An Analysis of Household Food Expenditure Systems in Tanzania

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Abstract

This paper analyzes urban and rural food consumption in Tanzania using the Generalized Translog (GTL) expenditure system. We reject a pooled model in favor of two separate urban and rural models. Results indicate that subsistence consumption has significant effect on food demand in rural areas, but it is less important in urban areas. Hence, ignoring differences between urban and rural regions can lead to incorrect inferences and policy recommendations.

1.0 Introduction

Subsistence consumption is a substantial part of household consumption in many developing countries particularly in rural areas. It is estimated that about 30 to 60 percent of farm production in Tanzania is consumed at the farm; the remaining portion is marketed (Moshi et al., 1998, Nkonya and Parcel 1999). Two major factors have enhanced subsistence consumption in Tanzania: inadequate food market infrastructure (especially in rural areas) and a household food self-sufficiency policy implemented by the government from mid 1970s to mid 80s (Ackello-Ogutu and Echessah, 1998). The latter required each household to produce enough food for their own consumption. The policy was implemented through mandatory acreage allocation to production of food crops in each household and by restricting selling. The policy was later relaxed following market liberalization in 1985 and the food security Act 1991. Nevertheless, it had considerable impact on development of food market infrastructure in rural areas.

Several studies have analyzed household food expenditure systems in predominantly subsistence-oriented societies, but most of them have assumed that

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consumers rely on markets for their food requirements. The effect of subsistence consumption particularly in rural areas of Tanzania has not been adequately incorporated in food expenditure studies. The current study examines food expenditure systems in rural and urban households in the Lake Zone of Tanzania. The study analyzes household consumption of major food items by incorporating pre-committed food expenditure as a proxy for household subsistence consumption.

The objectives of this study are to examine the consumption pattern of food items in rural and urban households, to investigate the effect of subsistence consumption on food demand, and to draw implications for food policy in Tanzania. A Generalized Translog expenditure functional form was used to estimate household food demand behavior. Results are used to assess the impact of subsistence consumption on food demand between rural and urban households.

The paper is organized in several sections. Review of household demand studies is presented in section two. In section three conceptual framework and economic theory are discussed, while the empirical model and estimation procedure are discussed in section four. Sections five and six discuss results and summary, while section seven provides concluding remarks.

2.0 Literature Review

Demand theory has been widely applied to determine individuals or households consumption behavior. Expenditure and price elasticity provide valuable information on how consumers react to price and income changes. This information has been useful in designing food policy and research needs for various consumer categories (Lau et al

1978, Jung and Koo, 2000, Abdulai and Auberta, 2003). Earlier demand studies have

focused on model specifications that represent agent's consumption decisions (Pollack

and Wales, Lau and Mitchell, 1971). In recent years, demand studies particularly in

developing countries have focused attention to analyzing consumer demand behavior

across differences income groups (Abdulai and Auberta, 2003). Findings from these

studies have been important for designing development policy options such as poverty

reduction programs targeting low-income families (i.e., food stamp, food support to the

poor, child food programs etc). However, despite extensive household demand studies

implemented in developing countries, there is little information on the effect of

subsistence consumption on household consumption behavior. Lau et al., (1978),

observed that in Taiwan, a household expenditure decision on agricultural items was

influenced by the level of non-cash consumption of agricultural products. Gibson (1998)

observed that in Papua New Guinea structural food demand and income elasticities were

different between rural and urban areas. Because rural households consume large parts

from their own production than urban households, different model specifications may be

required to account for the effect of subsistence consumption in households. Therefore,

omitting subsistence consumption in model specification could lead to incorrect

inferences.

Economists have used consumer theory to examine consumer behavior by

assuming that a consumer purchases goods and services with limited income and that

income is allocated among goods so as to maximize utility. Using weak seperability

assumption, consumers allocate total expenditure in two stages (Goldman and Uzawa,

1964). In the first stage, total expenditure is allocated between groups of goods, while in

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the second stage group expenditures are allocated between individual goods within a specific group. Weak separability is often implemented in demand studies to specify an empirically tractable model and to limit the number of parameters to be estimated (e.g., Eales and Wessells 1990; Piggott and Marsh 2003). Specifically to Tanzania, the major food items for an ordinary household include cereals, grains, beef and fish. As a result, the maintained hypothesis will be that these food items are related to each other as either complements or substitutes, and that they are weakly separable from other consumption goods.

The concept of weak separability has been used in many studies to estimate household consumption behavior based on market expenditure data (Pollack and Wales, 1969, Lau et al., 1978, Abdulai and Auberta, 2003, Jung and Koo 2000, Luchin et al., 2001). On the basis of expenditure elasticities as well as Marshallian and Hicksian elasticities various policy implications have been derived. However, when a substantial part of consumption is from subsistence production, the result is likely to differ from when total household consumption is from the market. We hypothesize that subsistence consumption affects household consumption demand of the major food items and that the effect is different between rural and urban area.

Various functional forms have been used in expenditure analysis studies, but the most commonly models are linear expenditure and/or translog functions of the Almost Ideal Demand System (AIDS) model (Deaton and Muellbauer, 1980). Lau and Mitchell (1971) proposed a "linear translog" (LTL) form obtained by introducing "committed quantities" into the homogenous translog function. Pollack and Wales (1981) further expand the idea of pre-committed quantities in dual analysis and in demand system

specifications. Bollino and Violi (1990) introduced a Generalized version of the Almost

Ideal and Translog (GAITL) demand systems, which nests both the generalized versions

of the AI and Translog with pre-committed quantities. They argued that the GAITL

model is a flexible form and gives good results compared to other models. Recently,

Piggott and Marsh (2003) incorporated pre-committed consumption in the Generalized

Almost Ideal Demand model to investigate the impact of food safety information in US

meat demand. The GTL model is used to estimate household food expenditures systems

in Tanzania. Because of structural differences households were grouped into rural and

urban areas and their expenditure systems are compared, particularly, the impact of pre-

committed quantities on expenditure share, as well as cross and own-price demand

elasticity. The advantage of this specification is that it is possible to assess the degree of

market-orientation between rural and urban households.

3.0 Theoretical Model

Models of consumption behavior are based on the assumption of utility

maximization subject to budget constraint (or a dual equivalent). In this paper we assume

a weakly separable utility function and assume individuals consume four food items (i.e.,

maize, rice, beef and fish) such that

$$MaxU = U(x_i ....x_i)$$
$$Subject to : \sum_{i=1}^{n} p_i x_i = y; i = 1...........N \tag{1}$$

Here U is household utility; x are quantities of food items consumed by individual

household (kilogram), p_i is the money price of the ith food item (Tanzanian Shillings per

kilogram), and y is total money expenditure allocated to food items (Tanzanian shillings).

Following Pollack and Wales (1981) subsistence consumption is incorporated in expenditure in the form of pre-committed quantities, c_i, which yields the following utility function

$$U^* = U(x_i^* .... x_n^*) = U(x_1 - c_1, ..., x_n - c_n).$$ (2)

The dual expenditure function is $E = c'p + E^*(p_1, ..., p_n y^*)$ and the dual indirect utility function is $V = (p_i .....p_n y^*)$ (Pollack and Wales 1981). Where $c'p$ is pre-committed expenditure, $y^* = y - c'p$ is supernumerary expenditure, and c is pre-committed quantities. Using Shephards Lemma and/or Roy's identity the Marshallian demand function is derived as $x_i = c_i + x_i^*(p_1, ..., p_n y^*)$. Hence, quantity is decomposed into a pre-committed quantity ci and a supernumerary quantity x^*_i.

4.0 Estimation Procedure

4.1 Empirical Model

The empirical model used in this study is a Generalized Translog function following Bollino and Violi (1990). The indirect utility function is specified as follows;

$$V(p, x) = (a(p)\ln x^* - \ln P)$$ (4)

Where; $a(p) = \alpha'_i - \frac{1}{2}(i'\Gamma i)\ln x^* + \ln(p')\Gamma i$ (5)

$$\ln P = \alpha_0 + \alpha^\ni \ln(p) + \frac{1}{2}\ln(p')\Gamma \ln(p')$$ (6)

i= $nx1$ unit vector, Γ is nxn coefficient matrix of γ_{ij}; α is a $nx1$ vector of coefficients and α_o is a scalar coefficient. Substituting (5) and (6) in (4) and using Roy's identity the following commodity expenditure share functions are obtained;

$$w_i = \frac{p_i c_i}{y} + \frac{y^*}{y} \left[\frac{\alpha_i + \sum_{i=1}^{n} \gamma_{ij} \ln p_j - \sum_{i=1}^{n} \gamma_{ij} \ln y^*}{\sum_{i=1}^{n} \alpha_i + \sum_{i=1}^{n} \sum_{j=1}^{n} \gamma_{ij} \ln p_j} \right] \tag{7}$$

Where $w_i's = \dfrac{x_i p_i}{y}$ are expenditure shares of individual food items. In order to conform

to utility maximization homogeneity, symmetric and adding-up restrictions were imposed

as follows;

Homogeneity: $i'\Gamma i = 0$ $\tag{8}$

Adding-up condition: $\boldsymbol{a}'i = 1$ $\tag{9}$

Symmetry condition: $\gamma_{ij} = \gamma_{ji}$ $\tag{10}$

4.2 Estimation Issues

Expenditure share equations were estimated as a system of nonlinear equations by

imposing symmetric restriction directly across equations. To avoid singularity in the

system the fourth equation was dropped from estimation; parameter estimates for the

fourth equation were recovered through general demand restrictions. To account for zero

consumption values in the data (discussed below) the GTL model was estimated using

the Expected-Maximization or EM algorithm (McLachlan and Krishnan, 1997).   In

effect, the EM algorithm proceeds in several steps. The model is estimated with zero

consumption values, then predicted values are used to replace zero consumption, and the

model is then re-estimated. This process is repeated until the estimated parameters

converge.   To test rural and urban data relative to the pooled data, likelihood ratio tests

were conducted using the statistic LR = $2(LL^P\text{-}LL^{R+U})$. Here LL^P is a maximized

likelihood value in the pooled sample and LL^{R+U} a total of maximized likelihood values

in rural and urban samples.

4.2.1 Uncompensated price Elasticities

Elasticity of price and expenditures were calculated from parameter estimates of

the GTL model. Price elasticities are calculated in two ways. The first is uncompensated

(Marshallian) elasticities that contain both price and income effects. The second is

compensated (Hicksian) elasticities, which only include price effects. Elasticities are

computed using equations (11) through (14).

Own-price elasticity

$$e_{ii} = \frac{1}{w_i y} \left[p_i c_i (1 - w^*) + \frac{y^* \gamma_{ii} + \sum_{j=1}^{4} \gamma_{ij} p_i c_i - w^* y^* \sum_{i=1}^{4} \gamma_{ii}}{\sum_{i-1}^{4} \alpha_i + \sum_{i=1}^{4} \sum_{j=1}^{4} \gamma_{ij} \ln p_j} \right] - 1 \tag{11}$$

Cross-price elasticity

$$e_{ij} = \frac{1}{w_i y} \left[-p_j c_j (w^*) + \frac{y^* \gamma_{ij} + \sum_{j=1}^{4} \gamma_{ij} p_j c_{ij} - w^* y^* \sum_{i=1}^{4} \gamma_{ij}}{\sum_{i-1}^{4} \alpha_i + \sum_{i=1}^{4} \sum_{j=1}^{4} \gamma_{ij} \ln p_j} \right] \tag{12}$$

Expenditure Elasticity

$$e_{\exp} = 1 + \frac{1}{w_i} \left[\frac{\dfrac{-p_i c_i}{y} + (w^*) \dfrac{\sum_{i=1}^{4} p_i c_i}{y} + (-\sum_{j=1}^{4} \gamma_{ij})}{\sum_{i=1}^{4} \alpha_i + \sum_{i=1}^{4} \sum_{j=1}^{4} \gamma_{ij} \ln p_j} \right] \tag{13}$$

4.2.2 Compensated price elasticity

$$e_{ij}^{*} = e_{ij} + w_j e_{\exp} \tag{14}$$

Where; $w_i^{*} = \left[\dfrac{\alpha_i + \sum\limits_{j=1}^{n} \gamma_{ij} \ln p_j - \sum\limits_{i=1}^{n} \gamma_{ij} \ln y^{*}}{\sum\limits_{i=1}^{n} \alpha_i + \sum\limits_{i=1}^{n} \sum\limits_{j=1}^{n} \gamma_{ij} \ln p_j} \right]$ \hfill (15)

5.0 Research Data

Data used in this paper came from Tanzania human resource survey conducted in Tanzania by the World Bank and the department of economics of the University of Dar Es Salaam, Tanzania (Ferreira and Griffin 1996). The survey covered 4900 households in 222 clusters national wide of which 43 clusters (946 households) were from the Lake Zone. The sample was divided into 2100 rural households and 2800 urban households. Household food expenditure data was collected on 23 food items using one-week recall period of the expenditure. Estimates of food expenditure include food paid by cash, imputed value for food paid in kind and gifts received during the recall period. In addition to quantities consumed, zero consumption of some food items during recall period was recorded. Consumer prices were recorded from each cluster during the survey period.

The paper analyzes expenditure system of four-food items, maize, rice, beef and fish for 106 rural and 172 urban households respectively selected from the Lake Zone of Tanzania. Market prices from 30 clusters in the Lake Zone were missing which limited our sample size to only 278 households (13 clusters). Descriptive statistics are summarized in Table 1. The analysis shows that on average prices of fish were same in

urban and rural areas, but prices of maize and beef were higher in urban area while average price of rice was slightly higher in rural than in urban areas. Households in rural areas consume more maize (19.34kg) compared to 10.10 kilograms in urban households; nevertheless, rural households consumed slightly less quantities of other food items than urban households. On expenditure rural households spend about 0.37 of total food expenditure on maize and 0.22, 0.21 and 0.21 on rice, beef and fish respectively. The urban households spend less than one third on each food item, with maize having the highest share of household expenditure (i.e. 0.28) followed by rice, fish and beef with average expenditure share of 0.25, 0.22 and 0.25 respectively. Generally total weekly household expenditures on the four food items are higher in rural areas (Tanzanian shillings 4700.80) than urban areas (Tanzanian shillings 4109.20).

6.0 Results and Discussion

6.1 Marginal Effects

Parameter estimates for all three samples are reported in Table 2. We found that many price coefficient estimates were not statistically significant, similar findings have been reported by Abdulai and Auberta (2003). We carried out a likelihood ratio test to test the hypothesis that linear combinations of price coefficients in the models is equal to zero, against the alternative hypothesis that they are not equal to zero (Table 3). The likelihood ratio statistic was calculated using the following formula $LR=2(LL^U-LL^R)$. Where LL^R is the maximum likelihood value obtained from estimating restricted models (without price parameters), and LL^U is maximum likelihood value obtained from estimating unrestricted models. Likelihood ratio test revealed a failure to reject the null

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hypothesis in the urban model, but reject the null hypothesis in rural and pooled models at 0.05 and 0.10 levels respectively. The results imply that rural households make their expenditure decisions by considering all food prices together instead of individual prices separately. Such consumption behavior is influenced by the fact that food expenditure constitutes large portion of household budget in Tanzania.

The insignificance of joint price coefficients in the urban model is surprising. However, this could be due to past government policy, which subsidized urban consumers (particularly cereals), through state controlled marketing agencies (Moshi, et al 1998). Prior to 1990 food marketing was done by state controlled companies who sold food crops to urban consumers at prices below the ex-store costs. Although food markets were liberalized in the mid eighties, Warburton et al., (1995) noted that until 1991 private traders still had to buy from state controlled unions rather than direct from farmers. This implies that the expenditure data was collected during the transition period from subsidized prices to market determined prices. Therefore, insignificant price coefficients reflect the effect of pricing system, which had lead to a situation whereby urban consumers were not reacting to market prices.

The likelihood ratio test on the null hypothesis that consumption behavior of rural and urban households is the same against the alternative that they are not the same indicates that the coefficients of the two samples are jointly statistically significantly different from the pooled sample at 0.05 levels. Therefore, we reject the null hypothesis and conclude that consumption behavior between rural and urban household is different implying that it would be inappropriate to estimate a joint model of rural and urban households.

Estimated coefficients indicate positive pre-committed quantities for maize and rice in urban sample and maize in rural sample (Table 2). Nevertheless, only rural households had maize pre-committed quantities that were statistically significantly different from zero at 0.10 levels. All pre-committed food items in pooled sample, beef and fish in urban, as well as rice, beef and fish in rural sample have negative signs. A positive sign for pre-committed quantities imply that households have some amount of subsistence consumption independent of price and household income. The result suggest that in rural areas about 17.7% of maize consumption is not affected by market prices, while in urban households is only 2.5% maize and 7.7% rice. The negative sign for pre-committed quantities is difficult to explain, one explanation would be that having subsistence consumption reduces total household consumption of a food item. Therefore, in the rural area there is a substantial decrease in consumption expenditure on fish when subsistence consumption exists.

In pooled sample own-prices of all food items are positive; implying that a unit increase in price of the food items would increase their total food expenditure. However, none of the prices is statistically significantly different from zero. Cross-commodity prices have mixed signs. In maize share equation, prices of rice, beef and fish are negative, but only rice and fish cross-price are statistically significant at 0.05 and 0.10 respectively. A unit increase in the price of rice and fish by one Tanzanian Shilling would decrease household expenditure share on maize by 0.0405 (or 54.60 Tanzanian shillings) and 0.03942 (or 53.14 Tanzanian Shilling) respectively. In rice expenditure share equation, rice and fish prices are positive, while beef cross-price is negative, however, only maize cross-price is statistically significant at 0.05 levels. An increase in price of

maize by one Tanzanian shilling would lead to an increase in household expenditure on rice by 0.0405 (41.43Tanzanian Shillings). Also, maize cross price is statistically significant at 0.05 levels in fish expenditure equation but negative, therefore, a unit increase in maize price will lead to a reduction of household expenditure on fish by 0.03942 (40.33 Tanzanian Shillings). Other cross-prices in the fish expenditure share function are positive but not statistically significantly different from zero. Rice and maize cross-prices in beef share equation are negative, while fish cross-price is positive, but none of the prices are statistically significant.

In the urban sample the own-price coefficients of maize and fish are positive but price coefficients of rice and beef are negative, nevertheless all prices are not statically significantly different from zero. Cross-price coefficients have mixed signs; however, none of the prices are statistically significant from zero. These results suggest that individual prices do not affect household consumption decisions on food expenditure; this could be due to the reason discussed earlier. In rural sample coefficients of own-price of maize and beef are negative consistent with the demand theory but insignificant. Own-price coefficients of rice and fish are positive which is contrary to expectations. The signs of cross-price coefficients are mixed. Maize-fish cross price coefficients are negative and statistically significant at 0.10 levels. A unit increase in price of fish would lead to a reduction of expenditure on maize by 0.0665 (115.31 Tanzanian Shillings) while a unit increase in price of maize would cause households to reduce expenditure on fish by 0.0665 (65.33 Tanzanian Shillings). Other cross-prices were not statistically significantly different from zero.

6.2 Expenditure and price elasticities.

Elasticities estimates are reported in Tables 4 and 5. Elasticities are useful measures of investigating consumer behavior and can be compared across-models and/or locations. Estimated supernumerary expenditure elasticities for all food items are positive, implying that maize, rice, beef and fish are normal goods. In the pooled sample supernumerary expenditure elasticities are close to one, implying that a one percent increase in households' income would cause a one percent increase in household expenditure on each food item. Abdulai and Aurberta (2003)[1] reported expenditure elasticities in Tanzania (Dar-Es-Salaam and Mbeya regions) to be 0.7413 for cereals and pulses combined and 1.0397 for meat, fish and eggs combined. Expenditure elasticities from the current study fall within the above range (maize 0.9070; rice 1.0996; beef 0.9073 and fish 1.1104).

In urban sample expenditure elasticity of rice is 1.3 implying that rice is regarded as luxury food by urban consumers in the sense that a fraction of expenditures devoted to rice increases proportionally more rapidly than income. On the other hand, maize, beef and fish are necessity because their expenditure elasticities are less than one (0.8952, 0.9450, 0.8704), implying that the fraction of expenditure increases at less as income rise. Estimated supernumerary expenditure elasticities for rural household reveals that fish is a luxury food item as its expenditure elasticity is greater than one (1.2002), while maize and rice have expenditure elasticity close to one (1.0321,1.0601). Expenditure elasticity of beef is 0.677, indicating that beef is a necessity in rural households.

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[1] Abdulai and Aurberta used a one-year data (June 1998-April 1999) to estimate households' food demand in Dar-Es-Salaam and Mbeya regions of Tanzania based on income groups.

In urban households, the Marshallian own-price elsaticities of individual food items have negative signs, implying one percent increase in own-price would decrease expenditure share of that particular food item which is supported by the consumer theory. Rice has the largest own-price elasticity in absolute terms followed by beef and fish while maize has the smallest own-price elasticity. Cross-price elasticities of fish with respect to maize and beef as well as cross-price elasticity of beef with respect to rice are all positive implying that they are gross-substitutes. Other cross-price elasticities have negative signs implying that they are gross-complements. In general, all cross-price elasticities are fairly low implying that consumption of one food item is less affected by prices of other food items.

In rural households, all Marshallian own-price elsaticities have negative sign, which is supported by the theory. Rice and fish have the largest magnitude of own-price elasticity in absolute terms followed by beef and maize. All own-price elasticities in rural area are larger than urban elasticities. A one percent increase in prices of maize, rice, beef and fish in rural area would decrease supernumerary expenditure by 1.0206, 1.1639, 1.0698 and 1.1704 percent respectively, while the corresponding changes in urban area would be 0.7374, 1.0006, 0.9886 and 0.8127 percents. The difference in magnitude indicates that rural households are more affected by price changes than their urban counterparts. Cross-price elasticity for fish with respect to rice and beef with respect to maize as well as rice with respect to beef are positive, hence are gross-substitutes. Other cross-prices elasticities have negative signs implying that they are gross-complements. All cross-prices are inelastic.

Hicksian own-price elasticities for urban household expenditure have same sign as their Marshallian counterparts, but Hicksian values are smaller in absolute terms than Marshallian elascticities. All own-price elasticity estimates in the urban sample are fairly low indicating that all food items in the diet of urban households are regarded as necessities. All cross-price elasticities are positive; hence the food items are gross-substitutes. Own-price elasticities of all food items are larger in absolute terms than cross-price elasticities hence consumption of these food items is insensitive to prices of other food items, than to their own prices.

In rural areas Hicksian own-price elasticities have similar signs as Marshallian elastcities, but are smaller than their counterparts as well. Rice, beef and fish have own-price elasticities close to one (-0.9356, -0.9299, -0.9190), while maize own-price elasticity is 0.6403, which imply that the food items are regarded as necessities in rural household diet. All cross-price elasticities except that of beef with respect to fish have positive sign hence are net-substitutes, while beef-fish cross-prices are net-complements.

7.0 Summary and Conclusions

The paper evaluates expenditure pattern of selected food items in rural and urban households in the Lake Zone of Tanzania. The results indicate that household consumption behavior is different between rural and urban households. In the rural area subsistence consumption has significant effect on maize expenditure in household but not on other food items. Urban households' expenditure decisions are not affected by existence of subsistence consumption. Contrary to expectation own-prices do not affect

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expenditure decisions of both rural and urban households, but cross-price coefficients of maize and fish significantly affect consumption of other food in rural household.

The computed expenditure elasticities indicate that the demand of maize, rice and fish will rise more than proportionately as rural households income rises. In the urban area future increase in household income would increase the demand of rice. Computed Hicksian elasticities show that rural households are more prices responsive than urban households. The cross-price elasticities are positive; hence both rural and urban consumers regard these food items as gross-substitute

From the analysis two implications can be drawn. First, when modeling consumer behavior in quasi-subsistence economy such as Tanzania, incorporating subsistence consumption for rural areas can improve demand estimates. Secondly, government policies (i.e., tax rates, infrastructure etc), which affect food prices, will affect rural consumers disproportionately.

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Table 1. Descriptive Statistics

		Mean	Std. Error	Minimum	Maximum
P o o l e d	Maize quantity (kg).	13.620	54.840	0.280	910.000
	Rice quantity	4.282	3.741	0.340	28.000
	Beef quantity	2.637	2.478	0.060	14.480
	Fish quantity	3.100	2.583	0.020	15.790
	Maize price (Tsh/kg)	119.010	39.578	40.000	250.000
	Rice price	219.600	29.919	125.000	290.000
	Beef price	334.210	51.342	150.000	400.000
	Fish price	315.070	83.375	150.000	420.000
	Maize Expenditure	0.311	0.160	0.008	0.994
	Rice Expenditure	0.236	0.117	0.003	0.658
	Beef Expenditure	0.216	0.127	0.002	0.643
	Fish Expenditure	0.234	0.125	0.002	0.643
	Total weekly Expenditure	4334.800	8335.000	299.600	0.137+06
U r b a n	Maize quantity (kg).	10.094	11.141	0.280	120.000
	Rice quantity	4.814	3.975	0.400	28.000
	Beef quantity	2.678	2.372	0.060	12.000
	Fish quantity	3.432	2.624	0.020	15.790
	Maize price (Tsh/kg)	121.920	44.791	80.000	250.000
	Rice price	218.020	21.016	150.000	260.000
	Beef price	346.690	24.520	270.000	400.000
	Fish price	315.120	82.960	160.000	420.000
	Maize Expenditure	0.282	0.149	0.008	0.671
	Rice Expenditure	0.248	0.117	0.031	0.658
	Beef Expenditure	0.221	0.132	0.027	0.630
	Fish Expenditure	0.249	0.119	0.007	0.622
	Total weekly Expenditure	4109.200	2508.300	299.600	21421.000
R u r a l	Maize quantity (kg).	19.340	87.625	1.820	910.000
	Rice quantity	3.418	3.158	0.340	21.540
	Beef quantity	2.569	2.651	0.150	14.480
	Fish quantity	2.562	2.430	0.040	14.000
	Maize price (Tsh/kg)	114.300	28.788	40.000	200.000
	Rice price	222.170	40.391	125.000	290.000
	Beef price	313.960	72.843	150.000	400.000
	Fish price	315.000	84.439	150.000	420.000
	Maize Expenditure	0.369	0.162	0.083	0.994
	Rice Expenditure	0.215	0.114	0.003	0.619
	Beef Expenditure	0.207	0.119	0.002	0.573
	Fish Expenditure	0.209	0.130	0.002	0.643
	Total weekly Expenditure	4700.800	13146.000	968.800	0.137 +06

Note: 1US$=480 Tshs. (1993)

Table 2. Parameter estimates for household food expenditures in Lake Zone, Tanzania

	Dependent Variable	Expenditure Share of Maize	Expenditure Share of Rice	Expenditure Share of Beef	Expenditure Share of Fish
Pooled Households	Intercept	0.2637** (2.0752)	0.1001 (1.1094)	0.1688* (1.7818)	0.4674
	Pre-Committed Quantity	-0.4349 (-0.5246)	-0.1506 (-0.3218)	-0.4069 (-1.2389)	-1.3945* (-1.9072)
	Maize Price	0.0584 (1.5236)	0.0405** (2.0761)	-0.00521 (-0.2197)	-0.03942* (-1.8011)
	Rice Price	-0.0405** (-2.0761)	0.02534 (0.6310)	-0.0311 (-1.1780)	0.01305 (0.6318)
	Beef Price	-0.00521 (-0.2197)	-0.0311 (-1.1780)	0.00152 (0.03512)	0.0180 (0.7536)
	Fish Price	-0.03942* (-1.8011)	0.01305 (0.6318)	0.0180 (0.7536)	0.08503
Urban Households	Intercept	0.3628** (2.4558)	0.0371 (0.3797)	0.19997* (1.9229)	0.4001
	Pre-Committed Quantity	0.2489 (0.2893)	0.3720 (1.3642)	-0.05647 (-0.2110)	-0.4154 (-0.6120)
	Maize Price	0.0735 (1.3642)	-0.0427 (-1.2171)	0.0094 (0.2347)	-0.0222 (-0.7367)
	Rice Price	-0.0427 (-1.2171)	-0.04132 (-0.5385)	0.0102 (0.1499)	0.02509 (0.8997)
	Beef Price	0.0094 (0.2347)	0.0102 (0.1499)	-0.0584 (-0.6813)	0.0221 (0.5394)
	Fish Price	-0.0222 (-0.7367)	0.02509 (0.8997)	0.0221 (0.5394)	0.0223
Rural Households	Intercept	-0.3002 (-1.0394)	0.2744 (1.5655)	0.3192* (1.7507)	0.7066
	Pre-Committed Quantity	3.3509* (1.7063)	-0.5882 (-0.4861)	-0.7982 (-0.8862)	-1.9836 (-1.6020)
	Maize Price	-0.0848 (-1.0943)	-0.0388 (-1.1719)	0.0292 (0.6224)	-0.0665* (-1.7747)
	Rice Price	-0.0388 (-1.1719)	0.0840 (1.1842)	-0.0542 (-1.596)	0.03171 (1.1345)
	Beef Price	0.0292 (0.6224)	-0.0542 (-1.596)	-0.02835 (0.3353)	0.0161 (0.5183)
	Fish Price	-0.0665* (-1.7747)	0.03171 (1.1345)	0.0161 (0.5183)	0.1376

Numbers in brackets are t-values; * means statistically significant at 10% level
** =Statistically significant at 5%.

Table 3. Hypothesis Testing for the Significance of Price Coefficient Estimates and Similarities of Consumption Behavior between Rural and Urban Households

Joint Price Effects	*Sample Similarities*
$H_0: \gamma_{11}+\gamma_{12}+\ldots\ldots+\gamma_{34}=0$	$H_0: \beta_i^U = \beta_i^R = \beta_i^P$
$LR = 2(LL^U - LL^R)$	$LR = 2(LL^P - (LL^U + LL^R))$
Model LR Values 　　Pool　　$= 15.736*$ 　　Urban　$= 10.897$ 　　Rural　$= 19.472**$ 　　$\chi^2_{0.10,9}=14.6837$ 　　$\chi^2_{0.05,9}=16.9190$	*LR Value*$= 41.816**$ 　　$\chi^2_{0.05,16} = 26.296$

Note: * means statistically significant at 10%
　　　** means statistically significant at 5%.

β_i^U = Coefficient estimates in the urban model
β_i^R = Coefficient estimates in the rural model
β_i^P = Coefficient estimates in the pooled model
γ_{ii} & γ_{ij} = Price coefficient estimates

Table 4. Uncompensated price and expenditure elasticities

	Item	Prices				Expenditure
		Maize	Rice	Beef	Fish	
P o o l e d	Maize	-0.8294	-0.0946	-0.0745	-0.0575	0.9070
	Rice	-0.1914	-1.1147	-0.0352	0.1713	1.0996
	Beef	0.1308	0.0691	-1.1810	0.0737	0.9073
	Fish	-0.1576	-0.1790	-0.0311	-1.1630	1.1104
U r b a n	Maize	-0.7374	-0.0105	-0.1550	0.0077	0.8952
	Rice	-0.1268	-1.0006	0.08952	-0.2603	1.2985
	Beef	-0.2090	0.1816	-0.9886	0.0710	0.9450
	Fish	0.0145	-0.1488	-0.0765	-0.8127	0.8704
R u r a l	Maize	-1.0206	-0.1514	0.2127	-0.0727	1.0321
	Rice	-0.2468	-1.1639	-0.0483	0.3989	1.0601
	Beef	-0.4294	0.0765	-1.0698	-0.1133	0.6772
	Fish	-0.1335	0.3595	-0.2557	-1.1704	1.2002

Table 5. Compensated price elasticities

	Item	Prices			
		Maize	Rice	Beef	Fish
P o o l e d	Maize	-0.5438	0.1190	0.2701	0.1547
	Rice	0.1549	-0.8558	0.2723	0.4286
	Beef	0.4166	0.2828	-0.9853	0.2860
	Fish	0.1921	0.4405	0.2706	-0.9032
U r b a n	Maize	-0.4850	0.2114	0.0430	0.2306
	Rice	0.2393	-0.6788	0.3765	0.0631
	Beef	0.0574	0.4158	-0.7795	0.3064
	Fish	0.2599	0.0670	0.2690	-0.5959
R u r a l	Maize	-0.6403	0.0709	0.4260	0.1434
	Rice	0.1439	-0.9356	0.1708	0.6209
	Beef	0.6790	0.2224	-0.9299	0.0285
	Fish	0.3088	0.6180	-0.0077	-0.9190