CONSUMER CHOICES AND DEMAND FOR TILAPIA IN URBAN MALAWI: WHAT ARE THE COMPLEMENTARITIES AND TRADE-OFFS?

Presentation by

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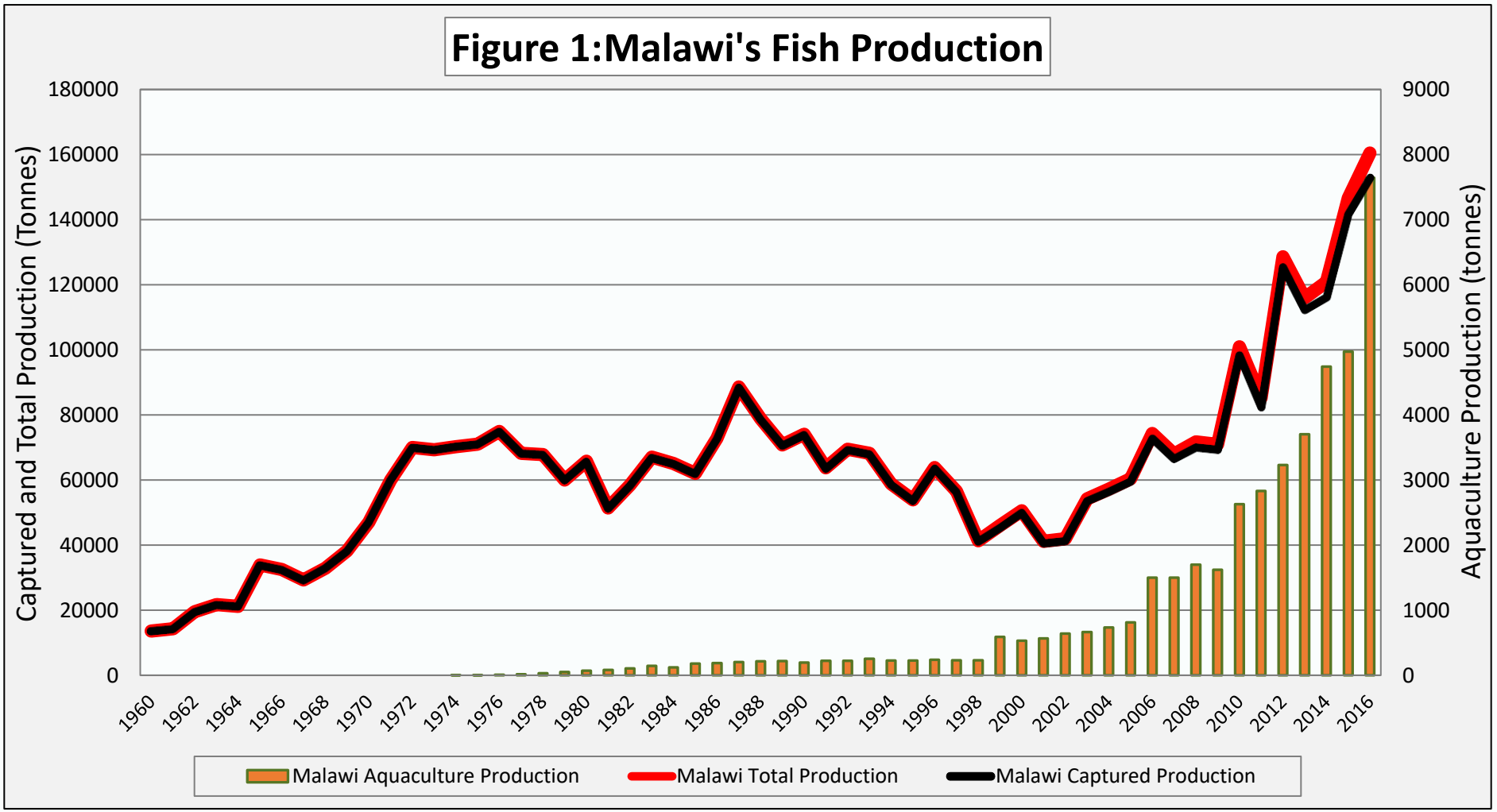
INTRODUCTION

- Fisheries sector has important nutrition and economic contribution.
  - employment opportunities
    - Malawi: about 60,746 annually and supporting livelihood of about 1.6 million people living along lakeshore areas (GoM, 2016)
    - World: about 12.3 million people (de Graaf et al., 2014)
  - contributes to Gross Domestic Product: 1.26% for Africa and 4% for Malawi (AUC-NEPAD, 2014; GoM, 2016).
  - low cholesterol white meat: rich in vitamins, iodine, potassium, iron, proteins, omega-3 fatty acids, calcium and zinc (Cai & Leung, 2017).

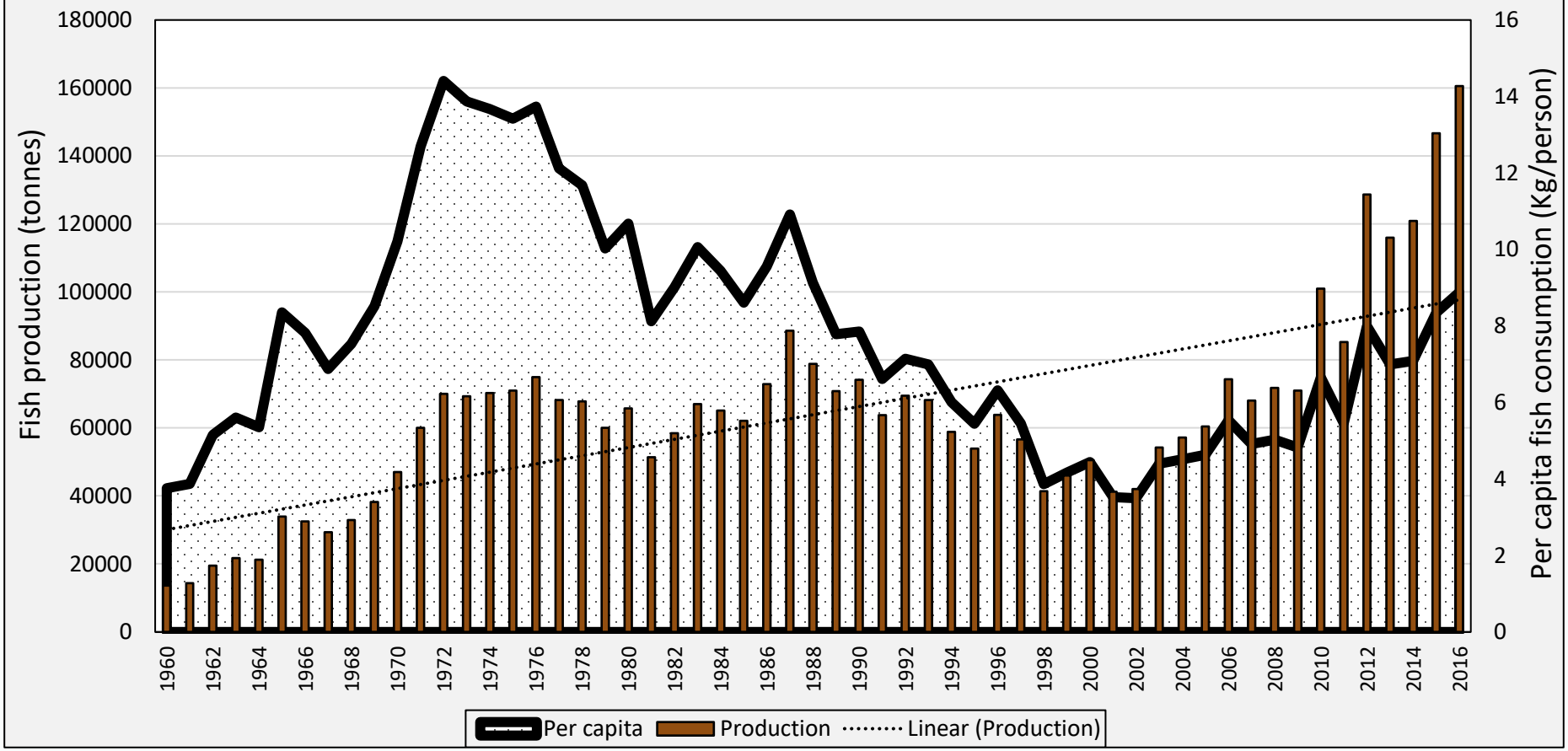
- Transitions in fisheries sector has had influence on the production levels in the country.



- Captured production was the same as total production until rise of aquaculture subsector.

- Per-capita fish consumption also used to be high but sector's challenges coupled with high population growth decreased the per capita consumption.

Figure 2: Malawi's Total Fish Production and Per Capita Fish Consumption



- Nevertheless, the increasing population is still presenting high demand of fish including tilapia

INTRODUCTION *Cont.…*

- The experienced challenges led to CRS Plan (2003 to 2015) and NFAP (2016 to present) which targeted different species especially tilapia.

- These have helped to boost the fish production levels especially the aquaculture sector (as noted on Figure 1).

- Some of the targeted species include L. Malawi *Oreochromis (Nyasalapia)* species *and Oreochromis shiranus* species as shown in the next slide.

Figure 3:Common tilapia species in Malawi

Oreochromis shiranus (Boulenger 1897a; Boulenger 1897b)

Oreochromis squamipinnis (Günther, 1864)

Oreochromis karongae (Trewavas, 1949)

Oreochromis lidole (Trewavas, 1935)

INTRODUCTION *Cont.…*

- Despite the noted rising trend in overall fish production in the country as indicated in the first and second figures;
  - Mulupwa (2018) and Singini *et al.* (2013) reported and forecasted declining production levels of tilapia species between 2011 to 2022.
  - M'balaka *et al.* (2018) reported fluctuating production levels between 2000 to 2015.
  - Breuil & Grima (2014) reported increasing tilapia production levels as contributed from the aquaculture sub-sector.
- However, demand for such fish products is still on the rise (Nankwenya et al., 2017)

RESEARCH PROBLEM

- Despite the challenges, consumers in Malawi are being presented with diverse processed and unprocessed tilapia products thus considering their nutrition importance.

- On the other hand, globalization, technological advancements, rising of the middle class, nutrition and food safety issues have influenced changes in consumer dietary patterns, choices, tastes and preferences of different food products (Tschirley *et al*., 2015).

- However, considering these transitions, there is lack of information backed with empirical evidence on consumer choice behaviour and demand for the tilapia products.

RESEARCH PROBLEM *Cont…*

- Previous studies focused on fish products in aggregation without considering their specific species (Nankwenya et al., 2017; Maganga et al., 2014).

- Therefore, the gap on how heterogeneities among consumers, market factors and unique differences/similarities among fish products from different species influence consumer choices and purchased quantities has not been fully addressed.

OBJECTIVES

Main Objective

- to assess factors that influence consumer choice behaviour and demand for processed and unprocessed *Oreochromis (Nyasalapia)* and *Oreochromis shiranus* species in Blantyre and Lilongwe cities.

Specific Objectives

1. to determine factors that influence consumers' choices of processed and unprocessed tilapia products.
2. to assess the drivers of quantities of processed and unprocessed tilapia products demanded and purchased for consumption.

HYPOTHESIS

- Socio-economic and demographic factors, access to products' availability and price information, tilapia products consumption frequency and tilapia attributes do not significantly influence consumers' choices of processed and unprocessed tilapia products.

- Socio-economic and demographic factors, access to products' availability and price information, tilapia products consumption frequency and tilapia attributes do not significantly influence the quantities of processed and unprocessed tilapia products demanded and purchased for consumption.

STUDY JUSTIFICATION

- Generated information on the influence of different factors on consumers' choices and demand for different tilapia products considering their unique differences and similarities.
- Information usefulness
  - Directly: designing and adjusting production, processing, distribution, and marketing strategies to meet consumers' choice and demand needs.
  - Indirectly: increased employment opportunities through induced positive changes along the value chain
  - Indirectly: increased production and consumption levels to help in meeting country's NFAP's objective aimed at increasing per capita fish consumption

METHODOLOGY

STUDY AREAS AND SAMPLE SIZE

- Lilongwe and Blantyre cities
- Calculated sample was 422 proportionally distributed in the two cities.
- Managed to collect 584, 310 for Lilongwe city and 274 for Blantyre

SAMPLING TECHNIQUE

- Multistage Sampling Technique
  1. Purposively selected the cities (proportionated the sample size)
  2. Randomly selected 14 wards in Blantyre City and 15 areas in Lilongwe City (proportionated the sample size)
  3. Consumers (households): Systematic Sampling Technique

Ethical consideration were made by getting consent from the respondents and maintaining high confidentiality and anonymity of the respondents throughout the study.

CONCEPTUAL FRAMEWORK

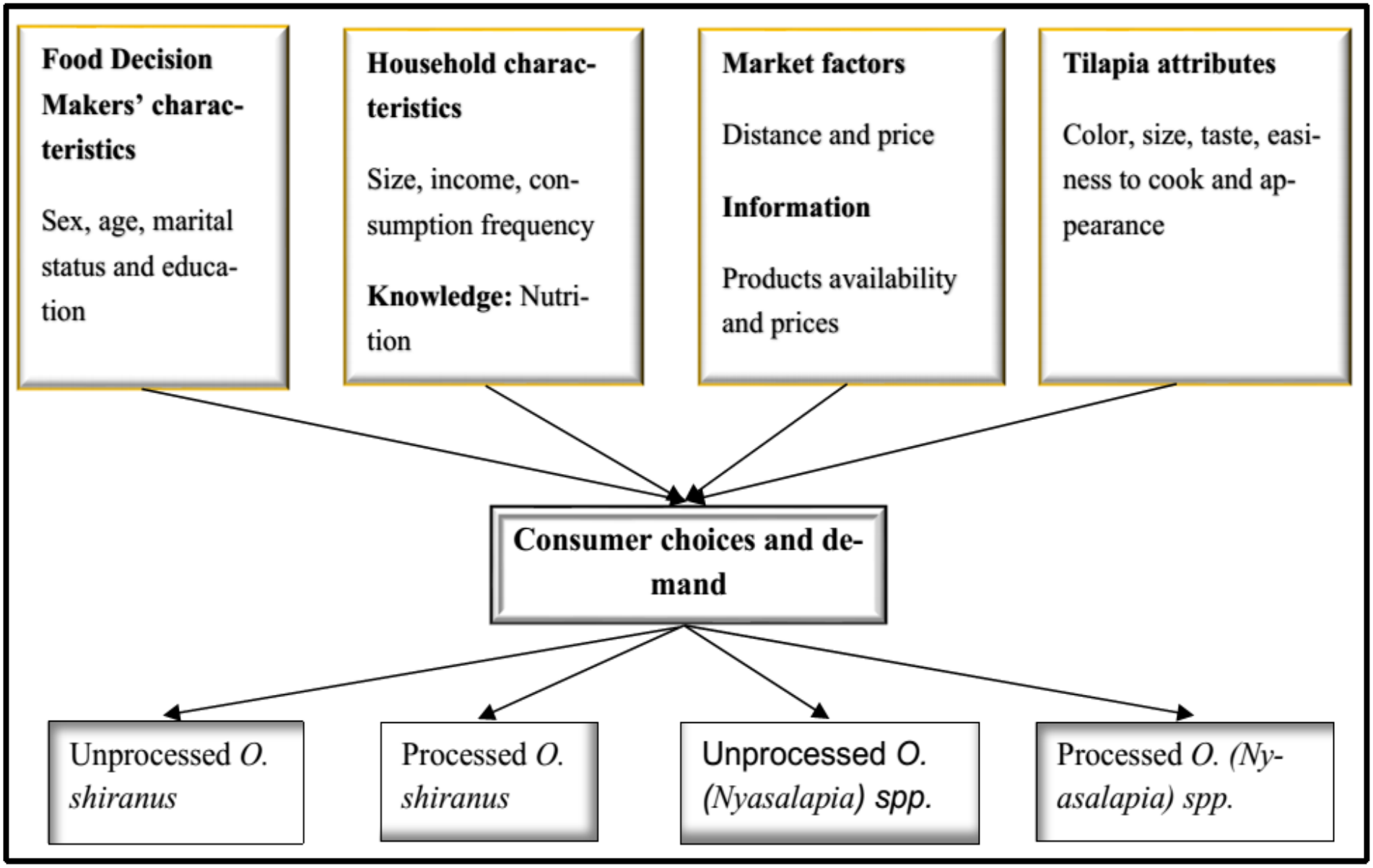


Figure 4:Conceptual framework

THEORY

- Used the random utility theory to explain how consumers made choices on various tilapia fish products and how they allocated income to a given quantity of tilapia product.
- Basic hypothesis about consumer behaviour is that a rational consumer will always choose the most preferred bundle from a set of feasible alternatives that will maximise utility (Varian, 2010).
- The theory is mathematically presented as;

$$U_{ij} = V_{ij} + \varepsilon_{ij}, \qquad \forall j = 1, 2, 3, 4$$

EMPIRICAL MODEL 1

First objective: consumer choices (MvProbit Model)

- Probit models

$$y_1 = \begin{cases} 1, & if\ y_1^* > 0 \\ 0, & otherwise \end{cases}$$

$$\vdots$$

$$y_4 = \begin{cases} 1, & if\ y_4^* > 0 \\ 0, & otherwise \end{cases}$$

- Error terms are correlated hence (Capellari and Jenkins 2003)

$$y_{ij}^* = \delta_j' X_{ij} + \varepsilon_{ij}, \qquad j = 1, \dots, 4$$

- For each choice

$$y_{ij} = \begin{cases} 1, & if\ y_{ij}^* > 0 \\ 0, & otherwise \end{cases}$$

EMPIRICAL MODEL 2

Second objective: quantities purchased (SUMvTR)

- Following Greene (2002)

$$q_j^* = x_j\beta_j + \varepsilon_j \qquad\qquad j = 1, \dots 4$$

- Stacked model

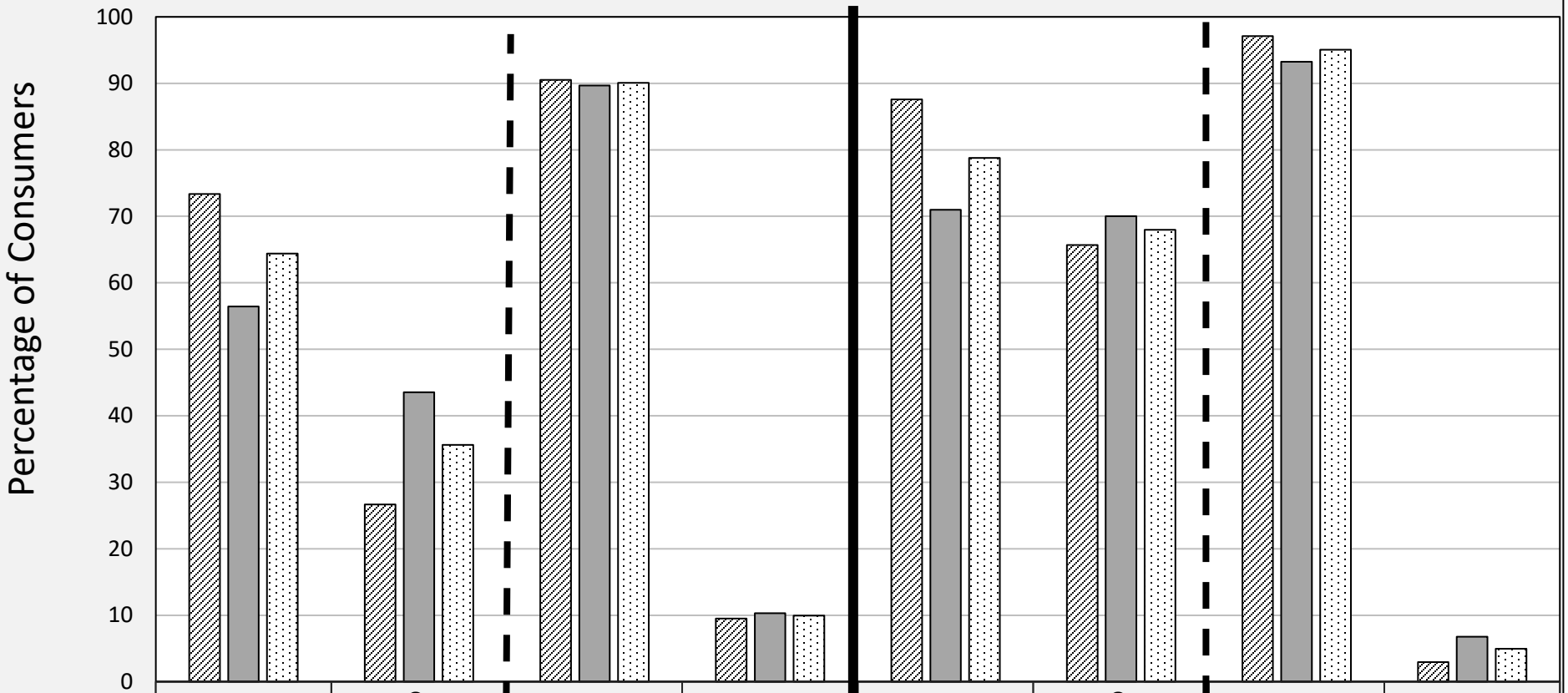
$$\begin{bmatrix} q_1^* \\ q_2^* \\ q_3^* \\ q_4^* \end{bmatrix} = \begin{bmatrix} x_{j1} & 0 & 0 & 0 \\ 0 & x_{j2} & 0 & 0 \\ 0 & 0 & x_{j3} & 0 \\ 0 & 0 & 0 & x_{j4} \end{bmatrix} \begin{bmatrix} \beta_1 \\ \beta_2 \\ \beta_3 \\ \beta_4 \end{bmatrix} + \begin{bmatrix} \varepsilon_{j1} \\ \varepsilon_{j2} \\ \varepsilon_{j3} \\ \varepsilon_{j4} \end{bmatrix} = x_{ij}\beta_j + \varepsilon_{ij}$$

- Truncated at zeros to strictly focus on the greater than zero consuming sub-sample

RESULTS AND DISCUSSION

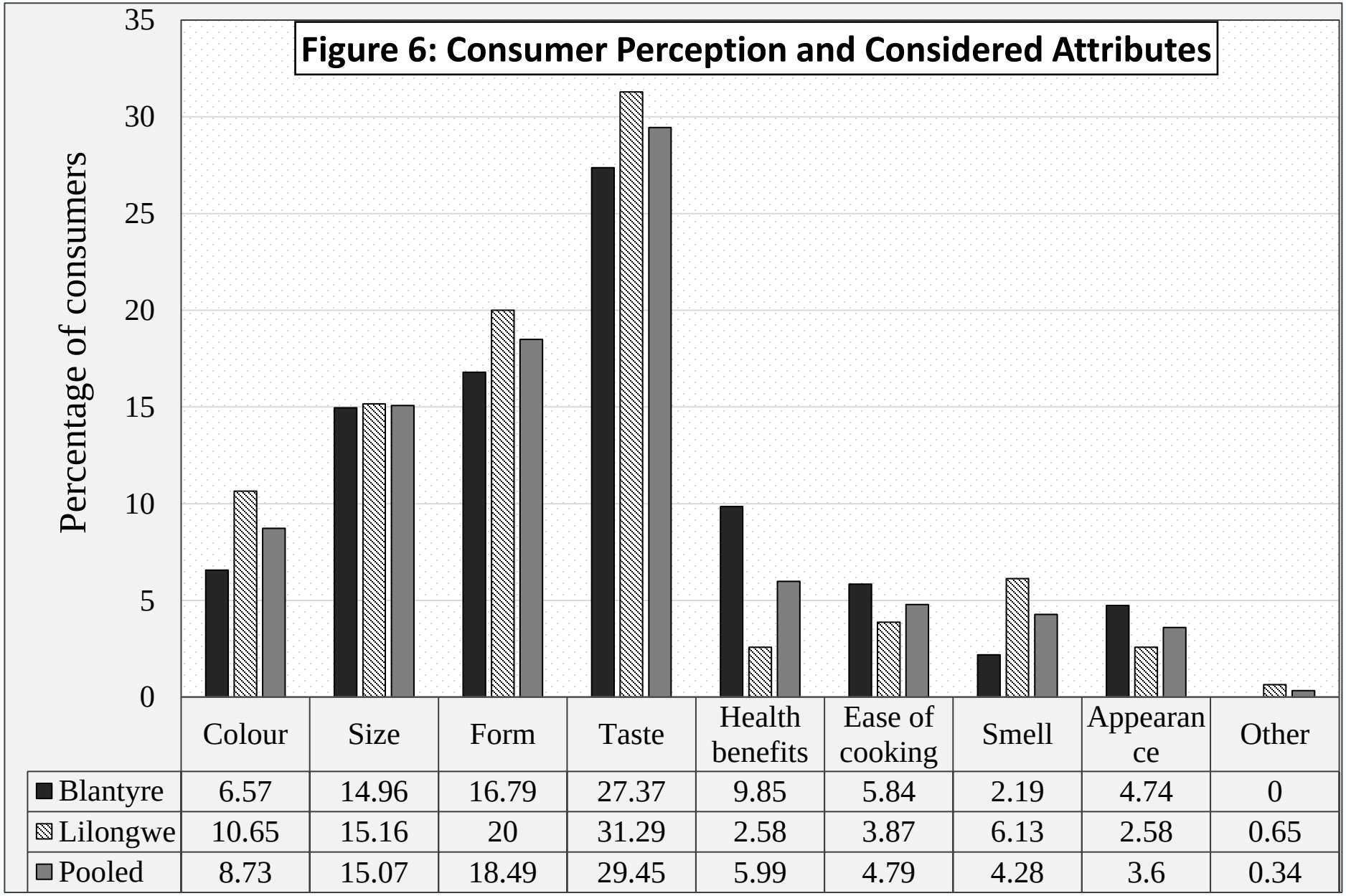
Preference and Choice Frequencies

Figure 5: Consumer Preferences and Choices



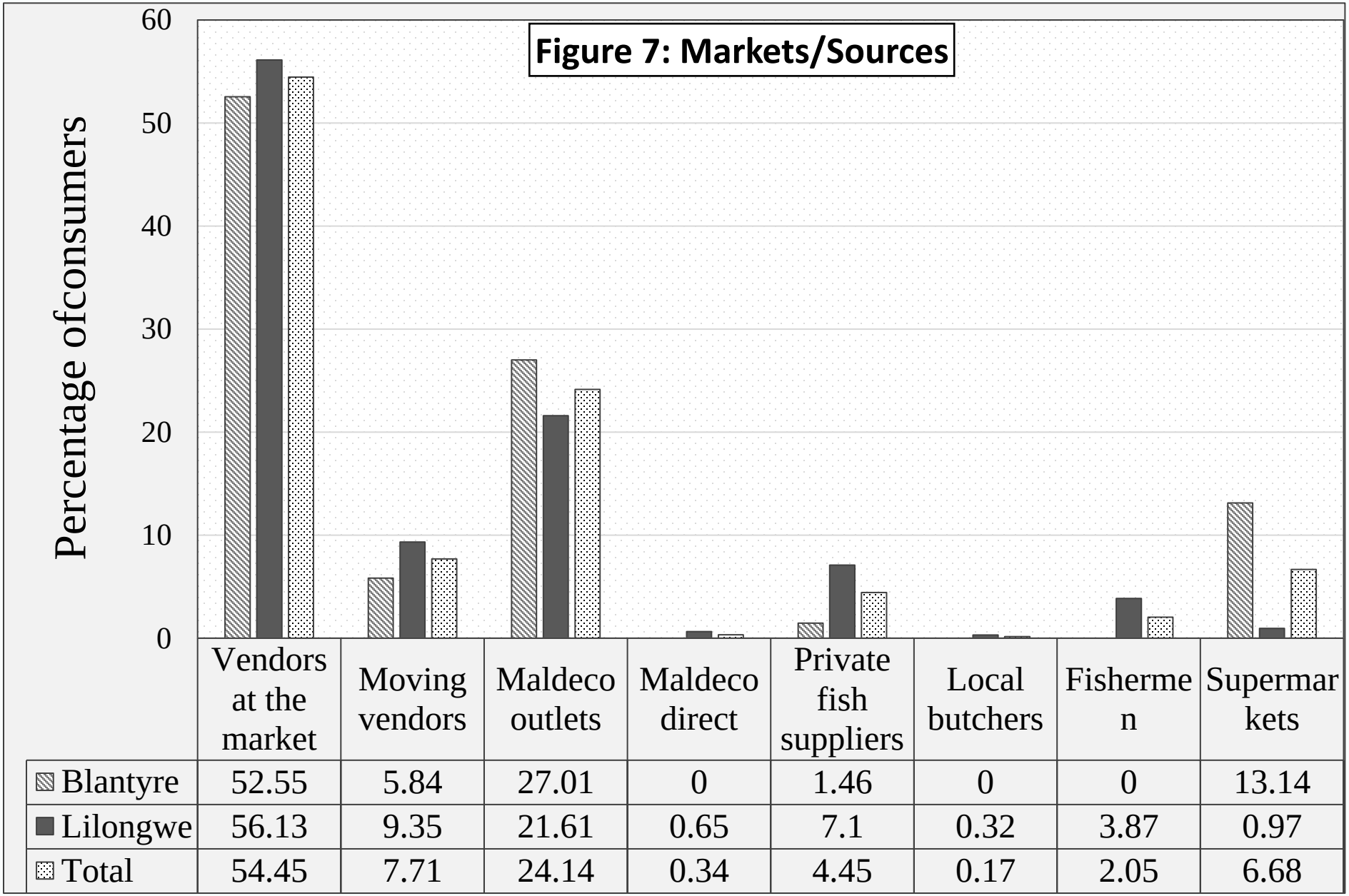
	Preference				Choice			
	O. Shiranus	O. (Nyasalapia)	Unprocessed	Processed	O.Shiranus	O. (Nyasalapia)	Unprocessed	Processed
Blantyre	73.36	26.64	90.51	9.49	87.59	65.69	97.08	2.97
Lilongwe	56.45	43.55	89.68	10.32	70.97	70	93.23	6.77
Total	64.38	35.62	90.07	9.93	78.77	67.98	95.03	4.97

Perception and Considered Attributes



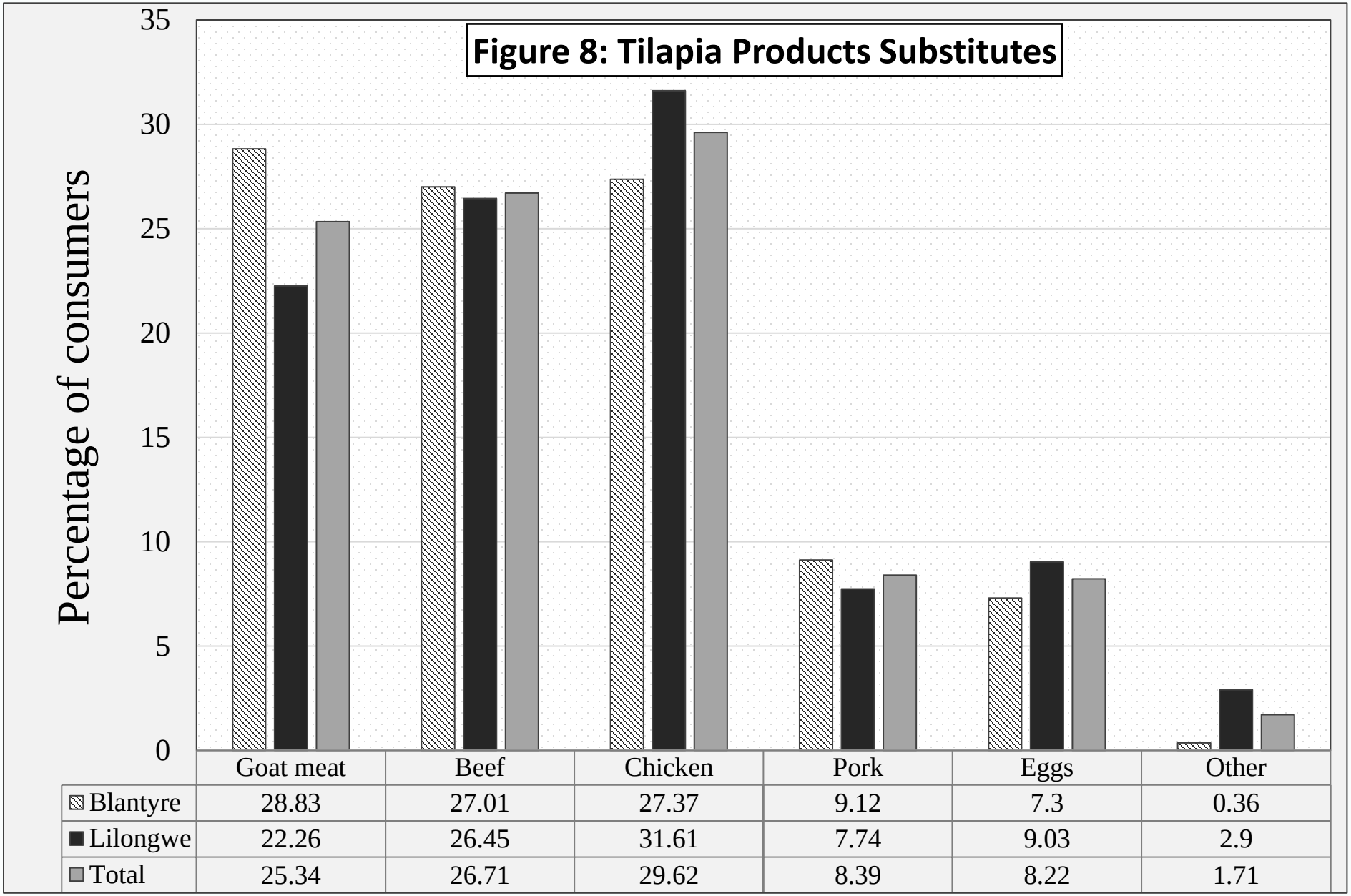
	Colour	Size	Form	Taste	Health benefits	Ease of cooking	Smell	Appearance	Other
Blantyre	6.57	14.96	16.79	27.37	9.85	5.84	2.19	4.74	0
Lilongwe	10.65	15.16	20	31.29	2.58	3.87	6.13	2.58	0.65
Pooled	8.73	15.07	18.49	29.45	5.99	4.79	4.28	3.6	0.34

Markets/Sources of Tilapia Products



	Vendors at the market	Moving vendors	Maldeco outlets	Maldeco direct	Private fish suppliers	Local butchers	Fisherme n	Supermar kets
Blantyre	52.55	5.84	27.01	0	1.46	0	0	13.14
Lilongwe	56.13	9.35	21.61	0.65	7.1	0.32	3.87	0.97
Total	54.45	7.71	24.14	0.34	4.45	0.17	2.05	6.68

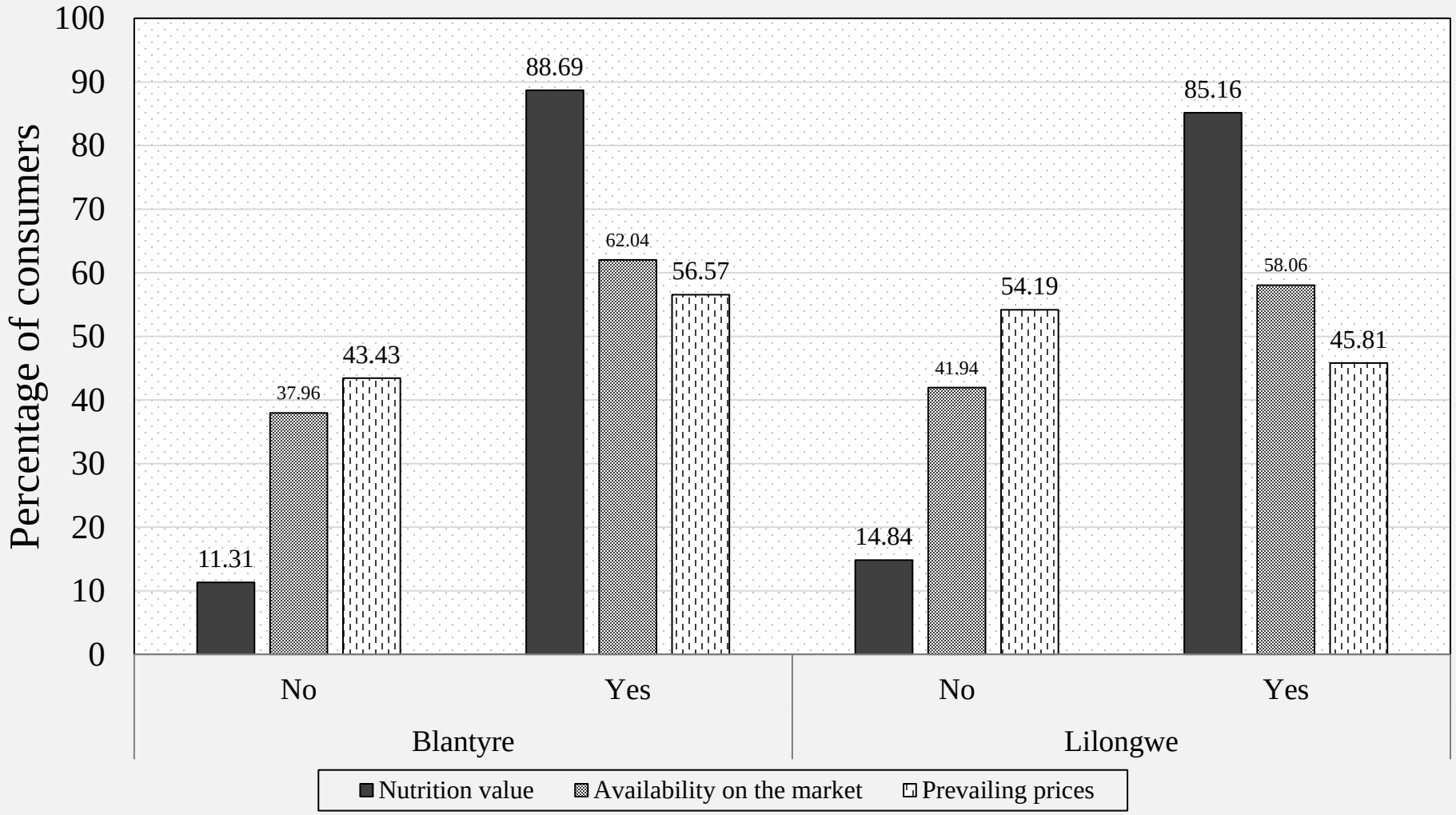
Tilapia products Substitutes



	Goat meat	Beef	Chicken	Pork	Eggs	Other
Blantyre	28.83	27.01	27.37	9.12	7.3	0.36
Lilongwe	22.26	26.45	31.61	7.74	9.03	2.9
Total	25.34	26.71	29.62	8.39	8.22	1.71

Nutrition Knowledge, Products Availability and Market Prices

Figure 9: Consumer Nutrition Knowledge, Products Availability and Market Prices



Purchased Quantities

	Unprocessed *O. shiranus* (n=440)	**Processed *O. shiranus* (n=82)**	**Unprocessed *O. (Nyasalapia)* (n=338)**	**Processed *O. (Nyasalapia)* (n=148)**
	Mean (Std. Dev)	Mean (Std. Dev)	Mean (Std. Dev)	Mean (Std. Dev)
Lilongwe	4.07 (3.84)	2.33 (2.47)	4.57 (4.22)	2.62 (2.94)
Blantyre	3.30 (3.19)	2.06 (1.52)	3.77 (2.64)	2.85 (2.13)
Combined	3.66 (3.53)	2.22 (2.13)	4.22 (3.64)	2.72 (2.60)
t-test p-value	0.022	0.570	0.046	0.591

Products prices

	Unprocessed *O. shiranus* (n=440)	**Processed *O. shiranus* (n=82)**	**Unprocessed *O. (Nyasalapia)* (n=338)**	**Processed *O. (Nyasalapia)* (n=148)**
	Mean (Std. Dev)	Mean (Std. Dev)	Mean (Std. Dev)	Mean (Std. Dev)
Lilongwe	2850.42 (1020.80)	2917.35 (982.06)	2169.26 (840.37)	2886.73 (999.65)
Blantyre	3396.00 (810.39)	3494.11 (1221.89)	2587.43 (1273.24)	2792.83 (1163.88)
Combined	3139.33 (954.13)	3149.46 (1114.60)	2348.65 (1066.79)	2844.22 (1074.35)
t-test p-value	0.000	0.021	0.000	0.598

Objective 1: Multivariate Probit Model Results and Discussion

- Used marginal effects to show the proportional/likelihood change in the dependent variable (choice) associated with a unit change in the explanatory variables (socioeconomic, institutional, market and tilapia characteristics) as evaluated at their means.
- Validity of the model

Number of observations	**584**
Wald chi^2(76)	**234.62**
Prob> chi2	**0.000**
Log pseudolikelihood	**-1149.3747**

Variance-covariance Matrix from MvProbit

	Unprocessed *O. shiranus*	Processed *O. shiranus*	Unprocessed *O. (Nyasalapia)*	Processed *O. (Nyasalapia)*
Unprocessed	1.00***			
O. shiranus	(0.000)			
Processed	-0.061	1.00***		
O. shiranus	(0.084)	(0.000)		
Unprocessed	-0.445***	-0.083	1.00***	
O. (Nyasalapia)	(0.067)	(0.082)	(0.000)	
Processed *O.*	-0.254***	0.297***	-0.053	1.00***
(Nyasalapia)	(0.075)	(0.080)	(0.075)	(0.000)

MvProbit Results

Variables	Unprocessed O. Shiranus	Processed O. Shiranus	Unprocessed O. (Nyasalapia)	Processed O. (Nyasalapia)
	dy/dx (Std. Error)	dy/dx (Std. Error)	dy/dx (Std. Error)	dy/dx (Std. Error)
Food decision-maker characteristics				
Sex (1=male, 0=female)	0.041 (0.041)	0.057* (0.031)	-0.037 (0.047)	0.008 (0.042)
Age (continuous)	-0.002 (0.002)	-0.0003 (0.001)	0.00008 (0.002)	0.002 (0.002)
Marital status (dummy)	-0.023 (0.045)	-0.058 (0.036)	-0.008 (0.053)	-0.003 (0.049)
Education (continuous)	-0.001 (0.004)	-0.004 (0.003)	-0.005 (0.005)	-0.003 (0.005)

Variables	Unprocessed O. Shiranus	Processed O. Shiranus	Unprocessed O. (Nyasalapia)	Processed O. (Nyasalapia)
	dy/dx (Std. Error)	dy/dx (Std. Error)	dy/dx (Std. Error)	dy/dx (Std. Error)
Household characteristic (continuous)				
Size	0.0001 (0.010)	0.006 (0.008)	-0.007 (0.011)	0.005 (0.010)
Income (log)	0.039* (0.020)	0.009 (0.015)	0.055** (0.022)	0.025 (0.019)
Consumption frequency (categorical variable where less than once a week is the base)				
Once a week	-0.018 (0.060)	0.092*** (0.034)	0.214*** (0.079)	0.044 (0.069)
Twice a week	-0.049 (0.057)	0.112*** (0.7361	0.236*** (0.076)	0.064 (0.067)
More than twice week	-0.087 (0.068)	0.189*** (0.047)	0.286*** (0.084)	0.029 (0.075)

Variables	Unprocessed O. Shiranus	Processed O. Shiranus	Unprocessed O. (Nyasalapia)	Processed O. (Nyasalapia)
	dy/dx (Std. Error)	dy/dx (Std. Error)	dy/dx (Std. Error)	dy/dx (Std. Error)
Geographical factor (dummy)				
City (1=Blantyre 0=Lilongwe)	0.169*** (0.033)	-0.048* (0.028)	-0.076* (0.039)	0.0004 (0.036)
Knowledge (dummy)				
Nutrition (1=Yes, 0=No)	0.092* (0.050)	-0.034 (0.043)	-0.009 (0.065)	0.131** (0.061)
Access to tilapia products information (dummies)				
Availability (1=Yes, 0=No)	0.036 (0.045)	0.081** (0.040)	-0.094* (0.053)	-0.050 (0.047)
Price (1=Yes, 0=No)	0.081* (0.046)	0.008 (0.038)	-0.159*** (0.050)	-0.053 (0.047)
Tilapia market factor (continuous)				
Distance (km)	-0.0005 (0.0007)	0.0003 (0.0006)	-0.0001 (0.001)	0.0008 (0.0008)

Variables	Unprocessed O. Shiranus	Processed O. Shiranus	Unprocessed O. (Nyasalapia)	Processed O. (Nyasalapia)
	dy/dx (Std. Error)	dy/dx (Std. Error)	dy/dx (Std. Error)	dy/dx (Std. Error)
Perception and Tilapia attributes consideration (dummies, 1=Yes and 0=No)				
Colour	-0.042 (0.037)	0.035 (0.029)	0.017 (0.043)	0.093** (0.037)
Size	0.050 (0.037)	-0.025 (0.031)	0.052 (0.041)	0.017 (0.038)
Taste	0.085** (0.035)	0.036 (0.032)	-0.055 (0.041)	0.116*** (0.037)
Ease to cook	-0.029 (0.050)	0.061 (0.037)	0.006 (0.055)	-0.120** (0.055)
Appearance	-0.001 (0.037)	0.026 (0.030)	0.037 (0.043)	0.106*** (0.037)

Objective 2: SUMvTR Model Results and Discussion

- Used coefficients to show a percentage unit change (logged) in the dependent variable (quantities) associated with a unit change or percentage unit change in the explanatory variables (socioeconomic, institutional, market and tilapia characteristics) as evaluated at their means.
- Validity of the model

Number of observations	**584**
Wald chi^2(80)	**850.40**
Prob> chi2	**0.000**
Log pseudolikelihood	**-893.72281**

Variance-covariance Matrix from SUMvTR

	Unprocessed ***O. shiranus***	**Processed** ***O. shiranus***	**Unprocessed** ***O.*** ***(Nyasalapia)***	**Processed** ***O.*** ***(Nyasalapia)***
Unprocessed	1.00***			
O. shiranus	(0.000)			
Processed	0.662***	1.00***		
O. shiranus	(0.122)	(0.000)		
Unprocessed	0.505***	0.680***	1.00***	
O. (Nyasalapia)	(0.050)	(0.092)	(0.000)	
Processed ***O.***	0.532***	0.841***	0.735***	1.00***
(Nyasalapia)	(0.070)	(0.067)	(0.036)	(0.000)

SUMvTR Results

Variables	Unprocessed O. Shiranus	Processed O. Shiranus	Unprocessed O. (Nyasalapia)	Processed O. (Nyasalapia)
	Coefficient (Std. Err.)	Coefficient (Std. Err.)	Coefficient (Std. Err.)	Coefficient (Std. Err.)
Food decision-maker characteristics				
Sex (1=Male, 0=Female)	0.108 (0.077)	-0.203 (0.147)	0.045 (0.086)	0.323*** (0.110)
Age (continuous)	0.003 (0.003)	-0.004 (0.006)	0.005 (0.004)	0.0008 (0.005)
Marital status (dummy)	-0.025 (0.081)	-0.123 (0.127)	0.028 (0.096)	0.136 (0.118)
Education (continuous)	0.025*** (0.009)	0.040*** (0.014)	0.026** (0.010)	0.012 (0.014)

Variables	Unprocessed O. Shiranus	Processed O. Shiranus	Unprocessed O. (Nyasalapia)	Processed O. (Nyasalapia)
	Coefficient (Std. Err.)	Coefficient (Std. Err.)	Coefficient (Std. Err.)	Coefficient (Std. Err.)
Household characteristic (continuous)				
Size	0.090*** (0.020)	0.054 (0.036)	0.083*** (0.019)	0.086*** (0.028)
Income (log)	0.161*** (0.038)	0.188*** (0.070)	0.152*** (0.039)	0.245*** (0.053)
Consumption frequency (categorical variable where less than once a week is the base)				
Once a week	0.303** (0.132)	-0.025 (0.597)	0.292* (0.163)	-0.171 (0.217)
Twice a week	0.394*** (0.129)	-0.061 (0.598)	0.276* (0.155)	0.022 (0.216)
More than twice a week	0.449*** (0.144)	0.114 (0.604)	0.616*** (0.169)	0.150 (0.228)

Variables	Unprocessed O. Shiranus	Processed O. Shiranus	Unprocessed O. (Nyasalapia)	Processed O. (Nyasalapia)
	Coefficient (Std. Err.)	Coefficient (Std. Err.)	Coefficient (Std. Err.)	Coefficient (Std. Err.)
Geographical factor (dummy)				
City (1=Blantyre 0=Lilongwe)	-0.157** (0.068)	-0.292** (0.125)	-0.073 (0.074)	0.329*** (0.105)
Knowledge (dummy)				
Nutrition (1=Yes, 0=No)	-0.080 (0.100)	-0.517*** (0.195)	-0.051 (0.113)	-0.754*** (0.174)
Access to tilapia products information (dummies)				
Availability (1=Yes, 0=No)	-0.206** (0.086)	-0.410*** (0.139)	-0.215** (0.088)	-0.060 (0.147)
Price (1=Yes, 0=No)	0.202** (0.090)	-0.058 (0.128)	-0.052 (0.095)	-0.094 (0.140)
Market factors (continuous)				
Price (logged - MWK)	-0.215** (0.084)	-0.117 (0.134)	-0.031 (0.081)	-0.525*** (0.122)
Distance (km)	0.003 (0.002)	0.005** (0.002)	0.001 (0.002)	0.001 (0.003)

Variables	Unprocessed O. Shiranus	Processed O. Shiranus	Unprocessed O. (Nyasalapia)	Processed O. (Nyasalapia)
	Coefficient (Std. Err.)	Coefficient (Std. Err.)	Coefficient (Std. Err.)	Coefficient (Std. Err.)
Perception and Tilapia attributes consideration (dummies, 1=Yes and 0=No)				
Colour	-0.072 (0.073)	-0.146 (0.162)	-0.142* (0.080)	-0.145 (0.104)
Size	0.007 (0.069)	-0.383*** (0.137)	-0.017 (0.080)	0.061 (0.109)
Taste	0.074 (0.072)	-0.205 (0.131)	0.017 (0.072)	-0.104 (0.108)
Ease to cook	-0.341*** (0.089)	-0.273* (0.163)	-0.049 (0.100)	0.306** (0.134)
Appearance	0.066 (0.069)	0.032 (0.111)	-0.052 (0.080)	-0.003 (0.093)

CONCLUSION

- Generate linked information on consumer decision-making processes on preferences, choice and purchased quantities.
  - most consumers generally prefer and choose *O. shiranus* over the wild *O. (Nyasalapia)*
  - mismatch between the correlates of choice and the quantity demanded for tilapia, suggesting that the determinants of choice are not the same as the determinants of demand
  - lower prices are likely to increase demand for fish products
  - Complementary and substitutability attributes of the products
- Information is important to help different stakeholders along the food chain to provide a product that meets the consumers' needs

RECOMMENDATIONS

1. Promote cost minimization strategies along the tilapia fish value chain
   - *produce more of the highly preferred medium-sized tilapia*
   - *Invest in fish feed production*

2. Promote tilapia fish production
   - *public and private investments in the aquaculture sub-sector*
   - *Supporting the producers with tilapia fingerings*
   - *providing fish breeding and management trainings.*

3. Promote tilapia fish processing:
   - *supporting small scale producers with trainings on fish processing*
   - *Large scale fish processers should be supported with or invest in facilities that shall enable them process more tilapia product*

RECOMMENDATIONS

4. Ensure tilapia fish products availability

- *invest in storage materials, promote the sector so that more people join the value chain*
- *support consumers with income generating activities.*

5. Promote or/and advertise the available tilapia products on the market

- *Price and availability information and nutrition knowledge dissemination*

LUANAR

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THANK YOU SO MUCH