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What Factors Influence Households' Expenditure on Fish? Evidence from Malawi

Fredrick Mangwaya Banda[1], Abdi-Khalil Edriss[2], Wilson Wesley Jere[3], Horace Phiri[4]

Abstract: The purpose of this study was to find the drivers of fish expenditure in urban Malawi using Blantyre as a case study. Previous demand studies on the fisheries sector in Malawi have concentrated on the determinants of consumer choices and demand for tilapia fish thereby making information regarding households' general consumption pattern of fish scanty. This study is, therefore, the first to provide an analysis of the drivers of fish consumption in Malawi employing primary data collected from the households in Blantyre city using a multistage stratified random sampling procedure. Results show that statistically significant negative determinants of per capita fish expenditure include the price of vegetables, the price of rice, the number of adults in the household, and the household's per capita food expenditure away from home, while, the price index of food, price of maize, the predicted value of food, and household's income level are the statistically significant positive drivers of per capita fish expenditure. General policy implications arising from this study are that policymakers need to ensure that people have higher incomes, and that food prices are kept low.

Keywords: capture fishery; per capita food expenditure; per capita fish expenditure; ordinary least squares regression; Tobit regression model

JEL Classifications: Q22; Fisheries; Aquaculture

1. Introduction

Food has always been one of the most widely used indicators of poverty such that every single effort to investigate any country's poverty level has always included measurements of food expenditures and food consumption. It is due to the recognition of the importance of food that the United Nations lists the eradication of hunger by 2030 among its 17 Sustainable Development Goals (SDGs). Similarly, the government of Malawi regards food security as being crucial in its poverty eradication efforts. This is evidenced by the fact that, in the year 2006, it came up with the national food security policy whose overall goal is to dramatically improve the access to food by all Malawians by, among others, ensuring that Malawians could purchase enough nutritious food in a dignified manner so as to live an active and healthy life.

[1] PhD in progress, Department of Agricultural and Applied Economics, Lilongwe University of Agriculture and Natural Resources (LUANAR), Malawi, Corresponding author: fmbanda@mubas.ac.mw.
[2] Professor of Applied Economics, Department of Agricultural and Applied Economics, Lilongwe University of Agriculture and Natural Resources (LUANAR), Malawi.
[3] Associate Professor in Fish Genetics, Department of Aquaculture and Fisheries Science, Lilongwe University of Agriculture and Natural Resources (LUANAR), Malawi.
[4] Senior Lecturer, Department of Agricultural and Applied Economics, Lilongwe University of Agriculture and Natural Resources (LUANAR), Malawi.

Additionally, in recognition of the significant nutritional and economic value of fish, the government of Malawi developed the National Fisheries and Aquaculture Policy (NFAP) whose main goal is to promote sustainable fisheries resource utilization and aquaculture development to contribute to food and nutrition security and economic growth of the country (GoM, 2016). Specifically, the NFAP aimed at increasing fish supply in the country to increase Malawi's per capita fish consumption from 8.12 kilogrammes in 2014 to 10 kilogrammes by 2020 (GoM, 2016) something which it has, regrettably, failed to achieve since only 9.51 kilogrammes were consumed per capita in 2020(GoM, 2021).

In Malawi, the fisheries sector is divided into three sub-sectors namely, capture fishery, aquaculture, and ornamental or aquarium trade, as explained in the subsequent paragraphs.

Further divided into artisanal and commercial production, capture fishery is practiced on Malawi's lakes and rivers such as Lake Malawi, Lake Chilwa, Lake Malombe, Lake Chiuta, and Shire River. In terms of their contributions to total catch, these water bodies contributed 93.88 percent, 1.82 percent, 2.28 percent, 0.93 percent, and 1.09 percent, respectively, to the total fish production in 2020 (GoM, 2021). Lake Malawi is, particularly, significant for fish production in that it has over 800 endemic fish species, which are of both local and international scholarly importance and act as a source of tourism. Specifically, it is the Southeastern arm of the lake which is highly productive due to the occurrence of seasonal hydrological events that result in plentiful supply of food for the fish.

Aquaculture, on the other hand, is mainly practiced in ponds in upland locations of the country and it is, largely, practiced by smallholder farmers. Despite there being signs of growth, Malawi's aquaculture sector is still in its nascent stage. Production rose from about 800 tons in 2005 to about 7,672 tons in 2016 and 9, 399 tons in 2020. The sector employs about 15,465 smallholder farmers, 61.51 percent of them being males and 38.49 percent females (GoM, 2021). The farmers are loosely organized in farmer clubs such that as of 2020, the total number of recorded ponds in Malawi was 10, 000 which translated to a total pond area of 251.59 hectares (GoM, 2021).

Ornamental or aquarium trade concentrates on Mbuna fish which is exported live to countries such as Germany, Hong Kong, Denmark, and France (GoM, 2021).

With respect to marketing, most of the high-valued fish from both aquaculture and capture fishery is sold to customers in the urban areas such as Blantyre, Lilongwe, and Mzuzu while the low-valued fish species are sold locally around the fishponds and the other water bodies. Traders transport these fish species using buses, pick-ups, bicycles, and motorbikes. The fish is sold either fresh or processed to prevent loss of quantity and quality. The main fish processing methods used include sun-drying, smoking, and salting. Fresh fish, either frozen or chilled, is particularly commonly sold in areas close to aquaculture farms and Malawi's lakes and rivers. In terms of market outlets, fish is either sold in public markets or supermarkets or retail outlets which are, mainly, owned by aquaculture companies. In the public markets, fish is usually sold based on size by piece, buckets, heaps, or units while in supermarkets and retail outlets, it is sold based on weight. According to Brummett (2000), the determinants of average retail prices of fish in Malawi include the fish market factors and the fish attributes. In terms of participation in fish marketing, fish trading is dominated by males as only a small proportion of women is engaged in fish processing and trading. Factors contributing to the lack of women's participation in fish marketing include lack of capital, and the traditional division of labour. The major species of fish that are caught and sold in Malawi include *Engraulicypris sardella*, *Copadichromis virginalis*, and *Lethrinops spp.; Oreochromis karongae (Lake*

Malawi Chambo); *Clarias gariepinus* (Catfish); *Rhamphochromis spp*; *Diplotaxodon*; and *Oreochromis shiranus* (Shire Tilapia).

1.2. Problem Statement

The finding that instead of achieving the per capita consumption of fish of 10 kilogrammes in 2020 only 9.51 kilogrammes were consumed per capita in 2020, as stated above, is very discouraging considering the numerous interventions the government of Malawi in the fisheries sector. However, information about factors that influence households' expenditure on fish is very scanty because previous demand studies on the fisheries sector in Malawi have concentrated on the determinants of consumer choices and demand for tilapia fish (Chikowi *et al.* 2020), or analysing factors affecting the demand for fish products, namely; smoked fish, dried fish, tinned fish, and fresh fish (Nankwenya *et al.* (2014). This study, therefore, bridges this knowledge gap by determining factors that influence Malawian households' expenditure on food, in general, and expenditure on fish. Furthermore, the study estimates the marginal effects of each determinant of food expenditure to get a clear picture of key factors that influence the likelihood of food purchases in Malawi. Research questions include: (1) How does a household's expenditure on food affect fish expenditure in Malawi? (2) Are there any interdependencies between fish consumption and the consumption of other food commodities in Malawi? Providing answers to these questions will help unearth immensely useful insights to policymakers on how they can improve Malawian households' food consumption, in general, and fish consumption. This, ultimately, can help improve the welfare of people in the country. Thus, this study contributes to the literature on fisheries by finding the drivers of fish consumption in Malawi, an area that has scarcely been given adequate attention by most studies in the fisheries sector in Malawi.

1.3. Concepts and Terms

This section provides a definition of some concepts or terms that have been used in the study.

1.3.1. Capture fishery refers to the harvesting of all kinds of natural living resources in both marine and freshwater bodies while aquaculture is the controlled farming of aquatic organisms such as shellfish, fish and even plants on land or in the open sea.

1.3.2. Design effect is a measure of how much sampling variability in a given sample differs from the sampling variability in a simple random sample.

1.3.3. Multicollinearity refers to a situation there is a strong correlation between two or more explanatory variables in a regression equation.

1.3.4. Heteroscedasticity refers to the presence of non-constant variance in the data set.

2. Solution Approach

2.1. Theoretical Framework

The analysis of the drivers of consumer expenditure on fish is based on the Neo-classical theory of consumer behaviour. This theory assumes that the overriding goal of a consumer is to maximize utility, which is defined as the level of satisfaction a consumer gets from consuming a good or a service. As a result, consumers base their purchases on their assessments of a product's or service's utility. It is assumed that a rational consumer will choose a consumption bundle which yields the highest level of utility. Based on this assumption, a set of demand equations can be derived, the parameters of which can be used in empirical research. Once the parameters are estimated consistently, it becomes possible to describe, explain and predict the demand behaviour of the consumer.

However, as pointed out by Lancaster (1966) the neo-classical theory of consumer behaviour has one drawback in the sense that it does not consider the effect of a commodity's attributes on the quantity demanded of the commodity. This weakness led to the emergence of Lancaster's attribute theory of consumer behaviour which considers the dynamic adjustment of the market (Lancaster, 1966). Lancaster's attribute theory posits that the price of composite good is a combination of the values of characteristics or attributes of the good. Thus, the demand for a good is necessarily the demand for the attributes contained therein. Therefore, using the attribute theory, this study assumes that individuals purchase fish because they are attracted by the attributes of fish such as being rich in essential fatty acids and micronutrients such as vitamin A, iron, and zinc which are significant for proper cognitive and physical development for human beings ((Phiri *et al.* 2013).

2.2. Empirical Literature Review

Several studies have been carried out to find the drivers of food expenditure in general and the drivers of fish expenditure. For instance, Dey et al. (2000) found that an increase in a household's income level leads to increased household expenditure on both food and fish. Also, Dey *et al*. (2000) found that household size has a negative influence on the per capita fish expenditure in Bangladesh, suggesting that as the number of people in a household increase, the household's per capita expenditure on fish decreases. Cavaliere *et al.* (2019) found that, in Italy, the purchases of fish are higher among households with female heads compared to those with male heads. Similarly, Thong & Solgaard (2017) found that households with higher incomes, more elderly people, married heads, and more educated people spend more on fish products. Furthermore, a study by Murray *et al.* (2017) found that, in British Columbia of Canada, households spend more on fish as when they have more young people.

2.3. Data and their Sources

The target population for the study was the households in the city of Blantyre. The households were selected using multistage stratified sampling procedure. Firstly, on the basis of income levels, the city was stratified into high- and low-density strata. Secondly, using simple random sampling, clusters were selected from each stratum. Thirdly, from each cluster, households were randomly selected to form the final sample. The study targeted either household heads or other members of the household who were primarily responsible for the purchase of food in the household as respondents. To determine the sample size, the study used the formula (Zikmund *et al.* 2009):

$$n = \frac{Z^2 pq}{e^2} \quad (1)$$

Where: n is number of respondents (households),

p is proportion of the population of the households in the city that were interviewed which, following Chikowi et al. (2020), was equal to 46 percent in this study.

$q = 1 - p$ is the estimated proportion of failures. It was equal to 54 percent in this study.

z is the statistical confidence level. This study used 95 percent confidence level which gave a z statistic of 1.96.

$e =$ the maximum allowance for error between the true proportion and the sampling proportion. For this study, the allowance of sampling error was not greater than 4 percentage points.

Using the above information, the representative sample size for the study was calculated as follows:

$$n = \frac{1.96^2 (0.46)\ (0.54)}{0.04^2} = 596 \quad (2)$$

However, upon factoring in the design effect, 525 households were added to the sample thereby adjusting the sample size for the study to 1,121 households. The data was collected through face-to-face interviews using semi-structured questionnaires. Specifically, the data collected included the socio-economic and demographic factors of the respondents and households' food purchase decisions. On consumption, information collected included the types and quantities of food consumed and the food expenditures in the past seven days. Consumers were also presented with *usipa, chambo, utaka, mlamba, kambuzi, matemba,* and *mcheni.* Thereafter, quantities purchased of each fish species alongside their prices were elicited.

2.4. Estimation Methods

The study has used different variables and estimation methods on the basis of the research question being addressed. Specifically, the ordinary least squares (OLS) regression model has been used to find the drivers of households' per capita food expenditure while the determinants of households' per capita fish expenditure have been investigated using the censored Tobit regression model. Table 1 provides a description of the variables that were used in the OLS per capita food expenditure regression model alongside their expected signs.

Table 1. A Description of the Variables that Were Used in the OLS Per Capita Food Expenditure Regression Equation

Variable	Description	Expected Sign
Dependent Variable		
LnPCFE	Natural log of per capita fish expenditure	+
Independent Variables		
PI	Price index of fish	+/-
Age	Age of the household head	+/-
Agesq	Square of age of household head	+/-
Years	Years of formal schooling	+/-
Primary	Dummy (1-primary education, 0-otherwise)	+/ -
Secondary	Dummy (1-secondary education, 0-otherwise)	+/ -
Hhsize	Household size	+/-
Children	Number of children less than 7 years old in a household	+/-
Adults	Number of adults more than 13 years in a household	+/-
Employed	Number of people employed in a household	+/-
Lnincome	Natural log income level of a household	-
Lnincomesq	Natural log of the square of income level of a household	+
Female	Dummy (1-if a household head is female, 0-otherwise)	+/-
Unmarried	Dummy (1-if a household head is married, 0-otherwise)	+/-
Low	Dummy (1-if a household is in a low-density area, 0-otherwise)	+/-

Source: Own compilations

As Table 1 shows that the dependent variable in the OLS per capita food regression equation was the natural log of the per capita food expenditure while the independents variables included socio-economic variables in addition to the price index of food. Table 2 presents variables that were used in the Tobit per capita fish expenditure regression model.

Table 2. A Description of the Variables that Were Used in the Tobit Per Capita Food Expenditure Regression Model.

Variable	Description	Expected Sign
Dependent Variable		
LnFE	Natural log of per capita fish expenditure	+
Independent Variables		
LnPO	Natural lo of price index of food	+/-
LnPV	Natural log of price of vegetables	+/-
LnPR	Natural log of price of rice	+/-
LnPMA	Natural log of price of maize	+/-
LnPCH	Natural log of price of chicken	+/ -
LnPE	Natural log of price of eggs	+/ -
FD^*	Predicted value of the per capita food expenditure	+/-
FD*sqd	Square of the predicted value of per capita food expenditure	
Age	Age of household head	
Agesq	Square of age of household head	

Children	Number of children less than 7 years old in a household	+/-
Adults	Number of adults more than 13 years in a household	+/-
Employed	Number of people employed in a household	+/-
Lnincome	Natural log income level of a household	-
Lnincomesq	Natural log of the square of income level of a household	+
Female	Dummy (1-if a household head is female, 0-otherwise)	+/-
Married	Dummy (1-if a household head is married, 0-otherwise)	+/-
Lnpcfew	Natural log of a household's per capita food expenditure away from home	+/-

Source: Own compilations

Table 2 indicates that the dependent variable in Tobit per capita fish expenditure regression model was the natural log of the per capita fish expenditure. Additionally, it shows that variables such as prices of various food commodities and the household's per capita food expenditure away from home are added to the list of the independent variables used in the OLS regression model.

3. Analysis of Results

This section presents the results of various regression models that have been used to address the study objectives. It focuses on the results from the food expenditure regression equation and the Tobit fish expenditure regression model.

3.1. Results from Food Expenditure Regression Equation

Using variables presented in Table 1, the following OLS regression equation was estimated:

$$lnPCFE = f(\,PI, Y, Z, \varepsilon_i) \quad (2)$$

Where:

$lnPCFE$ is the natural log of per capita food expenditure;

PI[1] is the household specific food price index;

Y is a vector of per capita household income which was expressed in both linear and quadratic forms;

Z is a vector of household characteristics, and

ε_i is the error term.

[1] It was calculated as the geometric mean of food prices given by $\sum w_i \ln P_i$, where w_i is food commodity i's share in total food expenditure.

Following Gujarati (2004), the study endeavoured to test and correct for the presence of the problems of non-normality, multicollinearity, and heteroskedasticity during the estimation of the OLS regression. The results of the foregoing tests are presented in the subsequent paragraphs.

3.1.1. Results of Normality Test

The normality assumption is one of the key assumptions underlying OLS regression model whose violation results in inflated standard errors leading to wider confidence intervals and wrong hypothesis testing. Ultimately, the violation of the normality assumption leads to biased estimates. A Kolmogorov-Smirnov test was, therefore, used to test for the presence of non-normality in the data used in the study. The Kolmogorov-Smirnov test gave a Chi-squared statistic with a p-value of $0.0000<0.01$ thereby suggesting the rejection of the null hypothesis no-normality. This implies that the data was normally distributed.

3.1.2. Results of Multicollinearity Test

The presence of multicollinearity problem results in inefficient or inconsistent parameter estimates and inaccurate p-values thereby making it difficult to separate the independent effect of each parameter estimate on the dependent variable (Gujarati, 2004). Hence, to detect and measure the presence and the severity of the multicollinearity problem, the study employed the variance inflating factors (VIF) results of which are shown in Table 3.

Table 3. Results of Multicollinearity Test

Variable	VIF	Tolerance
Lnincomesq	271.13	0.003688
Lnincome	270.74	0.003694
Age	45.41	0.022022
Agesq	44.62	0.022413
Years	5.68	0.176206
Secondary	3.91	0.255430
Primary	3.78	0.264871
Hhsize	2.58	0.388150
Adults	2.50	0.400565
Children	1.38	0.725149
Employed	1.37	0.729368
Low	1.17	0.855924
Female	1.09	0.918474
PI	1.07	0.932967
Unmarried	1.01	0.988765
Mean VIF	43.83	

Source: Own calculations

As indicated by Table 3, the mean VIF value for all the explanatory variables used in the OLS regression model was 43.83 thereby suggesting that there was a multicollinearity problem in the variables used in the OLS regression model since many of the regressors had VIF values far more than 10. Therefore, to control for the multicollinearity problem, the OLS regression equation was estimated without a constant.

3.1.3. Results of the Heteroscedasticity Test

The presence of heteroscedasticity in the data set has very damaging consequences in that it results in high standard errors, which in turn, leads to wider confidence interval problems and biased parameter estimates. The study used the Breusch–Pagan test for heteroskedasticity which yielded a chi-squared statistic value of 28.23 with an associated p-value of 0.0000. This led to the rejection of the null hypothesis of constant variance thereby suggesting the presence of heteroscedasticity in the data set. To surmount the heteroscedasticity problem in the study, robust standard errors were used during the estimation of the OLS regression equation, the results of which are presented in Table 4.

Table 4. Parameter Estimates of the Food Expenditure Regression Equation

Dependent variable: Per capita food expenditure

Variable	Coefficient	Robust standard error	t-statistic	p-value
PI	0.1587***	0.0511	3.11	0.002
Age	0.0121	0.0130	0.93	0.352
Agesq	-0.0001	0.0002	-0.74	0.463
Years	0.0061	0.0192	0.32	0.751
Primary	-0.3060	0.1968	-1.55	0.121
Secondary	-0.0282	0.0748	-0.38	0.706
Hhsize	-0.1816***	0.0255	-7.13	0.000
Children	0.0166	0.0529	0.31	0.754
Adults	0.0022	0.0256	0.08	0.932
Employed	0.0513	0.0338	1.52	0.129
Lnincome	1.0969***	0.0605	18.12	0.000
Lnincomesq	-0.0187***	0.0032	-5.88	0.000
Female	0.0337	0.0308	1.09	0.275
Unmarried	0.1617**	0.0769	2.10	0.036
Low	-0.0122	0.0566	-0.22	0.829
F (15, 589)	= 42678.03			
Prob > F	= 0.0000			

Note: Asterisks represent level of statistical significance: *(10% significance), **(5% significance), ***(1% significance).

Source: own calculations

As shown in Table 4, statistically significant positive determinants of the per capita food expenditure are the price index of food (p-value<0.01), the household's income level (p-value<0.01), and the household head's status of being unmarried (p-value<0.05). This suggests that an increase in the price index of food, an increase in the household's level of income, and the household head's state of being married will lead to an increase in per capita food expenditure. However, it is noteworthy that the coefficient of the squared income term is negative and statistically significant at a 1 per cent level of significance (p-value<0.01). This finding conforms to the finding by Dey *et al.* (2000) who found that the fish expenditure's response to changes in income is significant but non-linear. It, particularly, implies that as households' income levels progressively increase, per capita food expenditure also increases up until it reaches a maximum, beyond which, any further increase in the income levels results in a decrease in per capita food expenditure. This finding conforms to Engel's law which states that as a household's income level increases, the percentage of the income allocated for food purchases decreases.

Furthermore, Table 4 shows that household size is the statistically significant negative determinant of per capita food expenditure (p-value <0.01). This suggests that as the number of people in a household increase, there are more people who must share in the household's food budget thereby lowering the household's per capita food expenditure. This finding is consistent with the finding by Dey *et al.* (2000) who found that bigger households negatively influence the per capita food expenditure in Bangladesh.

In addition to the results presented in Table 4, the study computed conditional marginal effects for each variable. Conditional marginal effects are the elasticities of each variable computed at a specific value. The specific value used in this study is the mean. Table 5 presents the marginal effects of the variables. As shown in Table 5, for a unit change in the food price index, there will be a 15.87 percentage increase in the per capita food expenditure. Similarly, for a unit change in the household size, there will be an 18.16 percentage decrease in the per capita food expenditure. Also, Table 5, shows that for a unit change in household's income level, there will be a 110-percentage increase in per capita food expenditure. Lastly, the change of marital status of the household head from being married to being unmarried leads to a 10-percentage increase in the per capita food expenditure.

Table 5. Marginal Effects of the Parameter Estimates of the Food Expenditure Regression Equation

Dependent variable: Per capita food expenditure

Variable	Coefficient	standard error	t-statistic	p-value	X
PI	0.1587***	0.0511	3.11	0.002	-0.2066
Age	0.0121	0.0130	0.93	0.351	35.548
Agesq	-0.0001	0.0002	-0.74	0.462	1328.92
Years	0.0061	0.0192	0.32	0.751	13.6722
Primary	-0.3060	0.1968	-1.55	0.120	0.0497
Secondary	-0.0282	0.0748	-0.38	0.706	0.3891
Hhsize	-0.1816***	0.0255	-7.13	0.000	4.3676
Children	0.0166	0.0529	0.31	0.754	1.1242
Adults	0.0022	0.0256	0.08	0.932	2.7368
Employed	0.0513	0.0338	1.52	0.129	1.3874
Lnincome	1.0969***	0.0605	18.12	0.000	12.9607
Lnincomesq	-0.0187***	0.0032	-5.88	0.000	168.745
Female	0.0337	0.0308	1.09	0.274	0.6722
Unmarried	0.1617**	0.0769	2.10	0.035	0.0132
Low	-0.0122	0.0566	-0.22	0.829	0.0912
F (15, 589)	= 42678.03				
Prob > F	= 0.000				

*Note: Asterisks represent level of statistical significance: **(5% significance), ***(1% significance).*
Source: own calculations

3.1.4. Results from Fish Expenditure Tobit Regression Equation

In this study, the model for the determinants of per capita fish expenditure the dependent variable attains values equal to or greater than 0. In other words, the dependent variable is censored from below at 0. Consequently, applying OLS to a regression equation whose dependent variable, as in this case, is censored from below yields biased results. Hence, this study used the Tobit model to estimate the determinants of per capita fish expenditure. The Tobit model where the distribution of the dependent variable is censored from below at point α can be expressed as follows:

$$Y_i = \begin{cases} Y^* \; if \; Y > \alpha \\ 0 \; if \; Y \leq \alpha \end{cases}$$

Such that $Y_i = Y_i^* = X_i\beta + \varepsilon_i$ (2)

Where: Y_i^* is the latent variable and, in this study, it represents per capita fish expenditure,

X_i represents a vector of regressors as shown in Table 2,

β represents a vector of slope coefficients, and

$\varepsilon_i \sim N\ (0, \sigma^2)$ is the error term which is normally distributed with mean equal to zero, and has a homoscedastic variance equal to σ^2.

The Tobit regression model was estimated using robust standard errors and without a constant so as to control the problems heteroscedasticity and multicollinearity, respectively. The results of the Tobit fish expenditure regression equation are presented in Table 6.

Table 6. Parameter Estimates of the Fish Expenditure Tobit Regression Equation

Dependent variable: Per capita fish expenditure

Variable	Coefficient	Robust standard error	t-statistic	p-value
LnPO	0.6698***	0.0514	13.04	0.000
LnPV	-0.1087*	0.6020	-1.81	0.072
LnPR	-0.1779**	0.0858	-2.07	0.039
LnPMA	0.1915*	0.1118	1.71	0.083
LnPCH	0.1620	0.1134	1.45	0.148
LnPE	0.0185	0.0318	0.58	0.562
FD*	0.5545***	0.1830	3.03	0.003
FD*sqd	-0.0560***	0.0185	-3.03	0.003
Age	0.0098	0.0243	0.40	0.688
Agesq	-0.0001	0.0003	-0.40	0.687
Children	0.0330	0.0999	0.33	0.742
Adults	-0.1108**	0.0477	-2.32	0.021
Employed	0.0478	0.0591	0.81	0.419
Lnincome	1.1668***	0.1288	9.06	0.000
Lnincomesq	-0.0198**	0.0083	-2.38	0.018
Lnpcfew	-0.1151***	0.0377	-3.06	0.002
Female	0.0113	0.0550	0.21	0.838
Married	-0.1125	0.1240	-0.91	0.365

F (18, 387) = 8619.00
Prob > F = 0.000
Pseudo R^2 = 0.7976

*Note: Asterisks represent level of statistical significance: *(10% significance), **(5% significance), ***(1% significance).*

Source: own calculations

As indicated in Table 6, the estimated parameter of the price index for fish is positive and statistically significant at 1 percent level of significance (p-value<0.01), thereby, suggesting that an increase in the price index of fish will result in an increase in the per capita fish expenditure. This implies that fish is a necessity so much so that even if its price rises people will still continue buying it, thereby making the total expenditure on fish increase. This finding is consistent with the finding by Dey *et al.* (2000) who found that fish is a necessity in Bangladesh. Additionally, the coefficient for price of maize is positive and statistically significant (p-value <0.1) implying that an increase in the price of maize leads to an increase in per capita fish expenditure. The coefficients of the linear and squared forms of the predicted food expenditure variable exhibited statistically significant positive and negative signs, respectively. This suggests that there exists a nonlinear relationship between food expenditure and fish expenditure. Particularly, it shows that as the budget for food increases, progressively, the per capita expenditure on fish also increases up until it reaches a maximum beyond which it eventually declines. This shows the general behaviour of respect to food consumption whereby consumers have a certain threshold for food consumption such that upon reaching that threshold, consumers can never be induced to purchase more food even if their income levels have increased. This finding is consistent with the finding by Dey *et al* (2000) who found that there exists a non-linear relationship between food expenditure and fish expenditure in Bangladesh.

Furthermore, Table 6 shows that the coefficients of income and the squared term of income are statistically significant at a 1 per cent level of significance (p-value<0.01), even though they are positive and negative, respectively. This, again, suggests that there is a presence of a non-linear relationship between per capita food expenditure and households' income level. It, particularly, implies that as households' income levels progressively increase, per capita food expenditure also increases up until it reaches a maximum, beyond which, any further increase in the income levels results in a decrease in per capita food expenditure. This finding conforms to Engel's law which states that as a household's income level increases, the percentage of the income allocated for food purchases.

Table 6 further indicates that the price of vegetables, the number of adults in the household, and the household's per capita food expenditure away from home are statistically significant negative determinants of per capita fish expenditure. Particularly, it shows that an increase in the price of vegetables, an increase in the number of adults in the household, and an increase in the household's per capita food expenditure away from home lead to a reduction in the per capita expenditure on fish.

The finding that the number of adults in the households has a negative influence on the households' expenditure on fish is consistent with the findings by Murray *et al.* (2017) who found that, in British Colombia of Canada, households spend more on fish as the number of young people in the household increases. These findings are, however, inconsistent with the findings by Thong & Solgaard (2017) who found that households with more elderly people spend more on fish compared to those with a small number of elderly people.

4. Conclusion and Policy Implications

This study set out to investigate the drivers of both food expenditure and fish expenditure in Malawi. It has found that the positive determinants of a household's per capita food expenditure include the price index of food, the household's income level, and the household head's state of being unmarried while the household is the only statistically significant determinant of per capita food expenditure. Again, with respect to fish expenditure, the study has found that statistically significant determinants of negative determinants of per capita fish expenditure include the price of vegetables, the price of rice, the number of adults in the household, and the household's per capita food expenditure away from home. On the other hand, the study has found that the price index of food, the price of maize, the predicted value of food, and household income level are the statistically significant positive drivers of per capita fish expenditure.

Policy implications arising from this study are that in order to increase the consumption of food in Malawi, it is imperative that policymakers should ensure that households have a small number of people with a lot of income-generating activities. Having a lot of income-generating activities will enable households to spend more on food. Additionally, with respect to fish consumption, policymakers should do the following: make sure that the prices of vegetables do not just rise anyhow, make that households do have a small number of adults, through among others, the creation of a lot of employment opportunities, and make expenditure on food away from home unattractive. One of the possible ways of making food expenditure away from home is by charging higher taxes on restaurants and other food-eating joints. Other important policy options that can help increase households' per capita expenditure on fish include making sure households have a lot of income-generating activities and maintaining the price of food low. If these policies are successfully implemented, then the households' expenditure on both food and fish will improve thereby leading to an improvement in the welfare of Malawian households.

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References

Brummett, R.E. (2000). Factors Influencing Fish Prices in Southern Malawi. *Aquaculture.* 186 (3–4), pp. 243–251.

Cavaliere, A.; De Marchi, E.; Donzelli, F. & Banterle, A. (2019). Is the Mediterranean diet for all? An analysis of socioeconomic inequalities and food consumption in Italy. *British Food Journal.* doi.org/10.1108/BFJ-06-2018-0373.

Chikowi, C.T.; Ochieng, D.O. & Jumbe, C. B. (2020). Consumer Choices and Demand for Tilapia in Urban Malawi: What are the Complementarities and Trade-offs? *Aquaculture.* 530 (20).

Dey, M. M. (2000). Analysis of demand for fish in Bangladesh. *Aquaculture Economics and Management*. 4(1/2), pp. 63-81.

Dey, M. M.; Garcia, T. Y.; Kumar, P.; Piumsombun, S.; Haque, S. M, Li.; Radam, A. L.; Senaratne, A.; Khiem, N.T. & Koeshendrajana, S. (2008). Demand for fish in Asia: A Cross Country Analysis. The *Australian Journal of Agricultural and Resource Economics.* 52, pp. 321–338.

Gujarati, D. (2004). *Basic Econometrics.* New York: McGraw-Hill Companies

Lancaster, K. J. (1966). A New Approach to Consumer Theory. *Journal of Political Economy*. 74(2), pp. 132-157.

Malawi Government (2016). *National Fisheries and Aquaculture Policy*. Available at: http://www.unpei.org/malawi-government-national-fisheries-and-aquaculturepolicy-.

Malawi Government (2021). Annual Economic report 2021. Ministry of Economic Planning, Development and Public Sector Reforms. Department of Economic Planning and Development, Lilongwe.

Murray, G.; Wolff, K. & Patterson, M. (2017). Why eat fish? Factors influencing seafood consumer choices in British Columbia, Canada. *Ocean & Coastal Management*. 144, pp. 16–22. https://doi.org/10.1016/j.ocecoaman.2017.04.007.

Nankwenya. B.; Kaunda, E. & Chimatiro, S (2017). The demand for fish products in Malawi: An almost ideal demand system estimation. *Journal of Economics and Sustainable Development.* 8 (16), pp. 63–71.

Phiri, L.Y.; Dzanja, J.; Kakota, T. & Hara, M. (2013). Value Chain Analysis of Lake Malawi: A Case Study of Oreochromis spp (chambo). *International Journal of Business and Social Science*. 4(2).

Thong, N. T. & Solgaard, H. S. (2017). Consumer's food motives and seafood consumption. *Food Quality and Preference*. 56, pp.181–188. doi.org/10.1016/j. foodqual.2016.10.008.

Zikmund, W.G.; Babin, B. J.; Carr, J. & Griffin, M. (2010). *Business Research Methods.* 8th edition. Canada: South-Western Cengage Learning.