A QUANTITATIVE ANALYSIS OF DEMAND FOR FISH IN NIGERIA

by

Fatunla, G.T., Oladimu, O.L. and Ladipo, O.O.
University of Ife, Ille-Ife, Nigeria.

ABSTRACT

The paper discusses the relevant theoretical considerations and specifies a model in an attempt to quantify those variables, the changes of which, affect the internal demand for fish in Nigeria. Regression analyses carried out show that a generally rising trend in per capita income will increase the demand for fish, other things being equal. It is further revealed that even as the price of fish goes on increasing, consumers' demand for fish also tend to rise. The paper concludes by emphasising the need for a fish consumption survey in the country's fish demand.

INTRODUCTION

The study of the economics of fish demand and consumption is worthwhile not only in determining national (and localised) fish requirements but, in the final analysis, in satisfying public demand for fish products. The major objective of the present study is to underline the importance of changes in consumers' choice with respect to fish in Nigeria.

Fish is important not only for its calorific value but also as an important source of animal protein. Moreover, thousands of the Nigerian populace derive their livelihood directly from activities related to fish procurement, distribution and consumption.

The objectives of this study are two-fold. In the first instance, the paper seeks to quantify those variables, the changes in which, affect the internal demand for fish in Nigeria. On the basis of the analysis, this study also points out the implications of changes in the demand for fish particularly highlighting the difference between the amount of fish consumed and the amount demanded.

The paper is divided into four sections. In section II, theoretical considerations germane on the topic under investigation, are discussed while specifying the model for analysis. Section III gives the results and the economic interpretation of our analysis. In the last section, the summary and conclusion of the study are presented.

METHODOLOGY

Theoretical Considerations

In theoretical economics, a demand curve is supposed to be drawn under very strict conditions for given tastes, incomes, prices of related goods and a generally fixed environment. Under this formulation, quantity demanded is assumed to depend linearly on price Pt, consumer income yt, price of related good p't, changes in consumer tastes zt, and the disturbance term ut.

The demand for food in Nigeria is increasing rapidly. This is to be expected since economic growth gives rise to a number of forces leading to a rapid increase in demand for consumable items such as food. One such food item is fish.
Thus,
\[ q_t = \delta_0 + \delta_1 y + \delta_2 p + \delta_3 p' + \delta_4 y' + \epsilon_t. \]

In some cases, the inherent curvature of an economic relationship can be displayed in a non-linear function which can be transformed into a linear function. Such functions including the logarithmic and exponential are widely used in econometrics because they lead themselves readily to transformation into linear functions, a convenient property.

Demand functions of the constant elasticity type, can be written as
\[ x_{it} = \frac{A_i}{P_t} \frac{a_{i1}}{P_t} \frac{a_{i2}}{P_t} \ldots \frac{(P_{nt})^{x_{ni}}}{P_t} \frac{y_{ni}}{P_t} \frac{B_i}{P_t} u_{it}. \]

If logarithms are formed on both sides, the equation is transformed into
\[ \log x_{it} = \log A_i + \sum_{j=1}^{\infty} \log \frac{a_{ij}}{P_t} + \sum_{j=1}^{\infty} \log \frac{a_{ij}}{P_t} \ldots + \sum_{j=1}^{\infty} \log \frac{B_i}{P_t} u_{it}. \]

If this equation were expressed in absolute instead of relative prices and money instead of real income, the homogeneity property could be brought out as Klein (1962) has pointed out. This is done by setting the sum of all the exponential parameters to zero.

\[ x_{it} = P_{it}^{a_{i1}} P_{it}^{a_{i2}} \ldots P_{it}^{a_{i1}} y_{it}^{B_i} u_{it}. \]

where \[ \sum_{j=1}^{\infty} a_{ij} + B_i + \delta_1 = 0. \]

Believing as he does, that in agricultural markets, errors enter multiplicatively, Fox (1955) adopts a similar approach. He uses structural models composed of equations linear in the logs of all exogenous variables. An approach such as this has the advantage of producing direct estimates of the elasticity of demand.

In empirical studies of the market for various meats in the United States, Fox presents evidence that in any year, both domestic production and domestic consumption result mainly from prior decisions. In some of his equations, he estimates all coefficients from logarithmic first differences of original data, that is he employs:

\[ q = \log \frac{q_t}{q_{t-1}} \text{ rather than } q = \frac{q_t}{q_{t-1}} q. \]

A case can be put up for this, since in time-series regressions, the use of logarithmic first difference tends to reduce multicollinearity (through eliminating the effect of common trends and cyclical influences). Also, such a transformation is more likely to keep extra sample experience within the range of previously observed tradition.

In estimating a demand function for beef in the United States between 1922 - 1941 using the indirect least squares

\[ p = B_{1q} + B_{2y} + B_{3w} + y_d \]
where

\[ p = \text{rental market price}, \]
\[ q = \text{quantity demand}, \]
\[ y = \text{consumer disposable income (per capita)}, \]
\[ w = \text{weather}, \]
\[ v = \text{disturbance terms}, \]
\[ B_1, B_2 \text{ and } B_3 = \text{coefficients}. \]

Fox obtained results which differed from corresponding single-equation estimates (based on logarithmic first differences) by no more than one standard error.

Any attempt to test these relations of economic theory in developing countries is fraught with problems. The most pressing and immediate obstacle is a lack of suitable data. There are errors in reporting, compilation and publication of data collected by government agencies. Besides, the data record phenomena of the market (aggregates of specific kinds of transactions) whereas the theory deals with phenomena of the mind.

While conceding that situations of inadequate and often unreliable data existent in developing countries make studies on demand analysis a hazardous task, efforts still need to be made to make reasonable estimates on the basis of rational assumptions as a first basis for planning.

**Model Specification**

In the present model, demand is expressed as

\[ Q_{ft} = f(P_{ft}, P_{mt}, Y_t, T) \] ........................ (1)

where

\[ Q_{ft} = \text{per capita demand for fish in Nigeria in time } t, \]
\[ P_{ft} = \text{Retail price of fish in time } t, \]
\[ P_{mt} = \text{Retail price of meat in time } t, \]
\[ Y_t = \text{per capita income in Nigeria for year } t, \]
\[ T = \text{time trend (year } 1973 = 1, 1981 = 9). \]

In estimating the value for the dependent variable, \( Q_{ft} \), sales figures were used as a proxy. The values obtained were checked for consistency with figures obtained from the Federal Department of Fisheries and the Federal Office of Statistics, Lagos.

As explanatory variables, the prices of fish and meat were obtained and averaged out for major consumption centres in the country. The figures so obtained, as well as yearly per capita consumer incomes, were deflated by the consumer price index for food products for the nine-year period considered, 1973 - 1981.

Each of the explanatory variables was assumed to be non-stochastic. The disturbance term, used below in equation 2, was assumed to be normally distributed.

**Data Analysis Procedure:**

Multiple regression analysis was used to estimate two different functional forms: the linear and the exponential with the latter linearized by the use of a log transformation.

The functional form providing 'best fit' was the exponential function (equation 2) while the estimating equation was the transformed form (equation 3).
\[ Q_{ft} = a_0 P_{ft} + a_1 P_{mt} + a_2 Y_t + a_3 T + E_t \quad \ldots \quad (2) \]

\[ \log Q_{ft} = a_0 + a_1 \log P_{ft} + a_2 \log P_{mt} + a_3 \log Y_t + a_4 T + U_t \ldots \quad (2) \]

where

- \( Q_{ft}, P_{ft}, P_{mt}, Y_t \) are as previously defined.
- \( a_0 \) = Constant term.
- \( a_1, a_4 \) = Regression coefficients for explanatory variable used.
- \( T \) = Time trend.
- \( U_t \) = is \( \log E_t \) and is assumed log normal.

**ESTIMATION OF DEMAND**

Taking estimates from selected equations, our investigation revealed the following, among other things:

(i) the inclusion of time as a significant explanatory variable,

(ii) the inclusion of all types of fish in averaging out fish prices improved the 'fit' over the average price for three widely sold fish types (Mackerel, Skumia and Staversa).

In selecting our equations, the values of the coefficient of multiple determination, \( R^2 \), were used. The correctness of the form of equation was also weighed in practice against the ready understanding of the meaning of the coefficients.

Resultant equations are given in the table below. In interpreting the equations, it should be borne in mind that the model tested ignores a number of promising niceties: disposable income is taken as exogeneous no distinction is made between different types of meat; the demand and consumption patterns of fish and meat in the country as a whole are generalised.

<table>
<thead>
<tr>
<th>TABLE</th>
<th>Selected Regression Results on the Demand for Fish in Nigeria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equation Number</td>
<td>Commodity</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>All types of Fish</td>
</tr>
<tr>
<td>5</td>
<td>All types of Fish</td>
</tr>
<tr>
<td>6</td>
<td>Three widely sold types of Fish</td>
</tr>
</tbody>
</table>
Notes:-

(1) Figures in parenthesis are standard errors.

(11) The coefficients astericked are significantly different from zero (at the 5 percent level of significance).

On the basis of our selection criterion equation 5 seems to be the best-fitting equation. In that equation, the income coefficient, $Y_e$, is significantly different from zero. This is to be expected as growth in per capita income tends to increase quantity demanded of non-starchy foods especially in situations where previous consumption has been below saturation level.

Like $Y_e$, the time trend, T, is also significant over the period considered, 1973 to 1981. As time went by, the amount of fish consumed increased due to the effect of socio-economic and other factors.

In equation 5, as well as in other equations, the effect of the quantity of fish demanded on meat prices, is demonstrated. Even though we have assumed away such influences as consumer substitution between fish and various types of meat as the prices of meat vary, it is apparent from the resultant equations that as the quantity of fish demanded or purchased increases, the 'price of meat' declines. This is especially so in situations where it is more favourable, economically or otherwise, to consume fish.

Finally, our best-fitting equation shows the relationship between the quantity of fish demanded and the price of fish to be positive. This seems contradictory to a priori expectation as one would have expected an inverse relationship between price and quantity demanded. The explanation for this is that in most developing countries, quantity supplied often falls short of demand and the common assumption that $Q_c$ and $P_c$ relate in an inverse manner may not always hold true.

This observation can be explained even by static economic theory as depicted diagrammatically below.

Figure 1 - Diagramatic illustration of the relationship between the quantity of fish sold and fish price
At point A, as on points along the supply curve MM, inverse relationship between price and quantity holds, given that demand is fully satisfied. However, in situations where demand is far from being satisfied, and supply deficit NB exists, as occur in most developing countries, price keeps rising as demand increases (as long as quantity supplied is below quantity demanded).

If an observation of this sort occurs in a developed economy, however, a different explanation of the findings may be considered. This is not to say that the explanation given above is strictly the correct explanation for a developing economy itself. Indeed, our finding seems not to justify the assumption of using sales as a proxy for demand. Thus, the observation, of prices increasing as quantity increases, points to an identification problem. This will only occur if the supply function is what we have rather than a demand function.

**SUMMARY AND CONCLUSION**

The main objective of this paper has been to underline the importance of changes in consumers' choice with respect to fish in Nigeria. The paper quantifies those variables, the changes in which, affect internal fish demand in the country.

Regression analyses carried out show that a generally rising trend in per capita income will increase the demand for fish, ceteris paribus. It is further revealed that even as the price of fish goes on increasing, consumers' demand for it (fish) also tends to rise. This is because prevailing situations in Nigeria with respect to fish supply and demand seem to be such that the country is still far from meeting present (and future) requirements.

There is a pressing need for a fish consumption survey in the country to determine more accurately the country's fish demand with a view to satisfying public fish consumption. Meeting the nation's requirements has immense contributions to make to the process of national development.

**REFERENCES**


---

![Diagrammatic illustration of the relationship between the quantity of fish sold and fish price.](image)