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AN ANALYSIS OF PROTEIN AND CALORIE CONSUMPTION IN CENTRAL JAVA

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Abstract

This study analyses calorie and protein consumption in Central Java Province. The calorie and protein elasticity are derived from demand elasticity of the ten food groups encompassing cereals, fish, meats, eggs and milk, vegetables, fruits, oil and fats, prepared foods and drinks, other foods and tobacco products. Most of calorie and protein-price elasticity of the ten food group are negative. Consumption of calorie and protein are most responsive to prices of eggs and milk. Protein- price elasticities are less elastic than calorie-price elasticities. Calorie and protein-income elasticity are positive and become lesselastic in moving from lower to higher income households but protein is lessresponsi ve to income change than calorie.

Keywords: QUAIDS, demand elasticity, nutrient elasticity, Central Java Province
JEL Classification numbers: D12, O12

Abstrak

Studi ini menganlisis konsumsi kalori dan protein di Jawa Tengah. Elastisitas kalori dan protein dihitung dari elastisitas permintaan dari 10 kelompok komoditi makanan yang terdiri dari padi-padian, ikan, daging, telur dan susu, sayur-sayuran, buah-buahan, minyak dan lemak, makanan dan minumun jadi, makanan lainnya dan tembakau dan hasilnya. Sebagian besar elastisitas harga kalori dan protein adalah negatif. Konsumsi kalori dan protein adalah kelompok makanan yang paling responsif terhadap perubahan harga telur dan susu. Elastisitas pendapatan kalori dan protein adalah positif tetapi menjadi lebih elastis untuk rumah tangga berpenghasilan lebih tinggi tetapi protein kurang responsif terhadap perubahan pendapatan daripada kalori.

Keywords: QUAIDS, elastisitas permintaan, elastisitas nutrisi, Jawa Tengah
JEL Classification numbers: D12, O12

INTRODUCTION

Central Java is one of the most populous provinces in Indonesia with a population of 33.64 million people with poverty rates 5.107 million (15.18%) in 2011 (Central Bureau Statistics, Central Java, 2012). One indicator of society welfare is sufficient levels of nutrition that are consumed by people. Nutritional adequacy is measured based on the amount of calories and protein consumed by each human being. Although as one of the provinces which face the issues of population, food security in Central Java was relatively stable in 2011. Food Security and Vulnerability map in 2010 has increased compared to it in 2009. Of the 35 regencies/municipalities in Central Java, 28 regencies/municipalities were very secured food and a regency was secured food. In addition, surplus of rice, corn and cassava as a main staple food in 2011 reached 3.12 million tons, 2.59 million tons, and 3.18 million tons respectively (Badan Ketahanan Pangan, Central Java).

The existence of food security in Central Java is not yet able to push the adequacy of calorie and protein intake although consumption on calorie and protein has been increasing recently. The adequacy rate of calorie and protein intake in Indonesia is 2000 kcal and 52 grams per capita per day respectively. The average household consumption of calories and protein for the Central Java was 1,765.82 kcal, 1,893.82 kcal and 49.56 grams, 53.42 grams in 2008 and 2011 respectively. Calorie consumption was below the national average and standards of adequacy of calorie consumption in Indonesia while protein intake was above standards of adequacy but still below the national average. However, households in the Central Java are facing nutritional issues because the prices of food have been increasing recently.

The purpose of this study is to estimate the demand for nutrients in Central Java focusing on calories and protein. Many previous studies on nutrient demand in Indonesia have been conducted such as Moies (2003) and Skoufias (2003) but their studies focused on the national level. Skoufias et al., (2011) investigated micronutrient demand focusing only on starchy staple foods in Central Java. With geographic, economic and consumption patterns that vary across regions, previous study of nutrient demand at national level have not be enable to describe and capture the behaviour of household consumption of nutrients in a particular area at province level. Thus, the analysis of nutrient demand in Central Java in this study is expected to enrich the nutritional studies in Indonesia. In addition, the results of this study are expected tobe one of the important information to local governments in the Central Java province in addressing nutritional issues in society.

There mainder of this paper is written as follows. Section II discusses food and nutrient consumption patterns in Central Java. Model specification and data are presented in section III. The next section discusses the results. The final section provides some conclusions and policy implications of this study.

Food and Nutrient Consumption Pattern in Central Java

Household expenditures in Central Java can be classified into two major groups namely food and non-food expenditures. Food expenditures consist of 14 commodity groups encompassing cereals, tubers, fish, meat, eggs and milk, vegetables, legumes, fruits, oil and fats, beverage stuffs, spices, miscellaneous food items, prepared food, alcoholic beverages, and tobacco and betel. On the other hand, non-food expenditures includes 6 commodity groups encompassing housing and household facility, goods and services, clothing, footwear, and headgear, durable goods, taxes and insurance, and parties and ceremony.

People tend to spend less food and more non-food expenditures as their income increase. Table 1 presents food and non food expenditures in Central Java during 2010-2011. Food expenditures (51.79%) in Central Java were higher than the non-food expenditures (48.21%) in 2010, but the opposite condition occurred in 2011 where non-food expenditures (50.47%) were higher than non-food expenditures (48.21%). When viewed from areas in which households live either rural or urban areas, food expenditure was much higher than the non-food expenditure in rural areas. However, in urban areas non-food expenditure is greater than food expenditures. Roughly speaking, table 1 shows that as the purchasing power of consumer increases the percentage of food expenditure decreases. This indicates that the food consumption in Central Java follows the pattern of Engel’s law.

A nutrient is a chemical substance that any organism needs to live and grow or a substance used in an organism's metabolism which must be taken in from its environment. Nutrients are used to build and repair tissues, regulate body processes and are converted to and used as energy for every organism, including human being (Whitney, Elanor and Sharon Rolfes, 2005). Nutrient can be classified as micro and macro nutrient. Micronutrient includes such as iron, iron, cobalt, chromium, copper, iodine, manganese, selenium, zinc and molybdenum. In other hand, macronutrient consists of calorie, protein, fat, and carbhydrate, minerals, vitamins and water.

The distribution of food expenditures per capita population for Central Java in 2011 is shown figure 1. The highest contribution on total food expenditures was expenditures on prepared food and drink by 29%. Second highest contribution was cereals with sub groups such as rice, cassava, maize by 18%. Spending on high-value foods contributing significantly to calorie and protein intake from eggs and milk, meat and its product, fish, oils and fats were relatively low by less than 10%. However, interestingly expenditures on tobacco products to total household expenditure were relatively high (10%).

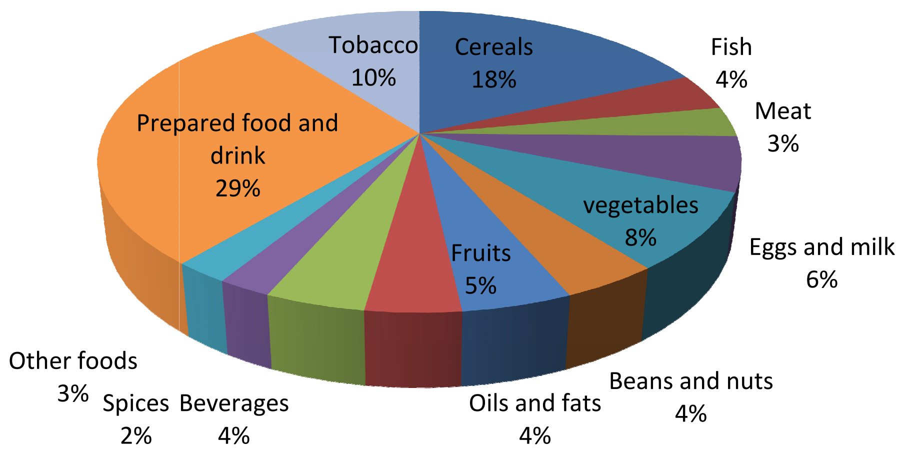
As previously discussed, the consumptions of calorie and protein have been increasing over last 10 years. Average Daily per Capita Consumption of Calorie (Kcal) and Protein (grams) in Central Java in 2011 are shown in Table 2. Cereal groups contributed mostly for calories and protein intakes, followed by prepared food and drink and oils and fats. The only food group that did not contribute to the consumption of calories and proteins was tobacco products. Consumption of calorie in rural households was higher than in urban households but protein intake in urban households was higher than in rural households.

Table 1: Food and Non-Food Expenditure , Central Java, 2010-2011 (Rupiah)

Items	**Urban**		**Rural**		**Urban and Rural**	
	2010	2011	2010	2011	2010	2011
Food	225,430	249,353	183,673	213,285	203,968	229,775
	(48.64)	(45.58)	(56.00)	(54.15)	(51.79)	(49.53)
Non-food	238,305	297,683	144,292	180,606	189,863	234,132
	(51.36)	(54.42)	(44.00)	(45.85)	(48.21)	(50.47)
Total	463,488	547,036	327,967	393,891	393,831	463,907

Note: the numbers in parenthesis is percentage of total expenditures
Source:CBS, Central Java, 2011

Figure 1. Percentage of Food Expenditure to Total Food Expenditure Central Java, 2011



Source: CBS Central Java, 2011

Table 2: Average Daily per Capita Consumption of Calorie (Kcal) and Protein (grams) by Food Group, Central Java, 2011

	Calorie (Kcal)			Protein (gram)		
Food Groups	Urban	Rural	Total	Urban	Rural	Total
Cereals	781.06	901.94	846.68	18.03	20.63	19.44
Fish	24.46	22.65	23.48	3.88	3.57	3.71
Meat	37.07	24.5	30.25	2.36	1.54	1.91
Eggs and milk	52.56	37.82	44.56	2.99	2.25	2.59
vegetables	38.66	48.15	43.81	2.33	3.14	2.77
Beans and nuts	66.8	66.45	66.88	6.53	6.52	6.53
Fruits	34.61	34.01	34.29	0.37	0.35	0.36
Oils and fats	202.1	217.48	210.72	0.21	0.28	0.25
Beverages	89.82	90.63	90.26	0.81	0.95	0.89
Spices	17.47	18.19	17.86	0.74	0.77	0.76
Other foods	51.35	50.84	51.08	1.04	1	1.02
Prepared food and drink	399.45	322.58	357.71	12.75	9.37	10.9
Total	1795.45	1836.25	1817.6	52.04	50.37	51.13

Sources: Source: CBS Central Java, 2012

METHODS

Model Specification

Nutrient demand can be estimated by direct or indirect methods. This study uses an indirect method to estimate nutrient demand in Central Java. Two steps are applied to calculate nutrient demand (protein and calorie) using indirect method. The first step is to estimate food demand to calculate demand elasticity and the second step is to estimate nutrient elasticities based on information available from demand elasticity. In the first step of this study, the two stage budget procedures are used to analyse food demand assuming that food is weakly separable from non-food. Total household expenditures are spent among food and non-food items in the first-stage budgeting, and then food household expenditures are spent among the each food group in the final stage budgeting.

Working-Leser model is used in the first-stage budgeting to calculate demand elasticity and is defined as (Chern et al., 2003):

$$w_i = \omega_o + \omega_1 lnX + \sum_{j=1}^{n} \rho_{ij}\, ln\boldsymbol{p_j} + \sum_{k=1}^{n} \pi_{ik}\, \boldsymbol{Z_k} + \varepsilon_i \quad (1)$$

where i and $j$are goods, w_i is the share of total expenditure allocated to the ith good, p_j is the price of the jth good, X is the household expenditures on goods, $\boldsymbol{Z_k}$ is the demographic variables consisting of household size, years of schooling of household head, age of household head, gender of household head, urban dummy variables, and two quarter dummy variables.

Uncompensated or Marshallian price (η_{ij}) and expenditure (η_i) elasticities in the first -stage budgeting are:

$$\eta_{ij} = \frac{\rho_{ij}}{w_i} - \delta_{ij} \quad (2)$$

$$\eta_i = 1 + \frac{1}{w_i}[\,\omega_i] \quad (3)$$

Where δ_{ij} is the Kronecker Delta (0 if $i \neq j$ and 1 otherwise). Both prices and expenditure elasticities are evaluated at sample means. To calculate income elasticity, this study uses Engle function:

$$lnx = \tau_o + \tau_1 lnY + \delta lnP + \sum_{k=1}^{n} \vartheta_{ik}\, \boldsymbol{H_k} + \mu_i \quad (4)$$

where x is the household expenditures on foods, Y is total household expenditure on food and non-food, P is price index of foods, and $\boldsymbol{H_k}$ is the demographic variables that are same as previously defined in equation (1). Following Chern et al., (2003), the income elasticity can be estimated as:

$$\xi_i = \eta_i \tau_1 \qquad (5)$$

A quadratic almost ideal demand system (QUAIDS) (Banks et al., 1996) is used in the second-stage budgeting given as:

$$w_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij}\, \boldsymbol{lnp_j} + \beta_i ln\left(\frac{X}{a(P)}\right) + \frac{\lambda_i}{b(P)}\left(ln\left[\frac{X}{a(P)}\right]\right)^2 + u_i \qquad (6)$$

where i and $j$are goods, w_i is the share of total expenditure allocated to the ith good, p_j is the price of the jth good, X is the household expenditure on goods in the system, $a(P)$ is the price index defined as $\ln[a(P)] = \alpha_0 + \sum_{i=1}^{n} \alpha_i\, lnp_i + 0.5 \sum_{i=1}^{n} \sum_{j=1}^{n} \gamma_{ij}\, lnp_i \boldsymbol{lnp_j}$,$b(P)$ is the Cobb-Douglas price aggregator given by $b(P) = \prod_{i=1}^{n} p_i^{\beta_i}$,$\gamma_{ij}$, β_i, and λ_i are parameters to be estimated, and u_i is an error term.

To capture demographic variables in estimating demand for food, we incorporate demographic variables into the intercept in equation (6) as defined $\alpha_i = \rho_{i0} + \sum_{k=1}^{m} \rho_{ik}\, d_k$where d_k is the demographic variables consisting of household size, educational level of household head (years of schooling), age of household head, gender of household head, and two quarter dummy variables (Quarter 2 and quarter 3).

Expenditure variables in equation (6) are endogenous variables. Endogeneity problem is solved by using instrumental variables (IV) (Zheng and Henneberry, 2010b). The properties of neoclassical demand theory consisting adding-up, homogeneity and Slustky symmetry can be imposed on equation (6) by restricting its parameters (Banks et al., 1996). The adding-up restriction is given by $\sum_{i=1}^{n} \rho_{i0} = 1$;$\sum_{i=1}^{n} \rho_{ik} = 0$;$\sum_{i=1}^{n} \gamma_{ij} = 0$;$\sum_{i=1}^{n} \beta_i = 0$; and $\sum_{i=1}^{n} \lambda_i = 0$; homogeneity is imposed as $\sum_{=1}^{n} \gamma_{ij} = 0$ for any i; and Slutsky symmetry is defined by$\gamma_{ij} = \gamma_{ji}$,$i \neq j$.

The second step of this study is to calculate nutrient elasticity both nutrient-price and income elasticities. Nutrient-price and income elasticities are (Zheng and Henneberry, 2012):

$$\pi_{kj} = \sum_i \Omega_{ij}\, a_{ki} q_i / \phi_k \qquad (7)$$
$$\eta_k = \sum_i \Omega_i\, a_{ki} q_i / \phi_k \qquad (8)$$

where π_{kj} is the nutrient-price elasticity, η_k is the nutrient-income elasticity, a_{ki} is the amount of the kth nutrient obtained from a unit of the ith food, q_i is quantity consumed and ϕ_k is the total amount of that nutrient obtained from various food and it is calculated as $\phi_k = \sum_i a_{ki}\, q_i$.

Data

This study uses the national social and economic survey of households in Indonesian (SUSENAS) in 2011 consisting 225 food and 113 non-food commodities. In the first-stage budgeting, all foods and non-foods are classified as food and non-food items. Food and non-food expenditures data are used in estimating demand for food. The SUSENAS provides information prices for each food but price of non-foods are not available. Then, foods are grouped into the ten food groups and aggregate price for food group is calculated by weighted average of price within groups using budget share as a weight (Jensen and Manrique, 1998). Price of non-food is calculated following Jensen and Manrique (1998) using the consumer price indexes for non-food items as a proxy for non-food prices. The Central Bureau of Statistics (CBS) provides consumer price indexes in four cities (Purwokerto, Tegal, Surakarta, and Semarang) as most important city in Central Java Province. This study uses the consumer price index of above 4 cities as a cluster to calculate price of non-food for each regency or municipality.

For the purpose of this study in the second-stage budgeting, 225 food commodities are classified into the ten food groups encompassing cereals, fish, meats, eggs and milk, vegetables, fruits, oil and fats, prepared foods and drinks, other foods and tobacco products. Aggregate price for each food groups is calculated as the first-stage budgeting. Following Jensen and Manrique (1998), unreported or missing aggregate prices are calculated by regressing observed prices on four regional dummies (Semarang, Surakarta, Tegal and Purwokerto as previously defined), seasonal dummies (second quarters and third quarter), and total household expenditures. The total number of households living in the Central Java province used for this study is 20,085 households. SUSENAS provides information about nutritional content for each food that households consume. SUSENAS uses a nutrient conversion table from the Ministry of Health and Nutrition Research Institute to calculate nutrient available to a household by multiplying the nutritional content of food items per unit of quantity to total quantity of that food items available. SUSENAS records household consumption of macronutrient consisting calorie, protein, fats and carbohydrate that are used for this study to estimate calorie and protein elasticity.

Estimating demand for foods in aggregate level reflects only one consumer behaviour. In fact, people from different income group have different consumer behaviour. Because of consumption patterns varying according to income level, welfare effects vary by income level as commodity prices change. Therefore, aggregate demand for foods and accordingly demand for protein and calorie in Central Java are estimated with different income groups. SUSENAS in 2011 also records household income but it contains a lot of missing income data (18.15%). Total expenditures are used as proxy for income Total (Moies, 2003). The total households are regrouped into 3 groups based on total household expenditure following BPS. The first group (stratum 1) account for 40% of the lowest household expenditures indicating low income households. The second groups (stratum 2) represent 40% of the medium household expenditures as medium income households. The third group (stratum 3) consist of 20% of the highest household expenditures considered as high income households.

Estimation Procedures

SUSENAS data for the Central Java used this study contain some zero expenditures for a given food expenditure. The percentages of zero expenditures for cereals, fish, meats, eggs and milk, vegetables, fruits, oil and fats, prepared foods and drinks, other foods and tobacco products are 3.83%, 30.49%, 60.21%, 20.13%, 6.86%, 33.18%, 5.88%, 0.10%, 3.94%, and 37.28% respectively. If the dependent variables in the demand system contain zero expenditure, the model is limited dependent variable or censored model. Therefore, the QUAIDS model in the second-stage budgeting is the censored model and causes biased estimation (Pan, Monhanty and Welch, 2008). The consistent two- step estimation procedure proposed is applied to solve biased estimation (Zheng and Henneberry, 2010a). Probit model is used to determine the probability of buying a given type of food in the first step with some explanatory variables encompassing the logarithms of prices of studies food groups, the logarithms of total household expenditure and demographic variables that are same as those used in equation (6). Finally, the estimated standard normal probability density function (Φ) and the estimated standard normal cumulative distribution function (φ) from the first-step estimation are incorporated in the QUAIDS model and defined as:

$$w_i = \{\alpha_i + \sum_{j=1}^{n} \gamma_{ij}\, lnp_j + \beta_i ln\left(\frac{X}{a(P)}\right) + \frac{\lambda_i}{b(P)}\left(\left[\frac{X}{a(P)}\right]\right)^2 + u_i\}\Phi(.) + \tau_i\varphi(.) + \varepsilon_i \quad (9)$$

The adding-up condition does not hold in the system of equations (9). Estimation of system equation (9) should be estimated on entire n equations in the demand system (Yen et al., 2002). Incorporating and φ into the system of equation (6) in the second step estimation causes heteroscedasticity. This heteroskedasticity in the second-step estimation of demand system leads to inefficient but consistent parameter estimates (Zheng and Henneberry, 2010a).

Following Bank et al., (1997), the Marshallian price and expenditure elasticities of the QUAIDS model with censoring model in the second-stage budgeting are calculated as follows:

$$e_{ij} = \frac{1}{W_i}\left\{\gamma_{ij} - (\beta_i + \frac{2\lambda_i}{b(P)}\left[ln\left(\frac{X}{a(P)}\right)\right])\left(\alpha_{ih} + \sum_{j=1}^{n}\gamma_{ij}\, lnp_j\right) - \frac{\lambda_i\beta_j}{b(\boldsymbol{P})}\left(ln\left[\frac{X}{a(P)}\right]\right)^2\right\}\Phi_i - \delta_{ij} \quad (10)$$

$$e_i = 1 + \frac{1}{W_i}\left[\beta_i + \frac{2\lambda_i}{b(\boldsymbol{P})}ln\left(\frac{X}{a(\boldsymbol{P})}\right)\right]\Phi_i \quad (11)$$

where δ_{ij} is the Kronecker delta (0 if $i \neq j$ and 1 otherwise). All price and expenditure elasticities in QUAIDS model are evaluated on the basis of parameter estimated and sample means of independent variables using equation (10) and (11). Standard errors of both price and expenditure elasticities are calculated using the delta method.

Both price and expenditure elasticities of demand for food groups in the second-state budgeting are conditional on total goods expenditure in the first-stage budgeting. Unconditional price (Ω_{ij}) and expenditures (Ω_i) elasticities are calculated as

$$\Omega_{ij} = e_{ij} + e_i[w_j + \eta_{ij}w_j] \quad (12)$$

$$\Omega_i = e_i\eta_i \quad (13)$$

where e_{ij} is the conditional Marshallian price elasticity, e_i is the conditional expenditure elasticity for jth food groups, η_{ij} is the Marshallian price elasticity of food in the first-stage budgeting, w_j is the expenditure share of jth food groups, and η_i is the unconditional expenditure elasticity for food in the first-stage budgeting. Finally, the income elasticity for ith food groups is given (Zheng and Henneberry, 2010b):

$$\Psi_i = \Omega_i\xi_i \quad (14)$$

where Ω_i is the unconditional expenditure elasticity for ith commodity within food groups and ξ_i the income elasticity of food in the first-stage budgeting.

RESULTS

The first-stage budgeting encompassing food and non-food commodity groups is estimated with Working-Leser model. Food demand is run separately for the three income groups and all sample. The Working -Leser model is applied to estimate food demand elasticity using the Ordinary Least Squares (OLS). The estimated parameter of the Working -Leser model are used to calculate uncompensated (Marshallian) and expenditure elasticities of food using equation (2) and (3). Then, income elasticity can be derived using Engle function and expenditure elasticities available from Working-Leser model applying equation (5)[1]. The first-step demand system based on the Working-Leser model give an unconditional price and expenditure elasticities of food.

Table 3 shows price, expenditure and income elasticities of food in the first-stage budgeting according to household income levels. The results indicate that demand elasticity both price and expenditure elasticities vary according income level. All own-price elasticities are negative as expected and less than unity. These results are consistent with economic theory. De-

[1] The estimations and results in the first-stage budgeting are available upon request.

mand for foods in the Central Java, therefore, is inelastic for all cases. All food expenditure elasticities are positive but less than 1. Like expenditure elasticities, income elasticity as a main economic policy is also positive but inelastic. These results indicate that demand for foods are normal good for all stratum. In addition, lower income are more responsive to price and income than higher income.

Next step for the second-stage budgeting is to estimate demand for the ten food groups encompassing cereals, fish, meat, eggs and milk, vegetables, fruits, oil and fats, prepared food and drink, other foods and tobacco products. Because the data set used contains some zero observations as discussed before, the consistent two step estimation procedure is employed to deal with these zero observation in order to avoid bias estimated parameters. Probit model were applied to estimate the ten food groups separately using maximum likelihood estimation in the first-step estimation. Then, demand for the ten food groups were estimated using QUAIDS model by including CDF and PDF from probit model using FIML estimation with homogeneity and symmetry condition imposed in the second-step estimation.

The difference between the QUAIDS used in this study and almost ideal demand system (AIDS) model is about the Engle Curve. The QUAIDS permits for a quadratic term in the estimation of the Engel curve while the Engle curve is assumed linear in income in the AIDS model. If the coefficient of non-liner relationship of the Engle curve in the QUAIDS model is zero then QUAIDS collapses to almost ideal demand system (AIDS). Among 30 estimated values of quadratic Engle curve, 28 coefficients are statistically significance at 10% or lower levels. These results indicate that QUAIDS model is not only appropriate model in estimating food demand system in Central Java but also superior to AIDS model across income level. Parameter estimates of the demand system for the ten food groups across income level in the second-stage budgeting indicate that 591 of 658 independent variables are statistically significance at 10% or lower levels. Among 220 independent variables for low income households, 195 (88.63%) independent variables are statistically significance at 10% or lower levels. Of 219 independent variables for each medium and high income households, 207 (94.52%) and 189 (86.3%) independent variables of both medium and high income are statistically significant at 10% or lower levels respectively. Additionally, All parameter estimates for standard normal PDF in the second-stage budgeting for each food group across income level are significant at 10% or lower level. These results show strong evidence that we must include zero expenditures in estimating demand for the ten food groups in Central Java.[2]

Table 3: Price, Expenditure and Income Elasticities of Food Demand, in the first-Stage Demand, Central Java, 2011

Income Level	Own-Price Elasticity	Expenditure Elasticity	Income Elasticity
All	-0.9351	0.7487	0.4668
Low income	-0.9832	0.8982	0.7943
Medium income	-0.9513	0.8222	0.6471
Highincome	-0.8571	0.4702	0.1029

Source: estimated using the 2011 SUSENAS

[2] The estimations and results in the second-stage budgeting are available upon request

Table 4: Conditional Own-Price and Expenditure Elasticity by Income Groups, Central Java, 2011

	Own-Price Elasticity			Expenditure Elasticity		
	Low	**Medium**	**High**	**Low**	**Medium**	**High**
Cereal	-0.822	-0.695	-0.588	0.877	0.867	0.935
	0.009	0.007	0.015	0.004	0.003	0.006
Fish	-0.966	-0.682	-0.915	0.640	0.441	0.793
	0.015	0.010	0.008	0.012	0.007	0.008
Meat	-1.140	-1.292	-1.130	0.670	0.828	0.943
	0.023	0.008	0.005	0.012	0.006	0.006
Eggs and milk	-0.969	-1.071	0.823	0.737	0.945	0.762
	0.017	0.004	0.010	0.010	0.008	0.008
Vegetables	-0.864	-0.903	-0.990	0.876	0.747	0.765
	0.011	0.006	0.009	0.009	0.005	0.008
Fruits	-1.006	-0.776	-0.880	0.559	0.591	0.772
	0.023	0.011	0.012	0.014	0.007	0.010
Oils and fats	-1.015	-0.835	-0.863	1.045	1.088	0.998
	0.014	0.012	0.019	0.011	0.006	0.012
Prepared food and drink	-1.084	-0.955	-1.031	1.414	1.360	1.281
	0.005	0.003	0.004	0.003	0.001	0.002
Other foods	-0.792	-0.794	-0.833	0.910	0.871	0.723
	0.010	0.008	0.014	0.017	0.010	0.015
Tobacco products	-1.115	-0.988	-0.787	0.782	0.867	0.908
	0.008	0.002	0.004	0.005	0.002	0.003

Note: Single, double and triple asterisk denote statistical significance at the 10%, 5% and 1% level respectively.
Source: estimated using the 2011 SUSENAS

The conditional price and expenditure elasticities for the ten food groups across income strata are reported in Table 4[3]. All own-price elasticities are negative and statistically significant at 1% level as expected by economic theory across income strata. Meat products are most responsive to price change, followed by prepared food and drink across income strata. The own-price elasticities among different income strata show that estimates do not vary across income strata. All conditional expenditure elasticities are positive and statistically significant at 1% level across income strata. Like the conditional own-price elasticities, conditional expenditure elasticities are relatively stable across income strata.

The conditional price and expenditure elasticities for the ten food groups across income strata in the second-stage budgeting do not reflect true demand elasticity because both elasticities depend on demand elasticity in the first-stage budgeting. Table 5 presents the unconditional price, expenditure and income elasticities of the ten food groups. All unconditional demand elasticities in the second-stage budgeting are calculated using equation (12), (13) and (14). All unconditional own-price elasticities are negative across income strata as expected by demand theory. The cereal group is least responsive and the meat groups are most responsive to price change. Not surprisingly, because cereals with rice as one sub group are a staple foods in Indonesia. The unconditional own-price elasticities do not vary across income strata. For example, the own-price elasticity of meat groups as most elastic food group for low income household is -1.14, as compared to -1.29 and -1.12 for medium and high income households.

[3] The cross-price elasticities are not reported to converse space and available upon request

Table 5: Unconditional Own-Price, Expenditure and Income Elasticity byIncome Groups, Central Java, 2011

	Own-Price Elasticity			Expenditure Elasticity			Income Elasticity		
	Low	**Medium**	**High**	**Low**	**Medium**	**High**	**Low**	**Medium**	**High**
Cereals	-0.82	-0.69	-0.57	0.79	0.71	0.44	0.63	0.46	0.05
Fish	-0.97	-0.68	-0.91	0.58	0.36	0.37	0.46	0.23	0.04
Meat	-1.14	-1.29	-1.12	0.60	0.68	0.44	0.48	0.44	0.05
Eggs and milk	-0.97	-1.07	-0.82	0.66	0.78	0.36	0.53	0.50	0.04
Vegetables	-0.86	-0.90	-0.98	0.79	0.61	0.36	0.62	0.40	0.04
Fruits	-1.00	-0.77	-0.87	0.50	0.49	0.36	0.40	0.31	0.04
Oils and fats	-1.01	-0.82	-0.81	0.94	0.89	0.47	0.75	0.58	0.05
Prepared food and drink	-1.08	-0.95	-1.02	1.27	1.12	0.60	1.01	0.72	0.06
Other foods	-0.79	-0.79	-0.82	0.82	0.72	0.34	0.65	0.46	0.04
Tobacco products	-1.11	-0.99	-0.78	0.70	0.71	0.43	0.56	0.46	0.04

Source: estimated using the 2011 SUSENAS

The all unconditional expenditure elasticities are positive but less than unity except for prepared food and drink for low and medium income households exceeding than unity or elastic. Prepared food and drink are most responsive to expenditure change across income level, followed by oil and fats. The expenditure elasticities of cereal group are relatively high ranging from 0.79 for low income families to 0.44 for high income families. However, expenditure elasticities do not vary across income level. The homogenous expenditure elasticities across income level may indicate that food expenditures across income level in Central Java are relative equally distributed.

Instead of expenditure elasticity, the income elasticity is main concern for economic policy. Like expenditure elasticities, all income elasticities are positive but inelastic across income level with exception for prepared food and drink (1.01) for low income household. Prepared food and drink are also most responsive to income change followed by oil and fats across income level. The income elasticities of cereal group as staple food are relatively high compared to other food groups across income strata. Unlike expenditure elasticity, variations of income elasticity across income level for the ten food groups are high when moving from low and medium to high income household. More over, income elasticity becomes less elastic as moving to higher income households. These results imply that higher income growth for lower income strata (low and medium income level) relative to high income strata would cause to greater demand for foods in Central Java province.

Table 6: Calorie and Protein Elasticity by Income Groups, Central Java, 2011

	Calorie			Protein		
	Low	**Middle**	**High**	**Low**	**Middle**	**High**
Price of						
Cereal	-0.3855	-0.2882	-0.2249	-0.3295	-0.2341	-0.1805
Fish	0.0282	0.2258	0.0195	-0.0202	0.1661	-0.0362
Meat	0.2298	0.1337	0.0256	0.1973	0.0927	-0.0174
Eggs and milk	-0.4268	-0.4209	-0.2400	-0.3600	-0.3467	-0.1758
Vegetables	-0.0184	0.0007	0.0443	-0.0540	-0.0263	0.0196
Fruits	-0.0240	0.1306	0.0196	0.0082	0.1544	0.0397
Oils and fats	-0.0664	-0.1440	-0.1009	-0.0666	-0.1298	-0.0856
Prepared food and drink	-0.3284	-0.2525	-0.2655	-0.2942	-0.2146	-0.2353
Other foods	-0.1113	-0.0248	-0.0393	-0.0976	-0.0228	-0.0217
Tobacco products	0.0766	0.0441	-0.0161	0.0739	0.0421	-0.0110
Income	0.7301	0.5416	0.0493	0.7107	0.5203	0.0481

Source: estimated using the 2011 SUSENAS

The main goal of this study is to estimate calorie and protein elasticity for the ten food group in the Central Java using indirect method based on price and income elasticities available in the demand system in the second-stage budgeting. The calorie (protein) -price elasticity represents the percentage change in calorie (protein) for 1% change in price of the ten studied food group. By contrast, the calorie (protein)-income elasticity measures the percentage change in calorie (protein) resulted of 1% change in income.

Calorie and protein-income and price elasticities of the ten food group across income strata are presented in Table 6. Table 6 is divided by two parts where the top part show calorie and protein-price elasticity and the bottom part indicate calorie and protein-income elasticity. Calorie-price elasticity of cereals is negative across income groups. Because cereals are a staple food, an increase in price of cereals lowers demand for cereals and accordingly reduces calorie intakes. However, low income households reduce most calorie consumption than other household. Prices of eggs and milk, oils and fats, prepared food and drink, other food have negative impact on nutritional availability across income groups. Calorie-price elasticities of other food groups such as fish and meat have a positive sign. An increase in price of those product increases calorie consumption through substitution effect by increasing demand for other food. Tobacco products do not contain nutritional effects such as calorie and protein. However, its calorie-price elasticity has positive for low and medium income household because of cross commodities effect. Calorie intake is most responsive to change in price of eggs and milk as compared to other studied foods. In general, most of calorie-price elasticity (18 of 30) are negative and become less elastic in moving from lower to higher income households. These findings imply that an increase in price of the ten-food groups decreases calorie consumption and lower income households reduce more calorie intake. Calorie-income elasticities are positive across income groups but become more elastic from higher income to lower income households. Therefore, lower income households get more nutritional benefit for increasing income.

Protein-price and income elasticities have same patterns as calorie-price and income elasticities but most of their magnitudes are smaller than calorie elasticity. Protein-price elasticity of cereals are negative across income level and became inelastic as income increases. As expected, magnitude of protein-price elasticity of cereals is smaller than calorie-price elasticity. Protein consumption is also most responsive to change in price of eggs and milk. Protein-price elasticity of tobacco products has only negative for high income households. Among 30 protein-price elasticity, 21 elasticities are negative. Like calorie, protein-price elasticities are more elastic from higher income to lower income households. As results, if price of the ten studied foods increase households decrease their protein consumption but lower income household would reduce more protein consumption. Calorie-income elasticities are also positive across income groups but become more elastic from higher income to lower income households. Lower income households consume more protein than higher income household as income increases.

CONCLUSION

This study estimates calorie and protein elasticity in Central Java using the indirect method. Household survey data SUSENAS in 2011 are used. Calorie and protein elasticities of the ten food groups are estimated across income groups. Most of calorie and protein-price elasticities are negative so that whenever price of studied foods go up households in Central Java would reduce calorie and protein consumption. Calorie and protein intake are most responsive to change in prices of eggs and milk as compared to other foods. More importantly, calorie and protein-price elasticity of cereals as staple food with rice as one subgroup are negative. These results suggested that as the price of rice goes up, people face nutritional deficiency. Calorie-price elasticities of the ten studied foods are more elastic than protein-price elasticities. Calorie and protein-income elasticity are positive and become more elastic from higher income to lower income households. Calorie is more responsive to income change than protein.

Because most of calorie and protein price elasticity of the ten studied food are negative and calorie consumption in Central Java was below standard of adequacy, some price policies should be addressed in facing undernutrion problem. First, maintaining affordable rice as staple food is critical for population well-being in Central Java. The Government of Central Java must maintain surplus staple foods such as rice, corn and cassava in order to stabilize the price of staple foods. Second, since calorie and protein intakes are most responsive to price of eggs and milk, stabilizing the price of eggs as main dish in consumption diet in Central Java is also important in solving undernutrion issues.

REFERENCES

Badan Ketahanan Pangan, Central Java, chttp://bkp.jatengprov.go.id, accessed on 1 January 2012 1:12 west Indonesia time.

Banks, J., R. Blundell, and A. Lewbel (1997), "Quadratic Engle Curves and Consumer Demand," *Review of Economics and Statistics*, 79,527-539.

Chern, S.W., K. Ishboshi, K. Taniguchi and Y. Tokoyama (2003), "Analysis of Food Consumption Behavior by Japanese Households," *Food and Agricultural Organization: Economic and Social Development*, Paper 152.

Central Bureau of Statistics (CBS), Central Java, SUSENAS 2008-2012.

Jensen, H.H. and J. Manrique (1998), "Demand for Food Commodities by Income Groups in Indonesia," *Applied Economics*, 30, 491-501.

Moies, J.P. (2003), *Indonesian Food Demand System: An Analysis of the Impact of the Economic Crisis on Household Consumption and Nutritional Intake*, Unpublished Doctor of Philosophy's Dissertation, The Faculty of Columbian College of Art and Sciences, Gorge Washington University.

Pan, S., S. Monhanty and M. Welch (2008), "India Edible Oil Consumption: A Censored Incomplete Demand Approach," *Journal of Agricultural and Applied Economics*, 40, 821-35.

Skoufias, E. (2003), "Is the Calorie-Income Elasticity Sensitive to Price Changes? Evidence from Indonesia," *World Development*, 31, 1291-307.

Skoufias, E., S. Tiwari and H. Zaman (2011), "Crisis, Food Prices, and the Income Elasticity of Micronutrient: Estimates from Indonesia," *The World Bank Economic Review*, doi: 10.1093/wber/lhr054, 1-28.

Yen, S.T., K. Kan and S.J. Su (2002), "Household Demand for Fats and Oils: Two Step Estimation of a Censored Demand System," *Applied Economics*, 14, 1799-1806.

Zheng, Z., and S.R. Henneberry (2010a), "An Analysis of Food Grain Consumption in Urban Jiangsu Province of China," *Journal of Agricultural and Applied Economics*, 42, 337-355.

Zheng, Z., and S.R. Henneberry (2010b), "The Impact of Changes in Income Distribution on Current and Future Food Demand in Urban China," *Journal of Agricultural and Resource Economics*, 35, 51-71.

Zheng, Z., and S.R. Henneberry (2012), "Estimating the Impact of rising food prices on nutrient intake in Urban China," *China Economic Review*, 23, 1090-1103.