GRAIN DEMAND AND CONSUMPTION IN MBALE, LIRA AND KABALE DISTRICTS OF UGANDA

THE CASE OF MAIZE, BEANS, GROUND NUTS AND RICE

H.Kato[1], B. Bashaasha[1] and J.Bonabana[2]

College of Agricultural and Environmental Sciences, School of Agricultural Sciences, Department of Agribusiness and Natural Resource Economics, Makerere University, P. O. Box 7062,Kampala Uganda

Corresponding author:hkkatebo@gmail.com

Abstract

Aspects of economic policy formulation and strategic industry planning in the food sector require estimates of food demand elasticities. Food grains are the main staple foods in Uganda and comprise about 90% of total food consumption. The study based on cross sectional data of the Uganda national household survey (UNHS) 2009/2010 collected by Uganda bureau of statistics (UBOS) between May 2009 to April 2010

The study estimates the grain demand elasticity and consumption in Mbale, Lira and Kabale districts of Uganda, the case maize flour, beans dry, rice and pounded ground nut. The study has two objectives; the first objective determines grain consumption pattern and the second estimates demand elasticity using LA/AIDS model. Structural stability of data, adding-up, homogeneity and symmetry restrictions of demand theory were tested, The system Wald test of linear homogeneity and symmetry showed that the estimated parameters of the model satisfied the null hypothesis of valid linear homogeneity and symmetry restriction of demand theory. Finally the LA/AIDS were estimated imposing homogeneity and symmetry restriction by means of SUR method.

The estimated expenditure coefficient for rice, beans and maize flour are negative and they are significant at 5% level of significance since their P-Values are less than 0.05. This indicates that rice, beans and maize flour are necessities in the Districts of Mbale, Lira and Kabale.

The coefficient of ground nuts pounded is positive and not significant at a 5% level of significance which implies that ground nuts are taken as substitutes in the three districts. All the Marshallian own price elasticities are found to be negative as expected. The negative own-price elasticity indicates that the demand curve of the corresponding commodity is downward sloping, that satisfied the law of demand. The own price elasticities for beans, maize flour, rice and ground nuts pounded were -0.89,-0.25,-1.13 and -0.72 respectively

Expenditure elasticities are negative and inelastic for the maize (-0.72), beans (-0.60),and rice(-0.98), this indicates that the three grains are necessary goods in Mbale, Lira and Kabale districts while the expenditure elasticity for ground nuts pounded (1.97) is positive meaning it’s a luxury or a substitute. The estimates of cross price elasticities show prevalence of substitutability where beans and ground nuts, maize and rice are substitutes while maize and beans, maize, and ground nuts, rice and beans, rice and ground nuts are complements.

1. INTRODUCTION

Uganda is a landlocked country in Eastern Africa lying 1º00´ North of the Equator and 32º00´ East of Greenwich. The country has a total land area of 241,039 square kilometers, over 75% of which is arable land and 25% comprises of inland waters and wetlands (USAID, 2012). Uganda has a population growth rate of 3.2% per year higher than the Sub-Saharan Africa average of 2.4% (UBOS, 2011). According to UNDP (2007), the midyear (2007) population projection for Uganda was 28.2 million, of which 87% were rural dwellers and 73% engaged in agriculture.

The economy of Uganda is dominated by the Agricultural sector since independence in 1962. Agriculture is the largest and most significant source for providing food, income generation and employment opportunities for the rural people in the country. Thus, the productivity, growth and efficiency of this sector are the center piece to any economic development planning of Uganda. This sector is dominated by food grains production and a few traditional cash crops like coffee, tea and cotton.

Although Uganda’s Agricultural sector has experienced various shocks due to natural calamities like floods, droughts, landslides and inadequate policy reforms, the growth in food grain production especially maize and beans have outpaced population growth largely because of the spread of green revolution technology in Uganda through input market liberalization. Agriculture is also the major source of raw materials for the domestic industry while at the same time it makes substantial contribution to the country‘s balance of trade (Sikuru and Ogemah,2005).

Following trade liberalization and formation of the East African Community (EAC) in the early 1990s and 2000s respectively, for the first time, food grain production exceeded the target requirement in Uganda but due to rapid population growth, food grain mainly rice is necessary to import to meet the chronic food shortage (Agona *et al.*, 2009).

The food security situation of Uganda depends on the development of Agricultural sector which provides 90% of yearly food requirement and hence its improvement contributes towards the economic growth and development of the nation (World Bank, 2011). Thus, any policy changes or shocks in this sector will largely affect the wellbeing of the majority, the consumers, the producers and the rural poor people who are directly or indirectly involved in this sector (MAAIF, 2011).

Agricultural share to GDP reduced from approximately 40% in 2001/02 down to 35% in 2004/05, as a consequence of structural adjustment and due to unreliable weather pattern, land fragmentation compounded by limited use of technology, post harvest loses, crop pests and diseases, poor road networks, limited Agricultural research and extension services, lack of credit, inefficient markets, bad weather, decreasing soil fertility, gender inequalities, heavy human disease burden and insecurity in the North and Eastern Uganda among other factors (UNDP, 2007 and UBOS, 2008).

Food availability situation in Uganda depends on domestic production, exports, imports and storage. In Uganda, maize and beans are the major food grains although ground nuts and rice are consumed at an increasing rate. Uganda produces enough quantities of the major foods like maize, beans and ground nuts and imports about 60,000 MT of rice mainly from Vietnam

(Nakakeeto, 2011).Although the share of food grain in the daily diet has decreased in terms of weight and calorie intake over the years, it is still the main source of food calorie and protein supply in Uganda (www.wfp.org/wfp078255.pdf).

Uganda needs about 240,000 MT of rice, 638,000 MT of maize, 370,000 MT of beans and 180,000 MT of ground nuts (USAID, 2012) for consumption per year. Demand for food is an important structural component within which the Agriculture sector must operate (WFP, 2006). The consumption of grains especially maize and beans in Uganda has increased over a period of decade particularly after 1996 and the prices of food grains in the world market have been steadily rising for years (FAO, 2008). After formation of the EAC, the production of food grain in Uganda increased slightly because of ready market from some member states (World Bank, 2011).

2 THE MODEL

2.1 THEORETICAL MODEL

Deaton and Muellbauer (1980) developed a demand system called the Almost Ideal Demand System (AIDS), it has the added advantages of being compatible with aggregation/duality over consumer's decision making without violating any of the axioms of rational consumer choice, has a functional form which is consistent with known household-budget data. It is derived from a specific cost function and therefore corresponds with a well-defined preference structure which is convenient for welfare analysis.

The AIDS model provides price and income elasticities that are consistent with consumer theory and are more flexible than those obtained from commonly used demand systems (Taljaard *et. al*, 2003), so following the standard practice a linear approximation is applied to the AIDS model making it Linear Approximated Almost Ideal Demand Systems (LA/AIDS). Because of the above advantages and properties, the AIDS model is chosen as an applied demand system for analysis.

2.2 Estimating an Almost Ideal Demand System Model

The Almost Ideal Demand System (AIDS) model of Deaton and Muellbauer (1980) is derived from utility function and is specified as an expenditure function. It belongs to the preference price independent logarithmic (PIGPIG) class and defines the minimum expenditure to attain a specific level of utility at a given price and satisfies the necessary conditions for consistent aggregation across consumers. Starting from a specific cost function, the AIDS model gives the budget share equations of the food grains as

$$w_i = \alpha_i + \sum_{j}^{n} \gamma_{ij} \ln p_j + \beta_i \ln({}^{X}/_{P^*})$$

Where w_i is the ith commodity budget expenditure share estimated as $w_{i=}p_j X_j /M$

α_i is the constant coefficient in the ith share equation,

γ_{ij} is the price coefficient associated with the jth good in the ith share equation,

p_j is the price on the jth good/ normalized nominal retail price of food grain

X_j are the quantities of goods/food grains

X is the total expenditure on all food grains in the system given by

$$X = \sum_{i=j}^{n} p_j \, q_j$$

in which q_i is the quantity demanded for the jth good. P^* is the aggregate price index defined by

$$\ln P^* = \alpha_O + \sum_{i=1}^{n} \ln p_i + \frac{1}{2} \sum_{i}^{n} \sum_{j}^{n} \gamma_{ij} \ln p_i \ln p_j$$

in the nonlinear AIDS model.

The aggregate price index makes the system non-linear which complicates the estimation process when aggregate annual time data are used.

Deaton and Muellbauer (1980) suggested a linear approximation of the nonlinear AIDS model by specifying a linear price index, the stone price index replaces aggregate price index, this index can be formulated as follows,

$$\ln P^* = \sum_{i=1}^{n} w_i \ln p_i$$

This gives rise to the linear approximate AIDS (LA/AIDS) model. In practice, the LA/AIDS model is more frequently estimated than the nonlinear AIDS model.

The advantage of the LA/AIDS model is that homogeneity and symmetry restriction are easily imposed and tested while adding up is automatically used and the budget share must sum up to unity.

To be in line with economic theory, different parameters in the nonlinear AIDS model/demand equation must satisfy the following restriction:

Adding up,

$$\sum_{i=1}^{n} \alpha_i = 1, \sum_{i=1}^{n} \beta_i = 0, \sum_{i=1}^{n} \gamma_{ij} = 0$$

They express the property that the sum of the budget shares equals 1

Homogeneity is satisfied if, and only if for all *i*

$$\sum_{j}^{n} \gamma_{ij} = o$$

The restriction expresses the prediction that the demand functions are homogenous of degree zero in prices and expenditure/income

And symmetry is satisfied if

$$\gamma_{ij} = \gamma_{ji}, j \neq i$$

Slutsky symmetry is satisfied only if the above restrictions hold.

3. Modeling household characteristics in AIDS

The aids model specified above without demographic variables. Ray (1982) incorporated the family size by using the Barten (1964) type household utility function and suggested the model as

$$w_i = \alpha_i + \sum_{j}^{n} \gamma_{ij} \ln p_j + \beta_i \ln({}^{X}/_{P^*}) + \eta_i \text{ In } z$$

Where, In $P^* = \alpha_i + \sum_j^n w_j \text{ In } P_j$ and x $= \frac{X}{Z}$ is the per capita household expenditure and γ_{ij}, η_i denotes the effects of prices and family size respectively on budget share. Here the use of family size, Z ,as a deflator for X.

3.1. Model specification

In order to further improve equation, the AIDS model is extended by incorporating the household characteristic occupation of the household head'. Thus, the final equation becomes

$$w_i = \alpha_i + \sum_{j}^{n} \gamma_{ij} \ln p_j + \beta_i \ln x + \sum_{i} \omega_{ij} D_i + \eta_i \text{ In } z + \varepsilon_i$$

i,j=1,2,….8; i=1,2,3,4

Where, ω_{ij} is the parameter of the model.

Also m $= \frac{x}{P^*}$

P_j = prices of different commodities

D_1=1, if the household head is a cultivator/farmer

0, otherwise

D_2=1, if the household head is a professional (salary)

0, otherwise

D_3=1 if the household head is a businessman

0, otherwise

D_4=1, if the household head's occupation is other than these

0, otherwise

3.2. Estimation

Data based on household surveys often present a major estimation problem which could be stemming from any given household as many goods have zero consumption, as the solution to this problem of non consumption, demand equations can be estimated by the censored regression model given by

$y_t = \beta' x_t + \epsilon_t$, if RHS>0

=0, otherwise

3.3 Estimation of Elasticities

The mashallian price and expenditure elasticities are given as below

Marshallian own price elasticities can be estimated by

$$\varepsilon_{ij}^{M} = -\delta_{ij} + \frac{\gamma_{ij}}{S_i} - \frac{\beta_i}{w_i} w_J,$$

$$\eta_i = 1 + \frac{\beta_i}{w_i}$$

Where δ is the Kronelker delta when $i \neq j$

The Hisksian cross price elasticites can be obtained through slutsky equation in elasticites for good i with respect to j

$$\varepsilon_{ij}^{H} = \varepsilon_{ij}^{M} + \eta \, w_j, \text{ as;}$$

$$\varepsilon_{ij}^{H} = -\delta_{ij} + \frac{\gamma_{ij}}{w_i} + w_j.$$

4. Variables in the model

The independent variables are the relative consumer prices for each type of food grain and the per capita household expenditure on food grains, the dependent variable is the expenditure/budget share of each grain for each equation.

The expenditure share of each type of grain (w_i) is expressed as the proportion of the consumer expenditure for each type of food grain divided by the per capita household expenditure for food grains in the system ($w_{i=}p_j\, X_j\, /M$) The real total expenditure is the ratio of total expenditure on food grains, total expenditure for food grains is the sum of consumer expenditure on each type of grain.

The demographic variables are; age, sex, level of education, household size and source of income

RESULTS

5. Household size

Table 1.The household size affects the per capita consumption of a given family, households with many family members tend to spend a lot or part of their income on food and demand large quantities. On average rural households tend to have many family members compared to their counterparts in urban areas, the same applies to income groups. Many households have family members between 3-5 members.

5.1. Empirical results

5.1.1. Food consumption pattern by households per District

Table 2**.**Per capita consumption levels are different between the income groups, in the rural and urban area and at district level. In urban areas, per capita consumption of rice is higher especially in Mbale district as compared to other districts, this means households have higher income and are less involved in Agriculture while in rural area especially kabale district, households consume more of maize flour than their counterparts.

Mbale district has the highest level of grain consumption compared to other districts and most households take beans, rice and maize as complements and pounded ground nuts as substitutes. Generally households in all districts consume more of beans than groundnuts; this is due to prices, product accessibility and longevity/durability

Food consumption pattern will be changed when the per capita income is higher than earlier. Increasing per capita income also led to diversification of food items.

Food consumption pattern will be changed when the per capita income is higher than earlier. Increasing per capita income also led to diversification of food items. Diversification of food items will improve the nutritional status and well-being of human life.

5.1.2. Systems Wald tests for Homogeneity and Symmetry

The important properties of a demand function which can be used to restrict an empirical demand function are; adding up, homogenous of degree zero in prices coefficient and the cross price derivatives are symmetry. The Wald test was used to test the hypothesis of linear homogeneity, symmetry, and both linear homogeneity and symmetry. To implement these tests, the LA/AIDS model was estimated without imposing homogeneity and symmetry and the budget share of others grain excluded to satisfy the adding up property

Table 3: The results indicated that the null hypothesis of the restrictions of valid homogeneity and symmetry are accepted at the 5 % significance level. This indicates that the used data are consistent with the consumer utility maximizing theory

5.1.3. Homogeneity of Sample Means

Table 4**.**The Significance value (P-Value) is 0.000, so it's significant at 5% level. Because of the P-value is significant, we reject the null hypothesis and conclude that there is a statistically significant difference between the means of the samples.

5.1.4. Test for Equality of Variances

The Levene's test allows us to check for equality of variance, if the spread of the data in the two different groups is different (Unequal variances), then the Levine's test will tell us that. Levene's test is used to assess the homogeneity of variance between sets of scores.

It tests the null hypothesis that "there is no significant difference between the sample variances". Remember that 'variance' is a measure of the spread of the data.

Table 5.Levene's test produces a significant result since P=0.000 (i.e. *P* is less than 0.05), then we conclude that "Equal variances are not assumed". In this case, the result suggests lack of homogeneity of variance and this makes our null hypothesis invalid hence there is a significant difference between the sample variances.

5.1.5. Parameter Estimates of an LA/AIDS for food grain Demand in Mbale, Kabale and Lira District (homogeneity and symmetry imposed)

5.1.5.1 Budget share parameter estimates of an LA/AIDS for food grain Demand in Mbale District

Table 6.The Probability F-statistic (0.00000) shows that the overall regression results are significant at 5% level. All the estimated budget share coefficients are statistically significant at a 5% level since their probability values are less than 0.05(P=0.0000<0.05), this is also clearly shown by the t-statistic where |t| >2.0 (rule of thumbs. Since all budget share in this study are positive, then the estimated parameter satisfy monotonicity in prices of the underlying cost function. The magnitudes of the coefficients in the table above show that rice takes the biggest part of households' budget in Mbale, followed by Maize flour, beans and groundnuts pounded take the least portion of the households' budget. The R^2 99.9% of the changes in the household budget on food grains are attributed to the consumption of beans, rice, maize flour and groundnuts pounded in Mbale District.

5.1.5.2. Budget share parameter estimates of an LA/AIDS for food grain Demand in Mbale District

Table 7.The Probability F-statistic (0.00000) shows that the overall regression results are significant at 5% level. All the estimated budget share coefficients are statistically significant at a 5% level since their probability values are less than 0.05(P=0.0000<0.05), this is also clearly shown by the t-statistic where |t| >2.0 (rule of thumbs. Since all budget share in this study are positive, then the estimated parameter satisfy monotonicity in prices of the underlying cost function. The magnitudes of the coefficients in the table above show that rice takes the biggest part of households' budget in Mbale, followed by Maize flour, beans and groundnuts pounded take the least portion of the households' budget. The R^2 99.9% of the changes in the household budget on food grains are attributed to the consumption of beans, rice, maize flour and groundnuts pounded in Mbale District.

5.1.5.3. Budget share parameter estimates of an LA/AIDS for food grain demand in Kabale District

Table 8**.**The Probability F-statistic (0.00000) shows that the overall regression results are significant at a 5% level. In addition, the estimated budget share coefficients are statistically significant at a 5% level since their probability values are less than 0.05. The magnitudes of the coefficients in the table above show that Maize flour takes the biggest part of households' budget

in Kabale District, followed groundnuts pounded, maize flour, rice and beans take the least portion of the households' budget. The R^2 shows that 99.9% of the changes in the household budget on food grains are attributed to the consumption of beans, rice, maize flour and groundnuts pounded in Kabale district. All budget share in this study are positive which implies that estimated parameter satisfy monotonicity in prices of the underlying cost function

5.1.6. Household Expenditure Parameter Estimates for Mbale District

Table 9: The results of the regression are significant at a 5% level since the Probability of the F-statistic (0.027082) is less than 0.05. The results further show that all the estimated expenditure coefficients are significant at a 5% level. Looking at the nature of the 4 food grains in Mbale district, the results show that maize flour, beans and rice are necessities since their coefficients are negative and groundnuts pounded is taken as a luxury in Mbale district.

The magnitudes of estimated expenditure coefficients show that households in Mbale district spend more on beans followed by rice, maize flour and spend less on groundnuts pounded since it's taken as a luxury. The R^2 58.9% of the changes in the household expenditure can be attributed to changes in the consumption of the four food grains.

5.1.7. Household Expenditure Parameter Estimates for Kabale District

Table 10.The results show that all the estimated expenditure coefficients are significant at a 5% level. Looking at the nature of the food grains under study in Kabale district, the results show that maize flour, beans and rice are necessities since their coefficients are negative and groundnuts pounded is taken as a luxury in Kabale district as it is in Mbale district. The magnitudes of estimated expenditure coefficients show that households in Kabale district spend more on Maize flour followed by beans, rice and spend less on groundnuts pounded since it's taken as a luxury. The R-squared value shows that 13.3% of the changes in the household expenditure can be attributed to change in the four consumption of the food grains and this clearly show that food grains take a small portion of the households' income in Kabale.

5.1.8. Household Expenditure Parameter Estimates for Lira District

Table 11**.**The overall results of the regression are significant at a 5% level since the Probability of the F-statistic (0.031182) is less than 0.05. The results further show that all the estimated expenditure coefficients are significant at a 5% level. The nature of the food grains under study in Lira district shows that maize flour, beans and groundnuts pounded are necessities since their

coefficients are negative and rice is taken as a luxury in Lira district. The magnitudes of estimated expenditure coefficients show that households in Lira district spend more on groundnuts pounded followed by Maize flour, beans and spend less on rice since it's taken as a luxury. The R-squared value shows that 94.8% of the changes in the household expenditure can be attributed to change in the four consumption of the food grains and this clearly show that food grains take a big portion of the households' income in Lira

5.1.9. Marshallian own price elasticity

Table 12.All the Marshallian own price elasticities are found to be negative as expected. The negative own-price elasticity indicates that the demand curve of the corresponding commodity is downward sloping, that satisfied the law of demand. The own price elasticities for beans, maize flour, rice and ground nuts pounded are; -0.89, -0.25,-1.13 and -0.72 respectively. This can be interpreted as: a 1 percent fall (rise) in the price of beans will increase (reduce) the quantity of beans demanded by 0.89 percent.

All expenditure elasticities are positive and for groundnuts pounded it is elastic, this implies that groundnuts pounded are not necessary food grains in the area under study. The expenditure elasticity for rice was 0.98, which is quite high but it is consistent within the high income group. The expenditure or income elasticity of groundnuts pounded is very high i.e. 1.97, which indicates groundnuts pounded demand increase a lot if incomes increase. Generally, Marshallian estimates provide better measure of the responsiveness for any particular grain to changes in its own-price than to the changes in the price of other grains. The relative low expenditure elasticity of beans (0.60) indicates that beans can be considered a necessity as a protein source.

5.1.10.Hicksian cross price elasticity

Table 13.The positive sign of the cross price elasticity of grains indicate that they are substitutes and the negative indicate that they are complements. The cross price elasticity of demand for beans with respect to maize flour is 0.31 and since it is less than zero, the beans and maize flour are complementary food grains. This implies that a unit increase in the price of beans will lead to a 31% increase in the quantity of maize flour consumed. That means the change of rice, and maize flour demand respond to pounded ground nuts price change is very low. The estimates of cross price elasticities show prevalence of substitutability where beans can be substituted for groundnuts pounded and maize flour can be substituted for rice.

The estimates further show that beans and maize flour, beans and rice, rice and groundnuts pounded, maize flour and groundnuts pounded are complements since their elasticities are positive. This implies that an increase in price of one grain will lead to a decrease in the quantity consumed of the other grain. Since all computed own-price Marshallian elasticities from the estimated parameters of LA/AIDS model are negative, thus, the concavity of the cost function at the sample mean is ensured. Since the estimated parameters of the model are consistent with all the theoretical restrictions, therefore the estimated elasticities are important implication for policy analysis.

5.1.11 Conclusion

From the results of the study, the estimated LA/AIDS model supported the theoretical properties of homogeneity and symmetry. Moreover, the other conditions for monotonicity and concavity of the cost function were satisfactory. Thus, the calculated elasticities from the estimated model are theoretical consistent and reliable. The Expenditure elasticities of rice, beans and maize flour are inelastic indicating that they are necessary food grains in Mbale, Kabale and Lira District, while the expenditure elasticity for groundnuts pounded was high and elastic. Hicksian compensated cross price elasticity indicated prevalence of substitutability where beans can be substituted for groundnuts pounded and maize flour can be substituted for rice. The estimates further show that beans and maize flour, beans and rice, rice and groundnuts pounded, Maize flour and groundnuts pounded are complements since their elasticities are positive. The Marshallian uncompensated showed that all expenditure elasticities are negative and for groundnuts pounded it is elastic which implies that groundnuts pounded are not necessary food grains in the area under study.

REFERENCES

Ahsan H.,Iftikhar Z. and Kemal M. Ali (2011) *The Determinants of Food Prices*: A Case Study of Pakistan, Pakistan institute of development economics, Islamabad

Agona A., Nabawanuka J.and. Muyinza H,(2009) *An overview of maize in Uganda*, Postharvest Programme. NARO Uganda

Akhtarul A., (2011) An Analysis of Consumption Demand Elasticity and Supply Response of Major Food grains in Bangladesh.

Asche, F., Wessells, C. (1997),*On price indices in the almost ideal demand system*. American Journal of Agricultural Economics, 79(5): 1182-1185.

Catalist-Uganda,(2012),Increasing Incomes by Sustainably Commercializing Smallholder Agriculture through Improved Productivity and Market Development Project proposal

Chalfant, J., (1987). “A Globally Flexible, Almost Ideal Demand System.” *Journal of Business and Economic Statistics*. 5(2): 233 – 242

Chern, W.S. Assessment of Demand-Side Factors Affecting Global Food Security.

Chern, W.S., Carter, C.A. and Shei, S.Y. (Ed.), *Food Security in Asia: Economics and Policies*. Cheltenham, UK: Edward Elgar Publishing Limited, 2000.

Crop area and production report (2010) Uganda census for agriculture 2008/09

Deaton, A. and Muellbauer, J. (1980): Economics and Consumer Behaviour. Cambridge University Press, New York.

Deaton, A. and Muellbauer, J. “An Almost Ideal Demand System.” *American Economics Review* 70 (1980a): 312-336

Dickey, D.A. and Fuller, W.A., (1979). “Distribution of the Estimators for Autoregressive Time Series with a Unit Root.” *Journal of the American Statistical Association* 74(366): 427 - 431.

Food and Agriculture Organization (FAO) of the United Nations (2011), Uganda Facts and Figures: (Online) Available form: FAOSTAT database (www.fao.org).

Haggblade. S.and Dewina.R, (2010) “Variation in staple food prices in Uganda: Causes, consequence, and policy options”, under the African Agricultural Marketing Project (AAMP

Kasozi J. (2011),Uganda increases production, decreases import of rice.

Liu H., and Deblitz C.(2007),Determinants of meat consumption in China, Asian agribusiness research centre, Charles Stuart University

Menyha E. (2010), effect of agricultural inputs and extension services on household crop production in Uganda.

Ministry of Agriculture, Animal Industry and Fisheries, (2011), statistical abstract, Agricultural Planning Department.

Mbeine E. and Ebong J. (2006), upland rice sub sector study report Iganga district, Eastern Uganda.

Moschini, G. "Units of Measurement and the Stone Index in Demand System." *American Journal of Agricultural Economics* 77 (1995): 63-68.

Nakakeeto G. (2011) The Impact of Technical Measures on Agricultural Trade: A Case of Uganda, Senegal, and Mali. Improving Food Security through Agricultural Trade

Nzuma J.M. and Sarker R (2008), An error corrected almost ideal demand system for major cereals in Kenya, Selected Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Orlando, Florida

Oroma L. (2010**)**, Effects of food aid on household consumption and marketed production: the case of maize in northern Uganda.

Okoboi.G,(2010) Of what merit is improved inputs use in Uganda's maize productivity Contributed Paper presented at the Joint 3rd African Association of Agricultural Economists (AAAE) and 48th Agricultural Economists Association of South Africa (AEASA) Conference, Cape Town, South Africa.

Paraguas M.D.S. (2006), Estimation of meat demand system in Malaysia: Model selection between The Rotterdam model and The FDLAIDS model,Universiti sains Malaysia.

Pouw N,(2005), food priorities and poverty in Uganda

Rose, D. *et al.*, (1999), Household food consumption in Mozambique: A case study in three northern districts.

Sikuru E.M.D and Ogemah V. (2005),Improving smallholder marketing of potatoes and Ground nuts in Eastern Uganda, Sustainable Agriculture Centre Research, Extension and Development in Africa

Shoreline Service Limited (2007), Grains sub sector analysis, Beans, Groundnuts, Sorghum and upland rice.

Sheng.T.Y. *et al*., (2008), Demand analysis of food in Malaysia: A study of malay ethnic

Table 1: Household size

Household size(people)	Frequency	Percentage
1	5	2.5
2	14	7.0
3	36	18.0
4	35	17.5
5	36	18.0
6	16	8.0
7	13	6.5
8	10	5.0
9	14	7.0
10	13	6.5
11	8	4.0
Total	**200**	**100.0**

Source: UBOS 2009/2010

Table 2: Food consumption pattern by households per District

District name			Residential status Urban (%)	Rural (%)	**Total (%)**
KABALE	Consumption item code	Rice	9.4	15.6	25.0
		Maize flour	10.9	18.8	29.7
		Beans dry	12.5	12.5	25.0
		Ground nuts pounded	10.9	9.4	20.3
	Total		**43.7**	**56.3**	**100.0**
LIRA	Consumption item code	Rice	10.0	15.0	25.0
		Maize flour	13.4	13.3	26.7
		Beans dry	8.3	20.0	28.3
		Ground nuts pounded	8.3	11.7	20.0
	Total		**40.0**	**60.0**	**100.0**
MBALE	Consumption item code	Rice	19.7	6.6	26.3
		Maize flour	17.1	10.5	27.6
		Beans dry	15.8	7.9	23.7
		Ground nuts pounded	15.8	6.6	22.4
	Total		**68.4**	**31.6**	**100**

Source: UBOS 2009/2010

Table 3: Systems Wald tests for Homogeneity and Symmetry

Parameter restrictions	Chi-Square Value	Std. Error	t-static	Sig.
Homogeneity	2.331	.027	11.239	.003
Symmetry	0.370	.039	8.756	.017
Homogeneity and Symmetry	1.291	.037	7.425	.000

Source: UBOS 2009/2010

Table 4: Test for Equality of Means

Method	Df	Value	Probability
Anova F-statistic	(17, 3580)	16.79216	0.0000

Source: UBOS

Table 5: Test for Equality of Variances

Method	Df	Value	Probability
Levene	(17, 3580)	18.68093	0.0000
Brown-Forsythe	(17, 3580)	10.86516	0.0000

Source: UBOS 2009/2010

Table 6: Budget share parameter estimates of an LA/AIDS for food grain Demand in Mbale District

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	0.999838	0.001975	506.3412	0.0000
Budget share G-nuts pounded	0.992164	0.005515	179.9025	0.0000
Budget share Rice	1.002916	0.002899	346.0031	0.0000
Budget share Maize flour	1.001147	0.002705	370.1168	0.0000
Budget share Beans	0.998337	0.002697 / 0.002697	-370.3168 / 371.1658	0.0000 / 0.0000

R-squared	0.999676	Mean dependent var	0.363600
Adjusted R-squared	0.999662	S.D. dependent var	0.316790
S.E. of regression	0.005822	Akaike info criterion	7.402585
Sum squared resid	0.002406	Schwarz criterion	7.278985
Log likelihood	281.5969	F-statistic	73014.66
Durbin-Watson stat	1.730296	Prob(F-statistic)	0.000000

Source: UBOS 2009/2010

Table 7: Budget share parameter estimates of an LA/AIDS for food grain demand in Kabale District

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	1.002679	0.002106	476.1548	0.0000
Budget share G-nuts pounded	1.002637	0.005038	199.0012	0.0000
Budget share Rice	0.998367	0.003044	327.9355	0.0000
Budget share Maize flour	1.005896	0.003069	327.7553	0.0000
Budget share Beans	0.993583	0.003031	327.7553	0.0000

R-squared	0.999579	Mean dependent var	0.254844
Adjusted R-squared	0.999558	S.D. dependent var	0.260244
S.E. of regression	0.005473	Akaike info criterion	7.517611
Sum squared resid	0.001797	Schwarz criterion	7.382681
Log likelihood	244.5636	F-statistic	47466.51
Durbin-Watson stat	1.792889	Prob(F-statistic)	0.000000

Source: UBOS 2009/2010

Table 8: Budget share Parameter Estimates of an LA/AIDS for food grain Demand in Lira District

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	1.004649	0.002268	443.0509	0.0000
Budget share G-nuts pounded	1.009285	0.006163	163.7709	0.0000
Budget share Rice	1.003708	0.003502	286.5953	0.0000
Budget share Maize flour	1.003406	0.003313	302.8856	0.0000
Budget share Beans	0.995998	0.003288	302.8856	0.0000

R-squared	0.999528	Mean dependent variable	0.291833
Adjusted R-squared	0.999503	S.D. dependent variable	0.272381
S.E. of regression	0.006073	Akaike info criterion	7.305646
Sum squared residue	0.002065	Schwarz criterion	7.166023
Log likelihood	223.1694	F-statistic	39545.64
Durbin-Watson stat	2.154276	Prob(F-statistic)	0.000000

Source: UBOS 2009/2010

Table 9: Household Expenditure Parameter Estimates for Mbale District

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	7758.798	3542.550	2.190173	0.0318
Expenditure Gnuts Pounded	-0.562833	0.236408	-2.380768	0.0045
Expenditure rice	0.102585	0.038378	2.672991	0.0031
Expenditure maize flour	-0.738383	0.248607	-2.970076	0.0427
Expenditure beans	-1.350411	0.454667	-2.970104	0.0003

R-squared	0.588890	Mean dependent variable	8720.833
Adjusted R-squared	0.191230	S.D. dependent variable	24223.12
S.E. of regression	23990.38	Akaike info criterion	23.06055
Sum squared residue	4.09E+10	Schwarz criterion	23.18415
Log likelihood	-860.7707	F-statistic	11.480908
Durbin-Watson stat	2.059728	Prob(F-statistic)	0.027082

Source: UBOS 2009/2010

Table 10: Household Expenditure Parameter Estimates for Kabale District

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	5950.745	1659.424	3.586031	0.0007
Expenditure G-nuts pounded	0.256122	0.452438	2.566092	0.0034
Expenditure Maize flour	-0.920619	0.034566	-2.596499	0.0031
Expenditure Rice	-0.623505	0.065561	-2.358512	0.0212
Expenditure Beans	-0.785918	0.479326	-2.596499	0.0037

R-squared	0.133370	Mean dependent variable	5910.938
Adjusted R-squared	-0.359960	S.D. dependent variable	9971.400
S.E. of regression	10149.28	Akaike info criterion	21.34865
Sum squared residue	6.18E+09	Schwarz criterion	21.48358
Log likelihood	-679.1570	F-statistic	6.270343
Durbin-Watson stat	1.833516	Prob(F-statistic)	0.006534

Source: UBOS 2009/2010

Table 11: Household Expenditure Parameter Estimates for Lira District

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	4781.055	2471.482	2.934489	0.0281
Expenditure G-nuts pounded	-1.076080	0.382836	-2.810807	0.0155
Expenditure Maize flour	-0.910760	0.422319	-2.156566	0.0162
Expenditure Rice	0.242981	0.086746	2.801050	0.0171
Expenditure Beans	-0.724123	0.242932	-2.980760	0.0023
R-squared	0.948220	Mean dependent variable		8903.125
Adjusted R-squared	0.463310	S.D. dependent variable		13618.23
S.E. of regression	13299.01	Akaike info criterion		21.89311
Sum squared residue	9.90E+09	Schwarz criterion		22.03273
Log likelihood	-652.7932	F-statistic		5.955433
Durbin-Watson stat	1.872708	Prob(F-statistic)		0.031182

Source: UBOS 2009/2010

Table 12: The estimates of own price Marshallian Elasticities

Items	Marshallian (Compensated)Price Elasticities				Expenditure Elasticity
	Beans	Maize flour	Rice	G-nuts pounded	
Beans	-0.89	-1.31	-0.82	-0.92	0.60
Maize flour	-1.03	-0.25	-0.74	-0.52	0.72
Rice	-0.36	-1.03	-1.13	-1.32	0.98
G-nuts pounded	-0.22	-1.08	-0.82	-0.72	1.97

Source: UBOS 2009/2010

Table 13: The estimates of Expenditure Elasticities

Items	Hicksian (Compensated)Price Elasticities			
	Beans	Maize flour	Rice	G-nuts pounded
Beans	-0.09	-0.31	-0.20	0.92
Maize flour	-0.50	-0.45	0.07	-0.01
Rice	-0.06	0.03	-0.23	-0.03
G-nuts pounded	0.72	-0.08	-0.04	-0.89

Source: UBOS 2009/2010