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Econometric Evaluation of Beef Demand Determinants in Port Harcourt Metropolis, Nigeria

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ABSTRACT
The study evaluated the determinants of beef consumption in urban and peri-urban areas of Port Harcourt, Nigeria. A stratified random sampling technique was used to select 70 households from two Local Government Areas (LGAs) in Port Harcourt. OLS multiple regression models (4 functional forms) were tried in analyzing the primary data gathered via a set of structured questionnaire. The test of hypothesis was done using Chow Break-Point test. It was found that price of substitute meat in the area, price of beef, marital status and household size of the respondents significantly determined the household's expenses on beef consumed. It was also found that there was a significant difference in the slope coefficients of the demand function of beef among peri-urban and urban households. It was recommended that incentives that will enable farmers supply beef at more affordable prices be put in place by the government to encourage the household consumption of beef and meat products in the area such as input subsidy, price incentives to farmers, improved storage facilities and power supply to help in effective storage of meat products, and need to create more awareness about family planning to make food security more feasible in the metropolitan households.

Keywords: beef demand, food security, Chow test, econometric analysis, Port Harcourt, Nigeria

1.0 Introduction

Anderson (2009) rightly noted that obtaining enough food is an important concern for every nation and in developing countries, food shortage remains a serious challenge. extremely serious problem. Worldwide, about 840 million people, or about 14 percent of the total population, do not have adequate food. These people suffer from undernutrition, a condition of nutrient deficiency that causes general weakness and fatigue, stymies mental and physical development, especially among children and render individuals susceptible to potentially fatal diseases such as dysentery, whooping cough, and tuberculosis. The majority of the world's undernourished people live in Africa (including Nigeria), China, India, and Latin America.
Meat (which includes beef, i.e., meat from cattle; mutton; chevon; pork; poultry; crustaceans and reptiles) is a nutritious food rich in essential amino acids in protein form. It also contains B group vitamins (most especially, niacin calcium, ash, iron and phosphorus. Meats, especially liver, according to Microsoft Encarta (2009) contain vitamins A and D. The Federal Ministry of Agriculture and Water Resources (2008) regretted that protein intake in Nigeria is inadequate and that Nigerians are still faced with a low daily animal protein intake per head per day of 10 grams compared to the FAO recommended intake of 36 grams. This is more worrisome when one notes that Nigeria has a rich potential for livestock development and protein food production. Beef, chevon, mutton, poultry and bush meat are some one of Nigeria's major sources of animal protein. FAO (n.d) noted that crops, livestock and fish have potentials for providing food and nutrition in the country yet there is threat of hunger and poverty. About 70% of the population live on less than N100 (US $ 0.7) per day the report added.

Given the above background it becomes necessary to have a cursory, scholarly investigation into the factors that could be responsible for Nigeria's protein deficiency from the demand perspective. The supply constraints have been examined by many scholars already. Therefore, besides the supply constraints there is a need to x-ray the determinants of household expenditures on meat products especially beef which is generally consumed in various parts of Nigeria. An examination of its demand determinants can result in output of evidence that can send signals to suppliers of beef in Nigeria and equally serve as guide for investment decisions and policy making in area of animal protein production and marketing as well as food security problem resolution in Nigeria. The choice of Port Harcourt metropolis, the oil resource base city of Nigeria, was instructive given its diversity of population which cuts across socioeconomic strata.

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The study was designed mainly to find out the soci0-economic factors influencing beef consumption in Port Harcourt urban and peri-urban households. Specifically, the study econometrically determined the factors influencing beef consumption in urban and peri-urban areas of the city; and found out whether there was a significant difference between urban and peri-urban areas (suburbs) of the city in terms of the magnitudes of these demand drivers of beef consumption in the study area.

1.1.0 Theoretical framework

According to Microsoft Encarta (2009) Encyclopedia, demand may be defined as the willingness of consumers to buy a product at a certain price, or the aggregate demand of all consumers in an economy for all products and services. Samuelson (1981); Samuelson& Nordhaus (2005) Reddy, Ram, Sastry and Devi (2008) and The Encyclopedia Britannica (2012) observed that the quantity of a commodity demanded can be seen to depend on the price of that commodity, the prices of all other commodities, the incomes of consumers, and their tastes. The quantity of a commodity that is available in the market depends not only on the price obtainable for the commodity but also on the prices of substitutable products, the techniques of production, and the availability and costs of labour and other factors of production.

As the price rises, the quantity offered usually increases, and the willingness of consumers to buy an article normally declines, but these changes are not necessarily proportional. The gauge of the responsiveness of supply and demand to changes in price is their *elasticity*. Elasticity is calculated as the ratio of the percentage change in the quantity demanded or supplied to the percentage change in price and can be represented in algebraic form as $E = {}^{\Delta Q}/_{\Delta P}$. Thus, if the price of a commodity decreases by 10 percent, and the sales of it consequently increase by 20 percent, the elasticity of demand for that commodity is said to be 2.

The demand for products that have good, readily available substitutes is likely to be elastic, because consumers can easily replace one good with another if its price rises. A product's demand may be inelastic if there are no close substitutes and if expenditures on the product constitute only a small part of the consumer's income. Firms faced with relatively inelastic demands for their products may increase their total revenue by raising prices; those with elastic demands cannot.

According to Samuelson (1981); Samuelson& Nordhaus (2005) Reddy, Ram, Sastry and Devi (2008) and The Encyclopedia Britannica (2012) though the concept of elasticity is most often associated with consumers' demand for a product, it can be applied to other variables. It may be used to measure the responsiveness of the quantity demanded by consumers to changes in their income. Another type of elasticity, known as the cross-elasticity of demand, measures the response in consumers' demand for one product to changes in the price of another. The cross-elasticity is likely to be positive if the products are substitutes for one another, because an increase in the price of one will result in an increase in demand for the other (Encyclopedia Britannica, 2012).

The level of commodities or goods/services demanded can be explained based on theory of demand and utility function approach. Quantity of beef demanded is then defined as the amount, in naira of

beef demanded by the individual. The total utility function can be expressed thus:

$$U = U(X1, X2, \ldots, Xn) \quad (1)$$

where U is the total individual/household utility, assumed to be a function of goods and services consumed. Xi is the individual/household demand for consumer and durable goods, i = 1, 2, . . . , n. Letting p1, p2, . . . pn represent the prices of goods and if household income is equal to its expenditures, then its total income can be represented thus:

$$Y = p1X1 + p2X2 + \cdots + pn\ Xn \quad (2)$$

Increase in one's income eases household's budget constraint, increasing its ability to consume more goods and services (including investment goods). If we let BeefDi represent quantity of beef demand by a household, such that Beef1 = Beef1(C), and let r represent the price of beef, then BeefDi = rBeefi represents demand for beef, subject to individual/household characteristics.

The demand for beef can be stated thus:

$$BeefD_i = f(Y, H, T, P) \quad (3)$$

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where $BeefD_i$ is the demand function for Beef. Y is household income (we use household wealth as proxy), H is a vector representing individual and household characteristics including sex, age, level of education, marital status and the number of household members. Other factors such as Po and Pb are prices of beef and prices of substitutes such as chevon and mutton which can influence the quantities of beef demanded.

1.2.0 Analytical framework : Given a data set $\{y_i,\ x_{i1}, \ldots, x_{ip}\}_{i=1}^{n}$ of *n* statistical units, a linear regression model assumes that the relationship between the dependent variable y_i and the *p*-vector of regressors x_i is approximately linear. This approximate relationship is modeled through a so-called "disturbance term" ε_i — an unobserved random variable that adds noise to the linear relationship between the dependent variable and regressors (Koutsyiannis, 1981,; Gujarati and Sangeetha, 2007; Greene, 2008 and Wikipedia, 2010). Thus the model takes form

$$y_i = \beta_1 x_{i1} + \cdots + \beta_p x_{ip} + \varepsilon_i = x_i'\beta + \varepsilon_i, \qquad i = 1, \ldots, n, \tag{4}$$

where $'$ denotes the transpose, so that $x_i'\beta$ is the inner product between vectors x_i and β. Often these *n* equations are stacked together and written in vector form as

$$y = X\beta + \varepsilon, \tag{5}$$

$$y = \begin{pmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{pmatrix}, \quad X = \begin{pmatrix} x_1' \\ x_2' \\ \vdots \\ x_n' \end{pmatrix} = \begin{pmatrix} x_{11} & \cdots & x_{1p} \\ x_{21} & \cdots & x_{2p} \\ \vdots & \ddots & \vdots \\ x_{n1} & \cdots & x_{np} \end{pmatrix}, \quad \beta = \begin{pmatrix} \beta_1 \\ \vdots \\ \beta_p \end{pmatrix}, \quad \varepsilon = \begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_n \end{pmatrix}. \tag{6}$$

Regression analysis using Ordinary Least Squares method (OLS) is built around certain assumptions. Two key assumptions are common to all estimation methods used in linear regression analysis: The design matrix *X* must have full column rank *p*. For this property to hold, we must have $n > p$, where *n* is the sample size (this is a necessary but not a sufficient condition). If this condition fails this is called the multicollinearity in the regressors. In this case the parameter vector β will be not identifiable — at most we will be able to narrow down its value to some linear subspace of R^p. Methods for fitting linear models with multicollinearity have been developed (See Koutsyiannis, 1981; Greene, 2008 and Gujarati and Sangeetha, 2007), but require additional assumptions such as "effect sparsity" — that a large fraction of the effects are exactly zero (Wikipedia, 2010).

Simply stated there must be enough data available compared to the number of parameters to be estimated. If there is too little data, then you end up with a system of equations with no unique solution. The regressors x_i are assumed to be error-free, i.e. they are not corrupted with errors of measurement. Though not realistic in many settings, dropping this assumption can lead to significantly more difficult errors-in-variables models (e.g. partial least squares).

Several other statistical properties of the data strongly influence the performance of different estimation methods:

- Some estimation methods are based on a lack of correlation, among the *n* observations $(y_i,\ x_{i1}, \ldots, x_{ip}),\ i = 1, \ldots, n$. Statistical independence of the observations is not needed, although it can be exploited if it is known to hold.
- The statistical relationship between the error terms and the regressors plays an important role in determining whether an estimation procedure has desirable sampling properties such as being unbiased and consistent.
- The variances of the error terms may be equal across the *n* units (termed *homoscedasticity*) or not (termed *heteroscedasticity*). Some linear regression estimation methods give less precise parameter estimates and misleading inferential quantities such as standard errors when substantial heteroscedasticity is present.
- The arrangement, or probability distribution of the predictor variables *x* has a major influence on the precision of estimates of β. Sampling and design of experiments are highly-developed subfields of statistics that provide guidance for collecting data in such a way to achieve a precise estimate of β.

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2.0 Research Methods

2.1.0 Study area: Rivers State is one of the 36 states in Nigeria. Agriculture is the major source of livelihood of the people of Rivers State and the agricultural policy of the state government is hinged on food production as it provides food for the bourgeoning population of households in the State, employment for young school leavers and university graduates as well. Major crops cultivated in the state include yam, cassava, maize, oil palm, banana and plantain. (Rivers State Agricultural Development Project, RSADP, 2003).

2.2.0 Sampling procedure: Two LGAs including Port Harcourt L.G. A. (representing urban areas) and Etche L.G.A. (a peri urban LGA) were randomly sampled for the survey. Out of these LGAs, 35 households were randomly sampled from lists of members of cooperative societies that involved women and men in the area. These bring to 70 the total number of households surveyed. The study relied heavily on primary data obtained from the above sample frame. However, secondary data were also used in writing the report especially journal articles, conference and seminar papers as well as online sources. A set of structured questionnaire and interview schedule were designed to elicit relevant responses from the household decision maker on domestic expenses issues (i.e. head of the household). The data include amount spent on buying beef, chevon, quantities purchased and household characteristics of the household head and his/her household.

2.3.0 Empirical Data Estimation Method: The major objective which is to find out the determinants of household level of expenses on beef consumption was attained using Ordinary Least Squares (OLS) regression methods involving use of four functional forms: linear, semi log, double log and exponential functions. The implicit form of the model was:

BFEXP = f(INCM, PRCCHVN, PRICBF, SEX, YRSOFEDU, HHSZ + μ). (7)

Where BFEXP = amount spent weekly on beef consumption in the household in Naira. PRICBF = Price of beef in Naira per kilogram; PRICCHV = Average price of substitute meat, chevon (goat meat) in Naira per kilogram; HHSZ = household size of the respondent (count), INCM = monthly income in naira (Discrete variable where 1 = N0 – N5000; 2 = >N5000 – N10,000, 3 = >N10000 – N15,000; 4 = above N15,000 – N20,000, 5 = .>N20000 – N100,000, 6 = Above N100000); YRSOFEDU = Years spent on formal education (count); MARITSTAT = marital status (discrete variable where 0 = single, 1 =separated, 2 = divorced, 3 = widowed and 4 = Married); while u is the stochastic error term. The model was estimated using EViews Econometric package. Before selecting the best fit model out of the four specified above and tried, the researcher considered standard model selection criteria such as values of Schwarz Information Criteria (SIC), Akaike Information Criteria (AIC) (the lower the values of the preceding statistics the better the model), the value of adjusted R^2 estimate (the higher the better), the level of significance (p value) of the F- ratio estimated (the lower the better) and the number of explanatory variables whose slope coefficients conform with theoretical expectations.

In order to be sure the regression model being used does not violate the assumptions of OLS earlier discussed the researcher conducted some econometric diagnostic tests including tests for normality of the distribution of the regression's residuals (using Jarque-Bera statistics); multicollinearity (using estimates of the uncentred and centred Variance Inflation Factors); and Heteroscedasticity (using Breusch-Pagan-Godfrey test). See Gujarati and Sangeetha, 2007; and Greene, 2008 for details. Chow test was used to test the hypothesis of the study. The Chow breakpoint test compares the sum of squared residuals obtained by fitting a single equation to the entire sample with the sum of squared residuals obtained when separate equations are fit to each subsample of the data.

EViews (2002) reports two test statistics for the Chow breakpoint test. The F-statistic is based on the comparison of the restricted and unrestricted sum of squared residuals and in the simplest case involving a single breakpoint, is computed as follows:

$$F^* = \frac{[\sum e_p^2 - (\sum e_1^2 + \sum e_2^2)]/K}{[\sum e_1^2 + \sum e_2^2)]/(n_1 + n_2 - 2K)} \quad \ldots 12$$

Where, n = number of observation (sample size = 70); $(\sum e_1^2 + \sum e_2^2)$ = total unexplained variation, $\sum e_p^2$ = pooled residual variance of the regression based on the two samples (n1, i.e. peri-urban sample + n2 which stands for urban household sample) (i.e. $\tilde{Y} = b_0 + b_1X) = \sum Y_p^2 - \sum \tilde{Y}_p^2$, with $(n_1 + n_2 - K)$ degrees of freedom. The symbol, p represents 'pooled' and K = total number of coefficients including the intercept, *bo*). The null hypothesis states that $b_i = \beta_i$, that is, there is no difference in the coefficients obtained from the two samples. This formula, according to EViews (2002), Gujarati and Sangeetha (2007), can be generalized naturally to more than one breakpoint. The F-statistic has an exact finite sample F-distribution if the errors are independent and identically distributed normal random variables while the log likelihood ratio statistic is based on the

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comparison of the restricted and unrestricted maximum of the (Gaussian) log likelihood function. Onoja, Ibrahim and Achike (2009) applied this model in econometric analysis of credit and farm resource technical determinants' efficiencies' differentials in cassava farms in Kogi State, Nigeria.

3.0 Results and Discussion

3.1.0 Factors influencing the demand for beef in the study area: The estimated parameters of the four functional forms tried in attempting find the best fit model that will best explain the determinants of beef consumption in Port Harcourt metropolis are presented in Table 1.0. Based on estimated Schwarz Criterion (and AIC), it was found that the Double Log model gave the best fittings since it had the lowest estimates of these parameters. Even when the adjusted R^2s and F-statistics were compared the double log model still came out with the best results with estimated adjusted R^2 and F-ratio of 0.69 (69%) and 23.33 (p value = 0.0000) respectively. The implication of the estimated adjusted R^2 is that 69 percent of the variation in the dependent variable (household expenses on beef) was as a result of the variations of the explanatory variables included in the model. The F-ratio was found to be statistically significant at 1 percent level. This implies that the null hypothesis of no significant joint effects of the explanatory variables' slope coefficients estimates in the model was rejected. In other words the explanatory variables jointly influenced the changes in the levels of consumption of beef in the households surveyed significantly. It is a sign of good fittings of the model too. Taking a look at the signs of the slope coefficients of the explanatory variables, it was

Table 1.0 : Estimates of Multiple Regression Parameters from Four OLS Models

MODELS	*Linear Model*		*Semi-Log Model*		*Double Log Model*		*Exponential Model*	
Variable	Coeff.	t-Stat.	Coeff.	t-Stat.	Coeff.	t-Stat.	Coeff.	t-Stat
Intercept	870.649	0.884NS	7.615	24.117***	10.431	5.984***	4092.87	0.670
INCM	613.580	4.225***	0.210	4.514***	-0.067	-0.358 NS	442.47	0.677
PRICHVN	0.408	0.516NS	0.000	-0.668NS	0.261	3.633 ***	736.15	2.930
PRICBEF	-1.313	-1.163NS	-0.001	-1.531NS	-0.422	-1.872*	-947.93	-1.200
SEX	-388.352	-1.489NS	-0.099	-1.188 NS	-0.012	-1.445NS	-51.40	-1.708
YRSOFEDU	26.292	0.813NS	0.004	0.369 NS	0.005	0.395NS	25.43	0.563
HHSZ	239.297	3.497***	0.068	3.097***	0.414	4.690***	1258.46	4.071
MARIST	314.679	2.554**	0.083	2.107NS	0.188	2.588**	723.91	2.842
R^2	0.71		0.69		0.72		0.68	
Adj. R^2	0.68		0.65		0.69		0.64	
AIC	16.63		0.54		0.41		16.73	
F-statistic	21.59		19.28		23.33		18.77	
Prob(F-stat)	0.00		0.00		0.00		0.00	

Source: Econometric Analysis output from EViews 7.0 by authors based on Field Survey, 2011.

found that almost all the explanatory variables in the model returned signs that conformed with a priori expectations except the monthly income of the household heads which returned negative sign in addition to the slope coefficient of the variable exerting an insignificant influence on beef consumption in the study area. Perhaps if a larger sample were employed this would have shown a better sign because it was gleaned from the other three models that the variable was rightly signed and significant. Price of the commodity itself (i.e. mean unit price of beef) indicated a negative sign and the slope coefficient was significant at 1 percent statistical level. This shows that as the unit price of the commodity increased the expenses on its consumption decreased. This is in line with the theory of demand given in the theoretical framework. Since we are using the double log model the slope coefficients estimated represent elasticities (see Gujarati and Sangeetha, 2007 and Greene, 2008).

The price elasticity of demand estimated was -0.422 (i.e. 0.42%). The response of demand for beef to price was very low even though it was significant. This could also mean that if such a low elasticity could result in a significant influence of expenses on beef consumption a higher price elasticity of demand of beef would result in a larger influence on the consumption of beef by households in the study area. The slope coefficient of the substitute's price (price of chevon) was positive and properly signed. Its elasticity was 0.26 (0.26%) and with its positive sign, it implies that a percentage increase in the price of chevon would bring about 0.26 rise in demand or expenses on beef consumption by the households. This is an indication of consumers switching from the next available substitute (chevon) to the other similar commodity (beef) when

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the substitutes' price has risen relative to the commodity erstwhile being consumed (beef). If prices of chevon had decreased relatively too, there could have been a drop in the expenses by households on beef as they go for the nearest substitute, chevon. This is not surprising. In Port Harcourt most households commonly consume beef, chevon and chicken. The behaviour of this variable is in line with text book theories on demand and supply (See Nordhaus and Samuelson, 2005 and Koutsyiannis, 1981). The finding indicated also that the cross-elasticity of the two products is positive. It would be recalled that Encyclopedia Britannica (2012) earlier asserted that the cross-elasticity is likely to be positive if the products are substitutes for one another, because an increase in the price of one will result in an increase in demand for the other. Two other variables that could represent the theoretical postulations on effects of population on demand for a commodity in this study could be seen from the effects of household size and marital status on the level of consumption of beef in the study area. It could be seen that the two variables in question were positively signed which means as their values tend to increase the level of beef consumption by the households would also increase. However, the values of marital status was discrete but ordered from "single" through "Separated", "widowed" to "married". The slope coefficient of household size in the result indicated an elasticity of 0.414 (about 0.41 %) implying that a unit increase in the household size of beef consumers in the survey would result in 0.41 percent increase in household expenses on beef in the area. It thus appears that larger households will provide larger market potentials for beef sellers even though the largeness of the household size may place a burden of larger household expenses on the household head. Similarly, the statistically significant slope coefficient estimate of marital status indicated that families that are married are more likely to consume larger quantities of beef and so may spend more on purchasing beef monthly. All the above findings conform to our literature or theories on demand as could be read in Samuelson (1981); Koutsyiannis (1981), Samuelson and Nordhaus (2005) Reddy, Ram, Sastry and Devi (2008) and The Encyclopedia Britannica (2012).

3.2.0 Diagnosis of the Residuals and Validation of the Econometric Tools: The above findings will be based on spurious regression analyses and may not be fit for policy making if our models do not possess valid characteristics or rather do not meet up with the assumptions of Ordinary Least Squares regression, which is the approach used in this analysis. Hence we had to discuss the results of the diagnosis tests of the model applied here. The first test, test of normality of the regression's residuals, gave a Jarque-Bera statistic of approximately 2.78, which was statistically insignificant even at 59 percent (p value = 0.52).

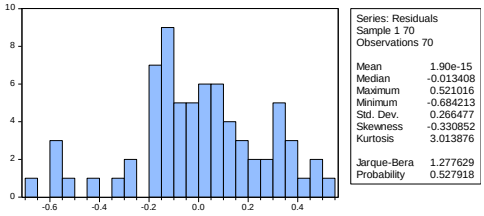

Figure 1: Results of Test of Normality of the sample's residual distribution

This means the null hypothesis of no skewness in residual distribution is accepted confirming that our residuals are normally distributed. With this result the normality assumption of OLS is not violated. The test for presence of severe multicollinearity in the model was done by examining the Variance Inflation Factors of the independent variables in the regrerssion model used. The average VIF was 1.36. This estimate is still far below the threshold of VIF which indicates presence of severe multicollinearity in a model. Gujarati and Sangeetha (2007) gave a value of 4 as the threshold beyond which one may regard a VIF as too high to tolerate in a model. Hence we cannot admit that the multicollinearity in our model was severe. Finally the test for presence of heteroscedasticity using

Table 2.0 Heteroskedasticity Test Result: Breusch-Pagan-Godfrey

F-statistic	1.656639	Prob. F(7,62)	0.1365
Obs*R-squared	11.02978	Prob. Chi-Square(7)	0.1373
Scaled explained SS	8.712785	Prob. Chi-Square(7)	0.2739

Source: Results of Regression Residual Analysis based on Field Data (2011)

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Breusch-Pagan-Godfrey test in the model returned an F-statistics of 1.66 approximately. This statistic gave an insignificant p value (even at 10 percent with p = 0.14). This is equally a good sign for the model as it confirms our assumption that the model has a residual that is homoscedastic and hence the fear of presence of heteroscedasticity in the model is hereby allayed. The foregoing results indicate that the model is quite valid and fit for policy making and analysis.

The test of hypotheses of equal regression slope coefficients in the two samples (urban and peri-urban households) gave a Chow statistics whose log likelihood was statistically significant at 0.014 alpha (5 percent) level. This result indicate that the consumption or expenditure patterns households on beef varied significantly between urban and peri-urban households in the study area.

Table 3.0 Results of Chow Breakpoint Test

Chow Breakpoint Test: 70
Null Hypothesis: No breaks at specified breakpoints
Equation Sample: 1 140

F-statistic	2.104796	Prob. F(8,54)	0.0511
Log likelihood ratio	18.99917	Prob. Chi-Square(8)	0.0149
Wald Statistic	16.83837	Prob. Chi-Square(8)	0.0318

Source: Econometric Analysis based on Field Survey, 2011 by authors.

It is not surprising as Port Harcourt city has population which is a mix of poor and wealthy households just like most cosmopolitan cities in developing countries. Those in the more urban areas therefore appear to spend more on beef than the peri-urban households who are more rural in terms of standard of living.

4.0 Conclusion

This study investigated the determinants of beef demand and compared the patterns of the demand across the urban and peri-urban households in the study area. It was found that price of substitute meat in the area (chevon), price of beef, marital status and household size of the respondents significantly determined the household's expenses on beef consumed. It was also found that there was a significant difference in the slope coefficients of the demand function of beef among peri-urban and urban households. Since cow production are not common practices in the state the enterprise of goat production which thrives in some parts of the city, especially the peri-urban areas, if developed can help bring down the expenses on beef in the area given that their cross elasticities were found to be positive. Hence government agencies in agriculture should promote the production of beef and effective marketing of cattle in the area. It was recommended that incentives that will enable farmers supply beef at more affordable prices be put in place by the government to encourage the household consumption of beef and meat products in the area such as input subsidy, price incentives to farmers, improved transport and storage facilities such as supply of good roads, power supply to help in refrigeration of slaughtered livestock and effective storage of meat products. It is also recommended that awareness about family planning to make food security more feasible in the metropolitan households needs to be created even though population increase can promote more sales of meat products.

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