

## Meat Demand Analysis in Umuahia Metropolis Abia State, Nigeria

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**Abstract:** This study analyzed the demand for meat products using an Almost Ideal Demand System (AIDS) model. Data were collected from randomly selected 100 households. Descriptive and inferential statistics as well as regression analysis were used to analyse the data. The findings show that there is a positive and significant relationship between the perception and consumption of meat by the respondents. Beef is consumed across households on a daily bases in Umuahia as 67% consume it 3-times per day. Age and income levels of respondents have significant effect on meat products consumption. There is also a significant effect between variation in prices and expenditure on meat products. The elasticities also imply that chicken is a luxury good and beef, mutton, pork and dog are normal goods for Umuahia households. With the exception of beef and dog price elasticities, the majority of the price elasticities exhibit the expected signs and magnitudes. This indicates that the demand for meat in Umuahia is very price elastic.

**Key words:** Meat demand, elasticity, almost ideal demand system, Umuahia metropolis

### INTRODUCTION

Livestock farming has remained an essential component of the agricultural sector of the Nigerian economy. This is true because livestock is a good source of animal protein which is needed for proper and balanced diet.

Adeshinwa *et al.* (1999) observed that the Food and Agricultural Organisation (FAO) recommended that an average of 200 g animal protein is required per day for healthy living in the developing countries. This therefore means that the general wellbeing of the people is directly dependent on the amount of animal protein consumption available to them. Cheeke (2002) explained that global demand for meat production will increase by 58% between 1995 and 2020 and that consumption of meat will rise tremendously by 2020.

Although FAO (2000) recommended the average protein requirement for healthy living and maintained that the meat protein consumption in most African countries is very low at a level of 25 g, yet in Nigeria, the consumption is even lower especially in the southern and eastern parts of Nigeria where in recent times human nutritionist have observed that the production of animal protein has not been high enough to meet the demand of the rapid population growth (Obi, 2003).

Obi (2003) asserted that much of the animal protein intake available to the southern and eastern parts of Nigeria comes from the north in the form of cattle, rams, dogs and goats.

Comparative Statistics by Ademosun (2000) puts Nigeria's total meat production at 810,000 tonnes for a population of about 110 million resulting in a meat production index of 22 g per caput per day. Sonaiya (1982) had rightly envisaged that as consumers become more articulate and organised, their demand for wholesome animal protein will exert a powerful influence upon quality, production method and strategies. He added that recent increases in expendable income of urban dwellers have tendencies to stimulate greater demand not only for quality but also quantity of meat products.

Although the most striking feature of meat consumption in many African society is the overwhelming importance of meat which contributes over 70% of total protein intake (Anthonio and Adeyokunu, 1973). Today, the increasing human population in the face if inelastic production strategies appear to have widened the demand-supply gap and accentuates society of meat products. Regmi (2002) supported this view and noted that the unprecedented growth that has occurred in the last half-century has created an additional demand for meat and general food in developing countries.

Beside the failure of meat production capacity to match with the human population growth, the distribution of livestock in Nigeria is apparently lopsided. Composite transportation cost incurred coupled with remote distance between major meat producing areas and consuming urban centres together make the value of wholesome beef, mutton, pork, chicken and dog meat often

unaffordable (Mdafri and Brorsen, 1993). Early empirical studies on meat production and consumption focused on single meat products analysis with little or no work done on the effect of prices on expenditures and effect of socio-economic variables on demand. The extensive use of single equation methods centered on the measurement of elasticities since they are easily understood and conveniently dimensionless. Hence, demand could be directly measured as the parameters of a regression equation non-linear in the logarithms of purchases, outlays and prices (Pollack and Wales, 2003). Considering the cosmopolitan and commercial nature of Umuahia in Abia State, where different groups of people now reside and co-exist, it becomes important to analyse their demand system using the non-linear AIDS model.

**Objectives of the study:** The objectives of this study were to:

- Analyse household perception and consumption of meat products in the study area.
- Ascertain the frequency of consumption of (beef, mutton, pork, chicken and dog) meat products in the study area.
- Analyse the effect of socio-economic variables on meat products consumption expenditure in the study area.
- Evaluate the effect of variation in prices on meat products consumption expenditures.
- Estimate the price and expenditure elasticities of the products in the study area and formulate appropriate recommendation based on the findings.

**Justification for the study:** Household demand has attracted both domestic and international attention as is reflected in the literature (Adegeye, 1989; Eales and Unnevelar, 1993; Wang and Bessler, 2002). These studies were either focused on broad groups of commodities (such as food, clothing and housing) or on whole food groups (such as grain, edible oil and meat) and so none of them was specially aimed at analysing micro level data of this kind. Bessler and Akleman (1998) studied the effect of expenditure growth and urbanization on food consumption in East Asia in particular the case of livestock commodity but did not address how consumption behaviour changed during the past two decades for certain specific livestock products. Adegbola (1990) made efforts to provide this kind of information, although he disaggregated livestock products into only three categories (ruminant meat, pork and poultry). This explains the need to pay attention to livestock farming and meat consumption in this direction and magnitude. Researchers had explained in the past that different

cultures react differently to meat consumption. For instance, while the predominantly Muslim communities see it as a taboo to rear and eat pork meat believing it is an unclean animal and purely on religious ground, the Christian communities appear divided on the issue. While some believe that nothing is wrong with the rearing and eating of pigs and dogs, others see it from psychological point of view as a dirty and ugly animal with awful odour and thus, should not be consumed. This study gives a diagnostic situation in the study area and is hoped to boost meat consumption in the area. This study however, hopes to add to the growing literature on household perception and consumption of meat products as well as add substance to the knowledge base of economists in formulating policy recommendations.

## MATERIALS AND METHODS

The data for this study were obtained from both primary and secondary sources. Field survey constituted the primary data, while research reports, journals and publications made up the secondary data. Questionnaire was the main instrument for data collection. It was however complimented with interview schedule.

**Sampling procedure:** The study covered both Umuahia north and south. A total of 100 household respondents were selected using simple random technique.

**Analytical technique:** A regression analysis was employed to measure household perception and consumption of meat products, using the pork meat as a case study. The model is explicitly specified as:

$$H_c = b_0 + b_1 H_p + e$$

Where:

$H_c$  = Household consumption of pork meat measured in kg.

$H_p$  = Household perception of pork meat measured using dummy variable (1 = perceived as good, 0 = perceived as bad).

$b_0$  = Constant

$b_1$  = Regression coefficient

$e$  = Error term

To ascertain the frequency of consumption of (beef, mutton, pork, chicken and dog) meat products, a simple descriptive statistical tool (frequencies and percentages) was used. Ordinary least square regression techniques were used to determine the effect of socio-economic

variables such as sex, age, level of education attained, household size and income level on meat products consumption expenditure.

The model for this is implicitly specified as:

$$Y = f(X_1, X_2, X_3, X_4, X_5, \ell)$$

Where:

- Y = Quantity of meat products consumed by household measured in kg.
- X<sub>1</sub> = Sex of the respondents measured by a dummy variable (male = 1, female = 0).
- X<sub>2</sub> = Age measured in years
- X<sub>3</sub> = Level of education measured by number of years spent in school
- X<sub>4</sub> = Household size measured by number of people in the house.
- X<sub>5</sub> = Income level measured in Naira (N)
- ℓ = Error term

Four functional forms of the models namely linear, semi-log, double-log and exponential were fitted.

In addressing the effect of variation in prices on meat products consumption expenditure and estimating price and expenditure elasticities of meat products, the Almost Ideal Demands System (AIDS) model developed by Deaton and Muellbauer (1980) was employed.

The AIDS has been a popular framework for establishing price and income elasticities when expenditure or budget share data are available (Karagiannis *et al.*, 2000). The Almost Ideal Demand System (AIDS) is a flexible, complete demand system which has the linearly approximated Almost Ideal Demand System, LA/AIDS and the non-linear almost ideal demand system components. This research employs the non-linear AIDS model which consists of a set of budget-share equations and is specified thus;

$$W_i = \alpha_i + \sum \gamma_{ij} \ln P_i + \beta_i \ln (E/P)$$

Where;

- W<sub>i</sub> = Expenditure or budget share of meat product i
- P<sub>i</sub> = Price of meat product i
- E = Total expenditure overtime
- P = An overall price index

α<sub>i</sub>, γ<sub>ij</sub> and β are parameters (constants). The non-linear AIDS model was fitted to the data in regression analysis using the package known as MATLAB.

The theoretical properties of homogeneity in price effect on income, the Slutsky symmetry of the cross price effects and the adding up of demand functions imply both

within and across equation restrictions on parameters Y and β. These restrictions can be written mathematically as follows for AIDS model,

$$\begin{aligned} \sum \alpha_i &= 1, \sum \gamma_{ij} = 1, \sum \beta_i = 1 \text{ (adding up)} \\ \sum Y_{ij} &= 0 \text{ (homogeneity)} \\ \gamma_{ij} &= \gamma_{ji} \text{ (symmetry)}. \end{aligned}$$

The expenditure elasticity (ε<sub>i</sub>) and price elasticity (ℓ<sub>ij</sub>) in the AIDS model are given by ε<sub>i</sub> = 1 + β/W<sub>i</sub>

$$\ell_{ij} = -\alpha_{ij} + \frac{\gamma_{ij}}{W_i} - \frac{\beta_i W_i}{W_i}$$

Where:

- W<sub>i</sub> = Share of each product,
- β<sub>i</sub> = Expenditure coefficient,
- ε<sub>i</sub> = Expenditure elasticity,
- ℓ<sub>ij</sub> = Price elasticity

## RESULTS AND DISCUSSION

Results from the regression analysis show a positive and significant relationship between perception of meat products by households and their consumption (Table 1). This implies that meat products are generally considered good and worth the consumption by the inhabitants of Umuahia metropolis. This is justified by the contribution of meat to the body in the form of protein to enhance the replacement of worn out tissues in the body. Results in Table 2, indicate that 30% of the respondents in the study area consume beef 2-times per day, 67% consume it 3-times per week. This implies that beef is consumed on a daily bases as contrasted by mutton, pork, chicken and dog meats. Mutton is mostly consumed once per week, pork is consumed 3-times per week, chicken is consumed once per week against dog meat which is consumed once in a while. The result shows that beef product is consumed across households in Umuahia.

On the effect of socio-economic variables on meat consumption behaviour, age and income level of the respondents were found to affect the consumption behaviour of the respondents. The linear function was selected amongst the fitted four functional forms as the

Table 1: Relationship between perception and consumption of meat products by respondents

Variable	Coefficient	t-ratio	R <sup>2</sup>
Constant	10.710	4.611***	0.216
Perception	14.522	5.194***	
F-ratio	26.977		
N	100.00		

Source: Field survey data, 2006, \*\*\* = 1% significance

Table 2: Frequency distribution of respondents according to consumption frequency on weekly bases

No of time	2-times	3-times	3-times	Once	Once in	Total
	per day	per day	per week	per week	while	
Beef						
Frequency	30	67	3	0	0	100
Percentage	30	67	3	0	0	100
Mutton						
Frequency	0	0	19	70	11	100
Percentage	0	0	19	70	11	100
Pork						
Frequency	0	0	56	35	9	100
Percentage	0	0	56	35	9	100
Chicken						
Frequency	0	0	38	59	3	100
Percentage	0	0	38	59	3	100
Dog						
Frequency	10	0	20	46	24	100
Percentage	10	0	20	46	24	100

Source: Field survey data, 2006

Table 3: Effects of socio-economic variables on meat consumption

Explanatory variable	Semi-log	Linear	Exponential	Double-log
Constant	-202.283 (-9.339)	-8.410 (-1.605)	1.590 (6.339)	-5.954 (-6.587)
Sex	-0.425 (-0.271)	-0.256 (-0.154)	3.729E-02 (0.469)	1.319E-02 (0.162)
Age	13.861*** (2.729)	0.254** (2.632)	9.557E-03 (2.070)	0.479** (2.260)
Educational level	2.183 (0.515)	2.183 (1.389)	0.118 (1.572)	0.112 (0.633)
Household size	-2.296 (-1.041)	-0.476 (-0.981)	-7.28E-03 (-0.313)	-4.99E-02 (-0.542)
Income level	16.062*** (8.939)	2.597E-04*** (11.666)	9.391E-06** (8.814)	0.648*** (8.637)
R <sup>2</sup>	0.618	0.717	0.616	0.607
F-value	30.445	47.579	30.188	29.023

Source: Field survey data, 2006, \*\*\*=1% significance, \*\*=5% significance, Values in bracket are t-ratios

lead equation based on having higher R<sup>2</sup> and F-ratio than all the other functional forms except the exponential function (Table 3).

The variation in the quantity demanded of meat as seen in Table 5, is accounted for by the independent variables (sex, age, educational level, household size and income level) by about 72% while the remaining 28% could be linked to other factors not included in the model.

On the effect of variation in prices on expenditure of meat products, the regression coefficients in Table 4, indicate the magnitude of the effect of changes in prices on expenditure on meat products. We can thus, reject a null-hypothesis of no effect between changes in prices and expenditure on beef, mutton, pork, chicken and dog meat products at 5% level. The joint effect in relative prices of each product shows 10 times the absolute effects on each value share of 1% increase in all prices of meat products. From the test results, beef, mutton, pork and dog meat products with expenditure coefficients of -0.4032, -0.0128, -0.006 and -0.4355, respectively, are found to be necessities while chicken with an expenditure coefficient of 0.03557 is a luxury in the study area. The expenditure elasticity of beef, mutton, pork, chicken and dog as estimated from the AIDS model are 1.1154, 1.0032, 1.0009, 0.9931 and 1.0552, respectively, indicating that when income increase, respondents will consume relatively more beef, mutton, pork and dog meat products and consume relatively less of chicken. The implication for chicken meat product is that when income increases by 10%, chicken expenditure will increase by 9.93%.

Table 4: Nonlinear AIDS regression parameter estimates of meat demand system

	Beef expenditure	Mutton expenditure	Pork expenditure	Chicken expenditure	Dog expenditure
Intercept ( $\alpha$ )	-1.7209*	-1.6880*	-1.6123*	-2.2620*	-1.2043*
Ci	(-3.4715 0.0297)	(-2.8325 -0.5436)	(.27109 -0.5136)	(-4.2841 -0.2398)	(-2.3681 -0.0404)
Expenditure coefficient ( $\beta$ )	-0.4032	-0.0128	0.0036*	0.0365	-0.4355
Ci	(-0.0927 0.0121)	(0.0454 0.0198)	(-0.0329 0.0258)	(-0.0239 0.0968)	(-0.0710 -0.0161)
Beef price	0.5110	0.6060	-0.2371*	0.5651	0.0518*
Ci	(-0.080 0.1839)	(-0.0360 0.1572)	(-0.2379 0.1905)	(-0.1444 0.0314)	(-0.9530 0.9633)
Mutton price	0.1388*	0.0146*	0.1343*	0.0519*	0.8922*
Ci	(0.0567 0.2208)	(0.0045 0.1247)	(0.0011 0.2676)	(-0.0028 0.1066)	(-1.4882 -0.2962)
Pork price	0.0418*	0.1222*	0.0948*	0.0782*	-0.9047*
Ci	(0.0321 0.1157)	(0.0680 0.1763)	(-0.0252 0.2148)	(0.0289 0.1275)	(-1.4415 -0.3678)
Chicken price	0.1243*	0.1184*	0.2314*	0.0769*	-1.5282*
Ci	(-0.0276 0.2762)	(0.0071 0.2296)	(-0.0152 0.4780)	(-0.0244 0.1781)	(-2.3560 -0.1495)
Dog price	0.0138*	0.2450	0.4700	0.9897	-2.5310
Ci	(-0.0676 0.0704)	(-0.0261 0.0751)	(-0.0651 0.1591)	(0.0530 0.1450)	(-0.7545 0.2484)
Joint price	-3.3707*	-2.2850*	-2.4583*	-3.0494*	-6.2441
Ci	(-2.6788 2.4047)	(-3.8662 -0.7039)	(-3.8825 -1.0342)	(-5.9761 -0.1228)	(-1.9541 0.7058)

Source: Field survey data, 2006, \* = Significance, Ci = Confidence interval

Table 5: Expenditure and price elasticities of meat products

Meat products	Expenditure elasticities	Price elasticities
Beef	1.1154	0.3018
Mutton	1.0032	-0.9747
Pork	1.0009	-0.3896
Chicken	0.9931	-0.4219
Dog	1.0552	0.2275

Source: Field survey data, 2006

Chicken is thus an income inelastic meat product and is a luxury in Umuahia metropolis. The high expenditure elasticity for beef indicates that beef consumption will not decrease drastically as long as consumers maintain their high per capita income. The price elasticities of mutton, pork and chicken show a negative sign as present in Table 5. The negative elasticities imply that as their prices increase by 10% there will be a corresponding decrease in their demand by 9.7, 3.9 and 4.2%, respectively. The non-negative elasticities of beef and dog meats do not mean that the demand theory does not hold.

### CONCLUSION

Umuahia is not only one of the livestock producing areas in Nigeria but also one of the largest meat consumers in this region of the country. The empirical results of this study suggest several points of interest for researchers, policy makers, planners and traders with involvement in Nigerian livestock production and marketing. First, expenditure elasticities for beef, mutton, pork and dog meat are highly elastic suggesting that Umuahia metropolis households will consume more of beef, mutton, pork and dog meat as incomes increase. In terms of beef, the expenditure elasticity is also highly elastic, implying that Umuahia metropolis consumers with low incomes will increase their consumption of beef as their incomes rise. Second, price elasticities of all meat items are fairly elastic. This suggests that any changes in meat prices could bring about a significant shift in meat consumption patterns in Umuahia metropolis.

Given the emergence of large unemployment in Nigeria and in Umuahia precisely, a major challenge confronting the government is how to design appropriate policies for the relative enhancement of low-income groups.

The strength of this study relative to previous meat demand studies in Umuahia metropolis and other cities is the use of observations pertaining to expenditure share rather than average income estimates for the population as a whole. Further studies will enhance the potency of these preliminary findings.

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