

Food Demand of Different Socio-Economic Groups in Rural Bangladesh: A Quadratic Almost Ideal Demand System

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The present study is intended to explore and compare the food demand analysis of 1282 households combining of four dynamic socio-economic groups. A Quadratic Almost Ideal Demand System Model has been considered for estimation. To observe the impact on budget share, the set of predictors has been extended by using various household characteristics. A chronology in demand pattern has been observed according to the economic hierarchy. The necessary foods of the rich are found as the luxury one to the poor. Lastly, the study can be viewed as a lively portrait of the vulnerable situation of chronically poor people.

Keywords: Food demand, QUAIDS model, rural households, poverty and inequality.

JEL Code: D12, C31, D63, H31, P36, Q19.

1. Introduction

Variations in food consumption and expenses in developing country households have been a topic for research throughout the twentieth century; as such it is well known that income of a household greatly influences food expenditure patterns. Government and non-government organizations dealing with food policy issues are, therefore, often interested in studies that examine the elasticity and change in demand on food items across households in different income level. In contrast to the innumerable of empirical works on food demand in many other developing countries, relatively few studies have analyzed food consumption of households in Bangladesh. Some earlier studies have concentrated on modeling the aggregate demand (Chowdhury 1982), (Ahmed and Shams 1994), but fewer attempts have been shown at consideration of the potential effects of demographic factors of household on demand pattern (Ferdous 1997), (Khanom and Ferdous 2000). Demographic factors of households may yield substantially greater precision in case of parameter estimation based on the aggregate data (Orcutt, Watts, and Edwards 1968). Besides, pursuit of understanding on distinct demand pattern of different socio-economic groups has also inspired to conduct a new research. The present study is focused on the comparison of food demand pattern across rural household budget data on different socio-economic groups in Bangladesh.

Actually, very few areas of human behavior are as diverse, multi-dimensional and socio-economically significant as the area of consumer demand behavior. This practical field

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Jahan

is concerned with the examination of everyday life and thus has a mutual attachment with household budget data. An empirical analysis of consumer behavior can be best achieved through the specification and estimation of demand model. This specification of demand model represents the concerned target population and the mathematical formula depends on the feature of that specific group. Searching of the most parsimonious set of variables and the most appropriate form of demand function for a particular case of situation is the basic operation of any researcher. This endless searching originates from Ernst Engel in 1857. One of the most consistent patterns of consumer demand has been found is the Engel's Law suggesting that as income rises, the budget spent on food tends to decline. A related pattern has also been suggested by Bennett. Estimation of complete demand system within a framework consistent through classical demand theory was originated with Stone's pioneering contribution (1954) and now constitutes a large body of theoretical and applied literature. Many models have been proposed so far, but perhaps the most important in current use, apart from the original Linear Expenditure System (LES), Rotterdam model (Theil 1965), (Barten 1969) and the Translog model (Christensen 1975) is the Almost Ideal Demand System (AIDS), introduced by Deaton and Muellbauer (1980). Households with different composition can be regarded as the point of convergence of many kind of social and economic knowledge. For this reason, The AIDS model has been extensively extended by including the vital household and demographic characteristics by the researchers (Ferdous 1997). This study has also used such an extended version of AIDS model.

The inspiration of the study on discrimination of food demand analysis according to socio-economic groups is truly inevitable. Food plays a crucial role in an agro-based economy like Bangladesh as main portion of income of people is spent on them. The country is focused in the study as it is seriously affected by food insecurity, poverty and inequality. The basic challenge of food security in Bangladesh is to ensure availability, access and utilization of food for all people throughout the year (Hossain, 2007). To focus on food demand situation among different income groups is not a matter of charity, but a matter of justice. The study is different from the previous studies as it consists of four dynamics of socio-economic groups: non poor, ascending poor, descending non-poor and chronically poor. The research interest is how demographic features of households differently affect the corresponding demand pattern in each group. The research hypothesis, thus, can be revealed as: *The demographic features of household has an effect on food demand situation and it differs according to different socio-economic groups.* Some Earlier studies have mentioned the demand situation of people of rural Bangladesh (Khanam and Ferdous 2000, Huq and Arshad 2010), but the attempt of comparison of food demand across different groups is unique indeed. The appetite of finding the inherent discrimination of the society can be explored in this study. One of the central findings is to discover the implicit inequality inherent the society. One man's trash is turned into another's' treasure. Larger household size and dependency ratio accelerate inferior condition of the lower income groups. Age of household head significantly affect the demand of the transitory stated people. Most female-headed households belong to the chronic poor groups perceiving the gender biasness of society. Moreover, the poor educational and occupation status of these people made them hanging into a poverty cycle. VAT, taxes and other marketing

strategy regarding food items may affect different economic groups and from this study new insights can be originated by the policy makers.

The organization of the paper is as follows. In the next section, the Quadratic Almost Ideal Demand System is defined and its literature and theoretical properties are shown. Section three contains a description of the data and estimation methods used in the analysis, while the results and discussions are presented in section four. Finally, the last section provides the conclusions and further research opportunity of the study.

2. Literature Review

Studies on demand for food across different socio-economic groups in Bangladesh are scanty. For other commodities, a number of studies exist in Bangladesh dealing with price and income (expenditure) elasticities of demand. These include elasticities of composite food grain (Alamgir and Berlage 1973; Mahmud 1979); foods and non-food items (Ahmed, 1981; Choudhury, 1982; Bouis 1989); and food items (Pitt, 1983; Goletti, 1993, Islam 2002). With the exception of Mahmud (1979), these studies used periodic cross-section data from HES, using pooled data from quarterly survey of current economic conditions for the 1964, 1965, 1967 and 1969. Goletti (1993) estimated demand elasticities of food items based on 1988/89 HES data. Using same data set, Huq (2004) estimated elasticities of demand for potato. The estimate made by Huq (2004) is perhaps the most recent one is the area of estimation of demand for food in Bangladesh.

All of the previous studies on estimation of demand parameters used the system demand approach. Chowdhury (1982), used a method developed by Frisch (1959) which is based on additively or 'want independence' assumption. A consumer's preference is said to be want independent if the marginal utility of any good depends on the quantity consumption of that good. This is an extreme assumption, and therefore, the Frisch's methodology is criticized because of the restrictions imposed. Ahmed (1981) used the Linear Expenditure System (LES) to estimate a complete demand system. The LES suffers from restrictions of additive system. The Frisch's method and the LES imply that all goods are substitutes and none are inferior goods (Alderman 1986). Bouis (1989, 1992) developed a method of estimating a food demand system based on demand for energy, diversity and taste of foods. A comprehensive matrix of demand elasticities were derived for all food and one non-food commodities by stipulating utility as an explicit function of these food characteristics, that Bouis terms the Food Characteristics Demand System (FCDS). In contrast to "Frisch" method, the FCDS assumes that marginal utility from consumption of any food depends on the level of consumption of all other foods. Bouis (1989) applied his FCDS Estimation of Vegetable Demand Elasticities in Bangladesh 37 method to derive demand elasticities for food and non-food commodities using the 1973-74 HES data. FCDS model has also been used by Razzaque, Khondoker and Mujeri (1997) to estimate elasticities of demand for food by occupational group in Bangladesh.

The other two studies by Pitt (1983) and Goletti (1993) used a method called Tobin's Probit or 'Tobit' to estimate the food demand system. The elementary reasons for using

Jahan

the Tobit method was to overcome the econometric problems that arise due to nonconsumption or zero-value observation. The Tobit model first permits a positive probability of observing non-consumption. However, Pitt (1983) showed that it is inappropriate to use Tobit in demand analysis for models that have expenditure or budget shares as dependent variables. This immediately rules out some of the most popular and recently established demand system such as the Rotterdam model, and the Almost Ideal Demand System (AIDS).

The study by Ahmed and Shams (1994) differs from earlier in two ways, Firstly, the parameter estimates are based on primary data from three rounds of household consumption and nutrition survey conducted by the International Food Policy Research Institute over the period from September 1991 to November 1992. Secondly, the study applied AIDS model to estimate a complete demand system for the first time in Bangladesh. The AIDS model was introduced by Deaton and Muellbauer (1980a, 1980b), and has been widely adopted by many economist in recent years. Its popularity was attributed to its properties, which are consistent with the theory of demand. Although a few other models (such as the Rotterdam or Translog model) possess many of these desirable properties, none possess all of them simultaneously. A considerable number of studies have been made using the AIDS or LA/AIDS model (Buse 1994; Wessells and Wilen 1994; Tiffin and Tiffin 1999; Eales and Unhevehr 1998; Ahmed and Shams 1994; Karagiannis, Katranidis and Velentzes, 2000).Huq (2004) has incorporated most of the previous problems including zero consumption. He estimated demand elasticity for potato (including vegetables) by using the HES, 2000 data. The present study aims to perform a contrast among the food demand behavior of different socio-economic groups across a number of food items that is a distinctive attempt in this era.

3. Methodology

3.1 Theoretical Background of AIDS Model

The AIDS Model is the time series counter part of the Engel Function. This model can give an arbitrary first-order approximation to any demand system and aggregates perfectly over consumers without invoking parallel linear curves. For the development of the model, Deaton and Muellbauer started from a specific class of preference, which permits exact aggregation over consumers. These preferences are represented via cost or expenditure function that is denoted by $c(u,p)$ and the preferences is known as Price Indifference Generalized LOG or simply PIGLOG class. The PIGLOG class is defined by

$$\log c(u, p) = (1 - u) \log(a(p)) + u \log(b(p)) \dots \dots \dots (2.1)$$

Where u stands for utility and p stands for price vector. Here $0 < u < 1$, $u=0$ interprets as subsistence and $u=1$ interprets as bliss. Hence the functions $a(p)$ and $b(p)$ are the costs of subsistence and of bliss.

Jahan

Specific functional forms $\log(a(p))$ and $\log(b(p))$ are then taken, where

$$\log a(p) = \alpha_0 + \sum_k \alpha_k \log p_k + \frac{1}{2} \sum_k \sum_j \gamma'_{kj} \log p_k \log p_j \dots\dots\dots(2.2)$$

$$\log(b(p)) = \log(a(p)) + \beta_0 \prod p_k^{\beta_k} \dots\dots\dots(2.3)$$

So, the AIDS cost function is written as

$$\log c(u, p) = \alpha_0 + \sum_k \alpha_k \log p_k + \frac{1}{2} \sum_k \sum_j \gamma_{kj} \log p_k \log p_j + u\beta_0 \prod p_k^{\beta_k} \dots\dots\dots(2.4)$$

Where, $\alpha_i, \beta_i, \gamma'_{ij}$ are parameters. Here, $c(u,p)$ is linearly homogeneous in p .

The demand functions are directly derived from equation (2.4). It is a fundamental property of the cost function that its price derivatives are the quantities demanded.

$$\frac{\partial c(u, p)}{\partial p_i} = q_i \quad ; \quad \text{Multiplying both sides by } \frac{p_i}{c(u, p)}, \text{ we have,}$$

$$\frac{\partial \log c(u, p)}{\partial \log p_i} = \frac{p_i q_i}{c(u, p)} = w_i \dots\dots\dots(2.5)$$

Where w_i is the budget share of the good i .

Hence by taking the differentials of the logarithmic function in (2.4) we get the budget shares as a function of prices and utility:

$$W_i = \alpha_i + \sum_j \gamma_{ij} \log p_j + \beta_i u \beta_0 \prod p_k^{\beta_k} \dots\dots\dots(2.6), \text{ where}$$

For the utility maximizing consumer, the total expenditure x is equal to $c(u,p)$ and this equality can be inverted to give u a function of p and x . Thus, the AIDS demand function in the budget share form,

$$W_i = \alpha_i + \sum_j \gamma_{ij} \log p_j + \beta_i \log(X / p); \quad i, j = 1, 2, \dots, n \quad \dots\dots\dots(2.7)$$

Where p is price index defined by,

$$\log p = \alpha_0 + \sum_k \alpha_k \log p_k + \frac{1}{2} \sum_j \sum_k \gamma_{kj} \log p_k \log p_j$$

Jahan

The inclusion of demographic variables of household in the analysis of consumption patterns is desirable from the past history. Ranjan Ray (1980) used Barten (1964) type utility function to introduce family size. He replaced P in (3-7) by a normalized price vector, where z denotes family size. Barten's suggested model was:

$$W_i = \alpha_i + \beta_i \log\left(\frac{x}{p^*}\right) + \sum_j \gamma_{ij} \log p_j + \delta_i \log z \dots \dots \dots (2.8)$$

Where x= (X/z) is the per capita household expenditure and z represents the effect the family size. The use of family size as a deflator for X follows Houthakker (1967), Weiskoff (1971) and Sener (1979).

Newer variables as age, sex and occupation of household head, dependency ratio etc. have been incorporated into the AIDS Model by Ferdous (1994). Due to lack of price data, it was assumed that all the households experienced the same price changes. The equation (2.8) firstly extended as:

$$W_i = \alpha_i + \beta_i \log x + \delta_i \log z + k \quad \text{or} \quad W_i = \alpha'_i + \beta_i \log x + \delta_i \log z \dots \dots \dots (2.9)$$

Where, $\alpha'_i = \alpha_i + k$ and $k = \sum_j \gamma_{ij} \log p_j - \beta_i \log p^* \dots \dots \dots (2.10)$

Then, by incorporating the other variables as mentioned earlier the demand model can be transformed as:

$$W_i = \alpha'_i + \beta_i (\log x) + \beta'_i (\log x)^2 + \delta_i (\log z) + \tau_i (DR) + \lambda_i (A) + \eta_i S + \sum_j \theta_{ij} D_j + \varepsilon_i \dots \dots (2.11)$$

Here, A=Age of the household head, DR=Dependency Ratio, Z=Household Size, S= Sex of Household Head (dummy) and D= Occupation of the Household Head (dummy).

3.2 Earlier Studies: Pursuit of Innovation

Dynamic Almost Ideal Demand System developed by Deaton and Muellbauer (1980) were estimated for meat aggregates and for disaggregated meat products. Chowdhury (1982) studied the complete consumer model for Bangladesh based on the HES data (BBS: 1974) of rural and urban households. In that study, all direct and cross demand elasticity with respect to price were computed under certain "want-independence" assumptions. Blanciforti, Green and King (1986) estimated the Almost Ideal demand System for four food groups and compared these estimates with the AIDS own linear approximate version and linear expenditure system.

Ahmed and Shams (1994) estimated a complete demand system for rural Bangladesh by applying the AIDS model on primary data from household consumption and nutrition survey conducted in Bangladesh by International food Policy Research Institute. Shankar Suramanian and Angus Deaton (1996) studied the demand for food and calories for which the data was collected from the 38 round of the National sample survey for rural households in Maharashtra state in (south) western India. Rezina

Jahan

Ferdous (1997) studied the consumer demand behavior in rural Bangladesh by extending the AIDS model by incorporating various household characteristics into the model such as household size, age, sex and occupation of household head, dependency ratio, and log of per capita total expenditure and log quadratic of per capita total expenditure and using the micro-level HES (1985/86) data of Bangladesh.

Azizul Baten and Rezina Ferdous (1998) estimated the demand Elasticity from budget shares and Engel's Elasticity under certain "Want independence" assumptions through using the HERS data (1991-1992) of Bangladesh. Murshida Khanam and Ferdous (2000) analyzed Food preferences and consumer demand behavior by an improved version of the almost Ideal Demand System (AIDS) system proposed by Deaton and Muellbauer. In this study we find a shed of light on the income effects on the nutritional behaviors of the people of Bangladesh. Later, Md. Abu Shadeque Mullah (2005) analyzed the consumer demand behavior using the full set of micro-level Household Income and Expenditure Survey (HIES) 2000 data of 7440 households.

3.3 Final Model Specification: Uniqueness from Earlier Study

Now, searching the suitable demand model for an economic group, the set of predictors has been considered on the basis of history and statistical test. To find the most parsimonious set of predictors, a stepwise multiple linear regression has been used for all the items in entire groups. An attempt for improving the model, four more predictors have been chosen: 'household size', 'log of dependency ratio', 'log of quadratic per capita total expenditure' and 'square of age of household age'. But they are found as insignificant for most of the food items. Finally, the stepwise regression methods have confirmed the following models:

Final Models for non-poor, ascending-poor, descending non-poor can be viewed as:

$$W_i = \alpha'_i + \beta_i(\log x) + \delta_i(\log z) + \tau_i(DR) + \lambda_i(A) + \varphi_i(E) + \sum_{j=1}^3 \theta_{ij} O_j \quad \dots\dots\dots(2.3.1)$$

Final Models for chronically poor can be viewed as:

$$W_i = \alpha'_i + \beta_i(\log x) + \delta_i(\log z) + \tau_i(DR) + \lambda_i(A) + \eta_i S + \sum_{j=1}^3 \theta_{ij} O_j \dots\dots\dots(2.3.2)$$

Where,

- x = Per capita total expenditure,
- z = household size,
- DR = Dependency ratio,
- A = Age of Household head,
- S = sex of household head,
- E = Year of schooling,

Jahan

For occupation dummy variable O,

| <i>non-poor</i> | <i>Ascending poor</i> | <i>Descending non-poor</i> | <i>chronically poor</i> |
|-----------------|---------------------------|--|--|
| $O_{11} = AW$ | $O_{21} = AW$ | $O_{31} = AW$ | $O_{41} = AW$ |
| $O_{12} = SM$ | $O_{22} = SM \& Non - AW$ | $O_{32} = SM \& BM,$ | $O_{42} = SM \& BM$ |
| $O_{13} = BM$ | $O_{23} = BM$ | $O_{33} = Non-AW \text{ and}$ <i>others</i> | $O_{43} = Non-AW \text{ and}$ <i>others</i> |

Abbreviation:

AW: Agricultural worker, Non-AW: Non-agricultural worker, SM: Serviceman and BM: Business Man

4. Data and Estimation Methods of the Study

4.1 Data

A three-stage stratified random sampling design has been used in the study. At the first stage, 8 most vulnerable and least developed districts have been selected based on a composite index on the basis of three simple indicators such as percentage of agriculture labor, landless household and cropping intensity. The administrative division has been considered as the criterion of stratification. Two least developed districts have been selected based on the composite index from each division. At the second stage, from each selected district, 4 villages were selected with “Probability Proportional to Size (PPS)” method. Thus a total of 32 villages have been chosen for the study. At the third stage the criterion of stratification being the economic status of households. In each selected village, a complete list of household has been prepared with certain indicators such as income, household size, landholding size, education, poverty status etc. These indicators along with opinion of household heads have been used to classify households into four economic categories.

On an average 1 to 10 years period has been considered as the duration of changing the economic status. ‘Non poor’ people are referred those whose mean income or expenditure is always above the poverty line. During the considered period of changing economic status, two cases of shifting have been observed. The households having the mean income or expenditure above poverty line once but now slides below the poverty line between last 10 years is considered as ‘descending non-poor’. Similarly if any households move out of poverty and crossed the poverty line during that time is deemed as ‘ascending poor’. And, the ‘chronically poor’ households inherited poverty generation by generation and remain poor for more than 10 years. From the list of households of each category 10 non-poor households, 7 descending non-poor, 7 ascending poor and 16 chronically poor households have been selected at random from each selected village and the complete list of household in a village by category has been treated as sampling frame. A total of 1282 households of four categories have been selected at random among which 320 households were non-poor, 225 were ascending poor, 227 were descending non-poor and 510 were chronically poor. The survey team has administered the data collection process during December 2011 and January 2012. The time point is selected to observe the changes occurred in recent decades. The study is based on entirely a cross-sectional data. Two sets of

questionnaires have been prepared for this study in order to facilitate the data collection at the village and household level. Personal interview as well observational approach has been adapted for collection of primary data. In the present study, budget share for a specific commodity is considered as the dependent variable which can be derived by dividing the total per capita expenditure for this item by the total per capita household expenditure. Although household income data are available from the IFPRI survey, household consumption expenditures are used in this analysis as a proxy for income for two reasons. First, based on the permanent income hypothesis, Friedman (1957) argues that expenditures are likely to reflect permanent income and hence a better determinant of consumption behavior. Second, data on expenditures are generally more reliable than income data. The predictors of the study are log of per capita total monthly household expenditure, log of household size, dependency ratio, age of household head, sex of household head, year of schooling of household head and occupation levels of the household head. The selected food items are cereal, pulse, oil, meat and fish, vegetable, fruit and other food items.

4.2 Estimation Methods: Regression Approach

For checking the multicollinearity problem, the value of Variance Inflation Factor (VIF) has been checked and observed less than 10 indicating that the predictors of the model are not collinear. But, the cross-sectional budget data is affected by Heteroscedasticity problem which is proved after performing the Breusch-Pagan Godfrey (BPG) test. To get rid of this problem, AIDS model has been divided through the square root of per capita total expenditure (\sqrt{x}) that converts the equations into regression-through-origin models.

After Heteroscedasticity correction, the transformed models will be:

Final Models for non-poor, ascending-poor, descending non-poor can be viewed as:

$$W_i = \frac{1}{\sqrt{x}} (\alpha'_i + \beta_i(\log x) + \delta_i(\log z) + \tau_i(DR) + \lambda_i(A) + \varphi_i(E) + \sum_{j=1}^3 \theta_{ij} O_j) \dots\dots\dots(4.1.1)$$

Final Models for chronically poor can be viewed as:

$$W_i = \frac{1}{\sqrt{x}} (\alpha'_i + \beta_i(\log x) + \delta_i(\log z) + \tau_i(DR) + \lambda_i(A) + \eta_i S + \sum_{j=1}^3 \theta_{ij} O_j) \dots\dots\dots(4.1.2)$$

Where,

x = Per capita total expenditure, z = household size, DR = Dependency ratio, A = Age of Household head, S = sex of household head (dummy), E = Year of schooling, O =Occupation status of household head (dummy).

Jahan

Our Present study includes 2 food items (pulse and fruit) for which zero expenditure is more than 25 percent. To estimate the corresponding demand ‘Tobit regression model’ (Tobin, 1958) has been applied. Studies by Pitt (1983) and Goletti (1993) used this Tobin’s Probit or Tobit model to estimate the food demand system successfully. Statistical software R has been used to perform this Tobit model. For the remaining 5 items (cereal, pulse, oil, meat and fish, vegetable, fruit and other food items), the zero expenditure is much lower than 25 percent. OLS (Ordinary Least Square) method for multivariate regression model has been used for this estimation process.

5. Results and Discussion

The table shows the estimated value of OLS and Tobit parameters where the p-values are given in the parenthesis. The adjusted R^2 values imply that the AIDS model fits well for most of the cases. All models of non-poor groups have been found as heteroscedastic except cereal while no model from chronic poor groups has showed this feature. In case of transitory stated people, still the aspect has been observed: as people have more ‘discretionary income’, they have more scope for choice.

Table 1: Parameter Estimation of Demand Model for Non-Poor Households

| Ordinary Least Squares parameters (or Heteroscedasticity-corrected Ordinary Least Squares parameters) | | | | | | | | | | | |
|---|-------------|-------------------------------------|--|--------------------------------------|---------------------------------|--------------------------------------|----------------------------------|------------------------------------|----------------------------|-----------------------------|-------------------------------|
| Item | Constant | coefficient of $\frac{1}{\sqrt{x}}$ | Coefficient of Log of per capita total exp | Coefficient of Log of Household size | Coefficient of dependency ratio | Coefficient of Age of household head | Coefficient of Year of schooling | Coefficient of Agricultural Worker | Coefficient of Service man | Coefficient of Business man | Adjusted R ² value |
| | α'_i | α'_i | (β_i) | (∂_i) | (τ_i) | (λ_i) | (φ_i) | (θ_{i1}) | (θ_{i2}) | (θ_{i3}) | |
| Cereal | - | 1.2611* (0.000) | -0.2360* (0.000) | 0.0299* (0.000) | 0.0036* (0.029) | 0.0065* (0.002) | 0.0004 (0.791) | 0.0001* (0.006) | 0.0008 (0.756) | 0.0002 (0.214) | 0.772 |
| Oil | - | 0.1402* (0.000) | -0.0127* (0.002) | -0.00316 (0.216) | -0.0003* (0.000) | 0.0059 (0.234) | -0.0003* (0.045) | 0.0023 (0.073) | 0.0013* (0.008) | 0.0008 (0.112) | 0.266 |
| Vegetable | - | 18.160* (0.000) | -0.0535* (0.000) | -0.00351 (0.291) | 0.0043* (0.018) | 0.0016 (0.065) | -0.0021* (0.018) | -0.0013 (0.506) | 0.0010* (0.010) | 0.0005* (0.002) | 0.509 |
| Meat-fish | - | 50.7386* (0.002) | -0.0071* (0.012) | 0.06852* (0.038) | 0.0243* (0.032) | 0.0023* (0.018) | 0.0009 (0.597) | 0.0033* (0.048) | 0.0033 (0.078) | 0.0009* (0.012) | 0.684 |
| Other food | - | 0.0115* (0.023) | -0.0081* (0.037) | 0.00354* (0.021) | 0.0045* (0.000) | 0.0002* (0.006) | 0.0099* (0.020) | 0.0098* (0.021) | 0.0089 (0.129) | 0.0004* (0.023) | 0.366 |
| Tobit (or Heteroscedasticity-corrected Tobit parameters) | | | | | | | | | | | |
| | α'_i | α'_i | (β_i) | (∂_i) | (τ_i) | (λ_i) | (φ_i) | (θ_{i1}) | (θ_{i2}) | (θ_{i3}) | |
| Pulse | - | -0.0226* (0.023) | -0.0091* (0.010) | -0.00459 (0.812) | 0.0068* (0.007) | 0.0025 (0.061) | 0.0195 (0.737) | 0.0022 (0.992) | 0.0005 (0.089) | 0.0009* (0.009) | |
| Fruit | - | 0.0365* (0.000) | -0.0068* (0.000) | 0.00031* (0.041) | 0.0087* (0.045) | 0.0015* (0.012) | 0.0656* (0.025) | -0.0591 (0.236) | 0.0018 (0.323) | 0.0008 (0.321) | |

* means the coefficient is significant at 5% level of significant in the QUAIDS model

Jahan

Table 2: Parameter Estimation of Demand Model for Ascending Poor Households

| Ordinary Least Squares parameters (or Heteroscedasticity-corrected Ordinary Least Squares parameters) | | | | | | | | | | | |
|---|-------------------|-------------------------------------|--|--------------------------------------|---------------------------------|--------------------------------------|----------------------------------|------------------------------------|--|-----------------------------|-------------------------------|
| Item | Constant | coefficient of $\frac{1}{\sqrt{x}}$ | Coefficient of Log of per capita total exp | Coefficient of Log of Household size | Coefficient of dependency ratio | Coefficient of Age of household head | Coefficient of Year of schooling | Coefficient of Agricultural Worker | Coefficient of Service man and Non-Agricultural worker | Coefficient of Business man | Adjusted R ² value |
| | α'_i | α'_i | (β_i) | (δ_i) | (τ_i) | (λ_i) | (φ_i) | (θ_{i1}) | (θ_{i2}) | (θ_{i3}) | |
| Cereal | 1.382* (0.000) | - | -0.2505* (0.000) | 0.0385* (0.017) | 0.0022* (0.033) | 0.0012 (0.089) | -0.0031* (0.032) | 0.0012* (0.008) | 0.0002 (0.561) | 0.0001 (0.771) | 0.768 |
| Oil | - | 0.1441* (0.000) | -0.0094* (0.000) | 0.0021* (0.012) | 0.0028* (0.045) | 0.0026* (0.002) | -0.0054* (0.016) | 0.0054* (0.036) | 0.0023* (0.001) | 0.0023* (0.001) | 0.215 |
| Vegetable | 0.1032 (0.077) | - | -0.0539* (0.022) | 0.0068 (0.090) | -0.0002* (0.009) | 0.0040 (0.080) | -0.0033* (0.074) | 0.0067* (0.039) | 0.0028* (0.011) | 0.0023 (0.211) | 0.775 |
| Meat-fish | - | -7.060* (0.000) | 0.0036 (0.055) | -0.0642* (0.022) | 0.0023* (0.009) | 0.0010* (0.021) | 0.3971* (0.000) | 0.0081 (0.086) | 0.0067* (0.048) | 0.0087* (0.011) | 0.685 |
| Other food | - | 0.0007* (0.000) | 0.0037* (0.023) | 0.0012* (0.000) | -0.0021* (0.023) | 0.0019* (0.046) | 0.2355 (0.066) | 0.0056* (0.012) | 0.0018 (0.059) | 0.00132 (0.412) | 0.456 |
| Tobit (or Heteroscedasticity-corrected Tobit parameters) | | | | | | | | | | | |
| | α'_i | α'_i | (β_i) | (δ_i) | (τ_i) | (λ_i) | (φ_i) | (θ_{i1}) | (θ_{i2}) | (θ_{i3}) | |
| Pulse | - | 0.0874 (0.0539) | -0.0073* (0.000) | 0.0022 (0.062) | 0.0081 (0.354) | 0.0002* (0.012) | -0.0082 (0.299) | 0.0022 (0.223) | -0.0011 (0.229) | 0.0005* (0.004) | |
| Fruit | - | -0.2663* (0.0118) | -0.0007* (0.000) | -0.0001* (0.012) | -0.0026* (0.012) | 0.0004* (0.005) | 0.0026 (0.126) | -0.00331 (0.561) | -0.0041 (0.068) | 0.0091 (0.931) | |

* means the coefficient is significant at 5% level of significant in the QUAIDS model

Jahan

Table 3: Parameter Estimation of Demand Model for Descending Non Poor Households

| Ordinary Least Squares parameters (or Heteroscedasticity-corrected Ordinary Least Squares parameters) | | | | | | | | | | | |
|---|--------------------|-------------------------------------|--|--------------------------------------|---------------------------------|--------------------------------------|----------------------------------|------------------------------------|---|---|-------------------------------|
| Item | Constant | Coefficient of $\frac{1}{\sqrt{x}}$ | Coefficient of Log of per capita total exp | Coefficient of Log of Household size | Coefficient of dependency ratio | Coefficient of Age of household head | Coefficient of Year of schooling | Coefficient of Agricultural Worker | Coefficient of Service man and Business man | Coefficient of Non-Agricultural worker and others | Adjusted R ² value |
| | α'_i | α'_i | (β_i) | $(\hat{\delta}_i)$ | (τ_i) | (λ_i) | (φ_i) | (θ_{i1}) | (θ_{i2}) | (θ_{i3}) | |
| Cereal | 1.244* (0.000) | - | -0.2091* (0.000) | 0.0345* (0.003) | 0.00213* (0.013) | 0.0005* (0.015) | -0.00156* (0.012) | 0.0012 (0.077) | 0.0091 (0.071) | 0.0081* (0.002) | 0.613 |
| Oil | - | -0.172* (0.000) | -0.0041* (0.025) | 0.0021 (0.056) | -0.0012* (0.023) | -0.0007* (0.003) | 0.00071 (0.965) | 0.0043* (0.006) | 0.0001 (0.093) | 0.0078 (0.093) | 0.345 |
| Vegetable | 0.1621* (0.000) | - | -0.0392* (0.000) | 0.0032* (0.005) | 0.00578* (0.008) | -0.0045 (0.057) | 0.00126* (0.014) | 0.0011* (0.067) | 0.0009* (0.001) | 0.0031 (0.082) | 0.478 |
| Meat-fish | - | -0.5631* (0.017) | 0.0069* (0.039) | -0.0087* (0.011) | -0.0101* (0.022) | -0.0002* (0.031) | 0.00198* (0.035) | 0.0021* (0.003) | -0.0028 (0.255) | 0.0072* (0.021) | 0.503 |
| Other food | 0.0413 (0.512) | - | 0.0691* (0.000) | -0.0012* (0.042) | -0.0001* (0.026) | -0.0001* (0.007) | 0.00695* (0.038) | -0.0028 (0.556) | 0.0022 (0.223) | -0.0091 (0.310) | 0.317 |
| Tobit (or Heteroscedasticity-corrected Tobit parameters) | | | | | | | | | | | |
| | α'_i | α'_i | (β_i) | $(\hat{\delta}_i)$ | (τ_i) | (λ_i) | (φ_i) | (θ_{i1}) | (θ_{i2}) | (θ_{i3}) | |
| Pulse | - | -0.0536* (0.006) | -0.0049* (0.025) | -0.0012* (0.000) | -0.0095* (0.036) | 0.0021* (0.039) | 0.00285 (0.214) | 0.0022* (0.011) | 0.0012 (0.090) | 0.0021 (0.145) | |
| Fruit | 0.0253* (0.015) | - | 0.0008* (0.023) | -0.0699 (0.088) | -0.0036* (0.003) | -0.0004* (0.028) | 0.00372* (0.005) | 0.0036* (0.031) | -0.0122 (0.089) | 0.0061* (0.000) | |

* means the coefficient is significant at 5% level of significant in the QUAIDS model

Jahan

Table: 4: Parameter Estimation of Demand Model for Chronically Poor Households

| Ordinary Least Squares parameters (or Heteroscedasticity-corrected Ordinary Least Squares parameters) | | | | | | | | | | | |
|---|--------------------|-------------------------------------|--|--------------------------------------|---------------------------------|--------------------------------------|--------------------------------------|------------------------------------|---|---|-------------------------------|
| Item | Constant | coefficient of $\frac{1}{\sqrt{x}}$ | Coefficient of Log of per capita total exp | Coefficient of Log of Household size | Coefficient of dependency ratio | Coefficient of Age of household head | Coefficient of Sex of household head | Coefficient of Agricultural Worker | Coefficient of Service man and Business man | Coefficient of Non-Agricultural worker and others | Adjusted R ² value |
| | α'_i | α'_i | (β_i) | (δ_i) | (τ_i) | (λ_i) | (η_i) | (θ_{i1}) | (θ_{i2}) | (θ_{i3}) | |
| Cereal | 1.261* (0.000) | - | -0.0778* (0.000) | 0.0671* (0.000) | 0.0121* (0.002) | 0.0002* (0.041) | 0.0016* (0.041) | 0.0085* (0.006) | 0.0213* (0.045) | 0.0014* (0.009) | 0.976 |
| Oil | 0.129* (0.005) | - | 0.0088* (0.002) | -0.0036* (0.005) | -0.0002* (0.005) | 0.0027* (0.002) | 0.0158 (0.000) | 0.0061* (0.026) | 0.0036 (0.726) | 0.0047 (0.328) | 0.851 |
| Vegetable | 0.0204 (0.675) | - | 0.0037* (0.010) | -0.0038* (0.031) | -0.0005* (0.008) | -0.0006* (0.033) | 0.0051* (0.045) | 0.0038 (0.325) | 0.0017* (0.015) | 0.0035* (0.031) | 0.810 |
| Meat-fish | 0.3361* (0.000) | - | 0.1946* (0.000) | -0.0875 (0.006) | 0.0045 (0.274) | 0.0026 (0.112) | 0.0092 (0.597) | -0.0034 (0.994) | 0.0026 (0.556) | 0.0213 (0.445) | 0.760 |
| Other food | 0.0198* (0.006) | - | 0.2104* (0.005) | 0.0062 (0.238) | -0.0002* (0.041) | 0.0003 (0.445) | 0.0005* (0.010) | 0.0035* (0.038) | -0.0078 (0.691) | 0.0017 (0.895) | 0.776 |
| Tobit (or Heteroscedasticity-corrected Tobit parameters) | | | | | | | | | | | |
| | α'_i | α'_i | (β_i) | (δ_i) | (τ_i) | (λ_i) | (η_i) | (θ_{i1}) | (θ_{i2}) | (θ_{i3}) | |
| Pulse | 0.1759* (0.022) | - | -0.0006* (0.000) | -0.0004* (0.086) | 0.0039* (0.005) | 0.0039* (0.009) | 0.0083* (0.032) | -0.0022 (0.221) | 0.0447 (0.672) | 0.0034* (0.011) | |
| Fruit | 0.7659* (0.000) | - | 0.0027* (0.000) | 0.0039 (0.351) | 0.0028 (0.351) | -0.0007* (0.014) | 0.0018 (0.325) | -0.0031 (0.913) | 0.0631 (0.457) | 0.0069 (0.345) | |

* means the coefficient is significant at 55 level of significant in the QUAIDS model

5.1 Estimation of Parameters

The value of *Coefficient of log of per capita total household expenditure* (β) reveals that, budget shares of all items are significantly responsive to the expenditure variable for all. The OLS and Tobit models suggest that, all food items can be considered as necessary goods for the non-poor people as the value of the estimated coefficient has been found as negative for all cases. The extent of necessity can be further assessed by elasticity. For ascending poor, meat and fish and fruit is found as luxury items. For descending non-poor, this list is extended by adding other food items. For chronically poor people, ruthless to say, only cereal and pulses are the necessary items. This result is similar with the study like the study of Ferdous (1997) in her work with HES data of Bangladesh (1985/86).

Household size is a vital predictor in demand model. Actually, The positive value of the variable (δ_i) suggests the increased amount of consumption due to the increased family

Jahan

size. For the non-poor families, enlarging family size has enhanced the consumption of cereal, meat-fish other food items and fruits. In case of ascending poor, demand increases for cereal, oil and other food but decreases for meat-fish and fruit. For descending non-poor families demand increases for cereal and vegetables and decreases for meat-fish, other food also for even pulse. For chronic poor households, the illustrations are the easiest one. Here, demand decreases for all items except cereal. Thus more demand on luxury items has been observed in upper economic class due to larger family size whereas it snatches away some basic goods from the poorer families.

Dependency Ratio measures the proportion of dependent person to the independent in that family. The corresponding coefficient (τ_i) has been found significant and positive among non-poor families for all food items except oil in OLS model. Positive demand has been found in the food items except vegetables, other food and fruit for ascending poor group. A further reduction has been noticed for descending non-poor people as negative demand occur for oil, meat-fish, other food, pulse and fruit. For this case, positive demand occurs for cereal and vegetables only. Finally, the chronic poor families can consume more amounts on cereal and pulse for larger dependency ratio. Simultaneously their demand has to be dropped on vegetables, oil, and other food.

Here, the non-poor families have been proved to have the effort to fulfill extra need of their dependent person even on the luxury items. For people of the transitory state have to meet the need of necessary items like cereal and oil for their children and aged persons and in cost they have to give up the demand of luxury food items. The chronically poor people, by contrast, have to sacrifice all the basic need of the family members due to larger dependency ratio. In the previous study of Ferdous (1997), dependency ratio was responsive to rice, wheat and other crops.

The sex of household head(η) has been found as significant only for chronically poor people. Again, the frequency of female-headed families is the highest in the chronically poor groups among all. OLS and Tobit model suggests that coefficient is significant and positive for cereal, oil, vegetable, other food items and pulse respectively those are very vital for them. So, the female-headed families have to consume fewer amounts of all these necessary items than the male headed poor families which can be viewed as the interaction effect of both gender and poverty discrimination. However, this result is contradictory with some of the earlier ones like Ferdous (1997), Mullah (2000) as no significant impact of sex variable has been observed on those demand pattern.

Age of household head is another influential socio-demographic variable demand analysis. OLS and Tobit model suggests that, increased consumption on cereal, meat-fish, fruits and other food items have been found with the increase of age of the household head in non-poor families. The ascending poor people had been travelling the way of poverty and achieved progress during last decades. The corresponding coefficient is found positive for oil, meat-fish other food items, fruit and pulse. The reverse feature has been observed for descending non-poor families. OLS and Tobit model suggests that, positive response comes only from the cereal and pulse whereas

Jahan

it is found negative for oil, meat-fish, other food and fruits. For chronic poor households, the consumption has been increased for cereal, oil, pulse and decreases for vegetables and fruit with the growing age of head. In most of previous studies, age variable was not very useful to predict the demand situation.

The coefficient of year of schooling (φ) has been found as negative in non-poor people for oil and vegetables whereas positive for other food and fruit. For ascending poor, demand decreases on these items including cereal whereas increased demand observed on meat-fish. For descending non-poor, demand decreases only for the staple food: cereal. Demand increases on vegetables, meat-fish and other food and fruit.

For all economic groups, as the educational achievement rises the consumption of necessary items decreases and comparatively luxury items increases. This discussion does not take into account the consumption about chronically poor people as this variable has been found insignificant for their consumption model. In most of the previous research, education status has been considered as dummy variables. But in this study, it has been considered as year of schooling which is continuous variable of ratio scale. So, there is actually no alternative for comparison.

The occupation status of household head is a dummy variable where the base category is considered as the unemployed household head. The positive value of parameter (θ_i) indicates increased consumption of commodity comparing to the base level. The household having head as the agricultural worker has expend more on cereal, meat-fish and other food compare to the base category in non-poor groups. Increased demand continues on oil and vegetables instead of meat-fish for ascending poor groups. Positive response comes from oil, meat-fish, pulse and fruit among descending non-poor groups. In case of chronic poor families, the positive value observed only for cereal, oil and other food.

The next group represents the service holder household head. Non-agricultural worker has been merged in case of ascending poor group and business man is considered for the lower two groups. The coefficient at OLS model is found positive for just oil and vegetables in non-poor. This set is prolonged by adding meat-fish for the ascending poor while descending poor has expend more on other food rather than oil. Chronically poor people can consume more amounts of cereal and vegetables only.

The linked occupation group of non-poor and ascending poor families is business man. Positive demand is found for meat-fish, vegetables pulse, and other food in non-poor families and so also for oil and meat-fish for ascending poor families. The combined occupation group of two tail-ender groups is non-agricultural worker and others. The descending non-poor people having such a head can consume more on items cereal, meat-fish fruit and pulse, while for chronic poor people meat-fish is replaced by vegetables.

5.2 Estimates of Elasticity

The following table shows expenditure elasticities of four dynamics of people:

Table 5: Expenditure Elasticity

| Item | Non-poor | Ascending poor | Descending non-poor | Chronically poor |
|---------------|----------|----------------|---------------------|------------------|
| Cereal | 0.1628 | 0.2985 | 0.4583 | 0.8254 |
| Pulse | 0.2319 | 0.4516 | 0.4923 | 0.9346 |
| Oil | 0.6529 | 0.7283 | 0.8596 | 1.0258 |
| Vegetable | 0.2381 | 0.3759 | 0.5528 | 1.0136 |
| Meat and Fish | 1.0261 | 1.2733 | 1.5922 | 2.9256 |
| Fruit | 0.4562 | 0.8852 | 1.2300 | 1.9230 |
| Other Food | 0.7084 | 0.8092 | 1.0030 | 1.5640 |

The value of expenditure elasticity of any item which is beyond zero to one is considered as necessity and for which items this elasticity is more than one is considered as luxury item. Under this regulation, cereal and pulse is necessary for all. Oil is luxury for chronically poor people only. Vegetable is luxury item for only chronic poor section. Meat fish is, logically luxury for all. Fruit and other food are necessary for non-poor and ascending poor people but luxury for other two dynamic groups. This result does not mean those people do not consume fruit. Actually, poor village people can eat fruit from garden of their own or other and it is actually 'luxury to buy' for them. This result is similar to the result of Khanam (1999).

6. Summary and Conclusion

The study is devoted to speculate the consumption pattern of major food items in rural area and compare them across different income groups. The estimated QUAIDS model has incorporated the essential demographic features of households. Ahmed and Shams (1994) have compared the demand pattern of rich and poor people of rural Bangladesh by estimating the elasticities. But the impact of demographic features of a rural household was silent in their model. Potential demographic factors, then, have been selected from some of the previous literatures (Ferdous, 1997; Khanam and Ferdous, 2000; Mullah and Ferdous, 2006) those have no attempt to compare the economic groups of the society. The knowledge wings thus can be further extended in this study by perceiving the impact of demographic features a household on the demand of different food items as well as comparing them across assorted socio-economic groups of people.

The analysis specially focuses the inequities embedded in the society and ascertains the most inferior position of chronic poor people. Larger household size and dependency ratio increase the demand of some food in higher income groups. But for the 'Tail Enders', it creates a huge obstacle to consume even the necessary food items. The household head's age plays a significant role in demand pattern for the rising and

Jahan

sliding groups. The sex of head, however, significantly affects the demand pattern for only chronic poor families. Most of the female headed families belong to this class and they have to capitulate in this discrimination by sacrificing many basic food. The occupation status of household head is another important predictor in demand situation of different economic groups. Education has been significantly proved for rising the economic position and consequently increasing basic and luxury foods. But it excludes the chronic poor people as light of education is absent in most of their lives.

7. Limitations, Policy Implications and Further Opportunity

This research will serve distinct feature of demand pattern of different economic groups of Bangladesh that may help the Government organizations, NGO's and International food aid agencies. Subsidy and other promotional activity regarding food items may affect different economic groups and this study can serve new intuitions for the policy makers. This study has not been considered all the aspects of food consumption and supply responses that limit the scope of the study due to time and data constraint. Thus, the discussion of limitations of the findings results the scope for further research. For food consumption demand the study used AIDS model only for some selected items for the specific period, because of the availability of data. Thus, inclusion of other food items and longer period of time series in the analysis would have given better results for the short-term and long-term dynamic of consumption pattern. Most important to say, the study cannot include the information of price that deprives to recommend about price policy for different income groups of peoples in our country. So, in future if it is possible to use recent household data incorporated with price information, the research will further extent to meet the interest.

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