DEMAND FOR FISH IN CALABAR
CROSS RIVER STATE, NIGERIA

By

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ABSTRACT

It is generally recognized from the food balance sheet prepared by experts (NADC, 1972, FAO, 1955; Oyenuga, 1967) that Nigeria is a protein deficient country. Not only is the daily intake of protein low but the contribution from animal sources is extremely low. Fish has been found to be the cheapest source of protein in Nigeria hence the consumption of fish will supply the needed protein at a relatively low cost.

The study, conducted in Calabar in 1981, was analysed using stepwise ordinary least square multiple regression technique as well as Pearson correlation analysis. The regression result was used to generate some demand curves for different levels of per capital income, as well as own price elasticity of demand.

The results show that both own price elasticity of demand for fresh and frozen fish decreased as the level of per capital income increased while income elasticity of demand increased as per capital income increased.

The calculated per capital consumption was found to be 5.18 kilograms and 4.31 kg per annum for fresh fish and frozen fish respectively. This is considered rather small since Calabar is a sea port where fish should be more readily available.

The values of own price and income elasticities indicate that more fish will be consumed at every increase in income if both production and marketing are improved.

INTRODUCTION

With the context of widespread hunger and malnutrition in developing countries, the greatest problem is that which results from inadequate protein in the diets of a large proportion of the population. Protein deficiency results in various clinical and sub-clinical conditions such as reduced growth rate and poor physical (and possibly reduced mental) development in children and adolescents, impaired health, reduced resistance to disease and lowered working ability in adults.

Fish holds the promise of reducing protein deficiency in the country. A casual survey in any market at any time shows that the cost of frozen fish is by far lower than that of other meat — and fish is of very high quality. The reliance on fish as a source of protein is even more accentuated following the recent episode of rinderpest and the drought in the Sahelian zone which considerably reduced the cattle population.

Nigeria with a total land area of 923.42 square kilometers and endowed with a long coastline—a good area of inshore waters with a vast and intricate network of water system which actually support fish (3) production should be able to produce most of the fish requirements of the citizens. The Third National Development Plan (2), asserted the development of the fishery industry will:

(e) eliminate the present foreign exchange drain which is used to import fish for domestic consumption and release such funds for development needs;
(b) earn foreign exchange by exporting products like shrimps which are in high demand in the world market;

(c) encourage the local manufacture of fish products such as fish meal and dehydrated fish which are at present being imported;

(d) provide employment to more Nigerians either directly or indirectly through such activities as boat building, net making, thus boosting the economy through the multiplier process.

Demand is a multivariate relationship. Some of the most important determinants of the market demand for fish (or any other product) are its own price, consumers' income, prices of other commodities, consumers' taste and preferences, income distribution, total population, consumers' wealth, credit availability, government policy, past levels of demands and income.

However, only four of the determinants of demand—prices of the commodity, other prices, income and tastes are emphasized in this study.

**Objectives of the Study**

Fish competes with meat and poultry for consumers' income and a place in the consumers' meal.

The objectives of this study are to identify the effects of beef, goat, per capital income and prices on the demand for fish. Specific objectives are:

(a) To identify the relationship (if any) between the quantity of fresh and frozen fish consumed and their prices, quantities of beef and goat consumed and consumers' income.

(b) Calculate own price elasticity of demand and income elasticity of demand for fresh and frozen fish and show their market implications, and

(c) Make suggestions for improving the marketing and distribution of fish to satisfy the existing demands and stimulate new demands for fish.

**METHOD**

The data used for this study were collected in 1981 from primary and secondary sources. The secondary sources were mainly the Department of Fisheries, Calabar, the Veterinary Division of the Ministry of Economic Planning and Statistics, Calabar. The estimated values of beef and goats slaughtered were obtained from the records of the Veterinary Division, Calabar. The monthly figures obtained were converted to kilograms by using dressing percentages. The 1981 population of Calabar was obtained through the projections of the 1963 national census figure for Calabar using the growth rate of 2.5% per annum.

The estimated values of fresh fish was that of the catches of fish in Calabar area. The primary data for the frozen fish were collected from the major cold stores in Calabar through the use of structured questionnaire. The values of fresh and frozen fish were divided by the estimated population to obtain the per capital fish consumption in Calabar.

The per capita disposable income was obtained from the 1980 World Bank Atlas.
RESULTS

The demand models used for the analysis are as follows:

1. For fresh fish
   \[ Q_{ff} = f(p_{ff}, Q_{bf}, Q_{gt}, Y, e_i) \]  \hspace{1cm} (1)

2. For frozen fish
   \[ Q_{ff} = f(p_{ff}, Q_{bf}, Q_{gt}, Y, e_i) \]  \hspace{1cm} (2)

Where:
- \( Q_{ff} \) = Quantity of fresh fish consumed
- \( Q_{ff} \) = Quantity of frozen fish consumed
- \( P_{ff} \) = Retail price of frozen fish
- \( Q_{bf} \) = Quantity of beef
- \( Q_{gt} \) = Quantity of goat meat
- \( Y \) = per capita disposable income
- \( e_i \) = disturbance term

The disturbance term is assumed to be normally distributed. The independent variables are assumed to be non-serially correlated hence problem of multi-collinearity is assumed to be minimal.

**Pearson Correlation**

The initial analysis was done with the help of a Pearson correlation run. The correlation coefficients for fresh and frozen fish respectively are as shown in Tables 1 and 2. Table 1 shows the correlation matrix using the data collected for fresh fish while Table 2 shows that for frozen fish.

**Table 1 — Correlation matrix using fresh fish data**

<table>
<thead>
<tr>
<th></th>
<th>Off</th>
<th>Pff</th>
<th>Qbf</th>
<th>Y</th>
<th>Qgt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pff - 0.31204</td>
<td>+</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qbf - 0.16389</td>
<td>-</td>
<td>0.20120</td>
<td>+</td>
<td>1.00000</td>
<td></td>
</tr>
<tr>
<td>Y + 0.16593</td>
<td>-</td>
<td>0.01669</td>
<td>-</td>
<td>0.04093</td>
<td>+</td>
</tr>
<tr>
<td>Qgt - 0.40816</td>
<td>-</td>
<td>0.29331</td>
<td>-</td>
<td>0.16463</td>
<td>-</td>
</tr>
</tbody>
</table>

Going through the correlation matrix, some inferences can be made:

1. The sign exhibited between the per capita income \( Y \) and quantity of fresh fish \( Q_{ff} \) shows that fresh fish is a normal good.

2. The relationship obtained between Quantity of fresh fish \( Q_{ff} \) and price of fresh fish \( P_{ff} \) exhibited a *priori* expectation. As the price of fresh fish falls, the quantity consumed of fresh fish increases. The demand curve will have a negative slope conforming to the law of demand.
3. The relationship obtained between fresh fish and goat meat and between beef and goat meat also exhibited a priori expectations. The pairs are substitutes.

4. The coefficients also show that the degree of multicollinearity among the variables was low and negligible. As Johnston (1963) explained, multicollinearity is the general problem which arises when some or all of the explanatory variables in a relation are so highly correlated one with another, that it becomes very difficult if not impossible, to disentangle their separate influences and obtain a reasonable precise estimate of their relative effect.

Table 2 - Correlation matrix using the frozen fish data

<table>
<thead>
<tr>
<th></th>
<th>$Q_{Fz}$</th>
<th>$Q_{Pfz}$</th>
<th>$Q_{Qbf}$</th>
<th>$Q_{Y}$</th>
<th>$Q_{Qgt}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Q_{Fz}$</td>
<td>1.00000</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>$Q_{Pfz}$</td>
<td>0.16916</td>
<td>1.00000</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>$Q_{Qbf}$</td>
<td>0.38317</td>
<td>0.20931</td>
<td>1.00000</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>$Q_{Y}$</td>
<td>0.22859</td>
<td>0.82234</td>
<td>0.17137</td>
<td>1.00000</td>
<td>-</td>
</tr>
<tr>
<td>$Q_{Qgt}$</td>
<td>0.38740</td>
<td>0.13534</td>
<td>0.09641</td>
<td>-0.09641</td>
<td>1.00000</td>
</tr>
</tbody>
</table>

Most of the insights postulated from Table 1 still hold in Table 2. Degree of multicollinearity is low and negligible among the variables except between $P_fz$ and $Y$ (i.e. price of fish and income).

Frozen fish and goat meat are substitutes; while goat meat and beef are normal goods.

Multiple Regression Result:

There was further analysis of the data through the stepwise multiple regression, using the Ordinary Least Squares (OLS) method. The linear equation was derived from the fresh and frozen fish consumed. In both equations the figures in parenthesis represent the estimated standard errors of respective regression coefficients.

3. $Q_{ff} = 262935.77598 - 25.45984 Q_{gt}$
\[
(9.25365)
\]
\[
14847.7192 Pf - 0.07622 Qbf + 15.2960 Y \\
(6162.49483) (0.99028) (24.30273)
\]
\[
R^2 = 0.61784
\]
\[
R^2 = 0.38173
\]
\[
F = 2.93271
\]

4. $Q_{Fz} = 57197.37660 - 4.19193 Q_{gt} - 2170.32681 Pf_{z}$
\[
(2.27224) (3589.46412)
\]
\[
+ 0.377796 + 10.31322 Y \\
(0.21903) (11.15332)
\]
\[
R^2 = 0.30455
\]
\[
R^2 = 0.15814
\]
\[
F = 2.08015
\]
At 5 per cent level of significance in equation 3, quantity of goat meat (Qgt) demanded and price of fresh fish were significantly different from zero.

In equation 4, the only variable which was significantly different from zero at the chosen 5 per cent level of significance was Qgt i.e. quantity of goat meat demanded.

In equation 4, quantity of goat meat demanded and price of fresh fish have negative regression coefficients. This shows that, as the quantity of goat meat available in the market decreases, the quantity of frozen fish demanded increases. Quantity of beef demanded and per capita income show positive relationship with quantity of frozen fish consumed. However, the coefficients of the two variables turned out to be insignificant.

In equation 3, only per capita income show positive relationship with quantity of fresh fish consumed. All other variables have negative regression coefficient and therefore show negative relationship with quantity of fresh fish. Of the variables, only the coefficients of Qgt and Pff turned out to be significant as mentioned earlier.

The F value of equation 3 is significant while that of equation 4 is not significant at the 5 per cent level of significance.

The variables in equation 3 explain about 38 per cent of the variability in fresh fish consumption.

The variables in equation 4 explain about 16 per cent of the variability in frozen fish consumption.

Equation 3 (the fresh fish model) was used to generate a family demand curves shown in Figure 1. Each curve presents a level of per capita income. For this study, the level of per capita income used ranged between N150.00 and N900.00.

Demand curves would have been generated for frozen fish but for the fact that the F value was not significant.

The demand curve for the fresh fish was used to calculate own price elasticity of demand (PED).

Keeping other variables at their arithmetic mean, the elasticity was calculated for various levels of per capita income.

Table 3 shows the own price elasticity of demand (PED) for fresh fish.

<table>
<thead>
<tr>
<th>Income (N)</th>
<th>PED at P = N2.90/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>150.00</td>
<td>-0.9978</td>
</tr>
<tr>
<td>400.00</td>
<td>-0.3443</td>
</tr>
<tr>
<td>548.88</td>
<td>-0.8777</td>
</tr>
<tr>
<td>900.00</td>
<td>-0.7932</td>
</tr>
</tbody>
</table>

Source: Computation from survey data.

Equation 3 was also used to calculate income elasticity of demand (IED) for fresh fish.
DISCUSSION

Figure 1 shows the generated family of demand curves for fresh fish. Each curve represents a particular per capita income. The demand curve for any commodity shows the relation between the price of that commodity and the quantity the consumers wishes to purchase.

The demand curves generated in this work was drawn at the arithmetic mean of the explanatory variables (that is per capita income, quantity of beef and goat).

The fresh fish demand curves are downward sloping. This indicates that the lower the prices of fresh fish, the greater will be the quantity that the consumers are willing to purchase. From Figure 1, when the retail price of fresh fish is ₦2.00 per kilogram, per capital consumptions are 5.90 kilogram/annum, 6.25 kg/annum, 6.60 kg/annum, and 7.05 kg/annum for per capita income levels of ₦150.00, ₦400.00, ₦548.86 and ₦900.00 respectively. When the prices rises to ₦2.90 per kilogram, per capita consumption falls to 4.49 kg/annum, 4.95 kg/annum, 5.14 kg/annum and 5.30 kg/annum at income levels of ₦150, ₦400, ₦548.86 and ₦900 per annum respectively. If the price of fresh fish falls, consumers will now purchase more of them and less of their substitutes (beef goat). The above results show that at any price level, as per capita income increases the per capita consumption of fresh fish increases. This is true of most low income countries. In high income countries, per capita income has comparatively less impact on food consumption levels than in low income countries. The physical quantity of all food consumed per person is relatively fixed in high income countries. In low income countries, with a rise in income, there is a marked increase in the demand for fish. Consumer substitute proteinous foods for starchy foods. For low income groups in high income countries, the situation is similar.

The arithmetic mean price of fresh and frozen fish for the period covered by this study (1961) was ₦2.90 and ₦1.18 per kilogram respectively. Arithmetic mean per capita income was ₦548.86.

At the arithmetic mean of all the explanatory variables (i.e. price of fresh fish, quantity of goat, beef and income), the estimated per capita consumption was 5.18 kilogram and 4.31 kilogram per annum for fresh and frozen fish respectively. This is equivalent to 14.20 grams and 11.30 grams per day respectively. When this is seen from the point of view that Calabar lies in the zone infected by tsetse fly which causes sleeping sickness on cattle, and also that Calabar is a sea port and fish is very important as the main source of protein, the per capita consumption of fish is low and gives some concern.

The multiple regression results exhibited some a priori expectations. The relation between prices of fresh and frozen fish, and their per capital consumption turned out to be negative one. This can also be observed in the generated demand curves. As the price of fish falls, more of it will be purchased. Of the two prices, only the price of fresh fish was significant at 5 per cent level of significance.

As the price of fish falls, the budget line of the consumer shifts to the right. This is due to the increase in the purchasing power of the given money income of the consumer. More fish will be bought because of the increase in purchasing power. There is a negative price effect.
Both fresh and frozen fish are normal goods. This is because there is increase in demand as per capita income increases. The regression results also show this. Per capita consumption of fresh and frozen fish show a positive relation with income. At the 5 per cent level of significance, per capita income is not a significant explanatory variable.

The regression result for fresh fish shows that goat meat is a substitute to fresh fish. Consumers can shift from goat meat to fish if the price of fish falls relatively to those of its substitutes. At the 5 per cent level of significance, the coefficient of goat meat is significantly different from zero.

The variable Qgt is significant at the 5 per cent level of significance in the frozen fish regression result. The results show that goat meat and frozen fish are substitutes. Beef and frozen fish are not substitutes. The correlation matrix table also shows a similar relationship between frozen fish with goat meat.

The correlation matrices in Table 1 and 2 confirm the findings exhibited by the regression result. Fresh and frozen fish are normal goods since per capita consumption of fresh and frozen fish were found to rise as their prices fall.

The estimated income elasticity of demand shown in Tables 3 are both positive and increasing with increase in per capita income level. Income elasticity of demand increases from 0.1209 to 0.2463 as per capital income increases from N400.00 to N900.00.

The estimated income elasticity was found to be greater than zero but less than one. That is, demand for fresh fish rises by a smaller proportion than does income.

Income elasticity of demand can be used to classify goods into 'luxuries' and 'necessities'. A commodity is considered to be a luxury if its income elasticity is greater than unity. A commodity is considered to be a necessity if its income elasticity is less than one. From this classification, fresh fishes are necessities in Calabar.

Own price elasticities of demand for fresh fish are shown in Table 3. Own price elasticity of demand for fresh fish decreases as per capita income increase. It is decreasing from 0.9978 to -0.7930 as income increases from N150.00 to N900.00 for fresh fish.

The price elasticity of demand is a measure of the responsiveness of demand to changes in the commodity’s own price. In this work, demand is inelastic for fresh fish.

**SUMMARY AND CONCLUSIONS**

Both own price elasticity of demand for fresh and frozen fish were each a statistically significantly explanatory variable of per capita consumption of fresh fish.

Arithmetic mean price of fresh fish was N2.90 per kilogram. Arithmetic mean price of frozen fish was N1.18 per kilogram. Arithmetic mean per capita income was N548.86.

Estimated per capita consumption was 5.18 kilogram per annum (14.20 gram per day) and 4.31 kilogram per annum (11.80 gram per day) for fresh and frozen fish respectively. This is small since Calabar is a seaport and also infested by tsetse fly. Even the Northern Nigeria that has comparative advantage in cattle production, the outbreak of rinderpest is causing a lot of havoc to cattle production necessitating alternative protein sources.

The per capita fish consumption was found to be low. This calls for ways of improving the supply of fish to the market. Both the State Government and the Federal Government could do a lot here. Programmes like the National Accelerated Fish Production Programme presently sited at Uta Ewa, Ikom Abasi Local Government Area of Cross River State and some parts of the country could be used in Calabar to improve supply of fish.
Other ways of improving fish supply include the introduction of improved fishing equipment and methods. Instead of manually paddled canoe, all fishermen should be introduced to engine canoe or boat. Better handling of catches to reduce losses through spoilage could also improve fish supply.

The values of own price elasticities and income elasticities indicate that more fish would be consumed at every increase in income especially if both production and marketing are improved. The marketing system where prices are decided by merely looking at the fish or at times the mood of the fish seller, could bring distrust between buyers and sellers. Weighing could be introduced so that prices are fixed per weight but this would need to be extensively policed to be effective.

REFERENCES


FIGURE 1: GENERATED FAMILY OF DEMAND CURVE WITH VARIOUS PER CAPITA INCOME (FRESH FISH)

- N900.00
- N548.00
- N400.00
- N150.00

Retail Price in Naira/kg

Per Capita Fresh Fish Consumption (kg/annum)