 1.4 percentage points reduction for low-income rural families). Similarly, low-income urban and rural families allocate less of their budgets to other cereals, both by 0.2 percentage points. Low-income urban families also reduce their budget shares for fish (0.5 percentage points), vegetables (0.2 percentage points), and sugar food items (0.1 percentage points). In response to a 20 per cent increase in rice prices, low-income urban families increase their budget shares for miscellaneous food items (2.3 percentage points), meat (1.1 percentage points), and drinks and fruit (by 0.2 percentage points each). In contrast, high-income urban and rural families allocate more money to rice (1.8 percentage points more for urban families versus 4.4 percentage points more for rural families) and assign less money to meat (1.2 percentage points for urban families and 4.4 percentage points for rural families). High-income rural families also decrease budget shares for fish, fruit, vegetables, drinks, and miscellaneous food items. On the other hand, high-income urban families decrease budget shares for fruit (0.4 percentage points) and drinks (0.3 percentage points).

In sum, our study suggests that either a 15 per cent decrease in income or a 20 per cent increase in rice prices leads, on average, to an increased share of spending on rice at the expense of decreased spending shares on other goods. An increase in rice prices decreases spending on meat, fish, and fruit and increases spending on miscellaneous food items (maize, bread, flour, milk, and others). In contrast, a decrease in income diminishes spending on miscellaneous food items. Finally, the effects of income and price shocks are heterogeneous across the income spectrum (low and high income) and location (urban and rural areas).

6. Conclusions and Policy Implications

Our study estimated food demand in the Philippines and assessed how income and price shocks affect food purchasing behavior. Unlike most studies that evaluated food demand in a one-step budgeting process, we first examined the household's share of income spent on food. We then studied the allocation of food expenditures across the different food categories. Applying Lewbel's Stone-Lewbel (1989) method to address the absence of price data from the 2018 FIES, the evidence points to a relatively inelastic response of rice demand to prices and expenditures compared to that of other food groups. In addition, we found that income elasticity for rice was inelastic and that demand for rice was less elastic for higher-income urban households than for rural households. In the short term, a market shock such as a 15 per cent drop in income or a 20 per cent rise in rice prices leads families to spend more on rice, which is a less expensive main food staple, and to spend less on relatively more expensive food items such as meat, fish, and other food groups. The evidence points to a differentiated impact of income and rice price shocks on low-income and high-income households.

The findings from our study lead us to several policy recommendations. First, this research has shown that a decrease in income and an increase in rice prices can potentially worsen food insecurity in the most vulnerable and poorest segments of the Filipino population. This implies that the resilience of the poorest consumers and the most vulnerable households must be addressed by providing adequate safety nets. As Valera et al., (2020) pointed out, low-income families would be protected by those safety net measures when, and even before, the income shock threatens their food security. Safety net measures might include expanding existing cash transfer programs or developing new programs. Policymakers, however, would have to ensure that the safety nets are well targeted to the poor and have significant fiscal resources backed by the government.

Second, the Philippine Rice Industry Roadmap (PRIR) aims to fill a major gap in estimating the country's rice demand by different consumer types under a liberalized trading regime for 2021–2035. Thus, the elasticity estimates generated from our study would be helpful for simulation and further analysis of various programs under the PRIR, particularly programs that ensure access to nutritious food. If policymakers adopt this policy lesson, it will further allow them to quantify the welfare effects of the nutritional programs under the PRIR. This, in turn, will improve the quality of advice in the planning, designing, and implementing of government programs and policies.

Third, results from our study show that food demand behavior tends to be different for urban and rural households. Therefore, public policy should focus on designing and implementing a more targeted policy approach tailored to rural and urban areas. Policy efforts in this direction include programs that improve accessibility to and availability of quality agri-fishery products such as rice, fish, poultry, livestock products, fruits and vegetables, and other essential commodities at affordable prices in urban areas.

While highlighting the importance of public policy, our article still has many unanswered questions. Methodologically, demand estimation by different rice classes is essential but is missing. Considering this explicitly, the model can go beyond characterizing specific rice market segments to support modern breeding programs, product profiling, market intelligence, and research and policy implications. It is also essential to do a follow-up study when the next FIES becomes available. In this context, it would be good to know more about the income and price shocks imposed by the COVID-19 pandemic and how the pandemic affects the food purchasing behavior of different households.

End Notes

1 An SSR of less than 100 per cent indicates inadequate food production. An SSR of 100 per cent suggests that the sector's food production capacity meets the population's needs. An SSR of greater than 100 per cent indicates that domestic production more than meets domestic requirements.

2 The Philippine Rice Industry Roadmap 2030 was created by the Department of Agriculture, Government of the Philippines. See, https://www.philrice.gov.ph/wp-content/uploads/2018/09/The-Philippine-Rice-Industry-Roadmap-2030.pdf.
Balié, Minot, and Valera (2021) show an analysis of the potential welfare effects of rice tariffication on different types of households, but they used only 2015 FIES data.

4 Food items included corns, rice, other cereals, fish, meats, fruits/vegetables, all others.
5 Note that the real per capita Gross National Product (GNP) declined by 20 per cent for four years in a row immedicately after the Philippines suspended payments on foreign debt.
6 Includes cabbage, water spinach, horseradish tree leaves, Chinese white cabbage, bitter gourd, eggplant, okra, tomato, hyacinth bean, mung beans, string beans, and others.
7 For studies discussing the advantages of rank three demand systems such as QUAIDS over other rank two demand systems, see, Decoster and Vermeulen (1998) and Cranfield et al., (2003).
8 We conducted a quadratic specification test, which suggested favoring a QUAIDS model.
9 Additionally, the plot of food group shares over household expenditure and a formal test for quadratic specification in demand system analysis suggest the superiority of the QUAIDS model over AIDS in our estimation.
10 One can derive this by substituting ordinary intercept term α_F, such that $\alpha_F = \alpha'_F + \sum_{d \epsilon D} \delta_d Z_d$.
11 Most variation in SL prices is derived from household heterogeneity and not from CPIs.
12 The Lewbel (1989) definition of SL prices uses good-level price indices. The maximum level of disaggregation of CPIs in our data contains category-level price indices. Thus, we use category-level price indices rather than good-level price indices to compute the SL prices.
13 First-stage results can be obtained from the authors.
14 Note that the shares of budget allocated to food and non-food items add up to 1. The expenditure elasticity of non-food can be calculated as $\varphi_{NF} = \frac{1-\varphi_F * S_F}{1-S_F}$.
15 https://psa.gov.ph/tags/family-income-and-expenditure-survey
16 The questionnaire consisted of seven parts: Part I – Identification and Other Information; Part II – Expenditures and Other Disbursements; Part III – Housing Characteristics; Part IV—Income and Other Receipts; Part V – Entrepreneurial Activities; Part VI – Social Protection; and Part VII – Evaluation of the Household Respondent by the Interviewer.
17 Derived by multiplying the expenditure elasticity by the sample mean income elasticity of food expenditures.
18 Quisumbing (1986) divided the sample into four quartiles.

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Conflict of interest

The authors declare no conflict of interest.

Data availability statement

Publicly available data can be obtained from https://psa.gov.ph/content/highlights-preliminary-results-2021-family-income-and-expenditure-survey-fies-visit-1
Price indices can be downloaded from https://psa.gov.ph/price-indices/cpi-ir/downloads.

Appendix A

Table A1. Estimated Stone-Lewbel (SL) price indices, Philippines, 2018.

Food group	Entire sample	Low-income families	Middle-income families	High-income families	Urban households	Rural households
RICE[1]	75.84	76.66	75.85	75.01	74.95	76.57
	(27.58)	(27.29)	(27.99)	(28.18)	(27.15)	(27.70)
OTHER CEREALS[2]	51.39	47.42	51.90	54.84	53.67	49.54
	(20.90)	(21.94)	(19.94)	(19.88)	(20.31)	(21.95)
MEAT[3]	88.34	82.34	88.10	94.57	91.49	85.78
	(27.95)	(28.25)	(27.40)	(26.60)	(26.46)	(29.29)
FISH[4]	69.39	65.82	69.05	73.30	70.57	68.44
	(24.46)	(25.13)	(24.00)	(22.40)	(23.83)	(26.60)
FRUIT[5]	103.74	105.49	102.94	102.78	102.47	104.76
	(31.90)	(32.99)	(31.08)	(29.94)	(31.93)	(33.72)
VEGE[6]	83.39	80.79	82.99	86.38	81.97	84.53
	(23.87)	(24.48)	(23.20)	(22.73)	(23.42)	(24.76)
SUGAR[7]	84.72	81.26	84.97	87.94	85.77	83.87
	(23.02)	(24.42)	(21.87)	(21.16)	(22.21)	(25.59)
DRINKS[8]	59.05	54.83	59.38	62.95	63.79	55.21
	(27.18)	(28.78)	(25.37)	(25.39)	(26.81)	(29.00)
MISC[9]	98.36	100.58	99.74	94.77	98.05	98.61
	(25.64)	(27.66)	(23.86)	(22.16)	(25.80)	(28.28)
Number of households	147,717	63,632	76,737	47,013	46,800	46,556

Source: Authors' computation using FIES 2018 https://psa.gov.ph/tags/family-income-and-expenditure-survey.
Notes: [1]Includes well-milled rice, regular rice, National Food Authority (NFA) rice, and other rice. [2]Includes maize and other cereals (maize, flour, cereal preparation, bread, pasta, and other bakery products). [3]Includes beef, chicken, goat, pork, and preserved. [4]Includes fish that is fresh, dried/smoked, preserved, and seafood. [5]Includes fruits that are fresh, dried, nuts, preserved, and others. [6]Includes vegetables, tubers, preserved, and products of tubers. [7]Includes centrifugal sugar, muscovado, refined brown sugar, and others. [8]Includes soft drinks, mineral, fruit juice, concentrates, and other non-alcoholic beverages. [9]Includes milk and others.
Numbers in parentheses are standard errors.

Table A2. Socioeconomic attributes of families in 2018 FIES, Philippines.

	All	Urban	Rural	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 7
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
Household head (HH) gender (=1 if HH female; 0 otherwise)	0.13	0.14	0.12	0.14	0.11	0.17	0.18	0.15	0.18	0.20
	(0.33)	(0.35)	(0.33)	(0.35)	(0.31)	(0.37)	(0.38)	(0.36)	(0.38)	(0.40)
HH age	47.99	46.09	48.79	51.00	48.89	48.82	47.98	49.37	50.55	49.35
	(13.43)	(13.23)	(13.44)	(13.73)	(13.51)	(13.44)	(12.92)	(13.70)	(13.95)	(14.04)
HH marital status (= 1 if HH married; 0 otherwise)	0.84	0.83	0.84	0.80	0.84	0.80	0.81	0.83	0.80	0.82
	(0.37)	(0.38)	(0.36)	(0.40)	(0.37)	(0.40)	(0.40)	(0.37)	(0.40)	(0.39)
HH employment status (= 1 if employed; 0 otherwise)	0.86	0.86	0.87	0.83	0.40	0.79	0.82	0.83	0.81	0.81
	(0.34)	(0.35)	(0.34)	(0.38)	(0.33)	(0.40)	(0.38)	(0.38)	(0.39)	(0.39)
Poor (= 1 if income below poverty line; 0 otherwise)	0.10	0.07	0.12	0.06	0.24	0.06	0.07	0.20	0.10	0.10
	(0.31)	(0.25)	(0.33)	(0.23)	(0.34)	(0.24)	(0.25)	(0.40)	(0.30)	(0.31)
Household size	4.58	4.68	4.54	4.72	4.86	4.84	4.91	4.99	4.79	4.86
	(2.06)	(2.16)	(2.01)	(2.10)	(2.20)	(2.18)	(2.26)	(2.25)	(2.19)	(2.34)
Num. of members < 5 years old	0.43	0.46	0.42	0.37	0.50	0.43	0.46	0.49	0.42	0.43
	(0.68)	(0.73)	(0.66)	(0.63)	(0.70)	(0.69)	(0.69)	(0.74)	(0.68)	(0.70)
Num. of members 5 to 17 years old	1.44	1.40	1.46	1.21	1.34	1.29	1.30	1.62	1.28	1.30
	(1.37)	(1.34)	(1.37)	(1.20)	(1.21)	(1.27)	(1.29)	(1.47)	(1.31)	(1.34)
Num. of members employed for pay	1.19	1.34	1.13	1.59	1.62	1.50	1.60	1.23	1.43	1.47
	(0.98)	(1.04)	(0.95)	(1.14)	(1.12)	(1.14)	(1.16)	(1.02)	(1.12)	(1.14)
Num. of members employed for profit (business)	0.81	0.64	0.87	0.78	0.80	0.55	0.56	0.75	0.69	0.65
	(0.79)	(0.74)	(0.80)	(0.70)	(0.76)	(0.74)	(0.70)	(0.78)	(0.79)	(0.82)
Rural (= 1 if household located in rural area; 0 otherwise)	0.70	NA	NA	0.83	0.84	0.42	0.36	0.81	0.64	0.44
	(0.46)			(0.37)	(0.36)	(0.49)	(0.48)	(0.39)	(0.48)	(0.50)
Observations (no.)	4,982	1,471	3,511	3,850	2,357	7,841	3,021	5,275	7,011	4,999

Source: FIES 2018, Philippine Statistics Authority https://psa.gov.ph/tags/family-income-and-expenditure-survey.
Notes: Numbers in parentheses are standard errors. Region 1 = Ilocos; Region 2 = Cagayan; Region 3 = Central Luzon; Region 4 = CALABARZON and MIMAROPA Region; Region 5 = Bicol; Region 6 = Western Visayas; Region 7 = Central Visayas.

Table A2. *continued*

	Region 8 Mean	Region 9 Mean	Region 10 Mean	Region 11 Mean	Region 12 Mean	Region 13 Mean	Region 14 Mean	Region 15 Mean	Region 16 Mean	Region 17 Mean
Household head (HH) gender (=1 if HH female; 0 otherwise)	0.16	0.12	0.15	0.12	0.12	0.21	0.13	0.07	0.14	0.13
	(0.37)	(0.33)	(0.36)	(0.32)	(0.32)	(0.41)	(0.33)	(0.26)	(0.35)	(0.33)
HH age	50.20	49.08	48.58	47.48	46.34	48.03	49.61	47.32	49.44	47.99
	(14.15)	(13.56)	(13.77)	(13.78)	(13.28)	(13.52)	(13.81)	(12.91)	(13.89)	(13.43)
HH marital status (= 1 if HH married; 0 otherwise)	0.80	0.85	0.83	0.84	0.84	0.79	0.81	0.86	0.83	0.84
	(0.40)	(0.36)	(0.38)	(0.37)	(0.37)	(0.41)	(0.39)	(0.34)	(0.37)	(0.37)
HH employment status (= 1 if is employed; 0 otherwise)	0.83	0.85	0.84	0.85	0.88	0.78	0.85	0.91	0.82	0.86
	(0.37)	(0.35)	(0.37)	(0.35)	(0.33)	(0.42)	(0.36)	(0.29)	(0.39)	(0.34)
Poor (= 1 if income below poverty line; 0 otherwise)	0.22	0.24	0.15	0.18	0.23	0.01	0.11	0.39	0.23	0.10
	(0.42)	(0.42)	(0.35)	(0.38)	(0.42)	(0.11)	(0.31)	(0.49)	(0.42)	(0.31)
Household size	4.85	4.89	4.77	4.55	4.66	4.81	4.86	5.00	4.95	4.58
	(2.33)	(2.16)	(2.16)	(2.07)	(2.05)	(2.20)	(2.33)	(2.20)	(2.32)	(2.06)
Num. of members < 5 years old	0.46	0.49	0.46	0.43	0.45	0.41	0.42	0.45	0.46	0.43
	(0.74)	(0.74)	(0.71)	(0.68)	(0.69)	(0.68)	(0.69)	(0.68)	(0.73)	(0.68)
Num. of members 5 to 17 years old	1.50	1.53	1.38	1.35	1.41	1.15	1.36	1.58	1.46	1.44
	(1.45)	(1.39)	(1.35)	(1.31)	(1.34)	(1.24)	(1.35)	(1.46)	(1.39)	(1.37)
Num. of members employed for pay	1.20	1.04	1.33	1.24	1.30	1.67	1.39	1.11	1.29	1.19
	(1.02)	(0.94)	(1.03)	(0.98)	(1.04)	(1.12)	(1.18)	(1.02)	(1.07)	(0.98)
Num. of members employed for profit (business)	0.85	0.76	0.68	0.71	0.69	0.34	0.84	0.67	0.77	0.81
	(0.88)	(0.80)	(0.80)	(0.79)	(0.78)	(0.64)	(0.81)	(0.71)	(0.84)	(0.79)
Rural (= 1 if household located in rural area; 0 otherwise)	0.88	0.64	0.48	0.45	0.48	NA	0.81	0.67	0.67	0.70
	(0.33)	(0.48)	(0.50)	(0.50)	(0.50)		(0.39)	(0.47)	(0.47)	(0.46)
Observations (no.)	6,496	2,640	4,885	4,857	3,934	12,199	6,084	4,151	4,205	4,982

Source: FIES 2018, Philippine Statistics Authority https://psa.gov.ph/tags/family-income-and-expenditure-survey.
Notes: Numbers in parentheses are standard errors. Region 8 = Eastern Visayas; Region 9 = Western Mindanao; Region 10 = Northern Mindanao; Region 11 = Southern Mindanao; Region 12 = Southern Mindanao or SOCCSKSARGEN; Region 13 = National Capital Region (NCR); Region 14 = Cordillera Administrative Region (CAR); Region 15 = Autonomous Region in Muslim Mindanao (ARMM); Region 16 = Caraga; Region 17 = Bangsamoro Autonomous Region in Muslim Mindanao (BARMM).

Table A3. Expenditure and price elasticities by income strata, urban subsample, Philippines, 2018.

	Expenditure			Uncompensated price		
Food group	Low	Middle	High	Low	Middle	High
RICE	0.827***	0.750***	0.685***	−1.003***	−0.954***	−0.919***
	(−0.016)	(−0.007)	(−0.006)	(−0.011)	(−0.006)	(−0.005)
OTHER CRLS	0.786***	0.889***	0.974***	−1.755***	−1.241***	−1.075***
	(−0.035)	(−0.012)	(−0.010)	(−0.023)	(−0.011)	(−0.008)
MEAT	1.089***	1.094***	1.129***	−0.903***	−1.077***	−1.071***
	(−0.017)	(−0.009)	(−0.009)	(−0.013)	(−0.011)	(−0.008)
FISH	1.060***	1.004***	0.982***	−1.247***	−1.152***	−1.065***
	(−0.018)	(−0.009)	(−0.008)	(−0.014)	(−0.009)	(−0.007)
FRUIT	0.795***	0.900***	1.099***	−1.003***	−1.029***	−0.997***
	(−0.029)	(−0.014)	(−0.013)	(−0.019)	(−0.012)	(−0.010)
VEGE	0.765***	0.742***	0.845***	−1.028***	−0.970***	−0.957***
	(−0.021)	(−0.009)	(−0.008)	(−0.018)	(−0.011)	(−0.008)
SUGAR	0.702***	0.606***	0.610***	−0.733***	−0.666***	−0.633***
	(−0.038)	(−0.017)	(−0.013)	(−0.042)	(−0.023)	(−0.015)
DRINKS	0.919***	0.818***	0.774***	−0.678***	−0.765***	−0.774***
	(−0.029)	(−0.014v	(−0.011)	(−0.017)	(−0.011)	(−0.008)
MISC	1.225***	1.263***	1.208***	−1.616***	−1.675***	−1.716***
	(−0.009)	(−0.006)	(−0.007)	(−0.009)	(−0.007)	(−0.007)

Source: Authors' computation using FIES 2018 https://psa.gov.ph/tags/family-income-and-expenditure-survey. Numbers in parentheses denote standard errors.
Notes: ***, **, * denote significance at 1 per cent, 5 per cent, and 10 per cent levels, respectively.

Table A4. Expenditure and price elasticities by income strata, rural subsample, Philippines, 2018.

	Expenditure			Uncompensated price		
Food group	Low	Middle	High	Low	Middle	High
RICE	0.785***	0.699***	0.682***	−1.034***	−0.819***	−0.924***
	(−0.011)	(−0.019)	(−0.008)	(−0.008)	(−0.017)	(−0.008)
OTHER CRLS	0.932***	0.975***	0.993***	−1.954***	−1.287***	−1.211***
	(−0.023)	(−0.010)	(−0.013)	(−0.016)	(−0.037)	(−0.012)
MEAT	1.057***	1.106***	1.140***	−0.938***	−0.865***	−1.014***
FISH	(−0.010)	(−0.012)	(−0.011)	(−0.007)	(−0.012)	(−0.011)
	1.154***	1.125***	1.122***	−1.300***	−1.100***	−1.196***
FRUIT	(−0.010)	(−0.011)	(−0.011)	(−0.007)	(−0.024)	(−0.010)
	0.953***	0.944***	1.053***	−1.166***	−1.075***	−1.183***
VEGE	(−0.021)	(−0.012)	(−0.017)	(−0.014)	(−0.017)	(−0.016)
	0.975***	0.929***	0.952***	−1.211***	−1.080***	−1.070***
SUGAR	(−0.013)	(−0.009)	(−0.012)	(−0.011)	(−0.019)	(−0.014)
	0.845***	0.817***	0.749***	−0.803***	−0.735***	−0.738***
DRINKS	(−0.020)	(−0.022)	(−0.017)	(−0.023)	(−0.032)	(−0.023)
	0.948***	0.940***	0.975***	−0.696***	−0.712***	−0.774***
MISC	(−0.019)	(−0.013)	(−0.016)	(−0.011)	(−0.024)	(−0.013)
	1.154***	1.193***	1.131***	−1.612***	−1.488***	−1.833***
	(−0.006)	(−0.012)	(−0.009)	(−0.005)	(−0.049)	(−0.010)

Source: Authors' computation using FIES 2018 https://psa.gov.ph/tags/family-income-and-expenditure-survey. Numbers in parentheses denote standard errors.
Notes: ***, **, * denote significance at 1 per cent, 5 per cent, and 10 per cent levels, respectively.

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