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Food Demand Analysis of Indonesian Households with Particular Attention to the Poorest

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Abstract

The purpose of this study is to analyze the demand responses of Indonesian households to food prices, income changes and other socioeconomic factors. The underlying assumption here is that inadequate information on household food expenditure patterns which vary across income groups and regions may have its contribution to the persistence of food insecurity. We use the Indonesian Family Life Survey data and methodologically we employ an extended form of the Quadratic Almost Ideal Demand System model which includes demographic and regional factors. Results reveal the well known pattern that food demand behavior varies significantly between urban and rural households as well as income groups. The poorest households consume relatively more staple food as well as alcohol and tobacco goods while the richest households consume relatively more meat, snack and dried food. It is shown that the poorest households' expenditure elasticity on alcohol and tobacco is high implying that the poorest households transfer their extra resources on alcohol and tobacco goods instead of more nutritious food items. Results also show that price and expenditure elasticities have changed across time (1997-2007). Own price elasticities have increased for most food items implying that people have become more responsive to changes in prices. In contrast, the expenditure elasticity has declined for most food items (except for 'alcohol and tobacco goods') which would imply welfare improvement since the 1997 crisis.

Keywords: food demand, QUAIDS, Indonesia

JEL Classification: D11, D12

1. Introduction

Food security is an essential issue in a developing country like Indonesia. Food is even considered as a 'political' good since food-related policies not only have impacts on economic aspects such as food consumption and production, but food is also closely associated with political issues. In the era of Soekarno[1], food was used as a tool to engage in the international political arena which resulted to international food aid disbursement to Indonesia and also involvement in the international world (Sidik 2004). In the era of Soeharto[2] achieving food (in particular rice) self sufficiency was put as the ultimate goal of food policy.

The most fundamental food-related issues in Indonesia have to do with food production, consumption and distribution. More importantly, food production is strongly linked to structural changes in Indonesia. In the 1960s, agricultural sector was the major contributor for national output (Hill 2000). However, manufacturing and service sectors successfully overtook the dominance of agriculture in the early 1970s. The increasing share of manufacturing sector was due to the rise of mining operations, particularly 'oil' combined with the 'oil price boom' (Piggot et al. 1993). The share of agricultural sector's contribution to the national output decreased sharply from 55 per cent in the 1960s to just above 10 per cent in the year 2000 and beyond. In addition, structural change from agricultural to non-agricultural sectors also altered the allocation of input factors, where labor force has also been absorbed into non-agricultural sectors. Despite the declining percentage contribution of agricultural sector in the national economy, the absolute amount of agricultural production has slightly increased during the last decade. Nevertheless, the growth rate of agricultural output could not keep up with the rate of population growth (ADB 2008).

Consumption pattern is considered as one of the most important indicators of economic development in a country. In theory, the change in consumption pattern is determined by price and income changes together with changes in tastes and preferences. As what is evident in most developing countries, food constitutes the largest share of household expenditure and within the food category, 'staple food' is the most dominant consumption category (Indonesian Bureau of Statistics 2009). In early 2000, the share of the budget spent on food was 58 per cent and it decreased to just around 50 per cent in 2009 and non-food consumption increased from 40 per cent

[1]Soekarno was the first President of Indonesia. He is a prominent figure in Indonesian history due to his leadership in fighting for the independence from the Netherlands colonization. He was elected as Indonesian President in the first 20years after gaining independence (Hil 2000).

[2] Soeharto was the second President of Indonesia. He ruled Indonesia from 1967 to 1998 (Schwarz 2000). He stepped down in 1998 from the presidency after large demonstration and request from Indonesian people. Soeharto era was notorious with the corruption, collusion and nepotism.

to 50 per cent during this period (Indonesian Bureau of Statistics 2009). The latest report from the Indonesian Ministry of Agriculture stated that average calorie availability and consumption[3] were 3035 kcal per capita and 2015 kcal per capita, respectively. This level is above the recommended energy availability and consumption which is 2200 kcal per capita and 2000 kcal per capita, respectively (Ministry of Agriculture 2007). This figure reveals that Indonesia should have been able to successfully meet the food need of its population. Aggregate income per capita, which stood at around 3500 USD in 2006, also confirms that Indonesia should have been food secure for at least all basic foods (ADB 2008).

However, the national-level figures might not represent the micro-level evidence. Despite food security pursued by Indonesian government through maintaining aggregate production and supply, this achievement has not been transferred to the households. There are still around 32 percent of households who consume less than the recommended diet (Rusastra et al. 2008). In addition, there are around 30 per cent of Indonesian children with inadequate nutritional status as represented by the high incidence of underweight and stunting (Schmidt 2002). Those evidences show that food insecurity in Indonesia is not a problem of aggregate (national) food availability (Tabor et al. 1999). Food insecurity is mainly a problem of reduced incomes and deterioration of purchasing power rather than national production and supply. Managing food security requires, therefore, not only understanding how policies influence the availability of food and income but also how households can have sustainable access to food and cope with insecurity and income shocks. According to Hartmanshenn et al (2002), national food security focuses more on addressing food availability, where at the household level, food access and utilization are the most pressing issues. Therefore, food security essentially depends on distribution of the economic growth (Timmer 1997, Timmer 2004).

To achieve food security at the household level, Indonesian government has established a 'Food Security Council' through Presidential Decree No. 132/2001 and generated several ambitious programs such as local food development and empowerment of *food security areas* [4] (Rusastra et al. 2008). Since 1999, the government continues to provide food aid for poor households through

[3] Calorie availability measures per capita per day availability of food (food expenditure) while calorie consumption refers to food consumption converted into calorie (Bouis 1995).

[4] Indonesia in cooperation with World Food Program developed food security atlas. It identified food secured and food insecure areas in 265 rural districts of 30 provinces in Indonesia.

subsidized price for rice. Nevertheless, food insecurity remains. Other policies[5] aiming at reducing food insecurity have so far failed. We hope that improved information about demand behavior may contribute to better policy designs. Designing remedial policy measures, without the comprehensive understanding of the household demand behavior, proved ineffective. Hence, it is vital to gain a thorough knowledge of the factors underlying the consumption pattern behavior for future food policy direction.

It is important for public policy to be well informed on how consumers change their expenditure on goods in response to changes of prices and income. This paper intends to improve knowledge and understand the heterogeneous pattern of food consumption behavior in Indonesia. Following Banks et al. (1997), this paper employs the Quadratic Almost Ideal Demand Systems (QUAIDS) with demographic effects incorporated in the model. This paper specifically examines the food expenditure patterns across income groups and regional differences. The main contribution of this paper is the unique combination of using household longitudinal data on QUAIDS methodology. Compared to other demand system models, QUAIDS is more appropriate (see section 3.1 for details) to analyze food demand behavior since it has the ability to capture the curvature of Engel's law. To our knowledge, this study is the first of its kind, especially in relation to the existing Indonesian food demand literature, to apply the QUAIDS methodology on the rich Indonesian longitudinal data set.

The organization of the rest of the paper proceeds as follows. Section 2 reviews existing literatures of food consumption in Indonesia. Section 3 describes the choices of modeling in demand systems. Data are explained in section 4. Section 5 discusses the estimation results followed by a brief section on limitations of the study and the last section provides concluding remarks.

2. Review of Existing Literature

A number of empirical studies (Alderman and von Braun 1983, von Braun and de Haen 1986,Deaton 1990, Garcia 1990, Michalek and Keyzer 1992, Molina 1994, Fan et al. 1995, Moro and Sckokai 2000, Abdulai 2002, Gould and Villareal 2006, Ecker and Qaim 2008) mentioned that food and calorie demands are income and price responsive. Notwithstanding, price elasticities and food consumption patterns vary across countries. In developed countries' context (Michalek 1992, Abdulai 2002, Chern et al. 2003), food demand is price and income inelastic and food was found to be a necessity good.

[5] These programs include people's food barn development, delayed selling system development, local food development, home yard utilization, participatory integrated development in rain fed areas as what have been formulated by Indonesian Food Security Council.

However, this figure might be strikingly different in the case of developing countries. Alderman and Garcia (1993) pointed out that change in food prices affected household welfare directly through real income and in the long term altered nutritional status. Ecker and Qaim (2008), using the case of Malawi, found that price elasticities are high for food demand while they are low for nutrient consumption. It is also found that price subsidies on staple food to promote food and nutrition security might result to undesirable effect while income related and direct nutrient intervention is better to improve overall nutritional status.

Several previous studies have been conducted to examine food demand in Indonesia. The studies assess food consumption pattern of Indonesian households using national expenditure survey conducted by Indonesian Bureau of Statistics and focused on cross sectional data. The classic food demand analysis was conducted by Kakwani (1977). Using 1969 Indonesian National Socio-Economic Household Survey (*Survei Sosial Ekonomi Nasional* - SUSENAS) data, this study aimed to estimate expenditure elasticities of eight food groups and non-food consumption, then compared the elasticities across several forms of Engel functions: semilog, linear, double log, hyperbolic, semilog inverse, double log inverse and log inverse. It is found that expenditure elasticities vary across different forms of Engel curve though the difference was not substantial. The study also evaluated price and income elasticity across different income groups. In all models, expenditure elasticities for cereals and cassava and vegetables were inelastic. Within food group, expenditure elasticity for eggs and milk and meat were the most elastic.

Timmer and Alderman (1979) and Dixon (1982) found similar results on the expenditure and price elasticities for selected food crops commodities. Deaton (1990) estimated food demand function for Indonesia with the focus on unit value and embraced that it is a valid proxy of price. Further, it is stated that the use of unit value accounts price and income elasticities of quality. The study estimated eleven food commodities. It is found that price elasticity for staple food is inelastic. Compared to Timmer and Alderman, cross price elasticity of cassava with rice in Deaton's study are significantly different. In Timmer and Alderman's, the cross price elasticity of cassava to rice price is 0.77, while Deaton's shows 0.15. This difference might be due to unit value specification. Jensen and Manrique (1998) estimated food demand of Indonesian urban households classified into different income groups. Food demand was classified into eight commodity groups. The study implemented AIDS and also incorporated demographic variables in the model. The study found that for high income household, rice was the least price responsive commodity and all food demand had expenditure elasticities less than unity. On the other hand, the low income urban households were

much more sensitive to the change of rice and fish price. The demographic variables were only significant for high income households.

In the last decade, studies on food demand have taken into account how economic crisis might have influenced consumption. Skoufias (2003) examined the effect of price and income on food and calorie demand. Using SUSENAS data of 1996 and 1999 round, this study attempted to capture the behavioral change of consumption in the aftermath of economic crisis. Nonparametric methods were implemented to observe the different elasticity estimates of poor and rich households. The empirical findings reveal that the income elasticity for calorie demand is slightly higher in 1999 (post crisis period) compared to that of in 1996 (pre crisis period). This figure indicates that the calorie-income elasticity is insensitive to price changes even when the price is very volatile in the crisis time. The households smooth their consumption in the time of crisis, as shown in this study, through the increase of calorie-income elasticity for cereals while the calorie-income elasticity for other food decreased.

Recent works on food demand in Indonesia were conducted by Widodo (2006) and Fabiosa et al. (2005). Widodo (2004) estimated food demand function of Indonesian households based on seven rounds of Survey of Living Cost Indonesia (1980, 1981, 1984, 1987, 1990, 1993 and 1996). Using Linear Expenditure System (LES), it is found that Indonesian households have the highest responsiveness of expenditure change on meat (0.367) and the lowest one on fruits (0.03). This finding shows that when there is an increase in income, the biggest proportion of this extra income will be spent for meat expenditure and the smallest proportion of it will go to fruit expenditure. Fabiosa et al. (2005) estimated nine food groups using 1996 SUSENAS data. An incomplete demand system (LinQuad) is implemented. In the case of cereals and vegetables, it is pointed out that Indonesian households mostly respond to changes in income through the change of the quantity demanded. Fruits and eggs-milk showed very low price elasticity while the highest price elasticity among nine food groups is meat and fish.

Notwithstanding, the previous empirical studies on food demand in Indonesia merely focus on cross sectional or pooled data which do not capture how the consumption behavior may change across time. The existing studies are also lacking non-economic factors such as household size and composition which could affect the consumption tastes and preference. Even though previous studies have been able to reveal food demand behavior, the empirical strategies used in the studies refer to expenditure share Engel functions that are linear in the logarithm of total expenditure. However, in the developing country setting like Indonesia, incomes highly vary across individuals and regions. The income effect of the various income groups should be fully captured in a demand model

in order to forecast how households respond to change of economic policies. Capturing the income effect with the extension of demographic variables will add value to the growing body of literature on food demand behavior in developing countries.

3. Demand System Models in Empirical Studies

Application of demand systems enables the modeling of allocation of total expenditures among commodities given a certain budget set. To apply demand theory in the real world, empirical model of demand system is needed. This section outlines selected demand systems including Linear Expenditure System (LES) developed by Stone (1954), the Rotterdam model (Barten 1964, Theil 1965, the Indirect Translog System (ITS) introduced by Christensen et al. (1975), Almost Ideal Demand System (Deaton and Muellbauer (1980), and Quadratic Almost Ideal Demand System (QUAIDS) by Banks et al. (1997). Those models chosen according to most commonly used models and the development of state of the art in consumer modeling. Based on features of each model, LES has a problem in describing demand behavior based on Engel's law. As income increase, a good might change from normal to inferior good which is implausible to examine in LES. The Rotterdam system is consistent with demand theory and has ability to examine relation across commodities. However, since it is not derived from specific utility or cost function, the model is inconsistent with utility maximizing behavior. The translog model is favorable in terms of its flexibility of functional form but has a major problem in the estimation due to relatively large number of independent parameters. AIDS demand function satisfies the principles in demand theory and its estimation is less complicated than other models.

3.1 Choice of a Specific Demand System Model for the Estimation Strategy: Quadratic Almost Ideal Demand System

The Quadratic Almost Ideal Demand System (QUAIDS) was developed by Banks et al. (1997). Based on non-parametric analysis of consumer expenditure patterns, it is shown that Engel curves require higher order of logarithm of expenditure. Further, Banks et al. (1997) stated that models that fail to account for Engel curvature showed to generate distortion in welfare losses when demand functions were estimated. Previous models such as AIDS did not consider this issue and linearized the logarithm of total expenditure in the model. QUAIDS extends AIDS model with quadratic logarithm of expenditure. Banks et al. (1997) applied the model to capture the curvature of Engel curve using UK

Family Expenditure Survey. Basically QUAIDS is a nested model of AIDS and also satisfies the properties of demand function.

QUAIDS model has almost similar features as AIDS and it is able to capture the Engel curvature. Therefore, QUAIDS has been chosen as the demand model for empirical strategy of estimation. Furthermore, this study extends QUAIDS model with demographic variables to investigate the role of non economic variables in food demand behavior. In the developing countries setting, there are only a few studies with the application of QUAIDS. Hence this study contributes to a small but growing body of literature on food demand behavior in developing countries.

3.2 Empirical Model: Quadratic Almost Ideal Demand System with Demographic Variables

In the econometric studies of food demand, partial and complete demand systems are used to model consumer behavior (Chern et al. 2003). However, most studies employed complete demand systems since they model consumer demand in a way that the systems specify the allocation of total expenditures for all goods in the budget. Accordingly, the models generate expenditure and price elasticities. The complete demand system employed in this study is Quadratic Almost Ideal Demand System (QUAIDS) (Banks, et al., 1997). As mentioned above, QUAIDS is an extension from Almost Ideal Demand System. QUAIDS includes higher order of expenditure term to capture the non-linearity of Engel Curve.

QUAIDS (Banks, et al., 1997) assumes that household's preferences follow quadratic logarithmic of household expenditure functions as the following:

$$\ln c(u, p) = \ln a(p) + \frac{ub(p)}{1 - \lambda(p)b(p)u} \qquad (1)$$

where *u* is utility, p is a set of prices, a(p) is a function that is homogenous of degree one in prices, b(p) and λ(p) are functions that are homogenous of degree zero in prices. The household cost function in QUAIDS is similar to AIDS if λ set to zero. The indirect utility function accordingly is as follows:

$$\ln V = \left\{ \left[\frac{\ln m - \ln a(p)}{b(p)} \right]^{-1} + \lambda(p) \right\}^{-1} \qquad (2)$$

where m is the total expenditure, ln a(p) and b (p) are the translog and Cobb-Douglas functions of prices as in AIDS formulation:

$$\ln P(p) = \alpha_0 + \sum_{i=1}^{K} \alpha_i \ln p_i + \frac{1}{2} \sum_{i=1}^{K} \sum_{j=1}^{K} \gamma_{ij} \ln p_i \ln p_j \quad (3)$$

$$b(p) = \prod_{i}^{n} p_i^{\beta_i} \quad (4)$$

The λ(p) in QUAIDS is defined as:

$$\lambda(p) = \sum_{i=1}^{K} \lambda_i \ln p_i, \quad \text{where} \quad \sum_{i=1}^{K} \lambda_i = 0 \quad (5)$$

The subscript *i* =1, …, K in the model denote the number of goods in the demand systems. Applying Shephard's lemma to the cost function (2.1) or Roy's identity to the indirect utility function (2.2), the QUAIDS expenditure shares is given as the following:

$$w_i = \alpha_i + \sum_{j=1}^{K} \gamma_{ij} \ln p_j + \beta_i \ln\left\{\frac{m}{P(p)}\right\} + \frac{\lambda_i}{b(p)}\left[\ln\left\{\frac{m}{P(p)}\right\}\right]^2 \quad (6)$$

where, w_i is food budget share of eight commodities and α, γ, β, and λ are parameters. Therefore, there will be eight equations in the demand system. When λ is equal to zero, the equation (2.16) represents AIDS model. The presence of higher order expenditure does not imply that QUAIDS is better compared to other AIDS (Gould and Villareal 2006). The quadratic term give a benefit to evaluate higher order of Engel curves while still maintaining utility maximization behavior assumption. Further, Banks et al. (1997) mentioned that the influence of demographic and other household characteristics can be involved in the model. Therefore, the QUAIDS model with household characteristics is represented as follows:

$$w_i = \alpha_i + \sum_{j=1}^{K} \gamma_{ij} \ln p_j + \beta_i \ln\left\{\frac{m}{P(p)}\right\} + \frac{\lambda_i}{b(p)}\left[\ln\left\{\frac{m}{P(p)}\right\}\right]^2 + \sum_{s=1}^{s} \partial_{is} D_{st}^h + u_{it}^h \quad (7)$$

where D is a set of household characteristics including household size, urban/rural, gender, education, and community level variables, where s refers to food groups and t refers to the year of survey.

In terms of theoretical aspects, QUAIDS model also satisfies the properties of demand function: adding-up, homogeneity, and symmetry. Adding up restriction requires that the total budget share is equal to one which means that the household does not spend more than the total budget (Deaton 1997).

Using non linear seemingly unrelated regression, these restrictions will be maintained during estimation.

From the QUAIDS model provided in equation (2.6), expenditure and price elasticities can be derived by differentiating equation (2.6) with respect to ln *m* and ln p_j, respectively. The derivation results are:

$$\mu_i \equiv \frac{\partial w_i}{\partial \ln m} = \beta_i + \frac{2\lambda_i}{b(p)}\left\{\ln\left[\frac{m}{a(p)}\right]\right\} \tag{8}$$

$$\mu_{ij} \equiv \frac{\partial w_i}{\partial \ln p_j} = \gamma_{ij} - \mu_i(\alpha_j + \sum_k \gamma_{jk} \ln p_l) - \frac{\lambda_i \beta_j}{b(p)}\left\{\ln\left[\frac{x}{a(p)}\right]\right\}^2 \tag{9}$$

The parameter α_i in equation (2.6) is the share of an item in the budget of a subsistence household, while $\beta_i + 2(\lambda_i/b(p))[\ln(x/a(p))]^2$ measures the effect of one per cent increase of real expenditure on budget share of good *i*. Unlike AIDS, QUAIDS[6] allows the variability of a commodity depending on the expenditure range. For instance, with a positive β and negative λ, a commodity is categorized as a normal good at low level of total expenditure but becoming inferior at high level of total expenditure. The expenditure elasticities can be calculated by:

$$e_i = \mu_i / w_i + 1 \tag{10}$$

From μ_{ij}, Marshallian uncompensated price elasticities can be calculated as:

$$e_{ij}^u = \frac{\mu_{ij}}{w_i} - \delta_{ij} \tag{11}$$

where δ_{ij} is equal to one if i=j and equal to zero if i≠j. From Slutsky equation, Hicksian or compensated price elasticities are calculated as follows:

[6] However, this model does not capture the quality effect of income as what have been developed by Deaton (1990). In addition, QUAIDS does not specifically address the issue of inter-temporal consumption but Banks et al. (1994) handled this issue using time series of cohort level data. .

$$e_{ij}^{c} = e_{ij}^{u} + w_j e_i \quad (12)$$

4. Data

This section discusses the data employed in this study. The descriptive results of household food expenditure patterns are also discussed in this section.

The data used in this research is Indonesian Family Life Survey Data (IFLS). IFLS is a longitudinal socioeconomic and health survey conducted in 1993, 1997, 2000 and 2007 (RAND, 2010). IFLS collects data on individual respondents, their families, the communities in which they live, and the health and education facilities they use. The first wave of IFLS was administered in 1993 interviewing 7,224 households. The second wave of IFLS sought to re-interview the same respondents in 1997. The next wave, IFLS3, was fielded on the full sample in 2000. The latest wave of IFLS was carried out in 2007. In IFLS4, like earlier waves, it re-interviewed all target households, plus new split-off households that contained at least one target respondent. IFLS is the only longitudinal data in Indonesia with a very high follow-up rate. The IFLS 2 was able to re-contact 94.4 per cent of IFLS 1 households. In IFLS 3 the follow-up rate was 95.3 per cent of IFLS 1 households. In IFLS 4, the follow-up rate was 93.6 per cent which of lower than previous waves of IFLS due to the longer time lag[7]. IFLS sample represented about 83 percent of the Indonesian population living in 13 provinces. Within these 13 provinces, enumeration areas (EA) were randomly chosen based on SUSENAS sampling frame. There are 321 EAs and within each EA, households were randomly chosen, also based on 1993 SUSENAS listings. 20 households were selected for urban EA and 30 households were chosen for rural EA (Strauss et al. 2009). This study only employs three rounds of IFLS: IFLS 2, IFLS 3 and IFLS 4. IFLS 1 is not used in the analysis since the expenditure module is not comparable to the next rounds of IFLS, particularly concerning with items of prepared food away from home.

IFLS provides a rich dataset of household expenditure on both food and non food expenditure. The food expenditure comprises of 38 items[8] and the recall period of these food expenditures is one week. For the purpose of this study, food expenditure of food items is used since IFLS does not provide quantity consumed by household. In addition to food expenditure, prices are also key variables in modeling demand. Fortunately, IFLS also provides detailed information from the

[7] The time lag of IFLS1, IFLS2, and IFLS3 is 3 years while the time lag between IFLS3 and IFLS4 is 7 years.

[8] There might be issues of product quality differences among these items particularly when the commodities are aggregated. In fact, quality will be reflected in the price of commodity as what have mostly discussed in the aspect of unit value (Deaton 1990). More particular, quality of the commodities might affect utility of which becomes a crucial issue in the aggregation (Lewbel 1996). It is assumed that quality choice is a function of household income, household characteristics, and also price and this study has involved those variables in the model. Detail discussion on the commodity aggregation is presented in section 4.1.

communities in which IFLS households are located and from the facilities that are used by the households. The information in the community level includes prices data in each EA. With the absence of quantity data in consumption, as is the case in IFLS data, price data from community questionnaire is preferable (Deaton and Zaidi, 2002). IFLS collected price data from two resources: traders/markets nearby the village office and POSYANDU (*Pos Pelayanan Terpadu* – community health post) cadre[9]. There are 31 price items collected which correspond to the commodities asked in expenditure module. In this study, prices are the average prices from two sources.

The use of longitudinal data provides opportunity to understand the dynamic behavior of households. For the purpose of this study, only panel households[10] are analyzed and split-off households are excluded from the analysis owing to the fact that split-off households might have different characteristics compared to their status in the original households. Moreover, price data are also not available for the split-off household who most of them not reside in IFLS original EA. The total number of observations in this study is 16,836 panel households. There are approximately 5600 households for each wave.

4.1 Household Expenditure on Food

As has been mentioned in the previous section, IFLS collected data on 38 food items' expenditure. Those data were collected by asking the households if they had purchased a particular food item during the past week of interview. To simplify the analysis and estimation in the demand systems, those food items are aggregated into eight food groups: staple, vegetables and fruit, meat and fish, oil, dairy products, alcohol and tobacco goods, snack and dried food, and other food (see Table 1). The aggregation is also important to see the pattern of consumption whether households are still consuming basic food or richer nutrient food. The food items are aggregated based on the substitutions of each food item and they are placed in a group where they are close substitutes. Lewbel (1996) proposes commodities aggregation which relaxes the assumption of perfect correlation among group prices. In micro data study setting, there is still limited empirical study of the prices and commodity grouping (Blundell et al. 1993). Following Bopape (2006), price data in this

[9] POSYANDU is one of health facilities used by Indonesian households. It provides health services, particularly for women and children. The services in POSYANDU are registration of pregnant women, basic observation and weighing for pregnant women and children, family planning and nutrition consultation, and provision of vitamins, food supplements, and contraceptives. Since the cadres were also involved for food supplement provision, hence their information for prices is assumed to be valid.

[10] Panel households in this study are defined as the original households interviewed in the first wave of IFLS and always followed and interviewed in all IFLS rounds.

study are also generated based on close substitutes as what has been applied in commodities aggregation.

This study is not immune from the missing data problem. To handle this issue, imputation-based methods are used to replace the missing data (Levy and Lemeshow 1999). In particular, method of imputation in this study is based on substitution of the mean. If price of certain commodity is missing in an EA, the gap will be substituted by the average price at village level. In addition, the imputation also captures the seasonality issue. Hence imputed prices are also based on the same interview month. Normally, community data collections of EAs which are close to each other were conducted in the same month. The imputation procedure was employed as follows: If there is a missing data in rice price in an enumeration area, the imputed price is the average rice price of the village belongs to the enumeration area and in the same interview month. When this is still missing, the imputed price is based on *kecamatan* (sub district) level where the village is located. The detailed price information is presented in Table A1 in the Appendix. The list of food groups is presented in Table 1.

Table 1. Composition of Food Aggregation

Food groups	***Food items***
Staple (including rice)	rice, corn, sago/flour, cassava, tapioca, dried cassava, sweet potatoes, potatoes, yams
Meat and fish	Meat (beef, mutton, water buffalo meat and the like, chicken, duck and the like), fish (fresh fish, oysters, shrimp, squid and the like), jerky, shredded beef, canned meat, sardine and the like, tofu, tempeh
Vegetables and fruit	Vegetables (kangkoong, cucumber, spinach, mustard greens, tomatoes, cabbage, katuk, green beans, string beans and the like), beans like mung-beans, peanuts, soya-beans, and the like, fruit like papaya, mango, banana and the like
Oil	Butter and cooking oil like coconut oil, peanut oil, corn oil, palm oil and the like
Dairy products	Eggs, fresh milk, canned milk, powdered milk and the like
Alcohol and tobacco goods	Alcohol, tobacco
Snack and dried food	Noodles, cookies, dried food, snacks, prepared food eaten and away from home
Other	Spices, sugar, and beverages

[11]

Table 2 presents descriptive figures of household characteristics. In this study, income groups are derived from household's per capita expenditure where the poorest households are those 20 per

[11] All tables are own estimation based on Indonesian Family Life Survey Data

cent of the bottom income and the richest households are those 20 per cent of the highest income. The mean household size shows a typical nuclear family which consists of a couple with children. Poorest households tend to have larger household size. Interestingly, urban households have slightly larger size than their rural counterparts. Though this is beyond the scope of the analysis, migration may partly explain this difference. The mean income per capita per month was 294,658 rupiahs[12] (equivalent of 32 USD) and the average level of education of household head was primary school[13]. It is shown that there is a wide gap across income groups and region. The difference of level of education of the household head is almost double between urban-rural households and richest-poorest households. The head of household of the poorest households even did not complete elementary school. Most of poorest and rural households are engaged in agriculture or farm activities. The gap of income per capita between the poorest and the richest is severe. The wide disparity of income and other socio-economic characteristics might have an influence on household consumption behavior.

Table 2 Selected Households Characteristics (based on pooled data)

Variables	***Pooled***	***Poorest***	***Richest***	***Rural***	***Urban***
Household size	4.37	5.38	3.49	4.22	4.56
Education of HH Head (years of schooling)	6.34	3.73	10.12	4.86	8.04
Age of Household Head	51.12	51.38	51.33	51.09	51.15
Proportion of Male Headed	0.80	0.83	0.77	0.81	0.79
Proportion of Farm	0.40	0.56	0.20	0.62	0.15
Household Income per capita (in '000 rupiah, monthly)	295	70	1050	226	377

The budget shares of each food group are presented in Table 3. It is shown that staple food is the dominant food expenditure for Indonesian household in all IFLS rounds which took almost a quarter of total food expenditure. The high share expenditure on staple food is typical for developing countries. The share of staple food decreased in 2000 but increased again slightly in 2007.

[12] One US dollar is equal to 9,000 rupiah (Indonesian currency) in February 2011.

[13] The average exchange rate (Rupiahs per US dollar) between 2000 and 2007 is based on Selected Key Indicators provided by Asian Development Bank (ADB 2008).

Households might shift their consumption to cheaper calorie source in this period. This figure is confirmed with the decline in the share of vegetables-fruit and meat-fish expenditure. Meat and fish, the more expensive source of calorie, formed the second largest share of food expenditure in all rounds. It is also shown that the consumption of dairy products was still low. It shared only five per cent of the total food expenditure. The figures also depict that expenditure for snack and dried food has increased which indicated that Indonesian households started to shift to fast and ready food. The increasing snack and dried food consumption will also bring consequences in the future. The tradeoff between home production and market production, particularly when women start entering the labor market, drive the households to consume ready food or food away from home which is already evident in most developed countries (Yen 1992, Nayga 1996).

Disaggregated by income groups, it is evident that the poorest households' dominant expenditure is staple food and the households are less likely to consume dairy product. The second dominant expenditure share of the poorest households is meat and fish. Surprisingly, expenditure share of alcohol and tobacco goods is higher than the consumption for diary product. Indonesian Consumer Foundation reported that 70 per cent of smokers in Indonesia are the poor which means that the poor is the main contributor for government revenue from tobacco (Kompas 2011). The severe smoking behavior of the poor might relate to addiction and lack of knowledge on nutrition. Table 3 also reports that the dominant share of expenditure of the richest households goes to snack and dried food, followed by meat and fish. While the richest group also spends some of their budget on alcohol and tobacco goods, yet their share of expenditure for better diet such as vegetables, meat and fish and dairy products are much larger than share of alcohol and tobacco goods expenditure. In terms of geographical aspect, urban households consume more snack and dried food and dairy product while rural households consume more staple food. Interestingly, the expenditure share of vegetables, meat and fish, oil and alcohol and tobacco goods are almost uniform.

Table 3 Share of Food Expenditure across Commodities, Income Group and Year

Food Group	*Pooled*	*Poorest*	*Richest*	*Urban*	*Rural*	*1997*	*2000*	*2007*
Staple Food	0.24	0.36	0.14	0.20	0.27	0.25	0.23	0.24
Vegetables and fruit	0.11	0.10	0.12	0.12	0.11	0.12	0.12	0.10
Meat and fish	0.17	0.14	0.19	0.18	0.17	0.17	0.18	0.16
Dairy products	0.05	0.03	0.07	0.06	0.04	0.05	0.05	0.05
Oil	0.04	0.05	0.04	0.04	0.05	0.04	0.04	0.05
Alcohol and tobacco goods	0.08	0.08	0.07	0.08	0.09	0.07	0.09	0.09
Snack and dried food	0.15	0.09	0.24	0.18	0.12	0.13	0.15	0.16
Other	0.15	0.16	0.13	0.14	0.16	0.15	0.15	0.14
N	16836	1675	1675	7692	9144	6593	5119	5124

5. Results and Discussion

This section presents the behavior of households' food consumption and results obtained from QUAIDS model based on Indonesia Family Life Survey. The first part of this section explains expenditure and price elasticities generated from QUAIDS model which are important for policy. The second part of this section shows how demographic variables are relevant for household food consumption. The last part of this section discusses food demand behavior of the poorest household.

5.1 Households' Responsiveness to Expenditure and Price Changes

The QUAIDS model shows that the quadratic term of food expenditure for all food groups is significant (Table A2 in Appendix). This result implies the nonlinearity of Engel curve with respect to total food expenditure for all food groups. Furthermore, QUAIDS allows the possibility of normal commodities changing to luxury or luxury goods becoming normal as depicted by the parameters. When a commodity has positive sign of expenditure and negative sign of higher order of expenditure term, this commodity is considered a luxury good at low levels of expenditure and necessity at high levels (Banks et al. 1997). Meat and fish are following this pattern while dairy products remain luxury in all expenditure ranges. The QUAIDS model is also estimated in each wave and income group. In such subsamples, the higher order of expenditure may not be different from zero since the subsamples present more homogenous expenditure pattern. The detail subsamples estimation results are reported in Table A5 and Table A6 in Appendix. In terms of policy purpose, how the households respond to price and income changes is explained from the expenditure and price elasticities.

Table 4 Expenditure Elasticities across Income Groups

	Pooled	*Poorest*	*Middle*	*Richest*	*Urban*	*Rural*
Staple	0.7564	1.0152	0.8798	0.8623	0.7866	0.7566
	(0.0083)	(0.0424)	(0.0201)	(0.0356)	(0.0135)	(0.0104)
Vegetables and fruit	1.0532	0.9967	0.9754	0.8380	1.0362	1.0659
	(0.0094)	(0.0639)	(0.0259)	(0.0288)	(0.0164)	(0.0130)
Meat and fish	1.1475	1.0358	1.1318	1.0494	1.0876	1.1771
	(0.0079)	(0.0549)	(0.0227)	(0.0228)	(0.0142)	(0.0109)
Dairy products	1.3025	1.2800	1.3793	1.1246	1.2017	1.4078
	(0.0140)	(0.1240)	(0.0453)	(0.0377)	(0.0779)	(0.0208)
Oils	0.8879	0.7960	0.7484	1.0744	0.9292	0.8625
	(0.0115)	(0.0712)	(0.0296)	(0.0511)	(0.0220)	(0.0151)
Alcohol and tobacco goods	1.0667	1.3568	1.2806	0.9849	1.0378	1.1030
	(0.0159)	(0.1327)	(0.0442)	(0.0560)	(0.1326)	(0.0205)
Snack and dried food	1.1586	0.9091	1.0203	1.0876	1.1163	1.1097
	(0.0125)	(0.1021)	(0.0373)	(0.0311)	(0.1015)	(0.0177)
Other	0.9131	0.9138	0.8963	1.0143	0.9160	0.9065
	(0.0070)	(0.0465)	(0.0189)	(0.0241)	(0.0118)	(0.0094)

Standard errors in parentheses

The estimated expenditure elasticities are reported in Table 4. For the 'all samples', most food groups are found to be elastic except for staple food, oils and other goods which are found to be inelastic and thus necessities. Expenditure on necessities increases with income, but more slowly in the percentage of magnitude. Dairy products have the highest expenditure elasticity followed by meat and fish. For meat and fish, 10 per cent increase in total food expenditure leads to 11.5 per cent in consumption of meat and fish. This finding points out that the increase of income shifts the consumption pattern from staple food to more meat, poultry, eggs, and dairy products. Even though this pattern is a good sign for Indonesia where more people will consume more nutrient food, the health problems as a consequence of this dietary change should also be anticipated. Staple food and oils are necessities for all sample, one per cent change in total food expenditure results to the change of staple and oils consumption less than proportionately. Interestingly, alcohol and tobacco goods expenditure elasticity is found to be elastic meaning that a 10 per cent increase of total expenditure will be responded by 10.6 per cent increase in demand. Compared to previous studies on alcohol and tobacco goods consumption (Erwidodo et al. 2002, Adioetomo et al. 2005), the expenditure elasticity in this study is pretty high although almost similar with study from Witoelar et al (2005). As adult good expenditures comprise from tobacco and alcohol, with the increasing tobacco consumption in the last decade and the elastic alcohol and tobacco goods expenditure, caution should be taken on

the possible crowding-out effect of alcohol and tobacco goods expenditure particularly on more nutritious food items.

The results also show that expenditure elasticities vary across income groups. This evidence reassures the importance of disaggregated analysis of consumption patterns by income groups in a developing country with wide income gap like Indonesia. Expenditure elasticity for staple food is elastic for the poorest group. Interestingly, expenditure elasticity for alcohol and tobacco goods of the poorest is the highest. This fact indicates that the change of income of the poorest households will be most corresponded to alcohol and tobacco goods expenditure. The Indonesian Consumer Foundation reported that there was a misuse of direct cash aid from government. Instead of transferring into more 'human capital' expenditure, more than 50 per cent of the direct cash aid was spent for smoking (Kompas, 2009). On the other hand, dairy product and dried food are luxury for the richest while staple, vegetable and alcohol and tobacco goods are necessities. Comparing between urban and rural areas, expenditure elasticity for staple food is slightly higher in urban than rural. One explanation might be related to the characteristic of rural households which act both as consumer and producer of staple food at the same time. Both urban and rural households are expenditure elastic for meat and fish, dairy product, alcohol and tobacco goods, and dried food. Rural household are more elastic for meat and fish and dairy product, while urban household more elastic for snack and dried food.

Table 5 presents estimation results of compensated ("Hicksian") and uncompensated ("Marshalian") price elasticities. The result shows that the signs of own price elasticities are as expected. Based on Marshallian price elaticities, only meat and fish are found to be unitary price elastic for all samples. This means a ten percent increase in the price of meat and fish leads to the decrease of around ten per cent in the consumption of meat and fish. Nevertheless, meat and fish become less price elastic when only substitution effects are considered as shown by the inelastic compensated (Hicksian) price elasticities. Comparing expenditure and price elasticities is important for policy direction. For all commodities, it is pointed out that expenditure elasticities outweigh price elasticities. It is indicated that income policies for food consumption seems to be more efficient compared to price policies as the expenditure elasticities for all food groups surpass the price elasticities.

For price elasticities, disaggregation based on income group reveals an interesting finding. The magnitude of price elasticities between the poorest and the richest households do not vary significantly. These two groups are price elastic on meat and fish, dairy products and alcohol and tobacco goods. However, the price elasticity of staple food for the poorest household is nearly close to unity. For the poorest household, when income effects are not considered, it is found that only

dairy products and alcohol and tobacco goods remain price elastic. Based on geographical aspect, urban households are price inelastic for all food groups, while rural households are price elastic for vegetables, meat and fish and alcohol and tobacco goods.

It is interesting to investigate the relationship of those food groups. Table A3 in Appendix reports the cross-price elasticities of eight food groups. 40 out of 56 cross-price elasticities are found to be different from zero and show a mixture of complementary and substitution relationship. Compared to own price elasticities, cross price elasticities in this study are much lower which implies that the consumers are more responsive to changes in own prices. All cross-price elasticities are found to be inelastic. The relationship between vegetables demand and meat and fish demand shows the largest substitution effects. On the other hand, the largest complementary effect is shown in the relationship between dairy products price and rice demand. Even though the size of elasticities is pretty small, staple foods, vegetables, meat and fish appear to be complementary to snack and dried food.

Another striking substitution effects, though inelastic, are found in the relationship between alcohol and tobacco goods demand and meat-fish demand. The vegetable-fruit price to meat- fish demand elasticity is 0.17 while the alcohol and tobacco goods price and meat-fish quantity elasticity is 0.11. The increase of vegetables-fruit prices will be responded by increasing meat-fish demand. Comparing between vegetables and meat-fish, Indonesian households diversify their diet more in terms of vegetables-fruit. However, the increase of vegetables fruit price lead households to shift to meat fish consumption, more expensive but more nutritious. The result from substitutive relation between alcohol and tobacco goods and meat- fish is also challenging for national food policy. Indonesian households seem to sacrifice meat and fish consumption when the prices of alcohol and tobacco goods increase so that they are able to maintain their expenditure on alcohol and tobacco. The large share of alcohol and tobacco goods expenditure, particularly for tobacco consumption has been traded off to richer nutrient food such as egg, meat, dairy products and also non food expenditure such as education and medical expenses (Bappenas 2006, Mukherjee 2006). Given this situation, the loss in terms of improved nutrition through meat and fish consumption will be considerable.

The longitudinal data set used in this study allows observing the dynamic behavior of households' responses across times. Table 6 presents price elaticities across time and shows that price elasticities for all food groups are changing during 1997 and 2007. Among eight food groups only price elasticities of staple food and alcohol and tobacco goods are very volatile even considering the substitution effects. World Bank (2008) reported that domestic wholesale rice price was increasing sharply during 2004 and 2007, from less than 3,000 rupiahs to almost 5,000 rupiahs. In 2000s,

Indonesian government recorded several critical food policies. In 1998, the monopoly power in the hand of *Badan Urusan Logististik* (BULOG) – the National Food Logistic Agency was abolished. From 2000 onwards, private import on rice was subject to specific tariff and it reached to 25 per cent of import price. Indeed, the tariff and other non tariff barriers contributed to the increase of rice price. To stabilize food market, BULOG and local governments regularly interfere in the market through special market operation for specific commodities such as rice, cooking oil, sugar and meat. The market operation is normally administered in specific season, particularly in *Idul Fitri - Idul Adha*[14] and also Christmas. Besides, market operation is also conducted when there is a sign of increase of commodities' prices and scarcity. These policies might explain the variation of expenditures and prices elasticities across years. More strikingly, price elasticity of alcohol and tobacco goods in 2007 was very elastic compared to that of in 1997. This behavior might be associated with tobacco and cigarettes policy in Indonesia. In fact, Indonesia was categorized as the big five of 'smoking country' and has lower tobacco tax compared to other Asian countries (Barber et al 2008). In the case of price elasticity of alcohol and tobacco goods, the increase of tobacco retail price might explain this phenomenon. The retail prices of cigarettes were almost doubled from 2000 to 2007 (Barber et al. 2008).

[14] *Idul Fitri* and *Idul Adha* are the two main Moslem holiday celebrations in Indonesia.

Table 5 Own Price Elasticities

	Pooled	***Poorest***	***Middle***	***Richest***	***Urban***	***Rural***
Marshallian Own Price Elasticities						
Staple	-0.7706	-0.9473	-0.7457	-0.8080	-0.6827	-0.8380
	(0.0324)	(0.1081)	(0.0440)	(0.1460)	(0.0642)	(0.0391)
Vegetables and fruit	-0.9580	-1.0703	-0.9848	-0.7772	-0.8483	-1.0297
	(0.0160)	(0.0654)	(0.0266)	(0.0488)	(0.0228)	(0.0231)
Meat and fish	-1.0032	-1.1402	-0.9741	-1.1228	-0.9202	-1.0532
	(0.0331)	(0.1510)	(0.0553)	(0.0979)	(0.0496)	(0.0454)
Dairy products	-0.9771	-1.2391	-0.8917	-1.0179	-0.9419	-0.9961
	(0.0367)	(0.1786)	(0.0660)	(0.0986)	(0.0542)	(0.0535)
Oils	-0.7367	-0.7757	-0.7380	-0.6215	-0.7981	-0.6891
	(0.0292)	(0.0981)	(0.0421)	(0.1221)	(0.0454)	(0.0390)
Alcohol and tobacco	-0.9451	-1.2450	-0.9617	-1.1954	-0.7940	-1.0255
goods	(0.0438)	(0.1868)	(0.0696)	(0.1439)	(0.1268)	(0.0526)
Snack and dried food	-0.9374	-0.7680	-0.9321	-0.9453	-0.9649	-0.9043
	(0.0181)	(0.0954)	(0.0313)	(0.0419)	(0.0411)	(0.0287)
Other	-0.9495	-0.7258	-0.9146	-0.8961	-0.9037	-0.9676
	(0.0230)	(0.0874)	(0.0356)	(0.0740)	(0.0357)	(0.0305)
Hicksian Own Price Elasticities						
	Pooled	Poorest	Midle	Richest	Urban	Rural
Staple	-0.5899	-0.6194	-0.5022	-0.6796	-0.5276	-0.6305
	(0.0324)	(0.1074)	(0.0437)	(0.1460)	(0.0643)	(0.0390)
Vegetables and fruit	-0.8391	-0.9666	-0.8799	-0.6698	-0.7265	-0.9135
	(0.0158)	(0.0643)	(0.0253)	(0.0488)	(0.0226)	(0.0229)
Meat and fish	-0.8071	-0.9988	-0.7963	-0.9073	-0.7289	-0.8571
	(0.0330)	(0.1505)	(0.0549)	(0.0974)	(0.0495)	(0.0451)
Dairy products	-0.9077	-1.2085	-0.8319	-0.9307	-0.8639	-0.9348
	(0.0367)	(0.1783)	(0.0660)	(0.0986)	(0.0554)	(0.0536)
Oils	-0.6978	-0.7343	-0.7038	-0.5798	-0.7601	-0.6493
	(0.0292)	(0.0980)	(0.0420)	(0.1221)	(0.0453)	(0.0390)
Alcohol and tobacco	-0.8556	-1.1651	-0.8525	-1.1282	-0.7101	-0.9301
goods	(0.0438)	(0.1863)	(0.0696)	(0.1433)	(0.1192)	(0.0526)
Snack and dried food	-0.7678	-0.6550	-0.8021	-0.7252	-0.7627	-0.7626
	(0.0183)	(0.0956)	(0.0314)	(0.0427)	(0.0291)	(0.0288)
Other	-0.8126	-0.5639	-0.7742	-0.7637	-0.7739	-0.8255
	(0.0229)	(0.0867)	(0.0352)	(0.0737)	(0.0354)	(0.0304)

Standard errors in parentheses

Table 6 Marshallian and Hicksian Own Price Elasticities across Waves

	1997	*2000*	*2007*	*1997*	*2000*	*2007*
	Marshallian Price Elasticities			**Hicksian Price Elasticities**		
Staple	-0.8642	-0.6178	-1.1332	-0.6795	-0.4407	-0.9490
	(0.0633)	(0.0749)	(0.0690)	(0.0633)	(0.0748)	(0.0689)
Vegetables and fruit	-0.9992	-0.9935	-1.0193	-0.8658	-0.8750	-0.9239
	(0.0359)	(0.0325)	(0.0267)	(0.0358)	(0.0320)	(0.0272)
Meat and fish	-0.9732	-1.2496	-1.0003	-0.7769	-1.0438	-0.8147
	(0.0536)	(0.0693)	(0.0801)	(0.0533)	(0.0692)	(0.0798)
Dairy products	-1.0459	-0.9585	-0.8497	-0.9766	-0.8905	-0.7794
	(0.0558)	(0.0637)	(0.0951)	(0.0558)	(0.0637)	(0.0951)
Oils	-0.8134	-0.9057	-1.1044	-0.7726	-0.8748	-1.0604
	(0.0641)	(0.0805)	(0.0775)	(0.0641)	(0.0805)	(0.0775)
Alcohol and tobacco goods	-1.2331	-0.7574	-1.6259	-1.1580	-0.6613	-1.5212
	(0.0657)	(0.0893)	(0.1526)	(0.0657)	(0.0892)	(0.1526)
Snack and dried food	-0.9439	-1.0030	-1.1064	-0.7858	-0.8349	-0.9257
	(0.0427)	(0.0306)	(0.0962)	(0.0429)	(0.0307)	(0.0964)
Other	-1.0689	-0.7908	-0.9365	-0.9266	-0.6550	-0.8016
	(0.0448)	(0.0590)	(0.0577)	(0.0447)	(0.0590)	(0.0577)

Standard errors in parentheses

5.2 Household Demographic Characteristics

In this study, household demographic characteristics are also introduced in the QUAIDS model to capture the effect of non economic variables on household food consumption. The variables are household size, regional dummy including urban and Java[15], education of household head, and gender of household head. The regional dummy is included to capture regional variation in food consumption patterns. Yet, food consumption pattern simultaneously correlates with level of regional development. The level of development in Indonesia is found to be imbalanced particularly between urban and rural as well as Java and outside Java (Hill 1992, Akita 2003) which led people to migrate.

In terms of household characteristics, household size has a positive effect on share of staple food expenditure but negatively effects expenditure share for meat and fish and dairy products. This finding shows that larger household tends to choose cheaper calorie food source rather than more

[15] Java is one of the main Islands in Indonesia. It is the central island where the capital city located and also known as the central of economy and government activities. Java is also the most densely populated in Indonesia.

expensive one such as meat and fish and dairy products. The regional dummy for Java and outside Java is significant for all food commodities but the direction varies across commodities. Households who reside in Java are likely to consume more vegetables, dairy products, and snack and dried food, while the outside Java households demand more staple food, fish and meat, oil, and alcohol and tobacco goods.

Gender of household also plays a role in the consumption behavior of households. Being a male-headed household has a negative and significant impact on the consumption of vegetables, meat and fish, dairy products and snack and dried food but it has a positive and significant impact on alcohol and tobacco goods consumption. This finding implies that male household head tends to invest relatively more to their preferred consumption. The education of household head has positive and significant influence on vegetables, meat and fish, dairy products, snack and dried and other food which means that more educated household head has more tendencies to invest relatively on more nutritious foods. In contrast, household head education affects staple and alcohol and tobacco goods consumption negatively. Thus, household head with lower education are likely to have higher alcohol and tobacco goods expenditure share.

Existing literature associates better education with higher income. In terms of food consumption behavior, literature confirms that education attainment correlates with better information on the importance of better diet which in turn affects nutritional status (Garett and Ruel 1999). Therefore, policies on broadening education access are in line with promoting better food consumption and improving household nutritional status. Providing information on nutrition and healthy diet through extension or informal meeting in the community might become an alternative strategy.

5.3 Food Consumption Behavior of the Poorest

The behavior of the poor households is often of policy interest for governments. This section focuses on the result explanation pertaining poorest households. Table 7 presents the expenditure elasticities of the poorest household. In 1997, staple food was expenditure elastic for the poorest household yet it became less elastic in the next periods. This fact somehow reports some evidence of Bennet's law which mentions that households switch from cheaper to more expensive calorie consumption as their income rise (Timmer et al. 1983, Fuglie 2004). Dairy products remain expenditure elastic during one decade. As has been mentioned earlier, the poorest households are expenditure elastic on alcohol and tobacco goods and these elasticities even increased in the period of one decade.

This study shows that lower income households tend to spend additional income more on alcohol and tobacco goods. While alcohol and tobacco goods consumption, particularly tobacco consumption in developed countries has decreased and became more inferior in the last decade (World Bank 2000), it is becoming a luxury good for poor households in Indonesia. The finding of this study embraces the facts that the poorest households highly expenditure responsive on alcohol and tobacco goods. Table A5 in Appendix presents the expenditure and its higher order estimates of the poorest households. It is found that both estimates are positive and significant and according to Banks et al (1999) these patterns indicate that alcohol and tobacco goods are luxuries.

Table 7 Expenditure Elasticity of the Poorest Household across Waves

	1997	***2000***	***2007***
Staple	1.1232	0.9129	0.9677
	(0.0601)	(0.0714)	(0.4189)
Vegetables and fruit	0.9089	1.0640	0.9804
	(0.0983)	(0.1061)	(0.3990)
Meat and fish	0.9333	1.1085	1.2387
	(0.0844)	(0.0855)	(0.6125)
Dairy	1.4963	1.0663	1.2389
	(0.2005)	(0.1948)	(0.2612)
Oils	0.7757	0.8645	0.7814
	(0.1044)	(0.1264)	(0.1671)
Alcohol and tobacco goods	1.1909	1.5788	1.4227
	(0.2168)	(0.1669)	(1.2463)
Snack and dried food	0.8115	0.9752	0.6652
	(0.1743)	(0.1595)	(0.2463)
Other	0.9118	0.8666	1.0573
	(0.0646)	(0.0779)	(0.2760)

Standard errors in parentheses

It is also important to note the results from cross price elasticities (Table A6 in Appendix). The largest substitution relationship is found in alcohol and tobacco goods price and meat and fish demand. The cross-price elasticity of these two goods is 0.40 in absolute value, which means that a 10 per cent increase in alcohol and tobacco goods price reduce meat and fish demand by four per cent. On the other hand, the largest complementary relationship is found in dairy products and staple food. The result shows that ten per cent increase in dairy products prices reduces the demand for staple food by six per cent. The prices of dairy products are relatively more expensive compared to other food commodities which unsurprisingly burdensome for poor households.

6. Limitations of the study

The study employs longitudinal data set between 1997 and 2007, and we believe that several factors that affect the consumption behavior have changed across time. The current study focuses on the consumption behavior changes as a result of price and income (expenditure is used as a proxy of income) changes in the time between 1997 and 2007. However, certainly, the quality of the food has also changed during the decade and unfortunately this quality difference is not considered in the model. The availability of substitutable food items, tastes and preferences might have also changed across the years. We used the same set of food items in the analysis in 1997 and 2007 and assumed that tastes and preferences remained constant, which in reality may not be the case. Another issue that has not been taken into account in this study is life-cycle consumption model which captures inter-temporal consumption aspects. It is important to incorporate inter-temporal consumption in the demand analysis since it might affect household welfare, particularly when certain policy is introduced. So, we suggest that studies of this kind in future could move forward and take the steps to incorporate these important variables which could change across time in the QUAIDS model specification.

7. Conclusion

This paper presents an analysis of food demand behavior of Indonesian households. In the case of Indonesia, this study is the first food demand analysis using QUAIDS which elaborates household characteristics and geographical aspects. In addition, the longitudinal data employed in this study is another advantage to level the dynamic behavior of food consumption which might vary across time. The results show that Indonesian households are price and expenditure responsive and food expenditure pattern varies across several demographic and regional contexts.

All food groups have positive expenditure elasticities but the magnitude of those elasticities differs for various food categories. In line with demand theory, all own price elasticities are negative. For the pooled sample, staple food, oils and other food are necessities while vegetables, meat and fish, dairy products as well as alcohol and tobacco goods are luxuries. Expenditure elasticity on alcohol and tobacco goods is very elastic for the poorest households while the richest households are expenditure elastic on dairy products. As expenditure elasticities for all food commodities surpass the own price elasticities, policy tools for enhancing income generating activities might be more effective compared to policies that affect price per se. Hence, in order to improve household food consumption, especially to consume rich nutrient food, 'income-oriented policies' as such will support households to improve their food consumption.

Nevertheless, results also show that poorest households demonstrate the highest expenditure elasticity on alcohol and tobacco goods which may suggest that a tax on these goods could affect demand strongly. Income support policies instead might transfer income to some extent to alcohol and tobacco goods consumption. There is potential to raise poor households' nutritional status since they are also expenditure elastic on meat and fish and dairy products.

This study also found that non-economic variables such as household size, education, gender and geographical factors are relevant for food demand. Education plays a key role on human capital expenditure through better consumption since households with better education invest relatively more on nutritious food items. Regional dimension also matters on food consumption. Java residents and urban households are likely to consume higher nutrition food items than their counterparts. . To sum up, a comprehensive analysis of food demand which account for those differences is essential to get a better understanding of household demand behavior and to shape food policy direction for improved diets.

References

Abdulai, A. 2002. Household Demand for Food in Switzerland: a quadratic almost ideal demand system, *Swiss Journal of Economics and Statistics*, 138(1): 1-18.

Adioetomo, M., Djutaharta, T., and Hendratno. 2005. Cigarette consumption, taxation, and household income: Indonesia case study. World Bank, HNP Discussion Paper No. 26.

Akita, T. 2003. Decomposing Regional Income Inequality in China and Indonesia using Two-stage Nested Theil Decomposition Method, *The Annals of Regional Science*, 31(7): 55-77.

Alderman, H. and von Braun, J. 1986. Egypt's food subsidy policy: Lessons and options, *Food Policy*, 11(3): 223-237.

Alderman, H., and Garcia, M. 1993. Poverty, Household Food Security, and Nutrition in Rural Pakistan, International Food Policy Research Institute, Research Report 96, International Food Policy Research Institute, Washington.

Asian Development Bank. 2008. *Key Indicators for Asia and the Pacific 2008: Comparing Poverty across Countries: the role of purchasing power parities*. Asian Development Bank, Manila.

Banks, J., Blundell, R., and Preston, I. 1994. Life-cycle Expenditures Allocations and the Consumption Costs of Children, *European Economic Review*, 38: 1391-1410.

Banks, J., Blundell, R., and Lewbel, A. 1997. Quadratic Engel Curves and Consumer Demand, *The Review of Economics and Statistics,* 79(4): 527-539.

Bappenas, 2006. *Rancangan Pangan dan Gizi 2006-2011* – Food and Nutrition Platform 2006-2011. Bappenas, Jakarta.

Barber, S., Adioetomo, M., Ahsan, A., Setyonaluri, D. 2008. *The Tobacco of Economics in Indonesia.* International Union Against Tuberculosis and Lung Disease, Paris.

Barnett, W. A., and Serletis, A. 2008. Consumer Preferences and Demand Systems, *Journal of Econometrics*, 147: 210-224.

Barten, A. P. 1964. Consumer Demand Functions Under Conditions of Almost Additive Preference, *Econometrica*, 32(1-2): 1-38.

Blundell, R. W., Pashardes, P., and Weber, G. 1993. What Do We Learn About Consumer Demand Patterns from Micro Data, *American Economic Review*, 83(3): 570-597.

Bopape, L. 2006. Heterogeneity of Household Food Expenditure Patterns in South Africa, Selected Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Long Beach, California, July 23-26. Available at: http://ageconsearch.umn.edu/bitstream/21300/1/sp06bo03.pdf [Accessed August 23, 2009].

Bouis, H. E. 1995.Comments on Part II methodological Issues, in N. Islam (ed.) *Population and Food in the Early Twenty-First Century: meeting future food demand of an increasing population.* International Food Policy Research Institute: Washington, D.C.

Byron, R. P. 1984. On the Flexibility of the Rotterdam Model, *European Economic Review*, 24(3): 273-283.

Chern, W.S., Ishibashi, K., Taniguchi, K., and Tokoyama, Y. 2003. Analysis of the Food Consumption of Japanese Households, *FAO Economic and Social Development Paper* 152, Food and Agriculture Organization of the United Nations, Rome.

Christensen, L. R., Jorgenson, D. W., and Lau, L. J. 1975. Transcendental Logarithmic Utility Functions, *The American Economic Review*, 65(3): 367-383.

Deaton, A., and Muellbauer, J. 1980. An Almost Ideal Demand System, *American Economic Review* 70(3): 312-336.

Deaton, A. 1990. Price Elasticity from Survey Data: an extension for Indonesian results, *Journal of Econometrics*, 44(3): 281-309.

Deaton, A. 1997. *The Analysis of Household Surveys: A Microeconomic Approach to Development Policy.* John Hopkins University Press, Baltimore.

Deaton, A. and Zaidi, S. 2002. Guidelines for constructing consumption aggregates for welfare analysis. *LSMS Working Paper* 135, World Bank, Washington D.C.

Dixon, J. A. 1982. *Food Consumption Patterns and Related Demand Parameters in Indonesia: a review of available evidence*. International Food Policy Research Institute, Washington.

Ecker, O., and Qaim, M. 2008. Income and Price Elasticities of Food Demand and Nutrient Consumption in Malawi, Selected Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Orlando, Available at http://ageconsearch.umn.edu/bitstream/6349/2/451037.pdf [Accessed August 23, 2009]

Erwidodo, Molyneaux, J., and Pribadi, N. 2002. Household food demand: An almost ideal. Demand Systems (AIDS), Working Paper.

Fabiosa, J. F., Jensen, H., and Yan, D. 2005. Household Welfare Cost of the Indonesian Macroeconomic Crisis, Selected Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Rhode Island, 24-27 July. Available at http://ageconsearch.umn.edu/bitstream/19311/1/sp05fa01.pdf [Accessed March 21, 2009]

Fan, S., Wailes, E. J., and Cramer, G. L. 1995. Household Demand in Rural China: a two-stage LES-AIDS model, *American Journal of Agricultural Economics*, 77(1): 54-62.

Fuglie, K. O. 2004. Challenging Bennett's Law: the new economics of starchy staples in Asia, Food Policy, 29: 187-202

Garcia, M. 1990. Resource Allocation and Household Welfare: a study of the impact of personal income on food consumption, nutrition, and health in the Philippines, Thesis of Doctor of Philosophy, Institute of Social Studies, The Hague, The Netherlands.

Garett, J., and Ruel, M. 1999. Are Determinants of Rural and Urban Food Security and Nutritional Status Different? Some Insights from Mozambique, *World Development*, 27(11): 1955-1975.

Gould, B. W., and Villareal, H. J. 2006. An Assessment of the Current Structure of Food Demand in Urban China, *Agricultural Economics*, 34: 1-16.

Hartmanshenn, T., Egle, K., Georges, M., Kessels, K., Manga, A., von Rauch, A., Wiesenhuetter, J. M. 2002. *Integration of Food and Nutrition Security in Poverty Reduction Strategy: a case study of Ethiopia, Mozambique, Rwanda, and Uganda*, SLE, Berlin.

Hill, H. 1992. Regional Development in a Boom and Bust Petroleum Economy: Indonesia since 1970, *Economic Development and Cultural Change*, 40(2): 351-379.

Hill, H. 2000. *The Indonesian Economy*, Cambridge University Press, Cambridge.

Indonesian Bureau of Statistics, 2009. *Statistical Year Book of Indonesia 2009*. Indonesian Bureau of Statistics, Jakarta.

Jensen, H., and Manrique, J. 1998. Demand for Food Commodities by Income Groups in Indonesia, *Applied Economics*, 30(4): 491-501.

Kakwani, N. 1977. On the Estimation of Engel Elasticities from Grouped Observation with Application to Indonesian Data, *Journal of Econometrics*, 6: 1-19.

Kompas. 2009. *Uang BLT Habis buat Merokok* – The Cash Transfer is Spent Out for Cigarette, Available at: http://bisniskeuangan.kompas.com/read/2009/02/26/19191949/Uang.BLT.Habis.buat.Merokok. [Accessed June 10, 2010]

Kompas. 2011. *Regulasi Rokok, ke Mana SBY Berpihak?* - Cigarettes Regulation, Where Does SBY Stand?, Available at: http://megapolitan.kompas.com/read/2011/03/21/19412620/Regulasi.Rokok.ke.Mana.SBY.Berpihak. [Accessed July 13, 2011]

Levy, P. S., and Lemeshow, S. 1999. *Sampling of Populations: methods and applications*, Wiley-Interscience Publication, Massachusetts.

Michalek, J. and Keyzer, M.A. 1992. Estimation of a two-stage LES-AIDS consumer demand system for eight EC countries, *European review of Agricultural Economics*, 19(2): 137-163.

Ministry of Agriculture. 2007. Sustainable Food Security Development in Indonesia: Policies and Its Implementation, Available at: http://www.unescap.org/LDCCU/Meetings/HighLevel-RPD-food-fuel-crisis/Paper-Presentations/C2-FoodSecurity/ASuryana-DOA-Indonesia-FoodSecurity.pdf [Accessed March 28, 2009].

Molina, J.A. 1994. Food Demand in Spain: an application of the almost ideal demand system, *Journal of Agricultural Economics*, 45(2): 252-258.

Moro, D., and Sckokai, P. 2000. Heterogeneous Preferences in Household Food Consumption in Italy, *European Review of Agricultural Economics*, 27(3): 305-323.

Mukherjee, N. 2006. *Voices of the Poor: making the services work for the poor in Indonesia*, The World Bank, Washington, D. C.

Nayga, M. R. 1996. Wife's Labor Force Participation and Family Expenditure for Prepared Food, Food Prepared at Home and Food Away from Home, *Agricultural and Resource Economic Review*, 179-186.

Piggot, R. R., Parton, K. A., Treadgold, E. M., and Hutabarat, B. 1993. *Food Price Policy in Indonesia*. Watson Ferguson & Co, Brisbane.

RAND. 2010. IFLS4 Public Release, Available at http://www.rand.org/labor/FLS/IFLS.html [Accessed December 22, 2010]

Ruel, M., Levine, C., Armar-Klemesu, M., and Maxwell, D. 1999. Good Care Practices Can Mitigate the Negative Effects of Poverty and Low Maternal Schooling on Children's Nutritional Status: evidence from Accra, *World Development*, 27(11): 1993-2009.

Rusastra, I. W., Napitupulu, T. A., and Bourgeois, R. 2008. The Impact of Support for Imports in Food Security in Indonesia, Bogor: UNESCAP-CAPSA.

Sadoulet, E., and de Janvry, A. 1995. *Quantitative Development Policy Analysis*, The John Hopkins University Press, Baltimore and London.

Schmidt, M. K., Muslimatun, S., West, C. E., Schultink, W., Gross, R., and Hautwast, J. G. A., J. 2002. Nutritional Status and Linear Growth of Indonesian Infants in West Java are Determined More by Prenatal Environment than Postnatal Factors, *Journal of Nutrition*, 132: 2202-2207.

Schwarz, A. 2000. *A Nation in Waiting: Indonesia's Search for Stability*, Westview Press, Boulder.

Sidik, M. 2004. Indonesia Rice Policy in View of Trade Liberalization, Proceedings of the FAO Rice Conference 2004: rice in global market, Available at http://www.fao.org/rice2004/en/pdf/sidik.pdf [Accessed November 13, 2010]

Skoufias, E. 2003. Is the Calorie-Income Elasticity Sensitive to Price Changes? Evidence from Indonesia, *World Development,* 31(7): 1291-1307.

Strauss, J., Witoelar. F., Sikoki, B., and Wattie, A. M. 2009. *The Fourth Wave of Indonesian Family Life Survey: Overview and Field Report Volume 1*, WR-675/1-NIA/NICHD, RAND Corporation, Washington D. C.

Stone, R. 1954. Linear Expenditure Systems and Demand Analysis: an application to the pattern of British demand, *The Economic Journal*, 6(225): 511-527.

Tabor, S.R., Dillon, H.S. and Sawit, M. 1999. *Understanding the 1988 food crisis: supply, demand or policy failure?* In International Seminar on Agricultural Sector During the Turbulence of Economic Crisis: Lessons and Future Directions Proceeding.17-18 February, Center for Agro-Socioeconomic Research: Bogor.

Timmer, P. C., and Alderman, H. 1979. Estimating Consumption Parameters for Food Policy Analysis, *American Journal of Agricultural Economics*, 61(5): 982-987.

Timmer, P. C., Falcon, W. P., and Pearson, S. R. 1983. *Food Policy Analysis*, The John Hopkins University Press, Baltimore and London.

Timmer, P. C. 1997. Farmers and Markets: the political economy of new paradigms, *American Journal of Agricultural Economics*, 79(2): 621-627.

Timmer, P. C. 2004. *Food Security in Indonesia: current challenge and the long-run outlook*, Center for Global Development, Working Paper 48.

von Braun, J., and de Haen, H. 1983. The effects of food price and subsidy policies on Egyptian agriculture. International Food Policy Research Institute, Washington, D.C.

Widodo, T. 2006. Demand Estimation and Household's Welfare Measurement: Case Studies on Japan and Indonesia, Available at http://harp.lib.hiroshima-u.ac.jp/bitstream/harp/1956/1/keizai2006290205.pdf [Accessed March 21, 2009]

Witoelar, F., Rukumnuaykit, P., and Strauss, J. 2005. Smoking Behaviour among Youth in Developing Countries: case of Indonesia, Selected Paper prepared for presentation at the Population Association of America, Available at http://paa2006.princeton.edu/download.aspx?submissionId=60756 [Accessed March 21, 2009]

World Bank. 2000. Curbing the Tobacco Epidemic in Indonesia, *East and Asia Pacific Watching Brief,* Vol 6, The World Bank, Washington, D.C.

Yen, S. T. 1992. Working Wives and Food Away from Home: The Box-Cox Double Hurdle Model, *American Journal of Agricultural Economics*, 75(4): 884-895

APPENDIX

Table A1 Prices across Waves

Prices	*1997*	*2000*	*2007*	*Rural*	*Urban*
Price Staple	855.985	1681.486	4483.462	2142.357	2307.84
Price Vegetables	967.3651	1895.693	2843.784	1688.67	1982.849
Price Meat	6166.837	13569.08	24854.95	13623.71	14743.73
Price Dairy	8533.196	20216.5	43140.3	22402.81	23010.38
Price Oil	2516.182	3604.371	3604.371	5480.272	5707.244
Price Alcohol and tobacco goods	1247.451	2999.591	7171.426	3531.972	3668.039
Price Snack	1711.632	4898.3	14769.02	6507.332	6884.621

Prices are in Rupiahs per kg

Table A2 Parameter Estimates for QUAIDS (Pooled Sample)

Variables	*Equation*	*Coeff.*	*Std. Error*
Constant	α_1	0.2726	0.0125
	α_2	0.0906	0.0050
	α_3	0.1993	0.0110
	α_4	0.0456	0.0058
	α_5	0.0524	0.0040
	α_6	0.0266	0.0073
	α_7	0.1319	0.0062
	α_8	0.1810	0.0074
Expenditure	β_1	-0.0610	0.0022
	β_2	0.0047	0.0012
	β_3	0.0263	0.0015
	β_4	0.0154	0.0008
	β_5	-0.0043	0.0006
	β_6	0.0013	0.0015
	β_7	0.0286	0.0021
	β_8	-0.0110	0.0012
Prices	γ_{11}	0.0416	0.0077
	γ_{12}	-0.0199	0.0026
	γ_{13}	-0.0064	0.0046
	γ_{14}	-0.0123	0.0027
	γ_{15}	0.0046	0.0021
	γ_{16}	-0.0054	0.0039
	γ_{17}	-0.0096	0.0031
	γ_{18}	0.0075	0.0035
	γ_{21}	-0.0199	0.0026
	γ_{22}	0.0070	0.0017
	γ_{23}	0.0207	0.0020
	γ_{24}	0.0012	0.0012
	γ_{25}	-0.0030	0.0008
	γ_{26}	-0.0087	0.0017
	γ_{27}	-0.0078	0.0014
	γ_{28}	0.0105	0.0016
	γ_{31}	-0.0064	0.0046
	γ_{32}	0.0207	0.0020
	γ_{33}	0.0043	0.0056
	γ_{34}	-0.0023	0.0024
	γ_{35}	-0.0078	0.0019
	γ_{35}	0.0101	0.0031
	γ_{37}	-0.0052	0.0021
	γ_{38}	-0.0135	0.0035
	γ_{41}	-0.0123	0.0027
	γ_{42}	0.0012	0.0012
	γ_{43}	-0.0023	0.0024
	γ_{44}	0.0020	0.0020

	γ_{44}	-0.0010	0.0011
	γ_{45}	0.0039	0.0018
	γ_{46}	0.0024	0.0012
	γ_{47}	0.0061	0.0018
	γ_{48}	0.0046	0.0021
	γ_{51}	-0.0030	0.0008
	γ_{52}	-0.0078	0.0019
	γ_{53}	-0.0010	0.0011
	γ_{54}	0.0113	0.0013
	γ_{55}	-0.0007	0.0013
	γ_{56}	0.0004	0.0008
	γ_{57}	-0.0039	0.0014
	γ_{58}	-0.0054	0.0039
	γ_{61}	-0.0087	0.0017
	γ_{62}	0.0101	0.0031
	γ_{63}	0.0039	0.0018
	γ_{64}	-0.0007	0.0013
	γ_{65}	0.0050	0.0037
	γ_{66}	0.0076	0.0020
	γ_{67}	-0.0118	0.0024
	γ_{68}	-0.0096	0.0031
	γ_{71}	-0.0078	0.0014
	γ_{72}	-0.0052	0.0021
	γ_{73}	0.0024	0.0012
	γ_{74}	0.0004	0.0008
	γ_{75}	0.0076	0.0020
	γ_{76}	0.0125	0.0027
	γ_{77}	-0.0004	0.0016
	γ_{78}	0.0075	0.0035
	γ_{81}	0.0105	0.0016
	γ_{82}	-0.0135	0.0035
	γ_{83}	0.0061	0.0018
	γ_{84}	-0.0039	0.0014
	γ_{85}	-0.0118	0.0024
	γ_{86}	-0.0004	0.0016
	γ_{87}	0.0055	0.0034
	γ_{88}	-0.0047	0.0015
Expenditure-squared	λ_1	-0.0021	0.0008
	λ_2	0.0018	0.0010
	λ_3	-0.0011	0.0006
	λ_4	0.0010	0.0004
	λ_5	-0.0072	0.0010
	λ_6	0.0089	0.0014
	λ_7	0.0033	0.0008
	λ_8	0.2726	0.0125

1 = staple food, 2 = vegetables and fruit, 3 = meat and fish, 4 = dairy products, 5 = oils, 6 = alcohol and tobacco goods, 7 = snack and dried food, 8 = other food

Table A3 Marshallian Own and Cross Price Elasticities

	Staple	*Vege and Fruit*	*Meat and Fish*	*Dairy*	*Oils*	*Alcohol and Tobacco Goods*	*Snack-Dried Food*	*Other*
Staple	-0.7706	-0.0541	0.0196	-0.0394	0.0302	-0.0073	-0.0050	0.0702
	(0.0324)	(0.0108)	(0.0194)	(0.0113)	(0.0088)	(0.0162)	(0.0127)	(0.0149)
Vegetables and fruit	-0.1889	-0.9580	0.1736	0.0079	-0.0286	-0.0807	-0.0767	0.0843
	(0.0229)	(0.0160)	(0.0177)	(0.0103)	(0.0072)	(0.0155)	(0.0127)	(0.0142)
Meat and fish	-0.0711	0.0652	-1.0032	-0.0205	-0.0521	-0.0604	-0.0517	-0.1025
	(0.0270)	(0.0138)	(0.0331)	(0.0140)	(0.0108)	(0.0102)	(0.0120)	(0.0204)
Dairy products	-0.3002	-0.0928	-0.0998	-0.9771	-0.0316	0.0536	0.0010	0.0656
	(0.0506)	(0.0277)	(0.0450)	(0.0367)	(0.0201)	(0.0344)	(0.0222)	(0.0346)
Oils	0.1301	-0.0248	-0.1560	-0.0162	-0.7367	-0.0089	0.0260	-0.0721
	(0.0483)	(0.0204)	(0.0425)	(0.0245)	(0.0292)	(0.0294)	(0.0186)	(0.0332)
Alcohol and tobacco goods	-0.0801	-0.1295	0.1083	0.0430	-0.0114	-0.9451	0.0817	-0.1508
	(0.0463)	(0.0216)	(0.0368)	(0.0218)	(0.0153)	(0.0438)	(0.0235)	(0.0283)
Snack and dried food	-0.1012	-0.1137	-0.0660	0.0082	-0.0042	0.0421	-0.9374	-0.0277
	(0.0212)	(0.0138)	(0.0143)	(0.0081)	(0.0056)	(0.0135)	(0.0181)	(0.0113)
Other	0.0701	0.1030	-0.0736	0.0448	-0.0223	-0.0729	0.0099	-0.9495
	(0.0237)	(0.0125)	(0.0233)	(0.0122)	(0.0097)	(0.0158)	(0.0108)	(0.0230)

Standard errors in parentheses

Table A4 Hicksian Own and Cross Price Elasticities

	Staple	*Vege and Fruit*	*Meat and Fish*	*Dairy*	*Oils*	*Alcohol and Tobacco*	*Snack-Dried Food*	*Other*
Staple	-0.5899	0.0312	0.1489	0.0009	0.0633	0.0562	0.1057	0.1836
	(0.0324)	(0.0108)	(0.0193)	(0.0112)	(0.0088)	(0.0162)	(0.0128)	(0.0149)
Vegetables and fruit	0.0628	-0.8391	0.3535	0.0641	0.0175	0.0076	0.0776	0.2422
	(0.0228)	(0.0158)	(0.0176)	(0.0103)	(0.0072)	(0.0155)	(0.0128)	(0.0141)
Meat and fish	0.2031	0.1947	-0.8071	0.0406	-0.0019	0.1454	0.1163	0.0695
	(0.0269)	(0.0137)	(0.0330)	(0.0140)	(0.0108)	(0.0179)	(0.0120)	(0.0204)
Dairy	0.0110	0.0542	0.1227	-0.9077	0.0254	0.1629	0.1918	0.2608
	(0.0504)	(0.0275)	(0.0448)	(0.0367)	(0.0201)	(0.0343)	(0.0223)	(0.0345)
Oils	0.3422	0.0754	-0.0044	0.0312	-0.6978	0.0656	0.1560	0.0610
	(0.0482)	(0.0202)	(0.0423)	(0.0245)	(0.0292)	(0.0294)	(0.0187)	(0.0331)
Alcohol and tobacco goods	0.1747	-0.0091	0.2905	0.0998	0.0352	-0.8556	0.2379	0.0091
	(0.0461)	(0.0212)	(0.0365)	(0.0218)	(0.0153)	(0.0438)	(0.0236)	(0.0282)
Snack and dried food	0.1757	0.0171	0.1320	0.0699	0.0465	0.1393	-0.7678	0.1459
	(0.0209)	(0.0134)	(0.0140)	(0.0081)	(0.0056)	(0.0135)	(0.0183)	(0.0111)
Other	0.2883	0.2061	0.0824	0.0934	0.0177	0.0037	0.1437	-0.8126
	(0.0236)	(0.0124)	(0.0232)	(0.0122)	(0.0097)	(0.0158)	(0.0108)	(0.0229)

Standard errors in parentheses

Table A5 Parameter Estimates for QUAIDS (Poorest Household)

Variables	*Equation*	*Coeff.*	*Std. Error*
Constant	α_1	0.2115	0.0631
	α_2	0.0650	0.0262
	α_3	0.2254	0.0451
	α_4	0.0426	0.0171
	α_5	0.0003	0.0177
	α_6	0.0573	0.0297
	α_7	0.1513	0.0432
	α_8	0.2466	0.0379
Expenditure	β_1	-0.0884	0.0574
	β_2	-0.0137	0.0254
	β_3	0.0184	0.0299
	β_4	0.0098	0.0115
	β_5	-0.0420	0.0126
	β_6	0.1083	0.0258
	β_7	0.0373	0.0484
	β_8	-0.0298	0.0315
Prices	γ_{11}	0.0243	0.0358
	γ_{12}	-0.0192	0.0113
	γ_{13}	0.0323	0.0177
	γ_{14}	-0.0129	0.0074
	γ_{15}	-0.0011	0.0089
	γ_{16}	-0.0184	0.0151
	γ_{17}	-0.0039	0.0145
	γ_{18}	-0.0012	0.0167
	γ_{21}	-0.0192	0.0113
	γ_{22}	-0.0073	0.0067
	γ_{23}	0.0252	0.0072
	γ_{24}	0.0033	0.0030
	γ_{25}	-0.0045	0.0034
	γ_{26}	-0.0072	0.0063
	γ_{27}	-0.0016	0.0059
	γ_{28}	0.0114	0.0071
	γ_{31}	0.0323	0.0177
	γ_{32}	0.0252	0.0072
	γ_{33}	-0.0181	0.0205
	γ_{34}	-0.0037	0.0067
	γ_{35}	-0.0001	0.0073
	γ_{35}	0.0282	0.0104
	γ_{37}	-0.0176	0.0075
	γ_{38}	-0.0462	0.0139
	γ_{41}	-0.0129	0.0074
	γ_{42}	0.0033	0.0030
	γ_{43}	-0.0037	0.0067

	γ_{44}	-0.0055	0.0043
	γ_{44}	0.0067	0.0033
	γ_{45}	0.0049	0.0045
	γ_{46}	0.0007	0.0031
	γ_{47}	0.0064	0.0055
	γ_{48}	-0.0011	0.0089
	γ_{51}	-0.0045	0.0034
	γ_{52}	-0.0001	0.0073
	γ_{53}	0.0067	0.0033
	γ_{54}	0.0124	0.0052
	γ_{55}	-0.0084	0.0049
	γ_{56}	-0.0006	0.0038
	γ_{57}	-0.0045	0.0061
	γ_{58}	-0.0184	0.0151
	γ_{61}	-0.0072	0.0063
	γ_{62}	0.0282	0.0104
	γ_{63}	0.0049	0.0045
	γ_{64}	-0.0084	0.0049
	γ_{65}	-0.0049	0.0117
	γ_{66}	0.0063	0.0078
	γ_{67}	-0.0005	0.0095
	γ_{68}	-0.0039	0.0145
	γ_{71}	-0.0016	0.0059
	γ_{72}	-0.0176	0.0075
	γ_{73}	0.0007	0.0031
	γ_{74}	-0.0006	0.0038
	γ_{75}	0.0063	0.0078
	γ_{76}	0.0285	0.0124
	γ_{77}	-0.0118	0.0078
	γ_{78}	-0.0012	0.0167
	γ_{81}	0.0114	0.0071
	γ_{82}	-0.0462	0.0139
	γ_{83}	0.0064	0.0055
	γ_{84}	-0.0045	0.0061
	γ_{85}	-0.0005	0.0095
	γ_{86}	-0.0118	0.0078
	γ_{87}	0.0464	0.0155
	γ_{88}	-0.0347	0.0184
Expenditure-squared	λ_1	-0.0050	0.0078
	λ_2	0.0050	0.0092
	λ_3	0.0011	0.0035
	λ_4	-0.0117	0.0038
	λ_5	0.0325	0.0080
	λ_6	0.0181	0.0149
	λ_7	-0.0054	0.0096
	λ_8	0.2115	0.0631

1 = staple food, 2 = vegetables and fruit, 3 = meat and fish, 4 = dairy products, 5 = oils, 6 = alcohol and tobacco goods, 7 = snack and dried food, 8 = other food

Table A6 Marshallian Own and Cross Price Elasticities of the Poorest Households

	Staple	***Vege and Fruit***	***Meat and Fish***	***Dairy***	***Oils***	***Alcohol and Tobacco Goods***	***Snack-Dried Food***	***Other***
Staple	-0.9473	-0.0641	0.1013	-0.0383	-0.0126	-0.0678	-0.0061	-0.0125
	(0.1081)	(0.0344)	(0.0554)	(0.0229)	(0.0269)	(0.0476)	(0.0419)	(0.0518)
Vegetables and fruit	-0.1920	-1.0703	0.2446	0.0324	-0.0474	-0.0586	-0.0117	0.1070
	(0.1103)	(0.0654)	(0.0703)	(0.0293)	(0.0323)	(0.0571)	(0.0552)	(0.0696)
Meat and fish	0.2344	0.1731	-1.1402	-0.0286	0.0017	-0.0651	-0.1367	-0.3422
	(0.1294)	(0.0536)	(0.1510)	(0.0495)	(0.0530)	(0.0498)	(0.0538)	(0.1018)
Dairy	-0.5949	0.0392	-0.2008	-1.2391	0.2777	0.1606	-0.0153	0.2264
	(0.3098)	(0.1446)	(0.2825)	(0.1786)	(0.1382)	(0.1843)	(0.1234)	(0.2293)
Oils	-0.0121	-0.0213	0.0408	0.1399	-0.7757	-0.0878	0.0348	-0.0664
	(0.1673)	(0.0868)	(0.1385)	(0.0636)	(0.0981)	(0.0917)	(0.0634)	(0.1164)
Alcohol and tobacco goods	-0.2983	-0.2327	0.3988	0.0608	-0.1042	-1.2450	0.0135	-0.0339
	(0.2416)	(0.1323)	(0.1724)	(0.0748)	(0.0811)	(0.1868)	(0.1094)	(0.1583)
Snack and dried food	0.0159	0.0227	-0.1317	0.0057	0.0094	0.0300	-0.7680	-0.0718
	(0.1148)	(0.0646)	(0.0619)	(0.0241)	(0.0279)	(0.0523)	(0.0954)	(0.0644)
Other	0.0081	0.0937	-0.2455	0.0398	-0.0259	0.0141	-0.0519	-0.7258
	(0.0944)	(0.0498)	(0.0784)	(0.0308)	(0.0339)	(0.0516)	(0.0421)	(0.0874)

Standard errors in parentheses

Table A7 Hicksian Own and Cross Price Elasticities of the Poorest Households

	Staple	***Vege and Fruit***	***Meat and Fish***	***Dairy***	***Oils***	***Alcohol and Tobacco Goods***	***Snack-Dried Food***	***Other***
Staple	-0.6194	0.0416	0.2399	-0.0140	0.0402	-0.0080	0.1200	0.1673
	(0.1074)	(0.0346)	(0.0544)	(0.0228)	(0.0266)	(0.0482)	(0.0420)	(0.0512)
Vege and fruit	0.1300	-0.9666	0.3807	0.0563	0.0045	0.0001	0.1122	0.2836
	(0.1075)	(0.0643)	(0.0694)	(0.0292)	(0.0320)	(0.0570)	(0.0555)	(0.0679)
Meat and fish	0.5690	0.2808	-0.9988	-0.0038	0.0557	0.2317	-0.0080	-0.1587
	(0.1286)	(0.0525)	(0.1505)	(0.0494)	(0.0528)	(0.0798)	(0.0541)	(0.1012)
Dairy	-0.1814	0.1724	-0.0260	-1.2085	0.3443	0.2361	0.1438	0.4532
	(0.3076)	(0.1426)	(0.2817)	(0.1783)	(0.1379)	(0.1841)	(0.1243)	(0.2275)
Oils	0.2451	0.0616	0.1494	0.1590	-0.7343	-0.0409	0.1337	0.0746
	(0.1650)	(0.0863)	(0.1385)	(0.0635)	(0.0980)	(0.0915)	(0.0638)	(0.1149)
Alcohol and tobacco goods	0.1400	-0.0915	0.5841	0.0933	-0.0336	-1.1651	0.1821	0.2065
	(0.2365)	(0.1303)	(0.1722)	(0.0748)	(0.0807)	(0.1863)	(0.1098)	(0.1550)
Snack and dried food	0.3096	0.1173	-0.0076	0.0275	0.0567	0.0836	-0.6550	0.0893
	(0.1093)	(0.0597)	(0.0596)	(0.0240)	(0.0269)	(0.0524)	(0.0956)	(0.0607)
Other	0.3033	0.1887	-0.1207	0.0617	0.0217	0.0680	0.0616	-0.5639
	(0.0932)	(0.0491)	(0.0779)	(0.0307)	(0.0337)	(0.0515)	(0.0423)	(0.0867)

Standard errors in parentheses

Table A8 Demographic Characteristics

Variables	*Staple*	*Vegetable*	*Meat-Fish*	*Dairy Products*	*Oils*	*Alcohol and Tobacco*	*Snack-Dried Food*
HH Size	0.0137	-0.0018	-0.0011	-0.0008	0.0002	0.0017	-0.0106
	(0.0007)	(0.0004)	(0.0005)	(0.0003)	(0.0002)	(0.0004)	(0.0006)
Urban	-0.0477	0.0068	-0.0033	0.0122	-0.0039	-0.0015	0.0443
	(0.0027)	(0.0014)	(0.0018)	(0.0010)	(0.0007)	(0.0018)	(0.0025)
Male HH Head	-0.0009	-0.0084	-0.0078	-0.0093	-0.0016	0.0419	-0.0211
	(0.0033)	(0.0018)	(0.0023)	(0.0013)	(0.0008)	(0.0022)	(0.0031)
HH Head Educ	-0.0050	0.0004	0.0016	0.0020	0.0000	-0.0012	0.0036
	(0.0003)	(0.0002)	(0.0002)	(0.0001)	(0.0001)	(0.0002)	(0.0003)
Java	-0.0184	0.0045	-0.0143	0.0030	-0.0021	-0.0087	0.0422
	(0.0028)	(0.0015)	(0.0020)	(0.0011)	(0.0007)	(0.0019)	(0.0026)

Standard errors in parentheses