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Drivers of Households' Demand for White and Red Meat in Nigeria

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Abstract

The consumption of red meat has become a major health concern for consumers, especially those related to the heart. White meat contains less fat and cholesterol and tends to regulate blood pressure and heart-related diseases. Research on white meat has not been given the desired attention, thus the need for the study on white meat demand in Nigeria. In this study, we used already obtained data to evaluate the drivers of demand of households for white and red meat. The data used were obtained from the Harmonised National Living Standard Survey (HNLSS) collected by the National Bureau of Statistics (NBS), Nigeria. The respondents surveyed comprised 33,102 households. Descriptive statistics and the Heckman 2-stage model were the analytical tools employed. Monthly expenditure on beef (\$21.66) is higher than on fish and poultry (\$21.58 and \$5.21, respectively) in the rural area. While households' expenditure on fish (\$17.63) is higher than on beef and poultry (\$14.01 and \$1.55, respectively) in the urban sector. Age, sex, higher health expenditure, residents in the rural sector and northwest zone adversely influence households' demand for white meat. Advocacy and enlightenment campaign on the nutritional and health benefits of white meat consumption is key for households that are male-headed and those that spend more on health issues; rural sector and northwest zone residents.



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Introduction

The demand for meat was observed to increase with an increase in the population and awareness about its nutritional value [1], with the production not able to keep pace with the demand of the fast-growing population [2, 3]. The meat consumption behavior of consumers tends to fall within the limit of culture, social class, family decisions and health status of the consumers [4]. Schroeder and Mark [5] identified three factors that jointly influence meat demand over time. These include consumer income, which is one of the non-price factors that affect poultry meat demand health/nutrition concerns and consumer preferences for meat product attributes. Since the 1970s, global production and demand for poultry meat also known as white meat have grown faster than that of any other meat [5-7]. During the 1990s, when other meat types experienced a downward demand trend, that of poultry meat accelerated and poultry continue to lead the expansion of the meat trade. Gueye [8] reported that poultry in rural areas is an important system for supplying the fastest-growing human population with high-quality protein and providing additional income to resource-poor small farmers. As reported by FAO [9], the poultry sector contributed about 25% of the country's agricultural GDP.

Meat and fish are an integral part of the diet of Nigerians, serving as a focal point for the family protein [10]. However, the consumption of animal protein in Nigeria is among the least in the world, estimated at 45.4 g compared to the FAO minimum of 53.8 g [11]. White meat is a type of meat, which is pale in color before and after cooking. It contains less fat and serves as a good source of vitamins, proteins and minerals. In addition, it controls weight gain, regulates blood pressure, reduces cholesterol and the risk of cancer. White meat consumption in adequate quantities ensures the normal functioning of the immune system, mucous membranes and metabolic processes [12]. Despite all these desirable qualities, less research attention was given to white meat and its products in Nigeria [13]. The consumption of red meat is known to trigger high blood pressure and other heart-related diseases, which is very rampant among households in Nigeria. However, its demand is adversely affected by health information, as consumers tend to consume less beef after information on its cholesterol level becomes available [14]. It is on this premise that

this study examined the consumption of white meat as a policy option for reducing health issues associated with the consumption of red meat among households in Nigeria.

Data collection and methods

The information was obtained from the Harmonised National Living Standard Survey (HNLSS) data 2015, collected by the National Bureau of Statistics (NBS), Nigeria. The respondents surveyed comprised 33,102 households in both the rural and urban sectors of the country. Data collected were subjected to both descriptive and inferential statistics. The descriptive statistics used are frequency counts, percentages and mean scores, while the inferential statistics were employed using the Heckman model. Descriptive statistics were used to analyze the socio-economic characteristics of the respondents and estimate the expenditure of households on the identified types of meat. Heckman model was employed to examine the determinants of the households' decision to demand, and actual demand for white meat in Nigeria.

Model specification

Heckman model was developed by Tobin [15] to determine the characteristics that influence the probability and actual demand of a commodity. The model involves a two-step process. In the first stage, the probit model was used to estimate the probability that a household purchases a food item or not. The dependent variable is a dummy, *i.e.*, $C_i = 1$, if the food item/group is purchased and $C_i = 0$ otherwise. Probit determines the decision variable C_i by $C_i = 1$, if $Z_i \geq Z_i^*$ and $C_i = 0$, if $Z_i < Z_i^*$. Z_i^* plays the role of a 'breaking point' and thus the threshold concept is explicitly incorporated in the model. Z_i^* is the critical value of Z_i at which the *i*th household decides to purchase the food item/group.

Where the unobservable Z_i is a linear combination of the observable explanatory variables:

$$Z_i = b_0 + b_1X_i \quad (1)$$

The full probit model is represented as follows:

$$Z_i = b_0 + b_1X_1 + b_2X_2 + \dots + b_nX_n \quad (2)$$

X_n is the number of specified explanatory variables,

$Z_i = (1 = \text{white meat purchaser, } 0 = \text{non-white meat purchaser})$

The second stage involves the estimation of the equation (OLS) of a subsample of households that purchased the white meat, given as follows:

$$E_t = f(X_1, X_2, X_3, \dots, X_s, \lambda) \quad (3)$$

Where E_t is the consumption expenditure on white meat of sub-sample that purchase white meat.

S is the number of explanatory variables, which are:

$X_1 = \text{Age (years)}$

$X_2 = \text{Household size}$

$X_3 = \text{Marital status (1 = married, 0 = otherwise)}$

$X_4 = \text{Income (\$)}$

$X_5 = \text{Price of white meat (\$/kg)}$

$X_6 = \text{Price of fish (\$/kg)}$

$X_7 = \text{Price of beef (\$/kg)}$

$X_8 = \text{Sector (1 = rural, 0 = urban)}$

$X_9 = \text{South-West}$

$X_{10} = \text{South-East}$

$X_{11} = \text{South-South}$

$X_{12} = \text{North-Central}$

$X_{13} = \text{North-West}$

Northeast zone is the base category.

λ second equation is a monotonically decreasing function of the probability that selected households purchase white meat.

$$\lambda = [f(Z_i)/1-F(Z_i)] \quad (4)$$

$i = 1, 2, 3, \dots, N$

$f(Z_i) = \text{Probability density function (PDF)}$

$F(Z_i) = \text{Cumulative Density function (CDF)}$

λ ensures that the estimated model does not suffer from selectivity bias. That is the subsample of households that purchase white meat and represents itself and exclude non-purchasers. The dependent variable for the second stage (OLS) is expenditure on white meat (E_t); the independent variables are as stated in the first stage.

Results and Discussion

The results of the socioeconomic characteristics of the respondents are highlighted in Table 1. The results revealed that about 86% of the respondents fall within the active working-age of 18-65 years. Furthermore, the mean age of households in Nigeria and across the two sectors was 48 years, conforming to a previous finding [16], where the mean age of households was 47.67 years. Suffice

to conclude that majority of household heads in Nigeria are in their active and productive age. About 85% belong to the male gender [17], while almost eight out of 10 respondents are males in the urban sector. The majority of households in Nigeria have a household size between one and four. The mean household size of four in the pooled data and urban sector and five in the rural sector is an indication that respondents in Nigeria have moderate household size. Furthermore, At least, eight out of 10 respondents in the pooled data and across the two sectors were married. The remaining two were either single, widowed, divorced or separated. This shows that household heads in Nigeria have a family to cater for, which shows their level of responsibility towards domestic issues.

As shown in Table 2, households spent highest on fish in the pooled data (\$18.60). However, monthly expenditure on beef is higher (\$21.66) than on fish and poultry, (\$21.58 and \$5.21, respectively) in the rural area. This may be attributed to the perceived lack of awareness of the health risks associated with the consumption of red meat in the rural sector. However, households' expenditure on fish is higher (\$17.63) than on beef and poultry (\$14.01 and \$1.55, respectively) in the urban sector. The expenditure share of households on the three meat types revealed that households spend 50% of their meat expenditure on fish in Nigeria and across the two sectors. Likewise, over 40% of the budget share on meat is spent on beef. Contrarily, expenditure share on poultry is less than one percent. This emphasizes the low demand for poultry in Nigeria.

The results of the first (probit) stage of the Heckman analysis show that the $\text{Prob} > \chi^2$ value of 0.000 implies the model accurately fits the data (Table 3). The results further revealed that age, household size health expenditure, residents in the rural sector and northwest zone are significant at 1%, except for sex, which is significant at 5%. These all adversely influence households' decisions to demand white meat in Nigeria. A unit increase in age, household size and expenditure on health would decrease households' decision to consume white meat. In other words, households that are aged, have a larger household size and spend more on health issues have a lower probability of consuming white meat. Likewise, residents in the rural sector and northwest zone of the country have a lower likelihood of consuming white meat. On the other hand, households'

Table 1 Socioeconomic characteristics of households in Nigeria.

| Variables | Pooled | | Rural | | Urban | |
|-----------------------|-----------|-------|-----------|-------|-----------|-------|
| | Frequency | % | Frequency | % | Frequency | % |
| Age | | | | | | |
| <18 | 40 | 0.12 | 33 | 0.13 | 7 | 0.001 |
| 18-65 | 2830 | 85.74 | 21460 | 86.04 | 6844 | 84.79 |
| >65 | 4668 | 14.14 | 3448 | 13.83 | 1220 | 15.11 |
| Mean | 47.67 | | 47.83 | | 47.623 | |
| Gender | | | | | | |
| Male | 28033 | 84.92 | 21624 | 86.70 | 6409 | 79.41 |
| Female | 4979 | 15.08 | 3317 | 13.30 | 1662 | 20.59 |
| Household size | | | | | | |
| 1-4 | 17980 | 54.46 | 13063 | 52.37 | 4917 | 60.92 |
| 4-7 | 10699 | 32.41 | 8337 | 33.43 | 2362 | 29.27 |
| >7 | 4333 | 13.13 | 3541 | 14.20 | 792 | 9.81 |
| Mean | 4 | | 5 | | 4 | |
| Marital status | | | | | | |
| Married | 28,023 | 84.89 | 21,489 | 86.16 | 6534 | 80.96 |
| Unmarried | 4,989 | 15.11 | 3,452 | 13.84 | 1537 | 19.04 |

income, prices of beef and poultry, northcentral, South-south, southeast and southwest positively influence households' decision to consume white meat. The variables are significant at 1% with the exception of northcentral, which is significant at 5%. Households' decision to consume white meat would increase if there were a unit increase in households' income and prices of beef and meat. This is an indication that households with higher income have a likelihood of purchasing white meat than those with low income. Similarly, residents of northcentral, south-south, southeast and southwest zones have a higher likelihood of demanding white meat, relative to northeast residents. Table 4 reveals the second (ordinary least square) stage of the Heckman model, which examined the factors influencing the actual demand for white meat by households in Nigeria. Age, sex, sector, household size, expenditure on health and northwest zone are the factors adversely influencing households' demand for white meat. All these variables are significant at $P < 0.01$. A unit increase in age household size and health expenditure would

reduce the demand for white meat by 0.47%, 3.14% and 13.63%, respectively. The implication is that households spend more on health issues of those that are aged and those with larger household sizes tend to demand less white meat [18]. Likewise, the demand for white meat decreases by 8.33%, 41.17% and 34.15% for respondents that are male, reside in the rural sector and northwest zone of the country, respectively. This implies that male respondents, those that reside in the rural sector and northwest zone consume less white meat, relative to the female respondents, those that reside in the urban sector and other geopolitical zones in the country.

Contrarily, households' income, prices of beef and poultry, and north-central, south-south, southeast and southwest zones have a positive effect on the demand for white meat. With a naira increase in households' income, the price of beef and poultry would increase households' demand for white meat by 54.70%, 30.65% and 25.15%, respectively. This, however, shows that households would demand more for white meat if the price of beef keeps increasing. The reason for this could be that white meat being a close substitute to red meat could be preferable due to the health benefits derived from its consumption [18-20]. Households would also not mind demanding more for white meat if its price increases. As expected, households that belong to the high-income group consume white meat more than those in the low-income category do. Similarly, the demand for white meat increases by 17.44%, 67.34%, 30.45% and 64.11% for residents

Table 2 Monthly expenditure of households on the selected types of meat.

| Meat type | Pooled expenditure (\$) | Rural | Urban |
|-----------|-------------------------|-------------------|-------------------|
| Fish | 18.60 (0.5256) | 21.58 (0.5328) | 17.63 (0.5054) |
| Beef | 15.88 (0.4361) | 21.66 (0.4403) | 14.01 (0.4243) |
| Poultry | 2.45 (0.0383) | 5.21 (0.0269) | 1.55 (0.0702) |

Note: Expenditure shares of the types of meats are in parenthesis.

of northcentral, South-south, southeast and southwest, respectively, relative to those that reside in the northeast zone. This implies that residents in these zones consume more white meat than those that reside in the northeast zone.

Table 3 Determinants of the households' decision to consume white meat in Nigeria.

| Variables | Coef. | SE | Z-score | P>Z |
|--------------------|---------|---------|---------|-------|
| Sex | -0.0069 | 0.0033 | -2.06 | 0.040 |
| Age | -0.0004 | 0.00009 | -4.38 | 0.000 |
| In Income | 0.0456 | 0.0050 | 9.08 | 0.000 |
| Rural Sector | -0.0343 | 0.0049 | -6.97 | 0.000 |
| Household size | -0.0028 | 0.0006 | -4.14 | 0.000 |
| In fish price | -0.0028 | 0.0049 | -0.57 | 0.569 |
| In beef price | 0.0334 | 0.0107 | 3.12 | 0.002 |
| In poultry price | 0.0243 | 0.0083 | 2.94 | 0.003 |
| Health expenditure | -0.0355 | 0.0052 | 6.80 | 0.000 |
| Northcentral | 0.01651 | 0.0070 | 2.36 | 0.018 |
| Northwest | -0.0299 | 0.0076 | -3.91 | 0.000 |
| South-south | 0.0589 | 0.0107 | 5.48 | 0.000 |
| Southeast | 0.0274 | 0.0089 | 3.08 | 0.002 |
| Southwest | 0.0595 | 0.0107 | 5.22 | 0.000 |

Wald chi² = 66345.84; Prob > chi² = 0.0000; SE = standard error; Coef. = coefficient

Table 4 Determinants of the households' demand for white meat in Nigeria.

| Variables | Coef. | SE | Z-score | P>Z |
|--------------------|---------|--------|---------|-------|
| Sex | -0.0833 | 0.0276 | -3.03 | 0.002 |
| Age | -0.0047 | 0.0006 | -7.26 | 0.000 |
| In Income | 0.5470 | 0.0157 | 34.83 | 0.000 |
| Rural sector | -0.4117 | 0.0230 | -17.88 | 0.000 |
| Household size | -0.0314 | 0.0045 | -6.94 | 0.000 |
| In fish price | -0.4560 | 0.0382 | -1.19 | 0.233 |
| In beef Price | 0.3066 | 0.1070 | 2.86 | 0.004 |
| In poultry Price | 0.2516 | 0.0741 | 3.39 | 0.001 |
| Health expenditure | -0.1364 | 0.0395 | 3.45 | 0.001 |
| Northcentral | 0.1744 | 0.0491 | 3.56 | 0.000 |
| Northwest | -0.3415 | 0.0548 | -6.23 | 0.000 |
| South-south | 0.6734 | 0.0492 | 13.69 | 0.000 |
| Southeast | 0.3045 | 0.0557 | 5.46 | 0.000 |
| Southwest | 0.6411 | 0.0549 | 11.69 | 0.000 |
| Lambda | 0.1099 | 0.0121 | 9.09 | 0.000 |

SE = standard error; Coef. = coefficient

Conclusion and recommendations

The major findings as revealed in the study emphasized that households' expenditure on white meat is lower in Nigeria and across rural and urban sectors of the country. Likewise, expenditure on beef is higher than on white meat and fish in the rural sector, which may be attributed to the lack of awareness of the health risks associated with the consumption of beef. Major factors that adversely affect the households' decision to consume white

meat are age, sex, higher health expenditure, residents in the rural sector and northwest zone of the country. Likewise, similar variables adversely influence the demand for white meat in Nigeria. Nevertheless, the income of the households favorably influences the demand for white meat. Advocacy and enlightenment campaign on the nutritional and health benefits of consuming white meat among residents that spend more on health issues, those in the rural sector, northwest zone and male respondents is of great importance. Likewise, income enhancing policy measures probably in the form of social safety nets is key, especially among the aged, to enhance their demand for white meat in Nigeria.

Competing interests

The authors declare no competing interests

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