Nutrient elasticities of food consumption the case of Indonesia (M.Yamin)

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Nutrient elasticities of food consumption: the case of Indonesia

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Abstract

Purpose – The purpose of this paper is to assess nutrients elasticities of calories, proteins, fats, and carbohydrates in Indonesia.
Design/methodology/approach – Quadratic Almost Ideal Demand System is used on Indonesian socioeconomic household survey data.
Findings – Expenditure elasticities of nutrients in overall model range from 0.707 (for carbohydrates) to 1.085 (for fats), but expenditure elasticities in rural areas are higher than those in urban area. Most of price elasticities of nutrients have very small absolute value (not elastic) and all values are lower than the expenditure elasticities. However, the price of five groups of food commodities, namely, rice, oil and grease, fishes, meat, and other foods give significant influence on nutrients consumption.
Research limitations/implications – This research only includes four micronutrients, namely, calorie, protein, fat, and carbohydrate.
Originality/value – This research is one of very limited literatures about nutrient elasticity of food consumption in Indonesia.

Keywords Indonesia, QUAIDS, Nutrient elasticity
Paper type Research paper

1. Introduction

Quality food consumption is one of the Indonesian Government's main concerns in the development of food security. Diets should be balanced in terms of nutritional composition. This would enable the population to perform daily activities and the country to achieve appropriate health standards. Based on the recommendations of the 2012 National Workshop on Food and Nutrition X, the Regulation of the Minister of Health No. 75 of 2013, the Indonesian Government has established that the minimum energy requirement is 2,150 kilocalories per capita per day, while the minimum protein requirement is 57 grams per capita per day. Nutrition plays an important role in human health because of its links to many socioeconomic and health variables, such as malnutrition, the prevalence of disease, educational attainment, and employment status.

In 2012, the average per capita caloric consumption in Indonesia was 1,848.17 kilocalories per day below the minimum energy requirement, while the average consumption of protein per capita per day was 5.2 grams below the standard of protein adequacy (BPS, 2013). Further, the consumption of energy and protein in Indonesia declined over the past few decades. The low nutritional intake is also reflected in the high rates of malnutrition among Indonesian children under age 5, which in 2013 reached 18.3 percent (Balitbangkes, 2013). Indonesia also faces the problem of the low diversification of food consumption, which is indicated by the low score for the desirable dietary pattern (*Pola Pangan Harapan*) and the high dependence on staple foods, especially rice.

During the period 2003-2013, the annual food-inflation rate in Indonesia, in general, exceeded 10 percent per year and was almost always higher than the total inflation rate. This means that, every year, food prices experienced considerable increases, and that these

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price increases exceeded those of non-food necessities. Further, when food inflation is low, total inflation is also low. Annual food inflation has shown large fluctuations. During the period under review, the lowest food-inflation rate was 3.88 percent for 2009 and the highest rate was 16.35 percent for 2008.

Increasing food prices have led to increases in the percentage of household budgets allocated to food consumption. This means that if household incomes remain relatively unchanged, then rising food prices will cause a decline in household purchasing power. Households often respond to this situation by reducing their demand for foodstuffs or by replacing what they normally consume with cheaper foodstuffs. Thus, an increase in food prices can influence household's food-consumption patterns in terms of both quantity and quality. Income is another factor that influences the quality of household food consumption. The higher the income, the higher the household's ability to provide food whose consumption meets an appropriate standard of health.

The impact of increasing food price and changing income levels on the quality of food consumption can be studied through the nutrients elasticity of household food consumption. This information is useful to policymakers in terms of designing policies aimed at food provision, and food-price stabilization, by guaranteeing food affordability, especially for low-income households. The main objective of this study is to assess the nutrients elasticities of calories, proteins, carbohydrates, and fats in Indonesia, using household survey data Survei Sosial Ekonomi Nasional (SUSENAS) conducted in 2013. Furthermore, this study is expected to provide information to assist policymakers in determining policies aimed at improving the quality of the food consumed so as to address the struggle against malnutrition in Indonesia.

Literature review

In recent years, researchers have been focusing on nutrition demand. Most studies have been on evaluating either the income or the price elasticity of nutrient consumption so as to determine the relationship between nutrients consumption (especially calorie consumption) and changes in income or food prices (Pitt, 1983; Behrman and Deolalikar, 1987; Sahn, 1988; Bouis, 1994; Huang, 1996; Subramanian and Deaton, 1996; Grimard, 1996; Dawson and Tiffin, 1998; Rae, 1999; Gibson and Rozelle, 2002; Skoufias, 2003; Moeis, 2003; Abdulai and Aubert, 2004; Fousekis and Lazaridis, 2005; Akinleye and Rahji, 2007; Babatunde *et al.*, 2010; Irz, 2010; Aromolaran, 2010; Ecker and Qaim, 2011; Skoufias *et al.*, 2011; Zheng and Henneberry, 2012; Widarjono, 2012; Anriquez *et al.*, 2013).

Conclusions differ regarding the effect of changes in income on nutrients consumption. This is because these studies had a wide range of estimates for income elasticities. Salois *et al.* (2012) reviewed studies of income-nutrients elasticity and found that the impact of income on nutrients consumption differs across the income distribution and between poor and rich countries. Santeramo and Shabnam (2015) concluded that the different results are also due to the quality of the data used in these studies. In a cross-country study on the impact of prices on nutrients consumption, Anriquez *et al.* (2013) found that a price increase reduces the mean consumption and worsens the distribution of calories across a population, thereby causing the nutritional status of the population to deteriorate.

There are relatively few studies on nutrients elasticities of food consumption in Indonesia. Using SUSENAS 1990 data, Rae (1999) studied the elasticity of food consumption with respect to total household expenditures in urban Java and found it to be very small, especially with respect to the elasticities of calories and carbohydrates consumption. Skoufias (2003) examined the income elasticity of the price impact on calorie consumption, using SUSENAS 1996 and 1999 data. Skoufias *et al.* (2011) also evaluated the income elasticity of other micronutrients before and after the economic crisis of 1997. The results show that the income elasticity of the consumption of calories and other micronutrients did not significantly change immediately before (1996) and after (1999) the crises. Moeis (2003) also used nutrients elasticities (calories, proteins, carbohydrates, and fats) to study the impact of the economic crisis of 1997, using SUSENAS data (1996, 1999). In contrast to Skoufias (2003) and Skoufias *et al.* (2011), Moeis (2003) concluded that the consumption of nutrients is responsive to income or expenditures; he also found that the elasticity of expenditures increased during the crisis, although the elasticity of nutrients relative to the change in the price of rice was quite small (between −0.20 and −0.22) and declined after the economic crisis. Widarjono (2012) also examined the elasticity of calories, proteins, fats, and carbohydrates consumed in Indonesia, by using SUSNAS 2011. He found that the expenditure elasticities ranged from 0.59 to 0.75 and were lower than the results of Moeis's (2003) study. Widarjono (2012) also found that the price of eggs and milk had the most influence on the consumption of calories, proteins, and carbohydrates.

3. Methods

The data used in this study were obtained from Indonesia's National Socioeconomic Survey for 2013 (SUSENAS). SUSENAS is a household survey that collects data on household consumption, which include over 200 food commodities consumed in Indonesian households. Since 2011, SUSENAS has conducted its survey on a quarterly basis, using the same sample size each quarter but different sample households. In this study, we used only the SUSENAS data from the survey conducted in March 2013.

This study consists of two stages of the estimation process. The first stage estimates the price and income elasticities, using Quadratic Almost Ideal Demand System (QUAIDS) of Banks *et al.* (1997). In the second stage, we calculate the nutrients elasticity of calories, proteins, fats, and carbohydrates. The QUAIDS models used in this study were formulated, following Ray (1983) and Poi (2012), by incorporating socio-demographic variables as follows:

$$w_i = \propto_i + \sum_j \gamma_{ij} \ln \boldsymbol{p}_j + (\beta_i + \boldsymbol{\eta}_i' \boldsymbol{D}) \ln \left[\frac{x}{\overline{m}_0(\boldsymbol{D}) a(\boldsymbol{p})} \right]$$

$$+ \frac{\lambda_i}{b(\boldsymbol{p}) c(\boldsymbol{p}, \boldsymbol{D})} \left\{ \ln \left[\frac{x}{\overline{m}_0(\boldsymbol{D}) a(\boldsymbol{p})} \right] \right\}^2 + u_i$$

where w_i is the budget share of the ith food group, p_j is the price of the jth food group, x is total household expenditures on food, $\boldsymbol{D}$ is the vector of the demographic variables, $\boldsymbol{p}$ is the vector of the price, $\overline{m}_0(\boldsymbol{D}) = 1+\rho'\boldsymbol{D}$, $c(\boldsymbol{p}, \boldsymbol{D}) = \prod_j \boldsymbol{p}_j^{\eta_j' \boldsymbol{D}}$, $\ln a(\boldsymbol{p}) = \alpha_0 + \sum_{(i=1)}^n \alpha_i \ln \boldsymbol{p}_i + \sum_{(i=1)}^n \sum_{j-i}^n \gamma_{ij} \ln \boldsymbol{p}_i \ln \boldsymbol{p}_j$ is the price index, $b(\boldsymbol{p}) = \prod_{i=1} \boldsymbol{p}_i^{\beta_i}$ is the Cobb-Douglas price aggregator, and $\propto_i, \gamma_{ij}, \beta_i, \lambda_i, \eta_i, \rho$ are unknown parameters.

We impose restrictions to the above demand model, namely, by adding up $\left(\sum_{i=1}^n \alpha_i = 1, \sum_{i=1}^n \gamma_{ij} = 0, \text{ and } \sum_{i=1}^n \beta_i = 0\right)$, homogeneity $(\sum_{j=1}^n \gamma_{ij} = 0)$, and symmetry $(\gamma_{ij} = \gamma_{ji})$, in order to be consistent with consumer demand theory. To simplify the estimation of demand, we use only 14 food groups, namely, rice, non-rice staples, tubers, fish, meat, eggs, milk, vegetables, pulses, fruits, oil and grease, beverage ingredients, spices, and other foods. The above QUAIDS model was estimated using a seemingly unrelated regression technique. Because of the non-linearity in the parameters and the cross-equation restrictions of the demand system, we used the iterative feasible generalized non-linear least squares estimation method to obtain more efficient estimates of the parameters. Adding up this restriction causes the singularity of the covariance matrix of the error term u_i, so that in the estimation process, the last equation in the demand system must be dropped (Poi, 2012).

Household demographic variables are included, in the model, to control for variations in the structure of preferences between households that are due to differences in their demographic characteristics. Some researchers also incorporate household demographic variables in their demand models, such as those conducted by Pollak and Wales (1981), Rain (1983), Deaton and Paxson (1998), and Denton *et al.* (1999). Research that examines food demand in Indonesia also incorporates demographic variables (Moeis, 2003; Widarjono, 2012). In this study, we use six demographic variables: household size, the number of children under five years of age, the urban/rural classification, household head education level (completed senior high school or not), household head employment sector (agriculture or non-agriculture), and income groups (40 percent lowest income, 40 percent medium income, and 20 percent highest income).

The purchase prices of the food commodities were not explicitly recorded in the SUSENAS questionnaire, so these raw data were not available. As a result, this research used the unit-value approach as an approximation of these prices; this method gives the ratio of food-commodity expenditures (in rupiahs) to the quantity of food commodities consumed. But, as noted by Deaton (1987), Cox and Wohlgenant (1986), and Hoang (2009), justification must be applied to the above unit-value approximation so as to handle variations in food prices or food quality. Following Hoang (2009), we used the following justification equations:

$$v_i = \bar{v}_i + \varphi_i x + \boldsymbol{\theta D} + \varepsilon_i \text{ and } p_i = \overline{\bar{v}_i + \widehat{\varepsilon_i}}$$

where $v_i = (1)/(n_i)\sum_k[(v_{ik})(x_{ik}/x_i)]$ and $v_{ik} = (x_{ik})/(q_{ik})$ are the unit values of the ith food subgroup and the kth food commodity, respectively; x_{ik}, x_i, and x are expenditures on the kth food commodity, the ith subgroup, and the total food expenditures, respectively; q_{ik} is the quantity consumed of the kth food commodity; n_i is the number of different food commodities in ith food subgroup; $\boldsymbol{D}$ is the vector of the demographic variables; φ_i and $\boldsymbol{\theta}$ are unknown parameters; ε_i is a residual; $\bar{v}_i$ and $\bar{v}_i + \widehat{\varepsilon_i}$ denote the means of the unit values at the community level (census block); and p_i is the adjusted price of the commodity to be used in the QUAIDS model.

The elasticity estimate of the QUAIDS model was calculated using the following equations (Poi, 2012):

(1) Income/expenditure elasticity:

$$e_{ix} = \frac{\mu_i}{w_i} + 1,$$

(2) Uncompensated price elasticity:

$$e_{ij} = \frac{\mu_{ij}}{w_i} - \delta_{ij},$$

(3) Compensated price elasticity:

$$e^*_{ij} = e_{ij} + e_{ix} w_j,$$

where: $\mu_i \equiv \frac{\partial w_i}{\partial \ln x} = \left(\beta_i + \boldsymbol{\eta_i}'\boldsymbol{D}\right) + \frac{\lambda_i}{b(\boldsymbol{p})c(\boldsymbol{p},\boldsymbol{D})} \ln \left[\frac{x}{\overline{m}_0(\boldsymbol{D})a(\boldsymbol{p})}\right]$, δ_{ij} is Kronecker δ ($\delta_{ij} = 1$ for $i = j$ and $\delta_{ij} = 0$ for $i \neq j$), and: $\mu_{ij} \equiv \frac{\partial w_i}{\partial \ln \boldsymbol{p}_j} = \gamma_{ij} - \mu_i(\alpha_i + \sum_k \gamma_{jk} \ln \boldsymbol{p}_k) - \frac{\lambda_i(\beta_i + \boldsymbol{\eta}_i'\boldsymbol{D})}{b(\boldsymbol{p})c(\boldsymbol{p}, \boldsymbol{D})}\{\ln[\frac{x}{a(\boldsymbol{p})}]\}^2$.

The nutrients elasticities consist of the elasticities of calories, proteins, fats, and carbohydrates, and are calculated following Pitt (1983), Sahn (1988), Huang (1996), Ecker and Qaim (2011), and Widarjono (2012) as follows:

(1) Income/expenditure elasticity:

$$E_N = \frac{\sum_i \sum_k c_{ikN} q_{ik} e_{ix}}{\sum_i \sum_k c_{ikN} q_{ik}},$$

(2) Price elasticity:

$$e_{Nj} = \frac{\sum_i \sum_k c_{ikN} q_{ik} e_{ij}}{\sum_i \sum_k c_{ikN} q_{ik}},$$

where E_N is the nutrients elasticity with respect to income/expenditure; e_{Nj} is the nutrients elasticity with respect to the price of food group j; C_{ikN} is the coefficient of the nutrient content (N) of food item k of food group i, q_{ik} specifies the average quantity consumed of food item k in food group i; e_{ix} denotes the income elasticity of food demand; and e_{ij} is the uncompensated price elasticity of food demand.

4. Results and discussion

Average nutrients consumption

The average calorie consumption per capita in Indonesia is 1,963.22 kilocalories per day below the Indonesian minimum daily energy requirement. The main sources of calories are rice, followed by oil and grease, beverage ingredients, and other foods. Caloric consumption from non-rice staples and tubers is still relatively small. In rural areas, the caloric consumption from rice, non-rice staples, oil and grease, and beverage ingredients is higher than in urban areas, whereas the caloric consumption derived from other foods (including prepared foods) is higher in urban than in rural areas.

In overall, the average consumption of proteins is 56.52 grams per capita per day, which is also below the minimum protein requirement. Proteins consumption also mainly comes from rice, followed by fish, and other foods (including prepared foods) in both urban and rural areas. The proportion of protein consumption from fish as a source of animal protein appears to be small, as well as is the consumption of protein derived from eggs. The consumption of vegetable proteins from legumes is also still quite small.

The consumption of fats in Indonesia averages 42.23 grams per capita per day, and carbohydrates consumption averages 311.47 grams per capita per day. The highest proportion of fats consumed come from oil and grease, followed by fats from other food groups, while the consumption of fat from meat appears to be very low. Rice is the main source of carbohydrate intake, followed by other food and beverage ingredients. The proportion of carbohydrates that are derived from non-rice staples and tubers also seems to be very low.

The consumption of calories, proteins, and carbohydrates is lower in urban areas than in rural ones, but average fat consumption is only slightly higher in urban than in rural areas (Table I).

Food demand elasticity

Table II presents the parameter estimates of the QUAIDS model. Of the coefficients, 147 of 252 (58.33 percent) are significant at the 5 percent level, while for the price coefficients 43.75 percent are significant at the 5 percent level. From the table, we can see that 10 of the 14 coefficients of the quadratic term are significant at the 5 percent level. This leads us to conclude that the model that uses a quadratic term is more precise than the linear model is.

Table III shows the expenditure elasticities and own-price elasticities for all groups of food commodities. In line with economic theory, all income/expenditure elasticities are positive and all own-price elasticities are negative. Milk has the highest expenditure elasticity, followed by meat, fruits, and other foods, and rice has the lowest expenditure elasticity. This means that changes in income mostly affect the consumption of milk, meat, fruits, and other foods but do

Table I. Average nutrients consumption per capita, per day, by food group

Food groups	Calories (kcal)			Proteins (gram)			Fats (gram)			Carbohydrates (gram)		
	Overall	Urban	Rural	Overall	Urban	Rural	Overall	Urban	Rural	Overall	Urban	Rural
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Rice	893.02	800.01	963.24	20.89	18.72	22.53	3.58	3.20	3.86	191.20	171.29	206.23
Non-rice staples	28.77	18.89	36.22	0.74	0.49	0.94	0.21	0.09	0.30	6.30	4.25	7.84
Tubers	52.21	21.50	75.40	0.41	0.22	0.56	0.11	0.05	0.15	12.40	5.07	17.93
Fishes	57.84	53.30	61.27	9.55	8.96	9.99	1.69	1.49	1.83	0.49	0.42	0.55
Meat	40.42	51.99	31.68	2.43	3.24	1.82	3.33	4.23	2.65	0.03	0.05	0.01
Eggs	25.44	29.69	22.23	2.02	2.36	1.76	1.80	2.10	1.57	0.11	0.13	0.10
Milk	26.26	37.39	17.86	1.00	1.49	0.63	1.04	1.57	0.65	3.30	4.44	2.44
Vegetables	40.04	34.80	44.00	2.70	2.20	3.07	0.67	0.61	0.71	7.06	6.07	7.81
Pulses	45.93	53.24	40.41	4.35	5.18	3.73	2.24	2.55	2.00	2.75	3.13	2.47
Fruits	44.71	44.91	44.56	0.51	0.53	0.51	0.33	0.35	0.32	10.71	10.75	10.67
Oil and grease	257.77	250.66	263.14	0.35	0.24	0.43	17.18	15.95	18.12	1.22	0.80	1.53
Beverage ingredients	106.10	98.46	111.87	1.13	1.11	1.15	0.21	0.20	0.21	27.00	25.11	28.43
Spices	14.54	15.16	14.07	0.60	0.63	0.57	0.67	0.72	0.64	1.75	1.80	1.72
Other foods	330.17	440.50	246.88	9.84	14.01	6.69	11.72	15.31	9.02	43.80	58.04	33.06
Total	1,963.22	1,950.50	1,972.83	56.52	59.38	54.37	44.78	48.41	42.04	308.12	291.34	320.79

Source: Authors' calculations

Table II.
Parameter estimates of the QUAIDS model

Independent variables (1)	$w1$ (2)	$w2$ (3)	$w3$ (4)	$w4$ (5)	$w5$ (6)	$w6$ (7)	$w7$ (8)	$w8$ (9)	$w9$ (10)	$w10$ (11)	$w11$ (12)	$w12$ (13)	$w13$ (14)	$w14$ (15)
	Dependent variables													
α_i (constants)	−0.320***	0.019***	0.030***	0.156***	0.150***	0.015***	0.230***	0.010	−0.030***	0.180***	0.002	0.025***	0.017***	0.518***
β_i ($\ln x/\boldsymbol{p}$)	−0.012**	0.004***	0.006***	0.004	0.011***	−0.008***	0.049***	−0.005	−0.017***	0.004	−0.003*	0.001	−0.005***	−0.031***
γ_{ij}														
ln $\boldsymbol{p}1$	0.110***	0.002***	−0.003***	−0.021***	−0.005***	0.001*	−0.022***	0.006***	0.008***	−0.021***	0.006***	0.001**	−0.006***	−0.057***
ln $\boldsymbol{p}2$		−0.006***	0.000	0.000*	0.001**	−0.001***	0.000**	0.003***	0.001***	−0.004***	0.003***	0.000	0.000	0.001***
ln $\boldsymbol{p}3$			0.000	0.001***	0.000	−0.001***	0.000	0.003***	−0.001***	−0.002***	0.000	0.000*	0.000	0.002***
ln $\boldsymbol{p}4$				−0.006***	0.000	−0.001*	−0.004***	0.006***	0.002***	0.003***	−0.001***	−0.002***	0.000*	0.024***
ln $\boldsymbol{p}5$					−0.006***	−0.004***	0.001*	−0.001	0.000	0.002***	−0.001***	0.001**	0.000	0.012***
ln $\boldsymbol{p}6$						0.002***	−0.003***	0.001***	0.002***	0.002***	0.001***	−0.001***	0.003***	−0.002***
ln $\boldsymbol{p}7$							0.018***	−0.002***	−0.002***	0.003***	−0.001***	−0.002***	−0.002***	0.014***
ln $\boldsymbol{p}8$								−0.015***	−0.004***	0.004***	−0.003***	0.000	−0.001***	0.004***
ln $\boldsymbol{p}9$									−0.012***	0.003***	0.001	0.003***	0.001***	−0.004***
ln $\boldsymbol{p}10$										−0.012***	0.002***	0.000	0.002***	0.017***
ln $\boldsymbol{p}11$											−0.006***	0.000	0.001***	−0.001**
ln $\boldsymbol{p}12$												−0.001***	0.001***	−0.001
ln $\boldsymbol{p}13$													0.003***	0.000*
ln $\boldsymbol{p}14$														−0.008***
λ_i ($(\ln x/\boldsymbol{p})^2$)	0.008***	0.001***	0.001***	0.000	−0.001**	−0.001***	0.003***	0.002***	−0.001***	−0.002***	0.001***	0.001***	0.000*	−0.011***
η_i														
$\boldsymbol{D}1$	−0.001**	0.000***	0.000	0.001***	0.001***	0.000***	0.001***	0.001***	0.000	0.001***	0.000	0.001***	0.000***	−0.005***
$\boldsymbol{D}2$	−0.008***	0.000***	0.000***	−0.001***	0.000**	0.000***	0.002***	−0.001***	0.000	0.001***	0.000***	0.000***	0.000**	0.008***
$\boldsymbol{D}3$	0.005***	0.000	0.000***	0.001***	0.000**	0.000***	−0.008***	0.001***	0.000***	0.000	0.001***	0.001***	0.000***	−0.001**
$\boldsymbol{D}4$	0.001**	0.000	0.000	0.000**	−0.001***	0.000***	−0.002***	0.001***	0.000***	−0.001***	0.000**	0.001***	0.000***	0.001**
$\boldsymbol{D}5$	−0.004***	0.000***	0.000***	−0.002***	0.000	0.000	0.001***	−0.002***	0.000***	0.000	−0.001***	−0.001***	0.000***	0.011***
$\boldsymbol{D}6$	0.003***	0.000***	0.000	−0.004***	−0.002***	−0.001***	−0.001***	0.001***	0.001***	−0.001***	0.001***	0.000**	0.000***	0.002***
$\boldsymbol{D}7$	0.008***	0.000***	0.000**	−0.004***	−0.003***	0.000***	−0.002***	0.005***	0.003***	−0.003***	0.002***	0.002***	0.001***	−0.009***
ρ	$\rho1 = -0.186$***		$\rho2 = -0.048$***		$\rho3 = 0.001$		$\rho4 = -0.055$***		$\rho5 = -0.027$*		$\rho6 = 0.049$***		$\rho7 = 0.195$***	

Notes: The empty cells are not stated because of the symmetry constraint. *,**,***Significant at 10, 5, and 1 percent, respectively
Source: Authors' calculations

Table III. Expenditure and own-price elasticities by food group and urban-rural classification

Food group	Expenditure elasticities			Uncompensated own-price elasticities			Compensated own-price elasticities		
	Overall	Urban	Rural	Overall	Urban	Rural	Overall	Urban	Rural
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Rice	0.390	0.305	0.462	−0.508	−0.420	−0.583	−0.434	−0.371	−0.479
Non-rice staples	0.768	0.769	0.767	−1.667	−1.897	−1.510	−1.661	−1.892	−1.502
Tubers	0.718	0.728	0.710	−1.018	−1.022	−1.015	−1.011	−1.016	−1.007
Fish	0.968	0.970	0.966	−1.059	−1.062	−1.056	−0.964	−0.971	−0.955
Meat	1.494	1.445	1.564	−1.197	−1.180	−1.220	−1.139	−1.120	−1.166
Eggs	0.945	0.931	0.963	−0.934	−0.934	−0.934	−0.906	−0.906	−0.906
Milk	1.740	1.650	1.906	−0.734	−0.778	−0.656	−0.675	−0.710	−0.605
Vegetables	0.791	0.791	0.791	−1.126	−1.141	−1.112	−1.038	−1.060	−1.014
Pulses	0.906	0.899	0.913	−1.368	−1.376	−1.359	−1.337	−1.346	−1.327
Fruits	1.447	1.421	1.482	−1.266	−1.254	−1.281	−1.186	−1.173	−1.203
Oil and grease	0.730	0.720	0.740	−1.153	−1.170	−1.136	−1.122	−1.143	−1.102
Beverage ingredients	0.780	0.777	0.784	−1.018	−1.022	−1.014	−0.979	−0.989	−0.969
Spices	0.926	0.926	0.925	−0.889	−0.879	−0.898	−0.866	−0.858	−0.873
Other foods	1.390	1.301	1.548	−1.242	−1.194	−1.326	−0.860	−0.772	−0.992

Source: Authors' calculation

not have much effect on rice consumption. Expenditure elasticities for rice and other foods differ the most between urban and rural areas as compared to the other food groups. For the fourth food group, namely, meat, milk, fruits, and other foods, the elasticity of expenditure is higher than the own-price elasticity, which suggests that the income effect on household consumption is higher than the price effect is. By contrast, eight food groups have own-price elasticities that are higher than their expenditure elasticities, namely, rice, non-rice staples, tubers, fish, vegetables, pulses, oil and grease, and beverage ingredients. For those eight groups, the price effect on household food consumption is higher than the income effect is.

Six food groups have absolute values of uncompensated own-price elasticities that are close to 1, that is, between 0.9 and 1.1; these include tubers, fish, eggs, vegetables, oil and grease, and beverage ingredients. This indicates that the percentage increase in the prices of foods in these groups is almost proportional to the percentage decrease in food consumption. The highest own-price elasticities are found for pulses, other foods, and fruits, but the lowest also belong to rice. As a main food commodity, rice has the lowest expenditure and own-price elasticities, where rising incomes and a change in price prices do not have much effect on rice consumption. Compared to the uncompensated own-price elasticities, all of the compensated own-price elasticities have lower absolute values, which shows that the effect of rising food prices on food consumption can be lowered through compensation.

For most food groups, the absolute values of the cross-price elasticity are very small, i.e., close to 0. From this, it can be concluded that the consumption of most food commodities is independent of the price of other similar foods. Nonetheless, a rise in the price of rice and vegetables causes the most response in terms of the consumption of other alternative foods, but elasticity is still very low (the cross-price elasticity can be seen in Tables AI-AVI).

Nutrient elasticities

Table IV presents nutrients elasticities of food consumption in Indonesia. All of the expenditure elasticities (as a proxy of income elasticities) are positive, which is in line with the theory that rising incomes lead to increases in nutrients consumption. By contrast, most of the price elasticities are negative, meaning that an increase in food prices leads to a decline in nutrients consumption, although not entirely. Some positive values of price elasticities arise because these food groups do not contain the corresponding nutrients.

In the overall model, the expenditure elasticities ranged from 0.707 for carbohydrates to 1.085 for fats. The consumption of fats and proteins is more elastic with respect to expenditure than is the consumption of calories and carbohydrates. This means that rising expenditures or incomes lead to the higher consumption of fats and proteins compared to the consumption of calories and carbohydrates. These results are consistent with those of Widarjono (2012).

In the overall model, the consumption of carbohydrates, calories, and proteins is most affected by changes in the price of rice. A 1 percent increase in the price of rice caused a decrease in the consumption of carbohydrates by 0.327 percent; caloric consumption decreased by 0.238 percent; and proteins consumption decreased by 0.216 percent. While the consumption of fats is most affected by the prices of oil and grease, other foods, and meat, in which a 1 percent increase in the price of oil and grease will reduce fats consumption by 0.347 percent, a 1 percent increase in the prices of other foods lowered fats consumption by 0.230 percent, and an increase in meat prices also reduced fats consumption by 0.197 percent. An increase in the prices of other foods also affects caloric consumption; that is, a 1 percent rise in the price of other foods caused a decline in calorie consumption by 0.130 percent.

In addition to the four food groups mentioned above, fish is another food group that has relatively high price elasticity of nutrients consumption. A 1 percent increase in the price of fish caused a decline in the consumption of proteins by 0.173 percent. Thus, in the overall

Table IV. Expenditure and price elasticity of nutrients consumption in Indonesia

Food group	Overall				Urban				Rural			
	Calories	Proteins	Fats	Carbohydrates	Calories	Proteins	Fats	Carbohydrates	Calories	Proteins	Fats	Carbohydrates
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Expenditure elasticity	0.820	0.927	1.085	0.707	0.792	0.909	1.059	0.668	0.848	0.942	1.121	0.744
Price elasticity												
Rice	−0.238	−0.216	−0.068	−0.327	−0.189	−0.177	−0.052	−0.268	−0.288	−0.260	−0.088	−0.383
Non-rice staples	−0.054	−0.048	0.010	−0.094	−0.051	−0.044	0.014	−0.095	−0.058	−0.053	0.005	−0.095
Tubers	−0.038	−0.014	−0.005	−0.059	−0.032	−0.013	−0.004	−0.051	−0.045	−0.015	−0.006	−0.067
Fish	−0.049	−0.173	−0.042	−0.026	−0.054	−0.177	−0.040	−0.034	−0.044	−0.171	−0.044	−0.020
Meat	−0.044	−0.109	−0.197	0.025	−0.043	−0.107	−0.190	0.028	−0.044	−0.110	−0.207	0.023
Eggs	−0.018	−0.048	−0.054	−0.002	−0.018	−0.048	−0.051	−0.002	−0.019	−0.049	−0.058	−0.002
Milk	−0.041	−0.053	−0.054	−0.038	−0.047	−0.060	−0.060	−0.044	−0.034	−0.044	−0.043	−0.032
Vegetables	0.016	−0.020	−0.039	0.045	0.019	−0.013	−0.039	0.053	0.012	−0.028	−0.041	0.038
Pulses	−0.011	−0.101	−0.070	0.024	−0.010	−0.105	−0.071	0.029	−0.010	−0.094	−0.069	0.021
Fruits	−0.049	−0.014	0.021	−0.098	−0.052	−0.016	0.024	−0.108	−0.048	−0.014	0.019	−0.089
Oil and grease	−0.109	0.012	−0.347	0.037	−0.109	0.015	−0.335	0.044	−0.109	0.009	−0.365	0.031
Beverage ingredients	−0.042	−0.009	−0.003	−0.074	−0.040	−0.008	−0.001	−0.072	−0.046	−0.011	−0.004	−0.076
Spices	−0.012	−0.014	−0.008	−0.017	−0.013	−0.014	−0.006	−0.020	−0.012	−0.015	−0.009	−0.015
Other foods	−0.130	−0.118	−0.230	−0.104	−0.153	−0.143	−0.246	−0.129	−0.103	−0.086	−0.210	−0.077

Source: Authors' calculation

model, we found five food groups that have a significant price influence on the nutritional intake of calories, proteins, fats, or carbohydrates, namely, rice, fish, oil and grease, meat, and other foods.

In urban areas, the expenditure elasticity is between 0.668 (carbohydrates) and 1.059 (fats), in which fats and proteins are also more elastic to expenditure compared to calories and carbohydrates. In rural areas, the expenditure elasticity appears to be higher than in urban areas; here, expenditures are also the lowest on carbohydrates (0.744) and the highest on fats (1,121). The expenditure elasticities of nutrients in the fourth food group tend to be lower in urban than in rural areas, indicating that the consumption of nutrients tends to be more easily met by urban dwellers compared to those living in rural communities.

In the overall model, in both urban and rural areas, increases in the prices of rice, oil and grease, fish, meat, and other foods have the most influence on nutrients consumption; however, none of them are price elastic. The greatest elasticity is seen in the price elasticity of caloric consumption with respect to rice prices and also in both urban and rural areas. But in urban areas, the price elasticity of caloric consumption with respect to the prices of other substitute foods is also relatively high. A 1 percent increase in rice prices caused caloric consumption in urban areas to decrease by 0.189 percent, which is lower than in the overall model. At the same time, caloric consumption in rural areas dropped by 0.288 percent. In urban areas, a 1 percent increase in the prices of other foods caused a decline in the consumption of calories by 0.153 percent.

The predominate price elasticities of proteins consumption in urban areas are for rice, fish, and other foods. Rural areas stand out in terms of the elasticity of proteins consumption with respect to the price of rice and fish. The price elasticity of proteins with respect to rice prices also tends to be lower in urban areas compared to rural ones. That is, a 1 percent increase in rice prices causes a drop in proteins consumption in urban areas by 0.177 percent and in rural areas by 0.260 percent. The elasticity of proteins consumption with respect to the price of fish is relatively similar between urban and rural areas, while the elasticity of the proteins consumption with respect to other food prices is higher in urban than in rural areas.

Fats consumption is most affected by price increases of foods commodities in three groups, namely, oil and grease, other foods, and meat, in both urban and rural areas. However, the elasticity of fats consumption, with respect to the price of oil and grease and meat, tends to be higher in rural than in urban areas. But, the elasticity of fats consumption from a price increase on other foods is lower in rural than in urban areas. A 1 percent increase in the prices of oil and grease causes a decrease in fats consumption by 0.365 percent in rural areas and 0.335 percent in urban ones, while a decline in the consumption of fats due to a 1 percent increase in meat prices is 0.207 percent in rural and 0.190 percent urban areas. The percentage reduction in fats consumption as a result of a 1 percent increase in the prices of other foods amounted to 0.246 percent in urban areas, and 0.210 percent in rural ones.

Carbohydrate consumption is only affected by increases in rice prices in both urban and rural areas as well as in the overall model, but the effect is lower in urban areas than in rural ones. The elasticity of carbohydrates consumption with respect to rice prices is −0.268 in urban areas while −0.383 in rural ones. A 1 percent increase in rice prices in urban areas results in a decrease in carbohydrates consumption by 0.268 percent, while in rural areas the effect is a 0.383 percent decrease in carbohydrates consumption.

Compared with the absolute value of price elasticities, all expenditure elasticities are higher, indicating that the income influence on the quality of food consumption is stronger than the price influence is. This finding is in line with the previous research on Indonesia conducted by Ilham *et al.* (2006), which used different methods and found that the price impact on caloric consumption is very small and that the income effect is higher.

5. Conclusion and recommendations

Using the SUSENAS data collected in March 2013, this study explains the nutrients-consumption pattern in Indonesia for 2013. From the descriptive analysis, the study found that the average nutrient consumption was below the minimum nutrients requirement, especially in terms of calories and proteins. The main source of calories comes from rice, followed by other foods, oil and grease, and beverage ingredients; the consumption of proteins mainly comes from rice, fish, and other foods; the consumption of fats comes mainly from oil and grease and other foods; and carbohydrate consumption is mostly obtained from rice and other foods. The consumption of calories, proteins, and carbohydrates is lower in urban than in rural areas, except for fats consumption, which is higher in urban areas.

Based on the elasticity of demand for food, we found that milk, meat, fruits, and other foods have the highest expenditure elasticities, and rice has the lowest. Six food groups have own-price elasticities that are close to unitary elasticity, namely, tubers, fish, eggs, vegetables, oil and grease, and beverage ingredients. The highest price elasticities are found for pulses and other foods, and fruits; the lowest are found for rice. As a main food commodity, rice has both the lowest expenditure and own-price elasticities, where rising incomes and changes in rice prices do not have much effect on its consumption. Most food groups have an absolute value of cross-price elasticity that is very small or close to 0, which means that most of food commodities are independent of the price of their alternatives.

The expenditure elasticities of nutrients, in the overall model, range from 0.707 (for carbohydrates) to 1.085 (for fats) and are higher in rural than in urban areas. The consumption of fats and proteins is more elastic with respect to expenditure than is the consumption of calories and carbohydrates. This means that rising expenditures or incomes lead to an increase in the consumption of fats and proteins that is higher than the increase in the consumption of calories and carbohydrates.

Most of price elasticities of nutrients have very small absolute values (not elastic) and all of these values are lower than the expenditure elasticities are. However, the price of commodities in the five food groups, namely, rice, oil and grease, fish, meat, and other foods, has a significant influence on nutrients consumption. In the overall model, the consumption of carbohydrates, calories, and proteins are most affected by changes in the price of rice, while the consumption of fats is most affected by changes in the price of oil and grease, other foods, and meat. In addition to the commodities in the four food groups mentioned above, fish is another food group that has a relatively large price elasticity of protein consumption. In contrast, the expenditure and price elasticities of nutrients in rural areas are higher than in urban areas.

The important policy implications of this study are as follows. First, a policy that aims to increase incomes would be very important in terms of improving the quality of food consumption in Indonesia. This policy would be even more effective than a food-price-stability policy would be. Second, to maintain the quality of the food consumed in Indonesia, rather that see it decrease due to price increases food-price stabilization policies could emphasize four food groups, in particular, namely, rice, oil and grease, fish, and meat.

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(The Appendix follows overleaf.)

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Appendix

Table AI.
Uncompensated cross-price elasticity (Marshallian), overall model

Food groups (1)	$w1$ (2)	$w2$ (3)	$w3$ (4)	$w4$ (5)	$w5$ (6)	$w6$ (7)	$w7$ (8)	$w8$ (9)	$w9$ (10)	$w10$ (11)	$w11$ (12)	$w12$ (13)	$w13$ (14)	$w14$ (15)
$w1$ = rice		0.012	−0.009	−0.059	0.034	0.018	−0.026	0.059	0.052	−0.034	0.039	0.021	−0.021	0.032
$w2$ = non-rice staples	0.208		−0.015	−0.025	0.101	−0.099	0.029	0.374	0.164	−0.404	0.312	−0.038	0.001	0.290
$w3$ = tubers	−0.226	−0.012		0.119	−0.023	−0.057	−0.043	0.319	−0.028	−0.189	0.020	0.042	0.000	0.378
$w4$ = fishes	−0.224	−0.004	0.010		0.009	−0.005	−0.038	0.058	0.021	0.038	−0.015	−0.015	−0.003	0.260
$w5$ = meat	−0.045	0.016	−0.014	−0.030		−0.122	−0.053	−0.042	0.005	−0.016	−0.033	0.012	−0.013	0.039
$w6$ = eggs	0.005	−0.029	−0.022	−0.015	−0.137		−0.049	0.035	0.066	0.081	0.038	−0.020	0.090	−0.053
$w7$ = milk	−0.401	−0.001	−0.023	−0.185	−0.070	−0.067		−0.089	−0.005	−0.017	−0.031	−0.071	−0.064	0.018
$w8$ = vegetables	0.025	0.028	0.028	0.068	0.013	0.014	0.005		−0.033	0.062	−0.022	0.005	−0.003	0.146
$w9$ = pulses	0.197	0.040	−0.010	0.070	0.029	0.060	0.023	−0.124		0.121	0.013	0.094	0.034	−0.084
$w10$ = fruits	−0.318	−0.067	−0.042	0.020	−0.010	0.029	0.000	0.053	0.055		0.031	−0.017	0.028	0.057
$w11$ = oil and grease	0.118	0.063	0.005	−0.012	−0.001	0.034	0.008	−0.052	0.017	0.081		0.005	0.027	0.132
$w12$ = beverage ingredients	0.009	−0.006	0.008	−0.011	0.037	−0.007	−0.017	0.013	0.068	0.017	0.002		0.016	0.110
$w13$ = spices	−0.265	−0.001	−0.002	−0.010	0.002	0.109	−0.062	−0.029	0.045	0.091	0.037	0.026		0.022
$w14$ = other foods	−0.168	0.004	0.007	0.051	0.009	−0.019	0.015	−0.007	−0.026	0.014	−0.007	−0.010	−0.009	

Source: Authors' calculation

Table AII. Compensated cross-price elasticity (Hicksian), overall model

Food groups (1)	$w1$ (2)	$w2$ (3)	$w3$ (4)	$w4$ (5)	$w5$ (6)	$w6$ (7)	$w7$ (8)	$w8$ (9)	$w9$ (10)	$w10$ (11)	$w11$ (12)	$w12$ (13)	$w13$ (14)	$w14$ (15)
$w1$ = rice		0.015	−0.005	−0.020	0.049	0.029	−0.013	0.103	0.065	−0.012	0.056	0.041	−0.012	0.140
$w2$ = non-rice staples	0.354		−0.008	0.050	0.131	−0.076	0.056	0.461	0.189	−0.362	0.344	0.000	0.020	0.501
$w3$ = tubers	−−0.089	−0.006		0.190	0.005	−0.035	−0.019	0.400	−0.004	−0.149	0.050	0.077	0.017	0.575
$w4$ = fishes	−0.040	0.004	0.019		0.046	0.024	−0.005	0.167	0.054	0.091	0.025	0.033	0.020	0.526
$w5$ = meat	0.239	0.028	0.001	0.117		−0.078	−0.002	0.126	0.055	0.066	0.029	0.086	0.024	0.449
$w6$ = eggs	0.185	−0.021	−0.012	0.078	−0.101		−0.017	0.141	0.097	0.133	0.077	0.026	0.113	0.207
$w7$ = milk	−0.070	0.014	−0.005	−0.014	−0.003	−0.015		0.106	0.053	0.079	0.041	0.015	−0.022	0.496
$w8$ = vegetables	0.175	0.034	0.036	0.146	0.043	0.037	0.032		−0.007	0.105	0.011	0.044	0.016	0.363
$w9$ = pulses	0.369	0.047	−0.001	0.159	0.064	0.087	0.054	−0.023		0.170	0.051	0.139	0.056	0.165
$w10$ = fruits	−0.043	−0.055	−0.027	0.162	0.046	0.072	0.050	0.215	0.103		0.091	0.055	0.063	0.454
$w11$ = oil and grease	0.257	0.069	0.012	0.060	0.027	0.055	0.033	0.029	0.041	0.121		0.041	0.045	0.332
$w12$ = beverage ingredients	0.158	0.000	0.016	0.066	0.067	0.016	0.010	0.100	0.094	0.060	0.034		0.035	0.324
$w13$ = spices	−0.089	0.007	0.007	0.081	0.038	0.137	−0.031	0.075	0.076	0.142	0.075	0.071		0.277
$w14$ = other foods	0.096	0.015	0.021	0.188	0.063	0.022	0.062	0.149	0.020	0.091	0.050	0.059	0.025	

Source: Authors' calculation

Table AIII. Uncompensated cross-price elasticity (Marshallian), urban

Food groups (1)	w1 (2)	w2 (3)	w3 (4)	w4 (5)	w5 (6)	w6 (7)	w7 (8)	w8 (9)	w9 (10)	w10 (11)	w11 (12)	w12 (13)	w13 (14)	w14 (15)
w1 = rice		0.014	−0.011	−0.074	0.038	0.020	−0.031	0.067	0.061	−0.044	0.046	0.023	−0.026	0.032
w2 = non-rice staples	0.288		−0.021	−0.042	0.129	−0.134	0.030	0.496	0.218	−0.553	0.417	−0.054	−0.001	0.356
w3 = tubers	−0.265	−0.015		0.134	−0.032	−0.069	−0.054	0.370	−0.035	−0.230	0.022	0.046	−0.002	0.425
w4 = fishes	−0.235	−0.004	0.010		0.009	−0.005	−0.040	0.061	0.023	0.039	−0.016	−0.016	−0.004	0.271
w5 = meat	−0.040	0.015	−0.013	−0.026		−0.112	−0.050	−0.038	0.005	−0.013	−0.030	0.012	−0.011	0.037
w6 = eggs	0.004	−0.029	−0.021	−0.013	−0.135		−0.048	0.037	0.066	0.082	0.038	−0.019	0.090	−0.047
w7 = milk	−0.336	−0.001	−0.019	−0.158	−0.061	−0.057		−0.079	−0.007	−0.016	−0.027	−0.061	−0.055	0.005
w8 = vegetables	0.029	0.030	0.031	0.073	0.012	0.015	0.003		−0.037	0.065	−0.024	0.005	−0.004	0.152
w9 = pulses	0.204	0.041	−0.011	0.072	0.029	0.062	0.021	−0.126		0.124	0.014	0.097	0.035	−0.087
w10 = fruits	−0.304	−0.064	−0.040	0.022	−0.009	0.028	−0.002	0.052	0.053		0.031	−0.015	0.027	0.055
w11 = oil and grease	0.132	0.070	0.005	−0.016	−0.003	0.037	0.008	−0.060	0.018	0.087		0.004	0.029	0.139
w12 = beverage ingredients	0.013	−0.008	0.009	−0.016	0.039	−0.009	−0.023	0.013	0.078	0.016	0.002		0.018	0.114
w13 = spices	−0.286	−0.001	−0.003	−0.011	0.001	0.119	−0.070	−0.031	0.050	0.097	0.040	0.028		0.020
w14 = other foods	−0.144	0.004	0.006	0.047	0.011	−0.015	0.015	−0.004	−0.022	0.016	−0.006	−0.007	−0.007	

Source: Authors' calculation

Food groups (1)	$w1$ (2)	$w2$ (3)	$w3$ (4)	$w4$ (5)	$w5$ (6)	$w6$ (7)	$w7$ (8)	$w8$ (9)	$w9$ (10)	$w10$ (11)	$w11$ (12)	$w12$ (13)	$w13$ (14)	$w14$ (15)
$w1$ = rice		0.016	−0.008	−0.045	0.051	0.029	−0.018	0.098	0.070	−0.026	0.057	0.036	−0.019	0.131
$w2$ = non-rice staples	0.411		−0.015	0.030	0.161	−0.111	0.061	0.575	0.243	−0.509	0.446	−0.021	0.017	0.605
$w3$ = tubers	−0.147	−0.011		0.202	−0.001	−0.047	−0.025	0.445	−0.012	−0.189	0.049	0.077	0.014	0.661
$w4$ = fishes	−0.079	0.002	0.018		0.049	0.024	−0.001	0.159	0.054	0.094	0.020	0.026	0.018	0.585
$w5$ = meat	0.192	0.024	0.000	0.110		−0.069	0.009	0.109	0.052	0.069	0.024	0.074	0.021	0.505
$w6$ = eggs	0.154	−0.023	−0.013	0.074	−0.096		−0.010	0.131	0.096	0.136	0.073	0.020	0.111	0.255
$w7$ = milk	−0.071	0.009	−0.005	−0.003	0.008	−0.008		0.089	0.046	0.078	0.034	0.010	−0.018	0.540
$w8$ = vegetables	0.157	0.035	0.037	0.147	0.045	0.039	0.035		−0.011	0.110	0.005	0.038	0.014	0.409
$w9$ = pulses	0.349	0.046	−0.003	0.156	0.067	0.089	0.058	−0.034		0.175	0.048	0.136	0.056	0.204
$w10$ = fruits	−0.076	−0.055	−0.028	0.155	0.050	0.071	0.056	0.197	0.099		0.083	0.045	0.059	0.515
$w11$ = oil and grease	0.248	0.074	0.011	0.052	0.027	0.058	0.037	0.014	0.042	0.128		0.035	0.045	0.372
$w12$ = beverage ingredients	0.138	−0.003	0.015	0.057	0.072	0.014	0.009	0.092	0.103	0.060	0.031		0.036	0.366
$w13$ = spices	−0.137	0.005	0.005	0.076	0.040	0.146	−0.032	0.063	0.080	0.150	0.075	0.067		0.320
$w14$ = other foods	0.065	0.012	0.018	0.169	0.065	0.023	0.068	0.129	0.020	0.091	0.043	0.048	0.022	

Source: Authors' calculation

Table AIV. Compensated cross-price elasticity (Hicksian), urban

Table AV. Uncompensated cross-price elasticity (Marshallian), rural

Food groups (1)	$w1$ (2)	$w2$ (3)	$w3$ (4)	$w4$ (5)	$w5$ (6)	$w6$ (7)	$w7$ (8)	$w8$ (9)	$w9$ (10)	$w10$ (11)	$w11$ (12)	$w12$ (13)	$w13$ (14)	$w14$ (15)
$w1$ = rice		0.011	−0.007	−0.045	0.030	0.016	−0.023	0.052	0.044	−0.025	0.034	0.020	−0.017	0.031
$w2$ = non-rice staples	0.155		−0.011	−0.013	0.083	−0.075	0.028	0.291	0.127	−0.302	0.240	−0.026	0.002	0.244
$w3$ = tubers	−0.192	−0.010		0.107	−0.015	−0.046	−0.034	0.275	−0.021	−0.153	0.019	0.038	0.002	0.335
$w4$ = fishes	−0.214	−0.004	0.009		0.009	−0.005	−0.035	0.055	0.020	0.036	−0.014	−0.014	−0.003	0.248
$w5$ = meat	−0.053	0.017	−0.015	−0.037		−0.137	−0.058	−0.048	0.006	−0.021	−0.038	0.012	−0.015	0.043
$w6$ = eggs	0.006	−0.030	−0.022	−0.017	−0.139		−0.051	0.033	0.065	0.079	0.038	−0.021	0.090	−0.059
$w7$ = milk	−0.519	−0.001	−0.029	−0.235	−0.087	−0.085		−0.106	−0.001	−0.017	−0.038	−0.089	−0.081	0.039
$w8$ = vegetables	0.021	0.025	0.025	0.064	0.013	0.013	0.007		−0.030	0.059	−0.019	0.005	−0.002	0.139
$w9$ = pulses	0.188	0.039	−0.010	0.067	0.028	0.057	0.026	−0.123		0.117	0.012	0.090	0.032	-0.079
$w10$ = fruits	– −0.337	-0.070	−0.044	0.018	−0.011	0.029	0.003	0.054	0.057		0.032	−0.019	0.028	0.060
$w11$ = oil and grease	0.105	0.057	0.004	−0.008	0.000	0.031	0.009	−0.045	0.015	0.075		0.005	0.025	0.124
$w12$ = beverage ingredients	0.006	−0.005	0.007	−0.006	0.034	−0.006	−0.012	0.013	0.059	0.019	0.002		0.015	0.105
$w13$ = spices	−0.245	−0.001	−0.002	−0.008	0.003	0.100	−0.055	−0.027	0.041	0.084	0.034	0.023		0.025
$w14$ = other foods	−0.212	0.004	0.009	0.058	0.007	−0.026	0.015	−0.014	−0.034	0.011	−0.011	−0.016	−0.014	

Source: Authors' calculation

Food groups (1)	$w1$ (2)	$w2$ (3)	$w3$ (4)	$w4$ (5)	$w5$ (6)	$w6$ (7)	$w7$ (8)	$w8$ (9)	$w9$ (10)	$w10$ (11)	$w11$ (12)	$w12$ (13)	$w13$ (14)	$w14$ (15)
$w1$ = rice		0.016	−0.002	0.002	0.046	0.029	−0.011	0.110	0.060	−0.001	0.055	0.046	−0.004	0.131
$w2$ = non-rice staples	0.328		−0.002	0.066	0.109	−0.052	0.049	0.387	0.153	−0.262	0.276	0.018	0.023	0.409
$w3$ = tubers	−0.032	−0.002		0.181	0.009	−0.025	−0.015	0.364	0.003	−0.115	0.051	0.079	0.021	0.488
$w4$ = fishes	0.004	0.007	0.021		0.042	0.024	−0.010	0.176	0.053	0.087	0.030	0.041	0.023	0.457
$w5$ = meat	0.299	0.034	0.003	0.125		−0.091	−0.016	0.147	0.059	0.061	0.035	0.102	0.027	0.380
$w6$ = eggs	0.223	−0.019	−0.010	0.083	−0.106		−0.025	0.153	0.098	0.130	0.082	0.034	0.115	0.148
$w7$ = milk	−0.089	0.020	−0.007	−0.038	−0.022	−0.028		0.131	0.064	0.082	0.050	0.021	−0.030	0.450
$w8$ = vegetables	0.199	0.034	0.035	0.146	0.041	0.036	0.028		−0.003	0.100	0.017	0.051	0.019	0.310
$w9$ = pulses	0.394	0.048	0.001	0.161	0.060	0.084	0.050	−0.009		0.165	0.055	0.143	0.057	0.118
$w10$ = fruits	−0.004	−0.054	−0.026	0.172	0.040	0.073	0.042	0.238	0.108		0.100	0.066	0.068	0.380
$w11$ = oil and grease	0.272	0.065	0.013	0.068	0.026	0.053	0.029	0.047	0.041	0.114		0.048	0.044	0.283
$w12$ = beverage ingredients	0.183	0.003	0.016	0.075	0.061	0.018	0.009	0.111	0.085	0.060	0.038		0.036	0.274
$w13$ = spices	−0.036	0.009	0.009	0.088	0.035	0.127	−0.030	0.089	0.073	0.133	0.076	0.076		0.224
$w14$ = other foods	0.137	0.021	0.027	0.219	0.060	0.020	0.056	0.179	0.019	0.092	0.061	0.073	0.028	

Source: Authors' calculation

Table AVI. Compensated cross-price elasticity (Hicksian), rural

Nutrient elasticities of food consumption the case of Indonesia (M.Yamin)

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