

AN ANALYSIS OF BEEF DEMAND IN A NIGERIAN URBAN CITY

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ABSTRACT

The level of beef demand and consumption in Nigerian cities has been questionably and progressively low. This study empirically modeled a demand function of beef meat in Lagos city with the aim of identifying major demand shifters. Based on the regression analysis, unit retail price of beef and disposable income were found to have significant and direct influences on the quantity of beef demanded. Further, trend and policy shift variables represented as SAP dummy were found to have significant but inverse effect on quantity of beef demanded. The study further showed that the quantity of beef (in number and meat equivalent) slaughtered has been on the decline and as such, the per caput beef consumption has become considerably lower over the years, when compared with the minimum value recommended for Nigeria by FAO. The future demand of beef is however estimated to be high. To meet this demand there is the need for both farmers and government to increase production levels of cattle by removing the bottlenecks in livestock husbandry.

Keywords: Beef, demand function, demand projection, animal protein, urban city.

INTRODUCTION

The economic development of a nation depends on her factor endowment including both human and natural resources. The productive capacity of workers is a function of how healthy and nourished they are. In Nigeria, the need for balanced diets has become a policy issue (Olayide and Olatunbosun, 1970). This need has taken an all-important dimension because of the lack of basic nutrients in the diets (carbohydrate, protein, fats, minerals, vitamins and water), which are necessary for proper body function. As early as 1965, the Food and Agricultural Organization (FAO) of the United Nation pointed out that the average Nigeria needed a daily protein requirement of 70 grams, 35grams of which were to come from vegetables and the balance from animal sources. Estimates in 1965 indicated that an average Nigerian consumed a total of 56.5gram of protein in that year. Over 90 percent of these were of vegetable sources. But as of 1985, there existed wide gap between the FAO recommended quantity of animal protein intake (35grams per person per day) and the actual intake (7.5 grams per person per day), (FAO, 1985and Oyenuga, 1974). But of recent, according to Nigeria's livestock perspective plan for 1991-2005 about 16.36 grams per person per day of animal protein source is consumed (Otchere, 1995). This value represents only about 23 percent of the minimum recommended. On the contrast the minimum recommended for industrialized nations is 90grams per person per day of which 75 percent comes from animal source.

Meat is the most important supplier of animal protein in Nigeria and beef is the single most important meat to the Nigerian consumer, contributing more than 32 percent of all meat consumed in the country (FAO, 1980). Literature are awash with studies to show that beef is second to fish as a basic source of animal protein mostly consumed in Nigeria and accounted for over 50 percent of total meat supply (Olayide, 1971; Olayide *et al*, 1972 and Omonona and Udoh, 1999). Adegeye (1975) revealed that 45 percent of the meat consumed in western Nigeria was beef. Ikpi (1990) also showed that between 1970 and 1989 beef contributed 70.93 percent of total meat consumed in Nigeria while goat meat, pork and mutton contributed 13.58%, 9.22% and 6.22% respectively. The demand of beef is motivated by the nutritive value and palatability of the meat. Besides, large expanding internal markets due to continuing rising standard of living, urbanization, rapidly expanding population and higher purchasing power have made demand of beef and other animal protein to outstrip supplies. This situation may even be more serious in certain areas with high population and insignificant production of cattle, especially in metropolitan cities. This is the case in Lagos city, which is known for its boisterous and congested nature. As observed by Olayide (1976), over 90 percent of the cattle population is produced in the savannah and semi-arid zones of northern Nigeria and are transported

down to the southern parts where the demand is high. This has effect on the population of cattle available for slaughter. In addition, the animals are raised in the inefficient system of nomadic where the cattle have experienced setback from drought and rinderpest attack. All these are capable of affecting the supply and demand for beef in the country. On the demand continuum, evaluation of the demand function for beef in a mega-city like Lagos is imperative and would point to future of cattle industry, food security and poverty alleviation in the country.

The demand and consumption of beef in Nigeria cuts across religion, tribe, culture and status. However, its effective demand is subject to certain conceivable factors that require empirical investigation to justify their effects. More often, beef has inelastic demand nature with respect to factors that have impact on its demand and consumption. It is on this note that this study seeks to establish an ordinary demand function for beef in the city of Lagos. In addition the study will determine the quantities and value of beef demanded per caput in Lagos city from 1980 to 1998 and project the future demand for beef in the city.

1. Conceptual issues and Research Methodology

The concept of utility helps to explain consumer behaviour given that the consumer attempts to maximize the utility derived from consumption. The consumer is assumed to be rational with a given income and the market prices of various commodities. Each consumer is a decision-making entity. The decision of the consumer includes what to buy, how much to buy and where to buy given his disposable income and the prevailing market prices. As such,

$$Q_b = f(P_b, \prod_{K=1}^n P_k, Y) \dots\dots\dots(1)$$

Where Q_b is quantity of beef consumed, P_b is price of beef, P_k is the prices of competing products and Y is disposable income (which is the demand curve shifter).

In traditional theory, the consumer has prior knowledge of the information about the availability of these commodities in the market, the prices, his income and also other factors that can affect his ability to demand. Normally, he buys more of a commodity when the price of the commodity falls and less of such a commodity when price rise. Also, a change in his income level will have a proportionate (more, less or unity) impact on demand of such commodity depending on the type of commodity (superior, inferior or normal commodity). Therefore, demand function is of homogeneous to the degree zero and single-valued function whose nature is affected by income and substitution effects. Ordinary demand function for beef can be derived from the analysis of utility maximization (Henderson and Quandt, 1980). Further, typical of economic issue that can experience dynamic trend and can respond to changes in economic system, macroeconomic distortions that do have significant effect on demand function. Domestic prices and real income levels are duly influenced when macroeconomic variables are distorted, especially during the period of economic recession.

In this study, the quantity of beef demanded would depend on the price of beef, prices of other meat product, or any close substitute, income and SAP as intercept dummy.

The Study Area and Data Needed

The study area is Lagos city. The choice of Lagos stemmed from the fact that the city can be regarded as "mini Nigeria". Every tribe, socio-cultural and economic status of people is resident in Lagos and as such what happens in the city can adequately represent the whole nation. According to 1991 population census, Lagos is the most populated city in Nigeria and is the commercial capital city of Nigeria.

This study utilized mainly secondary data sourced from Digest of Statistics, Annual Abstract of Statistics (Various Issues), Federal Livestock Department and National Population Bureau.

METHOD OF DATA ANALYSIS:

Demand function: This study assumed an ordinary demand model. The implicit form is given as:

$$Q_b = f(RP_b, RP_g, RP_p, RP_m, RP_r, DI, T, D) \dots\dots\dots(2)$$

Where Q_b = Quantity of beef demanded per caput expressed in kilogram; RP_b = Retail price of beef in naira per kilogram; RP_g = Retail price

of goat meat in naira per kilogram ; RP_p = Retail price of pork in naira per kilogram; RP_m = Retail price of mutton in naira per kilogram; RP_f = Retail price of fish in naira per kilogram; DI_t = Disposable income per person measured in Naira; T = Time trend measured in years; D = Dummy variable (1 = SAP period, 0 otherwise). By means of OLS estimation procedure, four functional forms were tried on the data collected. These include the linear, exponential, double logarithmic and semi-logarithmic forms. The choice and inclusion of the explanatory variables in equation (2) is based on theoretical justification as explained in the theory of demand function (Henderson and Quandt, 1980). But after initial regression, some of the regressors contributed less to the variability in demand of beef and were dropped from the model. Further, the inclusion of all the variables, leads to problem of multicollinearity and first-order positive autocorrelation. However, the choice of final variables that were considered to determine per caput demand of beef in Lagos city was done by way of stepwise regression. Therefore, the reduced model that allowed for statistical accuracy of the parameters and parsimony of the estimates, includes RP_b , RP_f , DI_t , T , and D as the major explanatory variables. However, out of the functional forms that were tried, double-log model was chosen as the lead equation that gives required magnitudes and signs of the estimators, though the best-fit equation.

Measurement of variables:

- 1) Quantity of beef demanded per caput expressed in kilogram: This is based on the number of cattle reportedly slaughtered and inspected in Lagos state in the publication of ministry of Agriculture and Cooperative and Federal Livestock, Abuja. These were converted to fresh beef equivalent by multiplying by the mean carcass weight. A mean carcass weight was determined by assuming the weight of the cattle to 350kg and 65 percent off the carcass to be got from each cattle. That is the dressing percentage is 65 percent (Aduku, 1996). Yearly total of beef equivalent were obtained and divided by the estimated population to obtain per caput demand. It was assumed that 10 percent of cattle consumed were not reported and not inspected by Veterinarian.
- 2) Retail prices of beef and fish in naira per kilogram: The retail price of beef was that of boneless beef, while the retail price for fish was the price of fresh fish. Both prices were deflated by the consumer price index (all food items) in order to make adjustment for change in money values.
- 3) Disposable income per person measured in Naira: This is income per head obtained by dividing the gross domestic product (GDP) by the estimated population.
- 4) Time trend measured in years: Time trend was included to account for effect of some other omitted variables which affect demand such as taste in the study area.

The explicit form of the equation is

$$\ln Q_b = \alpha_0 + \beta_1 \ln RP_b + \beta_2 \ln RP_f + \beta_3 \ln DI_t + \beta_4 \ln T + \beta_5 D + e_t \dots (3)$$

Demand projection

The main purpose of demand projection is to enable us to determine the magnitude of future demand for beef as an instrument of policy planning and plan implementation. The United State Department of Agriculture, USD equation (USDA, 1961) was used in the projection. The equation is chosen among others because it takes proper account of the positive contribution of population growth to projected demand. It also takes account of income elasticity of demand of the commodity in question.

It is given as:

$$Q_t = P_t / P_0 \{ Q_0 (1 + Y^{-1} ED)^2 \} \dots \dots \dots (4)$$

Where Q_t = Quantity of beef needed per capita for consumption at target date,

P_t = projected population at target date; P_0 = Average population in the city in the base year; Q_0 = Per capita quantity of beef consumed in the base period; ED = Estimated income elasticity of demand

for the commodity (beef); and Y^1 = Annual growth rate per capita income represented as the GNP. The formula used in projecting population is

$$P_t = P_0 (1 + r)^t \dots \dots \dots (5)$$

Where P_0 and P_t are as previously defined in equation (4) and r is the assumed annual rate of population growth in an urban city, which is 3.5 percent.

RESULTS AND DISCUSSION

Average Number and Quantity of Beef slaughtered in Lagos and the Per caput values.

The exploratory analysis to determine the quantity of beef that have been demanded revealed that the number of cattle slaughtered fluctuated over the period under review. In the base year, 1980 a total of 225,286 cattle were slaughtered. The number later increased to 268,552 cattle in 1981 showing about 19.20 percent increase. This increase did not last as only 218,633 cattle were slaughtered in 1982 showing about 18.39 percent reduction over the pervious year. This pattern is also reflected in the quantity (kg) of beef consumed: 81,102,895kg, 9,6678,655kg and 78,707,815kg for 1980, 1981 and 1982 respectively. However, table 1 shows the average number and quantity of beef together with per caput beef consumption for the period under review.

Table 1: Average Number and Quantity of Beef slaughtered in Lagos and the per caput values.

Periods	Number of cattle slaughtered	Quantity of Cattle Slaughtered (kg)	Per capita consumption (No)	Per capita consumption (kg)
1980-1985	348,300.7(0.39)	81,502,356(0.39)	0.148(0.37)	34.65(0.37)
1986-1989	218,217.3(0.66)	51,062,837(0.66)	0.084(0.69)	19.56(0.69)
1980-1989	296,267.3(0.50)	69,326,548(0.50)	0.1223(0.51)	28.62(0.51)
1990-1994	69,109.8(0.28)	16,171,693(0.28)	0.023(0.32)	5.49(0.32)
1995-1998	76,544(0.09)	17,911,296(0.09)	0.018(0.22)	4.38(0.22)
1990-1998	72,413.89(0.21)	16,944,850(0.21)	0.0214(0.30)	4.99(0.30)

Note that the values in parentheses are coefficient of variation

Source: Computed from the statistical bulletins.

The table reveals declining number and quantity of cattle that were slaughtered in Lagos from 1980 to 1998. These declining values correspond with equally declining per capita consumption. Specifically, in the period before the adoption of SAP as a macroeconomics policy framework the number and quantity of cattle slaughtered were 348,300.7(0.39) and 81,502,356kg. However, during the SAP period (1986-1989) the figures drastically reduced to 218,217.3 and 51,062,837kg with higher level of instability of about 66 percent. The 1990s witnessed sharp reductions in the number and quantity of cattle slaughtered. The reductions were from 218,217.3 and 51,062,837kg for 1986-1889 periods to 69,109.8 and 16,171,693kg (0.28) for 1990-1994 periods. On a general note, the number and quantity of cattle slaughtered in the 1980s were greater than those of the 1990s. Therefore, with the population of the metropolitan city growing at geometric rate because of influx of people and persistent decline in the number of cattle slaughtered, the per caput consumption correspondingly declined in a rather geometric pattern. For the period 1980-1985 the per capita consumption stood at 34.65kg but by 1995-1998 periods the value reduced to 4.33kg. The declining values of per caput beef consumption reechoed the findings of FAO and other literature that Nigerians have not met the recommended quantity of consumption of animal source protein; and that the per caput consumption has been on a decline over the years. It therefore means that beef, which incidentally is the most consumed source of animal protein, is fast becoming a luxury foodstuff and as such many households prepare their dishes without beef meat. With the foregoing, the decreasing per capita consumption of beef over the years points to pathetic situation of future beef demand and consumption.

Determinants of Beef Demand in Lagos City.

Ordinary demand function for beef in Lagos city is represented as follows;

$$\text{Ln}Q_b = 4.3326 - 0.3374\text{Ln}RP_b + 0.0816\text{Ln}RP_r + 0.4097\text{Ln}DI_t - 0.14406\text{Ln}T - 0.441D$$

(0.0538) *** (0.05077) (0.1110) *** (0.0184) *** (0.1509)**

$$R^2 = 0.854 \quad F_{stat} = 11.721^{**} \quad DW = 2.0703$$

Note: Values in parentheses are standard errors.

The model is parsimony in parameter estimates and shows a goodness of fitness of over 85 percent variation in the quantity of beef demanded over the periods as explained by the factors included in the model. The overall model is statistically significant and different from zero with an F-stat. of 11.72. Further, the diagnostic statistic of Durbin Watson calculated as 2.0703, which is greater than the dL of Durbin Watson statistic at probability level of 10 percent indicates no problem of first-order positive autocorrelation. As such, the estimates can be regarded as BLUE and adequate for economic interpretation and prediction.

Apart from the unit retail price of fresh fish that is considered as a substitute, all other factors included in the model are shown to be important factors that determine the demand of beef. From the coefficient of retail price of beef, the demand of beef is price inelastic and has inverse relationship with the quantity of beef demanded. The statistical significance of the coefficient indicate unit retail price of beef as a major demand shifter. As expected, the coefficient for proxy of disposable income measured as a quotient of GDP and Population (0.4071) is statistically significant and has a positive relationship with the quantity of beef demanded. Thus, there is less than proportionate demand for beef as the income level increases. Further, the inverse but significant nature of the coefficient of trend variable points to the fact that the quantity of beef demanded in Lagos city decreased as the year proceeded. However, table one confirms the empirical result. Therefore, it could be inferred that the quantity demanded of beef decreased by about 14 percent each preceding year. The coefficient of the intercept dummy is inversely related to the quantity demanded of beef and is statistically different from zero. It therefore implies that during the era of structural adjustment programme and post-era the quantity of beef demanded declined. In essence, the negative externality of the effect of SAP was also felt in the demand and consumption of beef in Lagos city.

Projected demand for Beef in Lagos City (1999-2005)

The projection of beef demand is shown in table 2. As shown in the table, the demand for beef will increase appreciably from the base year to year 2005.

Table 2: Projected Demand for Beef in Lagos and the per caput values.

Periods	Number of cattle to be slaughtered	Quantity of Cattle to be Slaughtered (kg)	Per capita Demand (No)	Per capita Demand (kg)
1999	87672	200515248	1.3343	24.8127
2000	93365	21847410	1.3701	26.4262
2001	99333	23243922	1.4210	28.1445
2002	105929	24787386	1.4665	29.9746
2003	112845	26405730	1.9065	50.6571
2004	120095	28102230	2.4784	85.6105
2005	127699	29880396	3.2220	144.6818
Mean	106704	24968903	1.8865	55.7580

Source: Computed from equation (4)

Table 2 shows that the average number of cattle to be slaughtered based on the available data would be about 106,704 which is translated into about 24,968,903 kg equivalent of beef carcass available for final consumption. As such, each resident of the metropolis would demand approximately 2 cattle per year. However, on yearly bases, there would be marginal increase in demand for beef over the preceding year. That is, in 1999 an estimated number of cattle to be slaughtered are 87,672 while in 2005 about 127,699 cattle would be slaughtered.

SUMMARY AND CONCLUSION

This study centered on empirical estimation of demand function for beef in Lagos city. The study has however revealed some interesting findings based on the set objectives. In the first instance, the study has shown that the quantity and number of cattle slaughtered in Lagos city between 1980 and 1998 was on a decrease and this adversely affected the per caput availability of beef demanded and consumed in the city for the period under review. The study however supports the report of FAO of generally low level of beef consumption in Nigeria over the years. Further, the study reveals the inelastic nature of demand for beef with respect to retail price of beef, disposable income and trend variable. Thus making beef to be a necessity produce in the food baskets of the residents. The study also reveals that the quantity of beef demanded was adversely affected by the policies of SAP. The projected demand for beef reveal that the demand for beef would be on the increase. Compared to the projected supply, it is evident that the recommended daily animal protein intake for individual would not be achieved. This calls for intensification of efforts in cattle production. In addition, the production of other animals, particularly those that are adapted to Lagos ecological zone should be embarked upon. These alternative meat sources will augment the beef supply in the market. It should be noted that the production of meat from different sources would require the participation of government, individuals, and corporate farms as well as non-governmental organizations. However, effective production of livestock requires the supply of necessary inputs at appropriate time and quantity.

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