An Analysis of Meat Demand in Bangladesh Using the Almost Ideal Demand System

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Abstract: Three types of meat are relevant for Bangladesh. These are beef, chicken and mutton. Meat demand in Bangladesh is studied using the Almost Ideal Demand System (AIDS). All three types of meat—beef, chicken and mutton – show inelastic demand. Cross price elasticities show dominance of substitutability.

Keywords: AIDS model, Elasticities, Kronecker delta

JEL classification Number: C13, C34, D12

1. Introduction

Deaton and Muellbauer (1980) are credited with the development of the Almost Ideal Demand System (AIDS) which has been the most commonly used demand system specification during the last 20 years. Buse (1994) reported that during 1980-91 as many as 89 empirical works used the AIDS in demand studies. Our references below show that there have been several works using the AIDS since 1991.

In studies of meat demand, AIDS has been widely used. There are several studies on US (Nayga and Capps, 1994; Brester and Schroeber, 1995; Holt and Goodwin, 1970), Canada (Reynonds and Goddard, 1991; Xu and Veeman, 1996), Japan (Hayes et al., 1990), UK (Burton et al., 1996; Tiffin and Tiffin, 1999), and Greece (Karagiannis et al., 2000). This

list, which could have been longer, does not include any work on any developing economy. This does not mean that there is no work on these economies but implies existence of very few works on the developing economies. So our work on meat demand in Bangladesh may be of interest to researchers in this area as the results presented in this paper are based on data of an economy which is structurally very different from the developed economies.

The AIDS has been found very suitable for the study of food demand of different types. The estimated coefficients can be converted to generate estimates of elasticities, which can throw light on price and expenditure responses of the consumers.

2.   Empirical Model

The AIDS is a versatile system capable of studying various aspects of food demand and its various components. In terms of budget shares, this is given by

$$S_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \, ln \, p_j + \beta_i \, ln\left(\frac{m}{P}\right) + e_t$$

where S_i is the budget-share of the ith commodity, α_i is the constant coefficient in the *i*th share equation, γ_{ij} is the slope coefficient associated with the *j*th good in the *i*th share equation, p_j is the price of the jth commodity, m represents total expenditure on the system of goods given by

$$m = \sum_{i=1}^{n} p_i q_i$$

in which q_i is the quantity demanded for the *i*th good. And p is the price index defined by

$$ln \, p = \sum_{i=1}^{n} w_i \, ln \, p_i \; .$$

that gives rise to the linear approximate AIDS (LA-AIDS) model. In practice, the LA-AIDS model is more frequently estimated (Deaton and Muellbauer, 1980). [1]

To be in line with economic theory, different parameters of the demand equations must satisfy the following restrictions:

Adding up: $$\sum_i \alpha_i = 1, \quad \sum_i \gamma_{ij} = 0, \quad \sum_i \beta_i = 0$$

Homogeneity: $$\sum_j \gamma_{ij} = 0$$

Symmetry: $$\gamma_{ij} = \gamma_{ji}, \quad i \neq j$$

The advantage of the AIDS model is that the homogeneity and symmetry restrictions are easily imposed and tested.

3. **Data**

For Bangladesh, three types of meat are relevant. These are beef, chicken and mutton. Data used for econometric estimation are quarterly and constructed by the authors, which are based on *Household Expenditure Survey (various issues)* and *Statistical Yearbook of Bangladesh (various issues)*. This study covers the period 1980 to 2000.

In some earlier studies (e.g., Karagiannis, et. al., 2000), pork and sausages were included. These are not relevant for Bangladesh as pork is eaten very little, the country being a predominantly Muslim one. Even Hindus who constitute the largest minority rarely eat pork here. Sausage still does not constitute a significant part of meat consumption here.

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[1] p is the price index which is also defined by

$$ln\, p = \alpha_0 + \sum_{i=1}^{n} ln\, p_i + \frac{1}{2}\sum_{i=1}^{n}\sum_{i=1}^{n} \gamma_{ij}\, ln\, p_i\, ln\, p_j \quad \text{in the nonlinear AIDS model.}$$

4.   Econometric Results

The estimated parameters of the AIDS for meat demand in Bangladesh are presented in Table 1. We estimate the model using Microfit.

Table 1: Estimated Parameters of the AIDS in Bangladesh, 1980 (Q$_1$) -2000(Q$_4$)

Parameters	Beef	Chicken	Mutton
β_i	-0.7770 (-6.66)	0.1675 (2.32)	0.6095
γ_{i1}	-0.0093 (-0.1020)	0.0568 (1.03)	-0.0475 (-0.68)
γ_{i2}		0.0919 (1.53)	-0.1487 (-2.47)
γ_{i3}			0.1962

Note: Figures in the parentheses denote t-values. The t-values do not appear for coefficients which have been obtained using relevant restrictions.

The estimated parameters of the AIDS equation do not have straightforward economic interpretation but forms the basis of elasticity elasticities. Two types of such elasticities – the Marshallian and Hicksian are reported.

5. Elasticity Estimates

The Marshallian price and expenditure elasticities are given by:

$$\varepsilon_{ij}^M = -\delta + \left(\frac{\gamma_{ij}}{S_i}\right) - \left(\frac{\beta_i}{S_i}\right)S_j$$

$$\eta_i = 1 + \left(\frac{\beta_i}{S_i}\right)$$

where δ is the Kronecker delta.

The Hicksian elasticities can be obtained through the Slutsky equation in elasticity for, namely, $\varepsilon_{ij}^{H} = \varepsilon_{ij}^{M} + \eta_{i}S_{j}$, as:

$$\varepsilon_{ij}^{H} = -\delta + \left(\frac{\gamma_{ij}}{S_i}\right) - S_j$$

The estimates of Marshallian own-price elasticities and expenditure elasticities are given in Table 2. The own-price elasticities are all found to be negative as expected. In absolute terms the value of elasticity is found to be lowest for beef followed by those for chicken and mutton. Of the three items mutton is the most expensive followed by chicken and beef. As such the results can be regarded as expected since the least expensive item is found to have the lowest elasticity. The value of expenditure elasticity is found to be highest for mutton followed by chicken. The expenditure elasticity of beef is found to be negative which was unexpected. The cross price elasticities all show substitutability. The extent of substitutability is highest between beef and chicken followed by those between beef and mutton, and chicken and mutton.

Table 2: Marshallian Elasticities for Meat Demand in Bangladesh, 1980 (Q_1) to 2000 (Q_4)

	Beef	Chicken	Mutton	Expenditure
Beef	-0.24736	0.8837	0.4718	-1.03563
Chicken		-0.91293	0.2761	1.463989
Mutton			-0.93965	3.080915

The values of Hicksian own-price elasticities are given in Table 3 show that these are all negative. Own price elasticity of chicken was most elastic followed by those of beef and mutton. The value of expenditure elasticity is highest for beef followed by that of chicken. The expenditure elasticity of mutton is found to be negative which is an unexpected result.

Table 3: Hicksian Elasticities for Meat Demand in Bangladesh, 1980 (Q_1) to 2000 (Q_4)

	Beef	Chicken	Mutton	Expenditure
Beef	-0.64266	0.5098	0.1684	0.509808
Chicken		-0.89357	-0.1190	0.168457
Mutton			-0.03725	-0.11901

The estimates of cross price elasticities show prevalence of substitutability between beef and chicken, and beef and mutton, and complementarity between chicken and mutton.

6.   Conclusions

The estimates of this paper add to the growing literature on meat demand using the AIDS framework. Since there are very few works on the developing economies, our results may be of interest to researchers working in this area. Our estimates show that all three types of meat -- beef, chicken, and mutton -- have inelastic demand. Cross price elasticities show dominance of substitutability.

Our failure to take corrective measures even after we encountered the problem of nonstationarity may be found to be not very uncommon in studies of this nature. It also brings to fore the fact that this type of research does not always follow the familiar secnario where presence of nonstationarity vanishes after first difference and ECM can be used.

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