UTAFITI [New Series] Special Issue, Vol. 4, 1998-2001: 57-70

An Econometric Analysis of Engel's Curve: The Case of Peasant Households in Northern Tanzania[1]

*Michael O.A. Ndanshau**

Abstract

A number of studies have explored the empirical relevance of the Engel's law by using household budget surveys in developed and developing countries. This article presents an empirical evidence on the applicability of the Engel's law in Tanzania. The analysis is based on a micro-survey data of peasant households in Northern Tanzania. Both statistical and econometric analyses demonstrate that household size and income significantly and positively determine expenditure on food and some other consumption items, depending on the area of the study. The age of the household is established to have no significant influence on expenditure on food, but only on other consumption items investigated. The study has also established that education has no significant influence on any expenditure items of the sampled households.

1. Introduction

In his 1857 study, Ernest Engel (1821 - 1896) concluded that the proportion of income spent on food declines as income increases, implying that "food is a necessity whose consumption rises less rapid than does income" (Nicholson, 1992, p.134). This conclusion forms what is known in the literature as Engel's law which has attracted particular attention in household budget studies. Because of data availability, pioneer and subsequent empirical tests of the Engel's law were limited to the economically advanced countries (Houthakker, 1957). Nonetheless, contemporary literature carries studies on the Engel's curve in the developing countries (Adamu, 1966; Cury, 1969; Okunade, 1985; and Strauss, 1982, 1984), and, Tanzania in particular (Kulliane, 1989; Kapunda 1988, 1983, 1977; Kulindwa, 1988; Mashindano, 1988; Sechambo, 1984; Ferdinand, 1984; Adkins, 1976a, 1976b; Ostby, 1968). The studies on Tanzania, like those on other less developed countries (LDCs) and economically advanced countries (EACs), share some salient characteristics. First, is their characterization by a search for the most appropriate

* Senior Lecturer, Department of Economics, University of Dar es Salaam.

mathematical form for the Engel's function. The most popular forms of equations subjected to empirical tests have included the linear and double-log functions. In addition, at least two studies have investigated the Engel's law by using semi-log and ratio-semi-log functions (see, Massel and Heyer, 1969; and Harris, 1964). A second feature in the existing studies is the test of Engel's law by using disaggregated consumption items, including food and non-food items. A third feature is marked by some tests of the Engel's law by using panel and time series data collected by the national household budget surveys (HHBS).[2] The main purpose of this paper is to investigate empirically the relevance of the Engel's law in Tanzania by using micro-survey data of rural households that were randomly interviewed in three of the ten districts in Arusha region.

2. Methodology

2.1. Data

The data employed here are from a 1989-90 survey carried out in three purposefully selected districts, namely, Arumeru, Babati and Mbulu, in Arusha region in Northern Tanzania. The data was collected by using a structured questionnaire which was successfully administered to a random sample of 256 livestock keeping and crop producing households that were drawn from a random sample of 21 villages in three of the ten districts in Arusha region.[3]

The sampled households were differentiated with respect to their peculiar demographic characteristics, income sources, wealth and expenditure baskets. As regards demographic characteristics, about 72 percent of all respondents were between 30 and 59 years of age. A 11.7 percent of the respondents were more than 65 years.[4] On the average, 85.4 percent of the sampled households in Babati were constituted of young respondents (below 59 years), and 7.3 percent were aged (above 65 years). In Arumeru, the respondents less than 59 years and more than 65 years accounted for 80.4 percent and 15.2 percent of the total sample, respectively. In Mbulu it was 70 percent and 17.5 percent, respectively.

About 84 percent of the sampled heads of the households were married, 5.1 percent were single and the remaining 10.5 percent were either divorced, separated or widowed. The majority (about 82 percent) of the respondents were males. These male respondents accounted for the largest proportion of the sampled households in each of the three districts. About 33 and 37 percent of the respondents in Babati and Arumeru district had at least four years of formal (primary school) education, respectively. This is in contrast to only about 3 percent of the household heads interviewed in Mbulu which had four years of formal education. A peculiarly high

proportion (about 49 percent) of the respondents in Mbulu district had between seven and eight years of formal education. Equally peculiar, Babati and Arumeru districts had a relatively smaller proportion (37.9 and 35.6 percent) of the respondents who had between seven and eight years of primary school education. In the overall, however, it can be inferred from the data set that illiteracy was lower in Babati and Arumeru districts than in Mbulu where up to 46.2 percent of the respondents had no formal education.

Agricultural production, defined broadly to include crop production and the keeping of livestock, was the main source of income in all the three sampled districts.[5] Out of the various sources of agricultural income, crop production was an important source of income in Babati and Arumeru where it respectively accounted for 60.8 percent and 50.2 percent of the total income earned by the sampled households. In Mbulu district, however, the main source (44.4 percent) of the agricultural income was earned from the keeping of livestock. According to the survey data, the average proportion of the household expenditure on food was 63.1 percent of the total expenditure of the sampled households in all the three districts. The share of expenditure on food in the total household expenditure was lower (62.1 percent) than the overall average in Arumeru and slightly higher (63.7 percent) than the overall average in Babati and Mbulu districts.

Table 1 shows a declining average share of the food expenditure in total expenditure as predicted by the Engel's law. A slight variation is, however, notable in Mbulu district at the high income group. This is explained by the relatively large size of the households and income earned from livestock in Mbulu district than in any of the other districts. The income from the livestock also appears to account for the empty cells in the low income groups in Mbulu and Babati.

Table 1: Average Share of Expenditure on Food Across Various Expenditure groups in the Sampled Districts in Arusha Region

Area	Expenditure Group (TShs. per annum)			
	0 - 25,000	*25,001 - 50,000*	*50,001 - 75,000*	*Over 75,001*
Overall	79.64	69.01	62.62	57.84
Babati	-	67.87	64.45	55.22
Arumeru	79.64	70.54	59.82	57.89
Mbulu	-	69.77	62.77	62.96

Source: Generated from the survey data

In the overall, the results presented in Table 1 are not only consistent with the Engel's law but are also similar to the results from previous studies in Tanzania, which utilized the 1969 and 1976/77 HHBS, and that obtained by studies in other developing countries (see, Kapunda, 1988; Ödegaard, 1985; Davey, 1963; Houthakker, 1957).

2.2. Estimation models and methods

The basic function for investigating the Engel's law includes expenditures on food items as a regressand and income as the only regressor. However, in accordance with the theory of consumer behaviour, the function for estimation also includes demographic factors, namely, household size, education, and age of the household head.[6]

The size of the household is expected to negatively enter the Engel's function.[7] This could, however, be for some products only because there could be other products whose consumption may not be inversely related to the size of the household or an extra child (Strauss (1982; Singh and Singh, 1971). Education also influences consumption patterns of the household. It negatively affects the tastes and preferences of the household (Kapunda, 1988; Massel and Heyer, 1969; and Ostby and Gulilat, 1969). The negative influence of education on consumption patterns of the households would also result if it first, induces preference for quality (balanced diet) over the quantity of food consumed. Second, if it mitigates thriftiness and a smaller size of household (through birth control). By the two avenues household expenditure on food would be inversely related to the level of education.[8] Moreover, it is not arguable that both high birth rates and the "traditional social welfare system" render the number of dependents to increase with the age of the household, and as a result, increases household expenditure on consumption items, especially that of food items. In this regard, household size would be positively related to household consumption expenditure.

In view of the above the general model for estimation is:

$$(1)\ C_{ij} = f(TEX_j, A_j, HS_j, Ed_j)$$

where C_i is the expenditure of j^{th} household on i^{th} consumption item, TEX_j is total expenditure of the household.[9] First, the variable enters the function as a proxy for the household income because of the measurement and problems of the income data in LDCs (Boateng, *et al.*, 1992; Adkins, 1976b; Ostby and Gulilat, 1969). Second, TEX includes net remittances because inward remittances are used for the up-keep of the household, and the outward remittances drain on that capacity (Massel and Heyer, 1969).

A_j and Ed_j[10] respectively are the age and educational level of the household head. Both measures are used as proxies for the age and educational level of the entire household, thus alluding to "single-pain" phenomenon by which the head of the household determines the consumption pattern of the entire household. HS_j is the size of j^{th} household not subjected to adult equivalent weights.[11]

It is note worthy that the theory of consumer behaviour is not explicit about the specific functional form for estimation.[12] In this study, however, the simple linear and double-log (log-linear) functions have been used. This is partly because, the two types of functions have been employed in most of the previous studies,[13] and yielded better estimates in the pretest carried out for this study. Thus, the general function (1) is expressed in linear form as:

$$(2) C_I = \alpha_i + \beta_i TEX + \gamma_i A + \delta_I Ed + \psi_i HS + u_i$$

and, in the double-log form as:

$$(3) C_I = \alpha_i + \beta_i \log \text{TEX} + \gamma_i \log A + \delta_I Ed + \psi_i HS + u_i$$

where *i* are the consumption expenditure items which comprise food, cooking oil, wood fuel (wood and charcoal), utensils, clothing, and medical expenses; u_i is a stuchastic error term which is assumed to be normally distributed with a zero mean and a constant variance.

From theory, the income (TEX) elasticity coefficient of demand is expected to be greater than zero but less than a unit for the necessary household's consumption items including food; and, the income elasticity is expected to be greater than unity for the luxurious consumption items. The coefficient of Ed is expected to be negative. The coefficient of A is expected to be positive, and, the coefficient of the HS is expected to be negative.

3. Empirical Results

3.1. Regression Results

The log-linear regression results for the six expenditure items of 256 households covered by the survey for which adequate data was available are summarized in Table 2. The results show that the total expenditure elasticities of all the six consumption items are positive. All, except the total expenditure elasticity of medical services, are significantly different from zero at the customary test levels. Table 2 further shows that the expenditure elasticities of food, cooking oil and utensils are highly significant than those of wood fuel and clothes which are statistically significant at the 10 percent test level. It is notable in Table 2 that the

total expenditure elasticity for food is less than unity, thus confirming the Engel's law. The total expenditure elasticities for the remaining items are less than unity, except utensils for which the estimated elasticity is greater than unity, a result which implies that utensils were a luxury. To note, the insignificance of the total expenditure in explaining the household's expenses on medical services could be attributed to the gradual growth of its size, dependence upon the free medical services supplied by the Government, and use of traditional medicines.

The result presented in Table 2 further shows that the elasticity coefficient of the size of the household with respect to all expenditure items are less than unity. Except wood fuel, the coefficient is positive as hypothesized. However, only the elasticity coefficient of the household size with respect to food is statistically significant. On the one hand, the insignificance and negative sign of the coefficient of the household size with respect to wood fuel denote that the variable is unimportant. This could be attributed to the fact that the mostly rural household surveyed cook food for all in a single wood and/or charcoal stove.[14]

Table 2: Overall Log-linear Regression Results

Consumption item	Constant	TEX	HS	A	Ed	R^2	F-stat.	df.
Food	3.137	0.667	0.068	-0.024	3.164E-03	0.46	52.64[a]	251
	(-)	(0.627)	(0.116)	(-0.027)	(0.031)			
	5.182[a]	12.725[a]	2.354[b]	-0.566	0.658			
Cooking oil	0.99	0.83	0.04	-0.35	5.62E-03	0.17	12.67[a]	251
	(-)	(0.34)	(0.03)	(-0.17)	(0.02)			
	0.59	5.66[a]	0.47	-2.92[a]	0.42			
Wood fuel	-1.57	0.95	-0.04	-0.26	0.05	0.13	2.35[c]	61
	(-)	(0.29)	(0.02)	(-0.09)	(0.12)			
	-0.32	2.34[b]	-0.18	-0.71	0.97			
Utensils	-4.25	1.24	0.04	-0.64	0.01	0.14	4.86	122
	(-)	(0.31)	(0.2)	(-0.20)	(0.04)			
	-1.07	3.51[a]	0.23	-2.34[b]	0.43			
Clothes	2.37	0.70	0.10	-0.60	0.02	0.18	5.37[a]	99
	(-)	(0.24)	(0.12)	(-0.23)	(0.08)			
	0.67	2.38[b]	1.21	-2.43[b]	0.82			
Medical charges	1.92	0.47	0.96	0.05	+0.03	0.02	0.63	100
	(-)	(0.12)	(0.03)	(0.01)	(0.07)			
	0.422	1.19	0.29	0.15	0.75			

Notes:

(1) a, b, c stands for statistical significance tests at 1%, 5% and 10% levels respectively.
(2) Figures in parentheses are *beta* coefficients.
(3) Figures in the third row of the results for each expenditure item are t-statistics.
(4) TEX_j= total expenditure (proxy for the household income), Aj= the age of the household head (a proxy for the age of the household), Ed_j= number of years of formal education of household, HS_j= size of the household.

According to Table 2, the age of the household is inversely related to the consumption expenditure of all items, except medical services. The results also reveal that the household age elasticity coefficient is less than unity for all expenditure items. The age of the household was a significant determinant of the household expenditures on only clothes, cooking oil, and utensils (Table 2). The household age elasticities of demand for utensils and clothes are particularly large (in absolute terms) if compared to that of the other items.

On the one hand, the positive signs on the household age elasticity with respect to medical expenses capture the fact of life that as aging takes effect, the members of the household become more vulnerable to diseases and sicknesses which prompt an increase in the share of the household income committed to medical services. As evident, however, the effect of the household age on medical expenditure is small and insignificant, probably due to the use of traditional medicines and free medical services offered by the Government. On the other hand, the negative signs on the household age elasticity coefficient with respect to all expenditure items, except medical expenses, depict a case of reduced expenditures on the respective items as the household grows old.

Furthermore, the negative impact of the household age on expenditures on the directly consumable items (food and cooking oil) in Table 2, is smaller than that on semi-durable expenditure items, including utensils and clothes. The small negative effect of the household age on food and cooking oil could be attributed to the gradual dwindling of the household size as it ages. This could be the case if some of the members of the household move away to form their own households. In contrast, the relatively larger negative impacts of household age on the expenditure on semi-durable items denote their durability and, as a result, a lack of a need to purchase new ones as the household ages.

Among the households sampled, education is a positive determinant of all the five consumption items presented in Table 2. Nonetheless, the education elasticities for all the five items are very small. None of them is statistically different from zero at the conventional test levels. In this regard, there is no meaningful inference which can be made about the influence of education on the expenditures of the sampled households.

In general, the regression results presented in Table 2 demonstrate that the total household expenditure (used as a proxy of income) and size of the household is an important determinant of expenditures on food. Moreover, income and age significantly determine expenditures on food, cooking oil, utensils and clothes. The

beta statistic reveals, however, that income has a higher explanatory power than the age of the household head. This is particularly so in the case of the food item. This result underscores income as the single most important variable which influenced the household expenditures on the six items. The overall sample regression results have also demonstrated that education is an insignificant determinant of the expenditure on the six items investigated.

It is worth noting that, the unadjusted coefficient of determination (R^2) is generally very low, but specifically relatively large (0.456) in the function estimated for the food item. This implies the regressands explained less than 50 percent of the variation in the expenditures on the six items. Following Kmenta (1971), the low R^2 are not atypical in household budget survey studies. Besides, the F-statistics are statistically significant in all of functions fitted, except that fitted for utensils and medical services. The significance of the F-statistics obtained implies that the explanatory variables explain variation in the dependent variables of the functions estimated.

3.2. Comparison of the Results

The estimated income (total expenditure) elasticities of demand for all the consumption items are positive and therefore in conformity with the Engel's law. Moreover, the magnitudes of the total expenditure (income) estimated by this study lies within the range already set by the previous studies in Ghana, Malawi and Tanzania (see, Kapunda, 1983, 1988; and Okunade, 1985). The partial elasticity coefficients of the food related and the non-food items, for example, wood fuel, and clothes, etc., are less than unity; this implies that such expenditure items are necessities. The partial income elasticities for utensils are greater than unity, implying they are luxurious goods.

The estimated significant relationship, at least between food consumption and the household size, has also been established by several other studies in Tanzania (see, Kapunda, 1988; Bamweguba, 1979; Mashuda, 1970; Ostby and Gulilat, 1968; and Adkins, 1976a, 1976b). Moreover, while the estimated household size elasticities with respect to clothing are all positive and statistically insignificant, that established by some of the previous studies are negative and statistically significant (see, for example, Kapunda, 1977; Ostby and Galilat, 1968). This could probably be explained by the unweighted household size used in the estimated functions.

Furthermore, the results have shown that the age of the household is not a significant determinant of the expenditures on food. A similar result was obtained by the study in Tanzania by Kapunda, 1977). Furthermore, the result of this study

shows that education has a positive but an insignificant influence on households' expenditure pattern.

Conclusion

This paper analysed the applicability of the Engel's law in Tanznia by using a random sample of 256 rural households covered by a survey in three of the ten districts in Arusha region.

The estimation results of this study bear some lessons for policy. Of particular interest is the income (total expenditure) and household size elasticities. The overall sample income elasticity with respect to food first, implies a prevalence of very low standard of living in the sampled areas; and second, it denotes very high vulnerability of the peasant households to fall in income that might result from drought, floods, etc. From the estimation results, a one percentage point fall in income would reduce food consumption by 0.6 percentage points. The two aspects underscore the importance of Government policies aimed at increasing incomes and fostering food security in the sampled areas. Among others, anti-inflationary policy measures could be pursued to both increase the peasants access to food and command over better inputs which would increase the supply of food. The income augmenting policies need to be complemented with a sensitization of family planning practices in the peasant economy. This is important because the empirical results demonstrate a positive and statistically significant effect of the household size on expenditures on food in the areas surveyed.

Apart from the food item, the empirical evidence reveals an existence of a very high demand for some of the non-food items, in particular utensils, which also have a very high income elasticity coefficients. Even though some of these high demand goods are necessities, the empirical evidence reveals that they are luxury goods by and large because of supply based constraints, particularly, transport. A rehabilitation of the transport infrastructure would thus improve the marketing of food and non-food items and aid the households have access to modern health services that are mostly located in the urban areas.

In the overall, it is worth noting that the areas covered by this study represent agro-economic zones typical of most border regions in Tanzania. However, generalization of the findings of the study cannot be claimed. This is largely because the data used are from a case study in a specific region. The empirical evidence generated require to be complemented by a more recent analysis of the data collected by the 1991 National Household Budget Survey (HHBS).

Additionally, use of the results presented in this article for policy and planning purposes is undermined by the rapid changes resulting from macro economic stabilization programmes put in practice since the mid-1980s. Clearly, these programmes have influenced the consumption pattern in Tanzania, but to what extent is a question which remains to be established empirically.

Furthermore, the study is not exhaustive in as regards the format of the estimation equations. The estimated linear format functions produced a relatively poor fit, if compared to the log-linear estimation results. Other contesting functional format remains to be subjected to empirical tests in future. Moreover, because of some inadequacies inherent in the data collected, some of the factors that influence consumption patterns in Tanzania have not been modelled here. For example, it remains of interest in future studies to establish the effect of sex, marital status, locational factors, etc., on the consumption pattern of the households. Equally important in future studies is an investigation of the effect of a heteroscedasticity problem on the robustness of the parameter estimates. The presence of heteroscedasticity, which might result from data problems and error in the specification of the models, would result in biased parameter estimates that undermine the predictive power of the models.

Notes

1. This study build on the data collected for a case study of Formal and Informal Credit Institutions in Arusha Region, Northern Tanzania. See, Ndanshau, 1996. I am thankful for comments made on the draft version of this paper by Professors. N.E. Osoro and Stephen M. Kapunda of the Department of Economics at the University of Dar es Salaam.
2. The studies which have ventured into the use of time series data include Blundell, Pshardes and Weber 1993; Kulliane, 1989; Mashindano, 1988; Iyengar and Raghuprasad, 1988; Kulindwa, 1985; and Ferdinand, 1984.
3. This can have an adverse effect on the data, especially where there are members of the households who contribute to the total income earned and/or contributes directly towards the household purchases.

4. This proportion of the sample was formed by head of household who headed several households of their married sons and/or single parent daughters; and, in this regarded they were *de facto* heads of family in what was referred to as *mji* that is, a homestead rather than a household constituted of members living under one roof and taking food from a same pot.

5. The statistics are based on the sume total of monetary and non monetary income. The latter was computed? by use of the then existing local market prices for the respective items in each district.

6. Other studies have also considered marital status, sex and occupation of the household head.See, Kapunda, 1978; and Harris, 1964.

7. This could, however, be for some products only because there may be other products whose consumption may not increase with an extra child in the household. See, Singh and Singh, 1971.

8. A balanced diet may, however, be expensive and, as a result, be given priority by the educated. This granted education would be positively related to the household expenditure on such food items.

9. It is noteworthy that prices are central in the theory of the consumer behaviour but have been ignored here because the data used are cross-sectional. This is also a common approach adopted in the previous studies on the Engel's law. See, Iyenger and Raghuprasad, 1988; Kapunda, 1977; and Singh and Singh, 1971.

10. In some studies, for example, Kapunda (1988), Ostby and Gulilat (1969) and Massel (1969), a dummy variable was assigned for this variable such that the literate heads of the households were assigned a unit and a zero for the illiterate.

11. Other studies have opted for an implicit modeling of the household size by using per-capita values of consumption expenditures and income in the estimated Engel curves. See studies by, among others, Barten, Theirl and Leenders, 1962; Harris, 1964; and Singh and Singh, 1971.

12. According to Okunade (1985), the functional form for estimation should be dependent upon the testable hypotheses, nature of data, goodness of fit and the purpose of the study.

13. For a detailed account and discussion on the various possible functional format for estimation, see Adamu, 1966.

14. The expenditure on charcoal was imputed by using the reported quantities and local market prices.

References

Adamu, S.O. 1966. Expenditure elasticities of demand for household consumer goods. *The Nigerian Journal of Economics and Social Studies,* 8, no. 3, pp. 481-90.

Adejumobi, E.O. 1970. Household expenditure in Ibadan: a statistical analysis of family budgets," *Nigerian Journal of Economics and Social Studies* 12, No. 3 (Nov.), pp. 289-302.

Adkins, R. 1976a. Engel's curve of four major consumption items from the 1969 Tanzanian Household Budget Survey. University of Dar-es-Salaam.

—. 1976b. Comparison of the Engel curves estimated from the 1969 Tanzanian household budget survey. University of Dar-es-Salaam.

Bamweguba, H.K.R 1979. An econometric analysis of the principal determinants of meat consumer demand in Dar es Salaam". Unpub. MA thesis, University of Dar es Salaam.

Barten, A.P., H. Theil and C.T. Leenders. 1962. Farmers' budgets in a depression period. *Econometrica,* 30, pp. 548-64.

Boateng, E.O. *et al.* 1992. A poverty profile for Ghana 1987-1988. *Journal of African Economies,* 1 no. 1, pp. 25-58.

Blundel, R., P. Pashardes and G. Weber 1993. What do we learn about consumer demand patterns from micro-data? *American Economic Recovery,* 9, no. 3, pp. 570-97.

Cury, B. 1969. Estimation of long-run changes in domestic demand for food in LDCs. a paper prepared for IBRD, Economics Department, Working Paper No. 33, January.

Ferdinand, C.K.T 1984. An econometric analysis of demand for chibuku in Dar es Salaam". Unpub. M.A. thesis, University of Dar es Salaam.

Harris, D.J. 1964. Econometric analysis of household consumption in Jamaica," *Social and Economic Studies,* 12.

Houthakker, H.S. 1957. An international comparison of household expenditure patterns, commemorating the centenary of Engel's law. *Econometrica,* 25, pp. 532-51.

Iyengar, N.S. and S. Raghuprasad 1988. Estimation of additive Engel curves in the presence of heteroscedasticity'. *Journal of Quantitative Economics,* 4, no. 2, July, pp. 279-291.

Kapunda, S.M. 1988. Consumption patterns and Tanzania's economic development. Ph.D. thesis, University of Dar es Salaam, August.

—. 1983. Engel's law and its application to Tanzania', ERB seminar paper, March.

—. 1977. An econometric analysis of consumer behaviour in selected areas of Tanzania. Economic Research Bureau, *ERB paper* no. 77.7, University of Dar es Salaam.

Kelley, A. 1981. Demographic impacts in demand patterns in the low-income setting. *Economic Development and Cultural Change,* 30, pp. 1-16.

Kmenta, J. 1971, *Elements of Econometrics.* New York: Macmillan Publishing Co. Inc.

Kulindwa, K. 1985. A residential demand for electricity in Dar es Salaam." M.A. Thesis, University of Dar es Salaam.

Kulliane, M.. Analysis of demand for food grains: the case of rice in Dar es Salaam." Unpub. M.A. Thesis, University of Dar es Salaam.

Mashindano, O. 1988. Estimating sugar consumption in Tanzania". Unpub. M.A. Thesis, University of Dar es Salaam.

Mashuda, F.B. 1969-70. An econometric study of the demand patterns in Dar-es-Salaam and Zanzibar. mimeo, University of Dar-es-Salaam.

Massel, B.F. 1969. Consistent estimation of expenditure elasticities form cross section data on household producing partly for subsistence. *Review of Economics and Statistics,* 51.

—. and J. Heyer 1969. Household expenditure in Nairobi: a statistical analysis of consumer behaviour. *Economic Development & Cultural Change* 17, no.2 (January), p.212-34.

Ndanshau, M.O.A. 1996. Formal and informal finance in the peasant economy: a case study in Arusha region, Northern Tanzania. Unpub. Ph.D Thesis, University of Dar es Salaam.

Nicholson, W. 1992. *Microeconomic Theory: Basic Principles and Extensions*, 5th Edition. Fort Worth: The Dryden Press.

Okunade, A. 1985. Engel's curves for developing nations: the case of Africa. *East African Economic Review,* 1, no. 1, December.

Ostby, I. 1968. An econometric study of demand patterns in Dar es Salaam: preliminary review. Economic Research Bureau *ERB paper* no. 68.5, University of Dar es Salaam.

—. and T. Gulilat 1969. A statistical study of household expenditure in Addis Ababa. *Eastern Africa Economic Review 1*, December.

Ödegaard, K. 1985. Cash Crop versus Food Crop Production in Tanzania: An Assessment of the Major Post-Colonial Trends". Unpub. Ph.D dissert, Lund University.

Prais, J.S. and H.S. Houthakker 1971, *The Analysis of Family Budgets.* London: Cambridge University Press 1971.

—. 1952-53. Non-linear estimates of the Engel curves. *Review of Economic Studies,* 20.

Sechambo, F. 1988. An econometric analysis of demand for charcoal in Tanzania: The case of Dar es Salaam and Mwanza. Unpub. M.A. Thesis, University of Dar es Salaam.

Singh, A. and H. Singh 1971. Changing consumption pattern in Punjab: projections of consumer demand for 1973-74. *Economic and Political Weekly,* 6, no. 50 pp. 2479-85.

Stone, R. 1954. Linear expenditure systems and demand analysis: an application to the pattern of British demand. *Economic Journal,* 54, pp. 511-27.

Strauss. J. 1982. Determinants of food consumption in rural Sierra Leone" *Journal of Development Economics,* 11, pp. 327-54.

—. 1984. Determinants of food consumption in rural Sierra Leone revisited. *Journal of Development Economics,* 16, pp. 77-104.

Summers, R. 1959. A note on least squares bias in household expenditure analysis. *Econometrica,* 27.

Tanzania. 1969. Bureau of Statistics, Official documents and files (1969/1970).

Tedford, J.R. *et al.* 1986. Adult equivalent scales once more- a developmental approach" *American Journal of Agricultural Economics,* 68, no. 2, May.

United Republic of Tanzania (URT). 1988. *1988 Population Census: Preliminary Report.* Dar es Salaam: Bureau of Statistics, Ministry of Finance, Economic Affairs and Planning.

MICHIGAN STATE
UNIVERSITY

The African e-Journals Project has digitized full text of articles of eleven social science and humanities journals. This item is from the digital archive maintained by Michigan State University Library. Find more at:
http://digital.lib.msu.edu/projects/africanjournals/

Available through a partnership with African e-Journals Project



Michigan State University
LIBRARIES