ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

Food Consumption Behavior in Uganda: A Censored Regression Analysis Using Micro-data

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Manuscript Info

Manuscript History:

Received: 18 June 2015
Final Accepted: 15 July 2015
Published Online: August 2015

Key words:

Consumer Economics, Income, Distribution, Food, Demographics

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Abstract

Rising incomes have lowered poverty rates and influenced food consumption patterns in Uganda. Additionally to incomes and prices and household demographics, changes in lifestyles, such as urbanization, home-production and other factors, shape consumption by location. Our study evaluates the consumption of 14 food groups, focusing on staple foods and using the LA/AIDS framework. We found that urban families consume more matooke (Green bananas), sugar, other cereals, oils, fruits and vegetables, fish, dairy products, other foods, and pulses than their counterparts in the rural areas. Households located in border districts more likely purchase maize, matooke, and meat than those in non-border areas.

INTRODUCTION

Since 1985 Uganda has been going through a period of transition; a transition from the era of dictatorship under Idi Amin and the subsequent failed governments to the present government of the National Resistance Movement (NRM) led by President Yoweri Museveni. During this period, Uganda has experienced relative political calm and has also recorded high economic growth rates. According to the United Nations Statistics Division the economy of Uganda grew at the average rate of 6.2% between the year 1987 and 2003. These positive developments have in turn impacted consumption patterns of Uganda. Economists have identified income and prices as the main determinants for consumption patterns. Other determinants that have been identified include household demographics, changes in lifestyles, regional factors, urbanization, home-production and other events. In this study, in addition to the said variables, border-effect will be examined as a possible determinant for consumption patterns. Understanding these factors is very important for food demand analysis in Uganda because it will give us a better understanding of how food demand responds to changes in prices, income, and government policies.

The purpose of this study was to analyze food demand patterns of Ugandan households and conduct econometric analyses of food demand structure utilizing 11 different variables, namely: income levels, price, region, urbanization status of the household, production of food by household, and border effect as well as the socio-demographic characteristics size of household, education status of head of household, sex of head of household, and age of head of household. The main objective was to test the hypothesis as to whether low income consumers resort to greater substitution within the starchy food groups (i.e. cereals).

The Linear Approximation of Almost Ideal Demand System (LA/AIDS), was tested econometrically for 14 food commodities using 1999/2000 Uganda National Household Budget Survey (UNHS) data from the Uganda Bureau of Statistics (UBOS) are used.

LITERATURE REVIEW

While there has been a proliferation of food demand studies elsewhere in the world, there is a very limited number of studies that have involved Africa and very few of these studies covered whole countries.

Some of the first studies in this area were by Savadogo and Brandt (1988) utilized the 1982-1983 survey of 65 households in Ouagadougou, Burkina Faso, and specified a demography-augmented LA/AIDS model, which had Engel aggregation restrictions imposed. The main results showed that two-thirds of the cereal budget was allocated to rice and wheat. Reardon et al. (1992), using 1984 to 1985 survey data conducted amongst 125 households in Ouagadougou, Burkina Faso, also utilized the demography-augmented LA/AIDS model, with Engel aggregation restrictions imposed and estimated using ITSUR method. The results showed that rice is the main urban staple food for both low- and high-income households. The results also show that although wheat and its products account for small percentage in budget share, this share increases with income. Nweke et al. (1992), in a study that covered southeastern Nigeria, estimated, using an OLS-Instrumental Variables method, elasticities of demand for major food items in a root- and tuber-based food system. Cassava was found to be the next most important staple food, especially for low-income households. The cassava product (gari) is a normal good, and its consumption increases as income increases among high-income urban households. Gari (cassava), rice, and legumes were found to be gross substitutes for yam. Dorosh et al. (1994) used a demography-augmented LA/AIDS model with symmetry and homogeneity restrictions imposed to test for food aid and poverty alleviation in Mozambique. They estimated income and price elasticities using survey data collected in the year 1991-1992 from 1816 households in the greater Maputo, Mozambique. The results from this study show that expenditure on food, as a percentage of income, was 80% for the poor and 65% for the non-poor.

Model Specification

This study will apply the LA/AIDS model, which was developed by Deaton and Muellbauer (1980a, 1980b). To begin, an AIDS model for the 14 food commodities is estimated as follows:

$$w_i = \alpha_\iota + \sum_j \gamma_{ij} \ln(pj) + \beta_j \ln(\frac{x}{p}) + \mu_\iota \ , \ i = 1,\ldots..14 \qquad (1)$$

where w_i (≥ 0) is the budget share of food product i, p_j is the price of food commodity j, x is the total expenditure on food commodity in question, μ_i's are random disturbances assumed with zero mean and constant variance, and P is a translog price index which is defined by:

$$\log P = \alpha_\iota + \sum_k \alpha_\kappa \ln p_k + \frac{1}{2}\sum_k \sum_l \gamma_{\kappa\lambda} \ln p_k \ln p_l \qquad (2)$$

k = 1,….,14 i = 1,……,14

The model defined by the Equations (1) to (2) is called the AIDS model. However, the price index in Equation (2) raises difficulties of estimation because of non-linearity in parameters. To avoid the non-linearity problem, Asche and Wessells (1997) suggested the application of the Stone index, which is widely used for LA/AIDS estimation. Moschini (1995) suggested the creation of a log-linear analog of the
Laspeyres price indexes as:

$$\ln(P^*) = \sum_j w_i \ln(p_i) \ , \qquad i=1,\ldots..,14 \qquad (3)$$

where w is the budget share among 14 commodities. The Stone index is an approximation proportional to the translog, which means that P = φP* where E (ln (φ)) = α_0. The LA/AIDS model with the Stone index is, therefore,

$$w_i = \alpha_\iota^* + \sum_j \gamma_{ij} \ln(p_j) + \beta_\iota \ln(\frac{x}{p^*}) + \mu_\iota^* \ , \qquad (4)$$

where $\alpha_i^* = \alpha_\iota - \beta_i \alpha_i$ and $\mu_i^* = \mu_i - \beta_i(\ln(\varphi) - E(\ln(\varphi))$.

According to Moschini (1995), prices will never be perfectly collinear. He found that applying the Stone index will introduce the units of measurement error. To overcome this measurement error problem, Moschini (1995) suggested the log-linear analogue of the Laspeyres price index be obtained by replacing w_i in Equation (3) with $\overline{w}_i$, which implies mean budget share. The Laspeyres price index, therefore, becomes a geometrically weighted average of prices:

$$\ln(P^L) = \sum_i \overline{w}_i \ln(P_i) \qquad (5)$$

When (5) is substituted into (4), it yields an LA/AIDS model with the Laspeyres price index as follows:

$$w_i = \alpha_i^{**} + \sum_j \gamma_{ij} \ln(p_j) + \beta_i (\ln(x) - \sum_j \overline{w}_j \ln(p_j)) + \mu_i^{**} \quad (6)$$

where $w_i = \alpha_i^{**} = \alpha_i - \beta_i(\alpha_0 - \sum_j \overline{w}_j \ln(p_j))$

To conform to microeconomic theory, the adding-up, homogeneity, and symmetry properties of a demand function can be imposed on the LA/AIDS parameters. The adding-up restriction is satisfied with given $\sum_i w_i = 1$ for all j;

$$\sum_i \alpha_t = 1, \sum_i \beta_t = 0, \text{ And } \sum_k \gamma_{kj} = 0 \quad (7)$$

The homogeneity restriction is satisfied for the LA/AIDS model, if for all j,

$$\sum_k \gamma_{jk} = 0 \quad (8)$$

Symmetry is satisfied by:

$$\gamma_{ij} = \gamma_{ji} \quad (9)$$

In this study, weak separability is assumed so as to allow a two-stage budget process. Food demand will be estimated by applying the Working (1993) model in stage one and LA/AIDS in stage two.

To include socio-demographic factors in this study, the basic LA/AIDS model that has been specified must be extended. This is done by following Pollak and Wales (1978, 1981) where they modified the original cost function so that the constant term becomes

$$\alpha = \alpha + \sum_{j=1}^{n} p_j d_j \quad (10)$$

where d_j represents household characteristics. This method is known as a linear demographic translation and is used to preserve the linearity of the system. As a result, the derived system of share equations takes the form:

$$w_i = \alpha_i^{***} + d + \sum_j \gamma_{ij} \ln(p_j) + \beta_i (\ln(x) - \sum_j \overline{w}_j \ln(p_j) + \mu_i^{***} \quad (11)$$

In the diary records method that was used to collect UNHS data, many zero expenditures are reported. The problem of zero expenditure has to be dealt with because if one includes zero observations in an econometric estimation without special treatment, this would lead to biased and inconsistent estimators (Intriligator et al., 1996). To treat the problem, the Generalized Heckman Procedure that was proposed by Heckman (1979) is applied. This approach follows a two-step estimation procedure that provides consistent and efficient parameter estimates. In step one, the probability that a given household would purchase a good is determined by a probit regression using all available observations. The probability is used to compute Mill's Ratios (λ) for each household and food commodity. In step two, Mill's Ratios (λ) are used as the instrument that incorporates censoring latent variables in the demand function.

DATA

Data for commodity groups described in this analysis were collected by the Uganda National Household Survey (UNHS) conducted nationally by the Uganda Bureau of Statistics (UBOS). The period covered by the survey is the fiscal year 1999-2000. A stratified, two-stage sampling design was applied in all districts, except the districts that lacked an Enumeration Area (EA) frame. In these districts, the sample was selected in three stages. For the districts with a two-sampling stage design, the first sampling unit was the EA of the 1991 population census in districts with the household as the second sampling unit. For each district with a three-stage sampling design, the first stage sampling unit was the parish, the second sampling unit was the LC-1 (village), and the third sampling unit was the household. About 10,700 households were covered in the survey, encompassing all the districts except Kitgum, Gulu, Kasese, and Bundibugio

RESULTS AND DISCUSSIONS

The expenditure coefficients for maize, fat and oil, dairy, and pulses are negative in the LA/AIDS estimations, implying that these food categories are necessities (Tables 2a, 2b). On the other hand, the expenditure coefficients for sugar, fish, cereal, fruit and vegetables, meat, and alcohol are positive, which implies that these

foods are luxuries. Results further showed that Ugandans with higher incomes consume more rice, fruits and vegetables, and soft beverages than their low-income counterparts. Low-income households consumed more staple food products, such as matooke, maize, and cereals.

In this study (Tables 2a, 2b), there was a positive and significant correlation between households located in urban areas and the consumption of fruit and vegetables. There was also a strong and positive correlation between these households and the consumption of matooke, maize, sugar, cereal, fats and oil, fish, dairy products, and alcohol. Households that reside in the border districts of Uganda consume significantly higher amounts of matooke, sugar, oils, fruits and vegetables, dairy products, alcohol and pulses than do households in the interior districts.

Education attainment of the head of household had a positive, significant correlation with food consumption. When the individual food groups are scrutinized (Tables 2a, 2b), households with heads that possess a higher education consume significantly higher amounts of maize and alcohol. Female headed households consumed more maize, rice, dairy products, sugar, beverages, and pulses, but less matooke, cereals, fats and oils, fish, and meats than male-headed households. There was also a positive and significant correlation between households with children under the age 6 (N1) and the consumption of food products, such as dairy products, meat, matooke, fats and oil, and fruits and vegetables. Households with members aged 13 to 19 (N3) and aged 20 to 55 (N4) consumed significantly larger amounts of matooke and fats and oils than their counterparts aged over 55 (N5) and the consumption of maize, cereal, rice, and beverage is important to households with these age groups.

Households that engaged in production of matooke experienced significant, reduced consumption shares of this food product relative to households that were not engaged in matooke production. Seasonal coefficients had significant explanatory influence in the consumption of meat, fish, and sugar. The expenditure elasticities (Tables 3a, 3b), for food and for all food groups are positive, implying that food is a normal good. The point elasticity estimates for matooke, maize, cereal, fish, meat, and pulses are greater than unity, implying that for these food categories, an increase in total food expenditures will result in more than proportionate increase in expenditure shares. On the other hand, estimates for rice, sugar, fruit and vegetables, meat, dairy products, and soft beverages are all less than unity, implying that an increase in future expenditures on food will result in less than proportionate increases in expenditures on these food groups.

Own-price elasticities for all food groups carried the expected negative sign. Own-price elasticities for alcohol, pulses, dairy, fruits and vegetables, and fats and oil are elastic, while staple food products, such as matooke, maize, rice, sugar, and cereals, are inelastic to price changes. Ugandan consumers consider pulses, dairy, meat, oils, sugar, rice, and maize as substitutes for cereals. However, cereal demand complements fruits and vegetables, soft beverages, and alcohol. Ugandan consumers view vegetables as a complement of rice, cereals, meat, dairy, beverages, and pulses, while pulses complement meat, vegetables, and fish consumption.

The results of the estimates for the compensated cross-price elasticities (Table 3b) indicates that these elasticities are fairly low, as compared to the uncompensated elasticities in almost all categories, but they do indicate that some food categories are gross complements, while others are gross substitutes. The cross-price elasticities of cereal demand with respect to the price for pulses, dairy, meat, oils, sugar, rice, and maize have positive signs, which imply that consumers view these products as substitutes. This result implies that an increase in the price of cereal will lead to Ugandan consumers increasing their demand for maize, rice, sugar, oils, meat, dairy, and pulses. This further indicates that a 10% increase in the price of cereal will lead to an 8.4%, 3.1%, 3.1%, 1%, 6.8%, 11.2%, and 10.7 % increase in the demand of maize, rice, sugar, oils, meat, dairy, and pulses, respectively. The cross-price elasticities of cereal demand with respect to the prices of fruits and vegetables, beverages, and alcohol are negative, which implies that these food products are complements. Vegetables have negative signs vis-à-vis rice, cereal, meat, dairy, beverages, and pulses. This leads to the conclusion that Ugandan consumers view vegetables as a complement of rice, cereal, meat, dairy, beverages, and pulses. Another important result is that pulses have a negative relationship with the consumption of meat, vegetables, and fish, indicating that pulses are considered complements of meat, vegetables, and fish.

Calculated price and expenditure elasticities for low-income households are shown on tables 4a, 4b. In these tables, only the cross-price elasticities are considered for discussion. Compensated cross-price elasticities for cereal demand with respect to the prices of matooke, maize, rice, sugar, dairy products, and pulses are all positive, implying that these foods are substitutes. This result indicates that at lower incomes, price changes results in greater consumer substitution within the starchy food groups. At the mean expenditures, the substitution within the starchy foods only occurs within maize, rice, sugar, and pulses. However, at the lower expenditures, this occurs within the starchy food groups of matooke, maize, rice, sugar, and pulses.

Table 1a. Probit Estimates of Parameters for Ugandan Household Food Purchases, 1999/2000.

Dependent Variable													**Stage 2**	
Decision to Purchase:	**MATOOKE 1**		**MAIZE 2**		**RICE 3**		**SUGAR 4**		**CEREAL 5**		**OILS 6**		**FRUIT & VEGE 7**	
Explanatory variables	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**
Intercept	0.371[a]	3.63	3.275[a]	9.17	1.684[a]	14.47	1.537[a]	9.82	-3.653[b]	-2.04	1.688[a]	11.67	-1.228	-1.82
EASTERN	0.500[a]	5.86	0.024[c]	1.85	-0.052[a]	-4.90	0.183[a]	8.65	0.608[b]	2.14	-0.017	-1.41	-0.096	-2.98
NORTHERN	-0.737[a]	-4.67	0.891[a]	6.53	0.214[a]	8.72	0.402[a]	9.99	0.603[b]	2.14	0.066[a]	3.95	-0.155	-3.21
WESTERN	0.079[a]	4.53	0.102[a]	5.01	0.042[a]	4.14	0.256[a]	9.32	0.317[b]	2.11	0.236[a]	8.58	-0.177[a]	-3.22
BORDER	0.265[a]	5.49	-0.795[a]	-6.31	0.006	0.64	-0.120[a]	-7.20	0.076[b]	2.16	-0.041[a]	-3.06	0.236[a]	3.18
PCFEXP	0.008[a]	4.91	0.024[a]	6.03	0.013[a]	5.80	0.015[a]	7.79	0.011[b]	2.20	0.015[a]	7.03	0.003[a]	2.48
PROD	0.156[a]	4.95	0.010	0.81	0.116[a]	7.33	-0.080[a]	-5.67	0.521[b]	2.13	-0.079[a]	-5.24	1.008[a]	2.99
URBAN	0.117[a]	4.65	-0.259[a]	-6.07	-0.278[a]	-7.80	-0.189[a]	-8.56	0.030[b]	2.10	-0.201[a]	-7.71	-0.241[a]	-2.87

Notes: Superscripts a, b and c indicate statistical significance at 99, 95 and 90 percent levels, respectively. Data source: UNHS 1999/2000

Table 1b. Probit Estimates of Parameters for Ugandan Household Food Purchases, 1999/2000.

Dependent Variable	**Stage 2**													
Decision to Purchase:	**MEAT 8**		**FISH 9**		**DAIRY 10**		**BEVERAGES 11**		**ALCOHOL 12**		**OFOODS 13**		**PULSES 14**	
Explanatory variables	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**
Intercept	-1.221[c]	-1.80	1.222[a]	7.28	-3.691[b]	-1.99	1.455[a]	26.47	-2.646	-1.01	1.057[a]	7.21	-8.211[a]	-7.94
EASTERN	0.084[b]	2.26	-0.013	-0.95	-0.164[b]	-2.06	0.141[a]	6.59	0.165	1.05	0.014[b]	2.23	0.399[a]	8.39
NORTHERN	0.073[b]	2.16	-0.023	-1.05	0.143[b]	2.07	0.267[a]	7.36	0.366	1.06	-0.007	-1.21	1.482[a]	8.61
WESTERN	-0.057[b]	2.11	0.282[b]	2.28	0.297[b]	2.06	0.345[a]	7.81	-0.114	-1.04	-0.006	-1.17	0.118[a]	7.10
BORDER	0.062[b]	2.21	0.050[c]	1.80	0.160[b]	2.06	-0.001	-0.10	0.043	1.05	-0.001	-0.13	-0.234[a]	-8.21
PCFEXP	0.012[b]	2.35	-0.004	-1.41	0.019[b]	2.09	-0.012[a]	-6.32	-0.001	-0.98	0.001	1.59	0.025[a]	8.36
PROD	0.363[b]	2.07	-0.027	-1.32	0.456[b]	2.06	-0.084[a]	-5.36	0.278	1.05	-0.046[a]	-3.65	3.186[a]	8.38
URBAN	-0.031[b]	-2.00	-0.028	-1.42	-0.405[b]	-2.05	-0.167[a]	-6.91	0.071	1.06	0.007	1.29	-0.068[a]	-5.24

Notes: Superscripts a, b and c indicate statistical significance at 99, 95 and 90 percent levels, respectively. Data source: UNHS 1999/2000

variable	Stage 1				Stage 2											
Budget share	FOOD		NON- FOOD		Matooke		Maize		Rice		Sugar		Cereal		Fats & Oils	
variable	coeff	t-stat	coeff	t-stat	coeff	t-stat	coeff	t-stat	coeff	t-stat	coeff	t-stat	coeff	t-stat	coeff	t-stat
Intercept	0.406[a]	6.50	0.585[a]	8.68	-0.008	-0.09	-0.083[c]	-1.86	0.094[c]	1.91	0.032	0.74	-0.392[a]	-2.59	0.005	0.18
CENTRAL	-0.021[a]	-7.64	0.024[a]	8.48	0.020	0.44	-0.029	-1.22	0.018	0.70	-0.025	-1.03	0.009	0.20	0.014	0.90
EASTERN	0.009[a]	3.16	-0.003	-0.94	-0.049	-0.94	-0.039[c]	-1.67	-0.005	-0.19	-0.050[b]	-2.14	0.059	1.20	-0.003	-0.18
WESTERN	-0.012[a]	-4.22	0.016[a]	5.18	-0.019	-0.43	0.011	0.43	0.010	0.36	-0.060[b]	-2.49	0.068	1.44	0.025	1.57
BORDER	0.002	0.81	-0.002	-0.67	0.092[b]	2.42	0.035[c]	1.88	0.001	0.03	0.042[b]	2.23	0.062[c]	1.81	0.032[a]	2.61
HHSIZE	0.001	1.32	-0.001	-1.10	-0.021[b]	2.09	-0.007	-1.19	-0.008	-1.34	0.002	0.38	-0.015	-1.52	-0.005	-1.37
HHAGE	0.000	-0.98	0.000	0.89	0.001[b]	1.96	-0.000	-0.05	0.000	0.24	0.000	0.87	-0.000	0.00	0.000	0.06
HHFEM	0.005[c]	1.89	-0.005[c]	-1.83	-0.045[c]	-1.70	0.007	0.49	0.017	1.06	0.000	0.01	-0.027	-0.99	0.009	0.99
HHHMS	-0.002[b]	-1.97	0.002[b]	2.08	-0.004	-0.24	0.009	1.13	-0.014[c]	-1.70	0.004	0.49	-0.008	-0.53	-0.006	-1.22
N1 (<6)	-0.004[a]	-2.65	0.004[a]	2.58	0.024[c]	1.70	0.004	0.55	0.012	1.42	0.001	0.12	0.012	0.88	0.008[c]	1.67
N2 (7 to 12)	-0.002	-1.53	0.002	1.23	0.019	1.16	0.012	1.35	0.004	0.38	-0.000	-0.04	0.017	1.04	0.003	0.21
N3 (13 to 19)	-0.002	-1.25	0.002	1.13	0.047[a]	3.02	0.008	0.96	0.010	1.08	-0.000	-0.06	0.017	1.09	0.005	0.82
N4 (20 to	-	-0.53	0.001	0.52	0.038	2.08	0.013	1.40	0.000	0.02	-	-0.21	0.029	1.61	0.013	1.95

54)	0.001				[b]						0.002				[c]	
PROD	-				-											
	0.039 [a]	-7.26	0.044	1.34	0.046 [c]	-1.70	0.003	-0.22	0.040 [b]	2.33	0.027 [c]	1.81	0.046	1.47	0.011	-1.09
TCEXP1	-															
	0.001 [a]	-7.30	0.001 [a]	7.34	0.001	0.54	0.002 [c]	1.65	0.002 [c]	1.89	0.000	0.22	0.001	0.26	0.000	0.27
TCEXP2			-		-		-									
	0.00 0 [a]	5.68	0.000 [a]	-5.62	0.000 [a]	-2.85	0.000 [c]	-1.63	0.000	0.05	- 0.000	-1.21	- 0.000	-0.54	-0.017	-0.62
URBAN	0.004 [c]	1.67	- 0.004	- 1.52	0.001	0.05	0.012	1.17	- 0.006	-0.58	0.004	0.37	0.010	0.53	0.006	0.89
QUARTE R	- 0.001	-0.30	0.001	0.41	- 0.035	-0.98	- 0.026	-1.41	0.003	0.15	0.011 [c]	1.79	0.015	0.43	- 0.006	-0.48
HHEducat ion	0.004 [b]	1.94	- 0.005 [b]	-2.11	- 0.020 [c]	-1.63	0.014 [b]	2.12	- 0.012 [c]	-1.75	- 0.010	-1.49	- 0.017	-1.42	- 0.003	-0.66
lTCEXPp	-						-									
	0.055 [a]	- 6.86	0.055 [a]	4.90	0.010	0.78	0.014 [b]	-1.98	- 0.006	-0.74	0.001	0.15	0.010	0.79	- 0.001	-0.15
lpmatook					0.060 [b]	2.43	- 0.000	-0.04	- 0.001	-0.05	- 0.000	-0.08	0.013	0.53	0.023 [a]	2.65
lpmaize					0.068	1.27	0.026	0.89	0.030	0.96	0.040	1.38	0.010	0.20	0.032	1.68
lprice					- 0.062	-1.03	0.018	0.58	- 0.008	-0.23	- 0.005	-0.16	0.061	1.05	- 0.022	-1.00
lpsugar					- 0.071 [b]	-2.04	0.004	0.21	0.003	0.14	- 0.006	-0.30	- 0.017	-0.51	0.003	0.25
lpcereal					0.179 [b]	2.51	- 0.050	-1.32	0.014	0.34	- 0.021	-0.55	0.015	0.21	0.005	0.18
lpfoil					- 0.004	-0.31	- 0.005	-0.71	0.006	0.83	- 0.019 [a]	-2.77	- 0.007	-0.56	- 0.002	-0.45
lpfeg					- 0.006	0.26	0.008	0.67	- 0.013	-1.06	0.013	1.17	- 0.001	-0.05	0.008	1.04
lpmeat					- 0.298 [a]	-2.82	- 0.048	-0.85	- 0.147 [b]	-2.36	- 0.098 [c]	-1.74	- 0.099	-0.95	- 0.042	-1.12
lpfish					- 0.016	-1.16	0.000	0.01	0.001	0.07	- 0.002	-0.27	0.005	0.36	0.001	0.22

lpdairy					0.552[b]	2.06	0.098	0.72	0.384[b]	2.56	0.017	0.12	0.409[c]	1.66	0.213[b]	2.41
lpbev					-0.002	0.24	-0.001	-0.45	0.003	0.84	-0.005	-1.47	-0.001	-0.15	-0.000	-0.11
lpalcohol					-0.047	0.84	-0.037	-1.23	0.007	0.21	-0.037	-1.27	0.043	0.79	0.066[a]	3.39
lppulses					-0.001	-0.02	-0.008	-0.42	-0.042[b]	-2.04	-0.004	-0.20	0.033	0.98	-0.017	-1.41
MR	-0.061[a]	-5.73	0.950[a]	7.45	-0.008	-0.19	0.007	0.35	0.004	0.32	-0.006	-0.31	0.132[a]	2.78	0.024[b]	2.25

Table 2a. Estimated Parameters of Heckman Two-Stage LA/AIDS model (UNHS 1999/2000).

Notes: Superscripts a, b and c indicate statistical significance at 99, 95 and 90 percent confidence levels, respectively.

variable														**Stage 2**
Budget share	**Fruit & veg**		**Meat**		**Fish**		**Dairy**		**Beverages**		**Alcohol**		**Pulses**	
variable	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**		**t-stat**		**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**
Intercept	0.169	1.53	-0.126	-0.67	-0.067	-1.17	-0.102	-1.21	0.080[a]	2.81	0.050	0.06	-0.034	-0.29
CENTRAL	-0.021	-0.66	-0.114	-1.51	0.027	0.90	0.039	1.48	-0.013	-0.83	-0.110	-1.52	0.031	1.24
EASTERN	-0.048	-1.49	-0.103	-1.35	0.010	0.32	-0.022	-0.83	-0.031[b]	-2.01	-0.112	-1.21	-0.007	-0.28
WESTERN	-0.007	-0.21	-0.056	-0.73	-0.030	-1.02	-0.007	-0.26	0.009	0.56	0.009	0.12	0.009	0.34
BORDER	0.063[b]	2.53	0.144[b]	2.46	0.027	1.21	0.078[a]	3.85	-0.006	-0.49	0.047	0.86	0.048[b]	2.56
HHSIZE	-0.007	-0.96	-0.014	-0.84	0.004	0.61	-0.003	-0.49	-0.006[c]	-1.69	0.044[a]	2.68	-0.010[c]	-1.69
HHAGE	-	-0.85	0.001	0.63	0.000	0.34	-	-1.62	0.000[b]	1.97	-	-2.48	0.000	1.12

	0.000						0.001[c]				0.003[b]			
HHFEM	-0.003	-0.16	-0.032	-0.69	-0.023	-1.29	0.017	1.09	0.011	1.16	-0.034	-0.79	0.019	1.30
HHHMS	-0.009	-0.81	-0.024	-0.96	0.005	0.52	0.002	0.24	-0.006	-1.11	-0.015	-0.66	-0.000	-0.05
N1 (<6)	0.025[b]	2.48	0.048[b]	2.04	-0.004	-0.46	0.020[b]	2.39	0.007	1.56	-0.015	-0.70	0.007	0.89
N2 (13 to 19)	0.004	0.31	0.023	0.82	0.006	0.51	-0.010	-0.98	-0.005	-0.91	-0.037	-1.37	0.003	0.35
N3 (20 to 54)	-0.005	-0.43	0.006	0.23	0.000	0.00	0.008	0.83	0.012[b]	2.23	-0.050[b]	-2.02	0.010	1.20
N4 (20 to 54)	0.012	0.92	0.015	0.50	0.003	0.30	0.003	0.27	0.008	1.34	-0.072[b]	-2.47	0.012	1.24
PROD	-0.042	-0.81	0.103[c]	1.93	-0.019	-1.04	-0.007	-0.41	0.021[b]	2.27	0.058	0.68	0.040	0.98
TCEXP1	0.001	0.78	0.001	0.17	-0.000	-0.08	-0.001	-0.70	0.001[c]	1.64	-0.000	-0.02	0.000	0.37
TCEXP2	0.000	0.18	-0.000	-1.35	-0.000[c]	-1.66	-0.000	-0.84	0.000[c]	1.75	-0.000	-1.03	0.000	0.28
URBAN	0.032[b]	2.22	-0.004	-0.14	0.003	0.24	0.002	0.15	-0.002	-0.32	0.010	0.29	-0.005	-0.46
QUARTER	-0.000	-0.00	0.033[c]	1.70	0.015	1.99[b]	0.020	0.96	0.018	1.45	0.028	0.50	-0.027	-1.39
HHHED	-0.002	-0.20	-0.044[b]	-2.18	-0.005	-0.65	-0.007	-1.01	-0.002	-0.50	0.017	0.88	-0.006	-0.87
lTCEXPp	0.000	0.05	0.019	0.90	0.004	0.49	-0.004	-0.51	-0.009[b]	-2.08	0.033	1.60	-0.005	-0.70
lpmatook	0.041[b]	2.25	0.037	0.87	-0.002	-0.16	0.049[a]	3.38	0.001	0.08	-0.069[c]	-1.73	0.026[c]	1.88
lpmaize	0.092[b]	2.37	0.055	0.60	-0.018	-0.49	-0.025	-0.77	0.022	1.18	-0.147[c]	-1.74	0.025	0.85
lprice	-0.03	-0.83	0.070	0.70	0.028	0.71	0.037	1.07	-0.011	-0.52	0.282[a]	3.03	-0.025	-0.76

	5													
lpsugar	-0.027	-1.12	-0.054	-0.95	0.006	0.27	0.012	0.59	-0.001	-0.12	-0.088	-1.57	-0.021	-1.11
lpcereal	0.009	0.18	0.081	0.68	-0.013	-0.28	0.040	0.94	-0.050[b]	-2.06	-0.123	-1.04	-0.038	-0.98
lpfoil	0.006	0.65	-0.015	-0.70	-0.013	-1.61	-0.008	-1.07	0.004	0.96	-0.037[c]	-1.82	0.009	1.22
lpfeg	0.005	0.31	-0.004	-0.12	0.010	0.72	0.026[c]	1.94	-0.025[a]	-3.39	0.014	0.40	-0.011	-0.89
lpmeat	-0.210[a]	-2.65	-0.313[c]	-1.77	-0.021	-0.30	-0.120[c]	-1.91	-0.064[c]	-1.77	0.294[c]	1.75	-0.146[b]	-2.51
lpfish	0.007	0.73	0.018	0.78	0.013	1.45	0.012	1.54	0.001	0.14	0.034	1.57	-0.003	-0.40
lpdairy	0.346[b]	1.99	0.817	1.87	0.109	0.65	0.305	2.06	-0.007	-0.08	0.057	0.15	0.1462	1.06
lpbev	-0.007	-1.54	0.006	0.59	0.005	1.24	-0.008[b]	-2.22	0.009[a]	4.32	0.007	0.73	0.001	0.19
lpalcohol	0.000	0.01	-0.050	-0.54	0.006	0.16	0.049	1.50	0.026	1.39	-0.091	-1.00	0.006	0.18
lppulses	-0.040	-1.61	-0.020	-0.34	0.013	0.56	0.014	0.71	0.012	0.99	0.030	0.56	0.016	0.83
MR	-0.053	-0.98	0.073	1.42	0.057[b]	2.43	0.073[b]	2.55	0.009	0.72	0.012	0.05	0.027	0.60

Table 2b. Estimated Parameters of Heckman Two-Stage LA/AIDS model (UNHS data, 1999/2000)

Notes: Superscripts a, b and c indicate statistical significance at 99, 95 and 90 percent confidence levels, respectively.

Table 3a: Uncompensated Price and Expenditure Elasticities: LA/AIDS with Inverse Mills Ratio

Food Item	**Uncompensated price elasticity**														
	Mean budget share	**mat**	**maize**	**rice**	**sugar**	**cereal**	**oil**	**veg**	**meat**	**fish**	**dairy**	**bev**	**alcoh**	**pulses**	**EXPEND. Elasticity**

Food	**44%**														**1.48261**
Non-food	**56%**														**1.84623**
matooke	5.7%	-0.622	0.078	-0.197	-0.089	-0.168	0.315	0.459	0.069	-0.098	0.183	0.062	-0.547	0.212	**1.04914**
maize	9.2%	0.130	-0.417	-0.397	0.148	0.740	1.005	1.829	-0.249	0.014	0.180	-0.555	-1.999	0.726	**1.09070**
rice	8.1 %	-0.278	-0.358	-0.435	-0.105	0.229	-0.930	-0.765	0.399	-0.035	0.390	0.731	2.493	-4.846	**0.89568**
sugar	9.1%	-0.134	0.144	-0.113	-0.701	0.220	0.211	0.033	-0.038	0.255	0.499	0.588	-0.825	-0.470	**1.00623**
cereal	4.4%	-0.120	0.378	0.139	0.116	-0.980	0.070	-0.107	0.181	-0.196	0.759	-1.716	-0.995	0.867	**1.12345**
oil	4.2%	0.213	0.461	-0.481	0.096	0.059	-1.022	0.166	0.021	-0.104	-0.040	0.187	-0.257	-0.010	**0.96308**
veg	4.1%	0.306	0.846	-0.399	0.012	-0.109	0.167	-1.290	-0.095	0.022	-0.160	-0.594	0.054	-0.448	**0.85339**
meat	14.1%	0.135	-0.417	0.730	-0.068	0.532	0.073	-0.315	-0.968	0.341	-0.636	-0.788	3.064	-1.886	**0.91728**
fish	10.2%	-0.171	0.015	-0.043	0.306	-0.459	-0.268	0.064	0.261	-0.857	0.196	0.530	0.396	-1.822	**1.02392**
dairy	6.5%	0.199	0.128	0.315	0.358	1.055	-0.060	-0.240	-0.280	0.117	-1.045	-1.715	-1.750	1.077	**1.04017**
beverage	2.0%	0.003	-0.134	0.189	0.131	-0.787	0.090	-0.304	-0.124	0.099	-0.561	-0.488	0.065	1.003	**0.55063**
alcohol	9.6%	-0.906	-1.239	1.147	-0.921	-2.172	-0.617	0.151	2.158	0.370	-1.744	0.364	-1.272	1.488	**1.05323**
pulses	5.6%	0.197	0.423	-1.350	-0.290	1.015	0.003	-0.536	-1.251	-0.953	1.539	2.845	0.818	-1.440	**1.16824**

Data source: UNHS 1999/2000

Table 3b: Compensated Price and Expenditure Elasticities: LA/AIDS with Inverse Mills Ratio

Food Item															
		Compensated price elasticity													
	Mean budget share	**mat**	**maize**	**rice**	**sugar**	**cereal**	**oil**	**veg**	**meat**	**fish**	**dairy**	**bev**	**alcoh**	**pulses**	**EXPEND Elasticity**
Food	**44%**														**1.48261**
Non Food	**56%**														**1.84623**
matooke	5.7%	-0.562	0.140	-0.145	-0.032	-0.104	0.370	0.508	0.122	-0.039	0.242	0.093	-0.486	0.279	**1.04914**
maize	9.2%	0.219	-0.324	-0.320	0.234	0.836	1.087	1.902	-0.170	0.102	0.269	-0.508	-1.909	0.826	**1.09070**
rice	8.1 %	-0.198	-0.275	-0.367	-0.028	0.314	-0.857	-0.701	0.468	0.042	0.469	0.772	2.573	-4.757	**0.89568**
sugar	9.1%	-0.045	0.237	-0.036	-0.615	0.316	0.293	0.106	0.039	0.342	0.588	0.635	-0.735	-0.371	**1.00623**
cereal	4.4%	-0.074	0.425	0.178	0.160	-0.830	0.113	-0.070	0.221	-0.151	0.804	-1.692	-0.948	0.918	**1.12345**
oil	4.2%	0.254	0.503	-0.446	0.136	0.103	-0.984	0.201	0.057	-0.064	0.001	0.208	-0.215	0.035	**0.96308**
veg	4.1%	0.347	0.890	-0.363	0.052	-0.064	0.205	-1.256	-0.059	0.063	-0.119	-0.572	0.096	-0.401	**0.85339**
meat	14.1%	0.278	-0.267	0.852	0.068	0.686	0.204	-0.198	-0.843	0.481	-0.495	-0.713	1.208	-1.726	**0.91728**

fish	10.2%	-0.064	0.127	0.047	0.409	-0.344	-0.171	0.151	0.354	-0.753	0.303	0.586	0.504	-1.702	**1.02392**
dairy	6.5%	0.263	0.195	0.370	0.419	1.123	-0.002	-0.188	-0.224	0.180	-1.028	-1.681	-1.686	1.148	**1.04017**
beverage	2.0%	0.024	-0.112	0.207	0.151	-0.764	0.109	-0.287	-0.105	0.120	-0.540	-0.477	0.086	1.026	**0.55063**
alcohol	9.6%	-0.806	-1.135	1.233	-0.825	-1.065	-0.525	0.233	1.245	0.468	-2.644	0.416	-1.072	1.600	**1.05323**
pulses	5.6%	0.253	0.481	-1.303	-0.237	1.075	0.054	-0.490	-1.203	-0.898	1.595	1.874	0.874	-1.202	**1.16824**

Data source: UNHS 1999/2000

Table 4a: Uncompensated Price and Expenditure Elasticities: LA/AIDS with Inverse Mills Ratio (LOW INCOME)

Food Item	**Uncompensated price elasticity**														
	Mean budget share	**mat**	**maize**	**rice**	**sugar**	**cereal**	**oil**	**veg**	**meat**	**fish**	**dairy**	**bev**	**alcoh**	**pulses**	**EXPEND. Elasticity**
Food	**44%**														**1.48261**
Non-food	**56%**														**1.84623**
matooke	5.7%	-1.110	0.174	0.046	0.003	0.015	0.331	0.419	0.0182	0.041	0.303	0.025	0.021	-1.328	**1.38963**
maize	9.2%	0.270	-0.778	-0.130	-0.169	0.810	0.332	0.676	-0.395	-0.170	-0.032	-0.946	-0.539	1.089	**1.06968**
rice	8.1 %	-0.012	-0.121	-0.638	0.086	0.456	-0.312	0.228	0.563	0.085	0.453	0.5653	0.822	-1.587	**0.67178**
sugar	9.1%	-0.034	-0.174	0.115	-0.975	0.629	-0.153	-0.778	4.839	1.083	2.202	2.097	-1.881	-1.290	**0.93375**
cereal	4.4%	0.008	0.413	0.279	0.330	-1.404	-0.053	-0.962	-0.708	-0.224	0.513	-0.840	-0.059	1.399	**1.11284**
oil	4.2%	0.221	0.152	-0.160	-0.071	-0.050	-1.126	-0.349	0.147	-0.126	-0.089	0.108	-0.079	0.325	**0.95997**
veg	4.1%	0.258	0.310	0.137	-0.363	-0.8852	-0.352	-0.616	-0.148	0.171	0.211	-0.845	-0.061	0.548	**0.89534**
meat	14.1%	0.078	-0.633	1.051	7.769	-2.185	0.520	-0.460	-1.752	0.279	-0.498	-1.330	1.483	-1.480	**1.19698**
fish	10.2%	0.077	-0.203	0.117	1.299	-0.519	-0.325	0.444	0.209	-0.594	0.172	0.989	0.717	-1.848	**1.02799**
dairy	6.5%	0.342	-0.017	0.326	1.561	0.717	-0.144	0.301	-0.207	0.105	-0.155	-4.845	-1.126	-1.187	**0.86276**
beverage	2.0%	-0.063	-0.227	0.166	0.480	-0.405	0.054	-0.438	-0.219	0.189	-1.538	-0.444	0.122	1.586	**0.14338**
alcohol	9.6%	-0.193	-0.636	1.170	-2.093	-0.200	-0.179	-0.134	0.937	0.657	-1.665	0.881	-0.307	-0.012	**0.76373**
pulses	5.6%	-1.231	0.6704	-1.155	-1.741	1.909	0.448	0.776	-1.481	-1.524	-1.051	1.443	0.123	-1.385	**1.40059**

Data source: UNHS 1999/2000

Table 4b: Compensated Price and Expenditure Elasticities: LA/AIDS with Inverse Mills Ratio (LOW INCOME)

Food Item	compensated price elasticity														
	Mean budget share	mat	maize	rice	sugar	cereal	oil	veg	meat	fish	dairy	bev	alcoh	pulses	EXPEND. Elasticity
Food	**44%**														**1.48261**
Non Food	**56%**														**1.84623**
matooke	5.7%	-1.030	0.235	0.085	0.056	0.079	0.386	0.470	0.086	0.099	0.353	0.033	0.0645	-1.248	**1.38963**
maize	9.2%	0.389	-0.686	-0.072	-0.089	0.905	0.414	0.752	-0.293	-0.082	0.041	-0.934	-0.474	1.029	**1.06968**
rice	8.1 %	0.092	-0.040	-0.587	0.157	0.541	-0.239	0.296	0.654	0.163	0.518	0.576	0.880	-1.448	**0.67178**
sugar	9.1%	0.084	-0.083	0.173	-1.055	0.723	-0.071	-0.702	1.941	1.170	2.276	2.109	-1.816	-1.171	**0.93375**
cereal	4.4%	0.068	0.460	0.309	0.371	-1.355	-0.011	-0.923	-0.655	-0.178	0.551	-0.833	-0.025	1.460	**1.11284**
oil	4.2%	0.275	0.194	-0.133	-0.034	-0.006	-1.089	-0.314	0.195	-0.085	-0.055	0.113	-0.049	0.380	**0.95997**
veg	4.1%	0.314	0.353	0.164	-0.326	-0.840	-0.314	-0.580	-0.100	0.212	0.246	-0.840	-0.030	0.604	**0.89534**
meat	14.1%	0.268	-0.487	1.143	7.896	-2.033	0.651	-0.338	-1.589	0.419	-0.381	-1.311	1.587	-1.289	**1.19698**
fish	10.2%	0.219	-0.093	0.186	1.394	-0.405	-0.227	0.535	0.331	-0.489	0.260	1.004	0.795	-1.705	**1.02799**
dairy	6.5%	0.427	0.048	0.367	1.618	0.785	-0.085	0.355	-0.134	0.168	-0.208	-4.837	-1.079	-1.102	**0.86276**
beverage	2.0%	-0.036	-0.206	0.179	0.499	-0.383	0.073	-0.420	-0.195	0.209	-1.521	-0.441	0.138	1.613	**0.14338**
alcohol	9.6%	-0.061	-0.534	1.234	-2.004	-0.094	-0.088	-0.048	1.051	0.755	-1.582	0.894	-0.234	0.121	**0.76373**
pulses	5.6%	-1.157	0.727	-1.119	-1.692	1.108	0.499	0.824	-2.418	-2.469	-1.005	1.451	0.164	-1.460	**1.40059**

Data source: UNHS 1999/2000

CONCLUSIONS

Ugandan households dwelling in urban settings differ significantly from their rural counterparts only in their consumption of fruits and vegetables. Low-income Ugandan households appear to substitute consumption within particular food groups, such as the starchy food group. For example, at low incomes, households substituted between cereal, matooke, maize, sugar, and rice, whereas at mean incomes, the household substitution is between cereal, rice, sugar, and maize. The inclusion of matooke as a substitute for these starchy staples, especially for low-income consumers, leads us to conclude that there is greater substitution within the starchy food group.

Ugandans with higher incomes consume more rice, fruits and vegetables, and soft beverages than their low-income counterparts. Low-income households, on their part, consumed more matooke, maize, and cereals, supporting previous studies in Africa that show higher income consumers shifting away from coarse grains, such as sorghum and millet. Significantly, households that are located in border areas consume greater quantities of matooke, sugar, oils, fruits and vegetables, dairy products, alcohol and pulses compared to interior districts.

Food purchases for households producing food (rural households) are more sensitive to price and income changes, especially as far as matooke is concerned. This sensitivity follows from these food-producing households being able to substitute home produced food for purchased food. As other studies have shown, home food production will lead to improved nutritional intake in Uganda. Because food and nutritional security is a major objective of the current government (NFNC, 2002), this study will also assist planners to identify policies that ensure adequate nutritional intake throughout Uganda.

The limitation of this study has been lack of up to date data because Uganda Household Survey data collection is not conducted on regular interval. Future studies should look at how the proliferation of mobile phones and the usage has affected consumption patterns in Uganda.

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