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Demand Analysis for Cassava in Rural and Urban Areas: Is it an Inferior or Normal Food?

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Abstract

This study examined the major factors that drive changes in cassava consumption pattern across income groups and consumer characteristics among urban and rural households to inform food policy formulation. The study, among other things, sought to provide evidence on whether or not cassava had become a normal food commodity in selected urban and rural households. Cross sectional data from 200 households were used to estimate single equation demand model through OLS method. Cassava expenditure elasticity was estimated for selected urban and rural areas across different income groups to test Engel's law. Descriptive analysis was used to identify the most preferred form of cassava product among consumers. The study was underpinned by the theory of consumer behaviour and demand. The findings indicated that boiled cassava is the most preferred product in the study areas. Preferences to cassava products are independent of their income levels. Whether low, middle or high income, almost all households bought a particular cassava product based mainly on their own assessment of the taste. The determinants of cassava expenditure in all consumer locations included age of household head, gender, household size, educational level and household income. Fresh cassava expenditure elasticity in urban and rural areas was positive, though inelastic ($0 < \eta < 1$), suggesting that cassava is a normal food commodity, it is a necessity good for life. The results provide convincing evidence that demand for cassava will continue to rise as income increases. Thus, it is short sighted to consider cassava solely a subsistence crop and inferior food.

Key words: cassava, consumption pattern, inferior food, normal food, demand model, income elasticity
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1.0 Introduction

Cassava is one of the most widely grown staple crops in Sub-Saharan Africa. Total production in Sub-Saharan Africa is estimated to be more than 140 million tones, which is greater than any other crop in the continent (FAOSTAT, 2016). Approximately 75 percent of Africa's cassava output is harvested in Nigeria, the Democratic Republic of Congo, Ghana, Tanzania and Mozambique. In Tanzania cassava production is second to maize and more than 1.3 million households are engaged in production of the crop in the country in an area over 860 000 hectares producing about 5 million tonnes (FAOSTAT, 2016; NBS, 2012). On the demand side, it has been estimated that the total use of roots and tubers in developing countries is projected to increase by 232 million tonnes to 635 million tonnes by 2020 and cassava's share of the increase is estimated to be 44 percent (Scott *et al.*, 2000).

Despite the speculations about the growing demand for cassava, the crop is facing a lot of challenges both on supply and market side. On the production side limiting factors include high cost of production versus low yields and production orientation towards subsistence instead of commercialization; genetically low yielding potential of local varieties; existence of abiotic stress and biotic stresses factors that include susceptibility of the commonly grown varieties to major diseases and pests such as cassava mosaic diseases, cassava brown streak disease (CBSD), cassava bacterial blight (CBB), cassava green mite (CGM), cassava mealy bug (CMB) and Nematodes (Mkamilo and Jeremiah, 2005). On the market side, among other things, the demand structure of the crop as a major source of food and cheap carbohydrates in most developing countries including Tanzania has not been ascertained.

In order to address these challenges, several researches on cassava are being conducted. However, most of them have been directed on the supply side including developing high yielding, early maturing and disease resistant varieties (Mkamilo and Jeremiah, 2005). Besides, researchers have been working on providing a more constant flow of cassava planting materials and breeding of cassava for ecological adaptation and resistance to pests and diseases, and get a better understanding of the physiology of cassava. On the market side research work on cassava demand and consumption has not drawn the attention of researchers to the same degree as its agronomy and genetics. The crop has generally been neglected in policy-decisions related to research on marketing; demand and consumption (FAO and IFAD, 2005, Nweke, 2002). It has been marginalized in food policy debates and burdened with the stigma of being an inferior commodity (Nweke, 2004). There is little empirical work that has been undertaken to quantitatively study the demand analysis for cassava in urban and rural areas with a purpose of identifying the most preferred cassava products among households in urban and rural areas, estimating demand functions for cassava in rural and urban areas and providing evidence on whether or not cassava had become a normal food commodity in selected urban and rural households. Instead, there is a generalized perception by many food policy analysts that cassava is an inferior food with an assumption attached to it that its per capita consumption will decline with increasing per capita income.

The present study, therefore, is an attempt partly to bridge the gap on the existing studies basically in three important ways. Firstly, by identifying the most preferred cassava products among households in urban and rural areas. Secondly, by specifically estimating demand functions for cassava in rural and urban areas of Tanzania and thirdly, by providing evidence on whether or not cassava had become a normal food commodity in selected urban and rural households.

2. 0 Literature Review

2.1 Theoretical framework

This study is underpinned by the theory of consumer behaviour and demand. Demand theory has been widely applied to determine individuals or households consumption behavior. In consumer theory and demand, individuals as units of consumption are viewed as attempting to maximize their utility (or satisfaction) from consumption of goods given their tastes and preferences and subject to a budget constraint, determined by their income, prices, and prices of other goods. Therefore for given tastes and preferences individual consumer food demand, or purchases, is a function of income and prices. However, for a group of consumers like a household, the demand function for individual consumers is extended to include demographic characteristics (age, race-ethnicity, schooling, and other variables) besides prices and income for capturing unobserved information on consumers' tastes and preferences (Lipsey and Crystal, 1999). While consumer’s demand gives the number of units of a particular product that the consumer would choose to buy at each possible price over a specified period of time.

The demand functions are based on the assumption that consumers seek to maximize their utility (or satisfaction) from the “n” goods (in this case cassava) given their tastes and preferences and subject to a budget constraint, determined by their income (in this case per capita income), price of the good of concern, and prices of other goods. Extending the demand function for individual consumers to a group of consumers like household requires the inclusion of certain household and socio-cultural factors, including household size, age, gender, educational background, occupation, and religious affiliation which is useful for capturing unobserved information on consumers' tastes and preferences (Chern *at el*., 2003).

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. It is through consumer behaviour and demand theory expenditure and price elasticity is derived. Expenditure and price elasticity provide valuable information on how consumers react to price and income changes. Such information has been useful in designing food policy and research needs for various consumer categories (Lau *et al*., 1978; Abdulai and Auberta, 2004).

2.2 Consumer Demand Theory and Econometric Models for Demand Analysis

According to Ferris (1998) the empirical analysis of consumer behaviour is not completely an application of the science of economics, but it also entails the artful eye of an econometrician. The author argues that the estimation of demand or expenditure models involves the application of econometric and mathematical tools for estimating single equations and by estimating systems of equations. This argument is consistent with Chern *at el*. (2003) who pointed out that an application of the theory of the consumer requires a specific model and in general, econometric studies of demand include both single equations and systems of demand equations. The demand functions can be generalized for a consumer or a household buying "n" goods as:

$$q_i = q_i(p_1, p_2, \ldots p_j, \ldots p_n, I),\ i = 1, 2, \ldots, n. \qquad (1)$$

Where q_i is the quantity demanded; p is the price of commodities, the subscript i denotes the commodities; and I is income. The "n equations" can be estimated by single equations or by systems of equations. Equation (1) is estimated in a budget share form. Extending the demand function for individual consumers to a group of consumers in most empirical applications requires the inclusion of demographic variables besides prices and income (Chern *at el*., 2003).

2.2.1 Single equation demand models

Single equation estimation involves estimating either one equation in the model, or two or more equations in the model separately. Single equation Engel curves has mostly been employed in estimating the demand functions and elasticities. Since the seminal work of Engel who studied the expenditure patterns of Belgian households in Germany, the estimation of Engel curves demand functions and Engel elasticities has occupied the central position in most household expenditure studies. Prais and Houthakker (1971) did a comprehensive review and performed estimations of demand using linear, hyperbolic, semi-logarithmic, double logarithmic, and logarithmic reciprocal single equation models. All of these forms were shown to have some advantages over the other forms for some of the goods or for part of the range of the relationship. The excellent review for that matter is presented by Brown and Deaton (1972) as well as Sadoulet and de Janvry (1995).

The major concern in the estimation of Engel functional model is that the functional form used should be consistent with observed consumer behaviour. The Engel functional form should be able to represent luxuries (commodities whose consumption increases more than proportionally with income), necessities (commodities whose consumption increases less than proportionally with income), and inferior goods (commodities whose consumption decreases as income increases) as shown in Table 1 below.

Table 1: Categorization of goods according to the signs and magnitudes of elasticities

Categorization with respect to the income elasticity	Elasticity (ŋ)	Categorization with respect to the own-price elasticity	Elasticity (E_{ii})	Categorization with respect to the cross-price elasticity	Elasticity (E_{ij})
Inferior good	ŋ < 0	Non-Giffen good	$E_{ii} < 0$	Gross substitutes	$E_{ij} > 0$
Neutral good	ŋ = 0	Giffen good	$E_{ii} > 0$	Gross complements	$E_{ij} < 0$
Normal good	ŋ > 0				
Necessity	0< ŋ < 1				
Luxury	ŋ >1				

Source: Sadoulet and de Janvry (1995)

Prais and Houthakker (1971) pointed out that the semi-logarithmic functional form performs quite well and is able to represent necessities, luxuries, and inferior goods, and allows the income elasticity to vary with income levels; the form is presented as follows:

$$q_i = a + b \ln y_i \quad (2)$$

However, the choice of the functional form should not only be based on practical criteria of goodness of fit, but also on principles of demand theory such as "the principle of adding-up" which requires that consumers do not spend more than their income (Houthakker, 1957). This principle places some restrictions on the demand elasticities of each goods, known as Engel's and Cournot's equations. Simply put, these equations state that changes in income and prices determine changes in the composition of the budget constraint but leave its value unchanged.

One of the functional forms that satisfy "the principle of adding-up", and that is able to represent closely consumer behaviour is the "Working-Leser functional form". The model was originally proposed by Working (1943) and elaborated by Leser (1963), hence, the name "Working-Leser". This model states that the budget share of given item is a function of logarithm of the total expenditure. Simply put, the model relates the commodity budget shares to the logarithm of per capita expenditure. It is presented as follows:

$$w_i = a_i + b_i \ln y \quad (3)$$

Other explanatory variables are added to increase the explanatory power of the model. The quadratic term (square of the log of expenditure) is introduced in the model, thus the problem of misspecifications is also minimized.

The Working-Leser model (Equation 3) satisfies the adding-up condition (which states that when the budget share of one commodity increases, another share must be reduced to maintain the budget constraint of the household) provided that the sum of the parameters a_i estimated over all commodities in the household budget is equal to one, and that the sum of the parameters b_i is equal to zero ($\sum a_i=1$, $\sum b_i=0$). It allows for luxuries, necessities and inferior goods and for elasticities to vary with income. Finally, the form is linear in the logarithm of expenditure, and is easily estimated by ordinary least square (OLS) equation by equation, with the adding-up restrictions being automatically satisfied (Banks *et al*., 1997). More recent research on Engel curves has focused on the estimation of the Working-Leser equation using polynomials in the expenditure term (by adding quadratic or cubic terms) and non-parametric or semi-parametric methods. Unlike the standard parametric Working-Leser form, these methods allow expenditure elasticities to vary in any direction for the same good over the entire range of household expenditure (ibid).

2.2.2 System of demand equations

System of demand (complete demand system) involves estimating two or more equations in the model jointly. It involves the simultaneous estimation of complete demand systems containing demand equations for every commodity groups. The major advantage of system estimation is that it uses more information, and therefore they results in more precise parameter estimates. However, the major disadvantages are that it requires more data and is sensitive to model specification errors (Stone, 1954). Numerous algebraic specifications of demand systems now exist, including the linear and quadratic expenditure systems, the Rotterdam model, Translog models and the almost ideal demand system (AIDS) and the linear approximate version of the AIDS specification.

During the 1980s and 1990s, these models, with extensions, were used to estimate demand for food products, and more complex flexible forms were also developed. However, the emphasis was still on the price and income effects, and the approach was frequently the modelling of the representative consumer using time-series data. The working-leser model became more popular since Deaton and Muellbauer (1980) proposed the almost ideal demand system (AIDS), which collapses to the working-leser for cross sectional data.

Our study on rural and urban household demand analysis for cassava in Dar es salaam and Coast Region in Tanzania uses survey data on cross sections of households which do not contain observations in price variations (Brown and Deaton, 1972), the principal analytical model adopted is the Working-Leser Engel functional form and the exact specification we use is what is known as semi-logarithmic quadratic functional form (SLQF) of the Engel equation.

2.3 Household Composition and Aggregation

There exists a vast literature regarding the aggregation of individual living standards into household living standards, two broad issues arise in this literature - the issue of household size and issues relates to household composition. Thus, a three adult household is unlikely to have equivalent consumption requirements to a household with one adult and two young children. Therefore, a household has to be aggregated into a number of adult equivalents. This is consistent with Deaton and Muellbauer (1980) who argued that in order to account for differences in household size and composition, total household consumption has to be divided by the number of adult equivalents and adjusted to take into account economies of scale. The correct estimation of Engel curves should be performed using expenditure per adult equivalents rather than per capita expenditure, because the use of the latter has the effect of overestimating food expenditure by households of larger size.

There are two reasons for why per capita expenditure is inappropriate for the estimation of Engel curves. First, children in developing countries consume proportionally more food than adults. For example, consumption by infants is likely to consist mainly of food among poor families. As a result, for the same level of per capita expenditure, larger households spend more on food. Households of different size have different Engel curves and the shape of the curve may be biased if household size is correlated with income. Thus, the solution to this problem is to divide household expenditure by units of adult equivalents using appropriate equivalence scales, rather than by household size. Equivalence scale reflects the fact that there are scale economies in a household.

There are several methodologies adopted in statistics including dividing household expenditure by the square root of household size, rather than by household size. However, the choice of a particular equivalence scale depends on technical assumptions about economies of scale in consumption as well as on value judgments about the priority assigned to the needs of different individuals such as children or the elderly (Lanjouw and Ravallion, 1995). In this study we use adult equivalence scale defined by National Bureau of Statistics in Tanzania (2009) in its 2007

Household Budget Survey (HBS) as shown in Table 2 below.

Table 2: Adult Equivalence Scale

Age Groups	Sexual Category	
	Male	**Female**
0-2	0.40	0.40
3-4	0.40	0.48
5-6	0.56	0.56
7-8	0.64	0.64
9-10	0.76	0.76
11-12	0.80	0.88
13-14	1.00	1.00
15-18	1.20	1.00
19-59	1.00	0.88
60+	0.80	0.72

Source: NBS, (2009)

2.4 Previous Food Demand Studies in Tanzania

Various studies have examined the issues of food demand in urban and rural areas. However, only a handful of them focus on Sub-Saharan Africa (SSA) and of these even fewer focus on Tanzania. Of the few studies that have analyzed food demand in urban and rural areas in Tanzania include Mafuru and Marsh (2003), Ananda *et al.*, (2003), Chongela *et al.,* (2014), Mazengo *et al.*, (1997), Abdulai and Auberta (2004) and NBS (2014). None of these studies has disaggregated food items into cassava and its products. Besides, in Tanzania, little empirical work has been undertaken to quantitatively study the demand analysis for cassava in urban and rural areas with a purpose of identifying the most preferred cassava products among households in urban and rural areas, estimating demand functions for cassava in rural and urban areas and providing evidence on whether or not cassava had become a normal food commodity in selected urban and rural households. Besides, most of these studies have considered food items in an aggregated manner. None of them has disaggregated food items into cassava and its products.

While Mafuru and Marsh (2003) have analyzed urban and rural food consumption in Tanzania using the Generalized Translog (GTL) expenditure system, they focused on four-food items namely, maize, rice, beef and fish. Cassava was not included in their analysis. Results indicated that subsistence consumption has significant effect on food demand in rural areas, but it is less important in urban areas.

Ananda *et al.*, (2003) estimated price and food expenditure elasticities for twelve food groups in Tanzania by applying the linearized Almost Ideal Demand system to the latest household survey data. The results indicate that maize, rice, other cereals, pulses, sugar, edible oils, fish, starch, fruits and vegetables, meat, and other foods are price inelastic while milk and dairy products have unitary elasticity of demand. Most of the food groups are income elastic. The results also reveal that household income and family size have significant effects on food demand patterns.

Another study by Chongela *et al.,* (2014) employed the Almost Ideal Demand System (AIDS) to estimate the consumer demand system of agri-food consumed by the households in Tanzania using Household Budget Survey (HBS) dataset for 2007 conducted by National Bureau of Statistics (NBS) of the United Republic of Tanzania. Empirical results revealed that households' food budget share was 60% on average per month. The own price elasticity of demand for aggregated agri-food was inelastic (0.86). Income elasticity of demand for aggregated agri-food was 0.96. Results suggested government intervention in terms of agri-food price stabilization policies and programmes as well as income support policies.

Mazengo *et al.,* (1997) analysed food consumption in rural and urban Tanzania. Their studies focused on characterizing rural-urban differences in the meal and snack patterns and intakes of energy and nutrients. They found that all urban and 92% of rural subjects had three daily meals, and snacks were as commonly eaten in both areas of the survey. Foods of animal origin, such as meat and milk, were seldom used by the rural subjects.

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Abdulai and Auberta (2004) analyzed demand for food and nutrients in Tanzania. However, the study focused on nutrients and the estimated expenditure elasticities for the nutrients ranged from 0.307 for iron to 1.26 for Vitamin B_{12}. The results reflected the higher expenditure elasticities for meat, fish, eggs, milk, and milk products, as well as fruits and vegetables, relative to cereals and pulses.

Household Budget Survey conducted by NBS (2014) indicated that the food budget share (including cassava) in Tanzania Mainland was 56.4 percent and the computed food budget share for Dar es Salaam, other urban areas and rural areas were 43.6 percent, 50.4 percent and 62.0 percent respectively. Household lived in Dar es Salaam spent more on non-food items such as kerosene, charcoal, transport, health, education, housing, clothing and recreation than the population living in other urban areas. The household who lived in rural areas spent more on food than on non-food items.

3. 0 Materials And Methods

3.1 Data for the study

The data set for this analysis is from a recent survey of 200 households in Dar es Salaam and Coast Regions of Tanzania. A two-stage sampling method and a combination of stratified and systematic random sampling techniques were used to select 100 respondent households each in Dar es Salaam and Coast Regions. In the first stage, two regional administrative areas; Dar es Salaam representing urban areas and Coast Region representing rural areas were purposively selected to reflect the most cassava producing and consuming areas.

In the second stage, two local government authorities Ilala Municipal Council and Mkuranga District Council in Dar es Salaam and Coast Region, respectively were randomly selected and stratified into low, medium, and high income areas with the help of the local government authorities in the respective study areas. Within each income stratum, a systematic random sampling technique was employed to select respondent households. The households selected through the systematic random procedure were visited and household heads were interviewed. The set of data collected consisted of information on personal and household characteristics of interest (age, education, gender and household size which was later transformed into adult equivalence scale), different forms of cassava products preferred by household, expenditure on cassava and per capita household expenditure. The per capita household expenditure data were used as a proxy for household income because of the measurement and problems of the income data in Least Developing Countries (Boateng *et al.,* 1992).

3.2 Analytical framework

The principal analytical tool we use is the Engel curve, which relates budget shares devoted to various food groups (in this case cassava), to total household per capita expenditures and other household characteristics such as demographic composition. The reason attached to its selection is as recommended by Brown and Deaton (1972) that in those situations where all we have are cross-sectional data from household which do not contain observations in price variations, we are limited to the estimation of Engel curves. Exact specification we use is Working-Leser Engel functional form.

The first reason for choosing this algebraic specification is related to the characteristics of the survey data, the type of commodity studied and the expected magnitudes for the income elasticity to be estimated. The second reason attached to its selection is the fact that, it allows the income elasticity to vary with income and it has been shown to give a satisfactory description in most food studies (Prais and Houthakker, 1971). The third reason is its ability to represent inferior, necessity and luxury properties of the good under the study. In addition, it satisfies the adding-up criterion. Indeed, despite that the specified Engel functional form satisfies the adding-up criterion, this was not a concern since we did not estimate a complete demand system.
The Working-Leser Engel functional form is specified as:-

$$w_i = \alpha + \beta_i \log(\exp) + \mu_c \qquad (4)$$

Quadratic term (square of the log of expenditure) is added as proposed by Banks *at el.,* (1997) to minimize the problem of Heteroscedasticity and allowing the model to represent inferior, necessity and luxury properties of the good under the study. Indeed, we add other explanatory variables (household characteristics) to increase the explanatory power of the model and minimize the problem of misspecifications. The empirical specification of the model is presented in equation (5) below:-

$$w_c = \alpha + \beta_1 \log(\exp) + \beta_2 \log(\exp)^2 + \beta_3 hhs + \beta_4 edu + \beta_5 age + \beta_6 gender + \mu_c \qquad (5)$$

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Where;
w_c Budget share devoted for fresh cassava,
exp Household total per capita consumption expenditures (TZS),
hhs Household size and composition (adjusted to adult equivalents scale)
edu Number of years of formal education completed by household head
age Age of the household head in years
Gender Gender of household head
α and β_s Parameters to be estimated; and
μ_c Is a random error term

Using equation (5), the total expenditure elasticities can be derived using the formula in (6) below (Deaton *et.al*., 1989).

$$E_i = 1+[\partial w_c/\partial \log(exp)]/w_c = 1+[\beta_1+2*\beta_2 \log(exp)]/w_c \qquad (6)$$

It is noteworthy that prices are central in the theory of the consumer behaviour but in this study we have ignored because we use cross-sectional data from household which did not contain observations in price variations as recommended by Brown and Deaton (1972).

4. 0 Empirical Results and Discussion

Study results indicated that the most preferred cassava product in urban and rural households was boiled cassava followed by *futali/mseto*, stiff porridge (*ugali*) and others forms such as mixing maize meal with cassava flour to enhance taste and acceptability, roasted cassava and smoked cassava as indicated in Appendix 1. However, it is worth noting that, boiled cassava was not normally consumed alone. There was a number of compliments, the commonest being tea. This is a clear indication that boiled cassava is a substitute of bread and other foodstuffs that go together with tea. Following a Chi-square test of independence conducted, the study supported the hypothesis of independence between cassava product preference and level of income at 1% level of significance (Figure 1). This implies that, whether low, middle or high income, almost all households bought a particular cassava product based mainly on their own assessment of the taste.

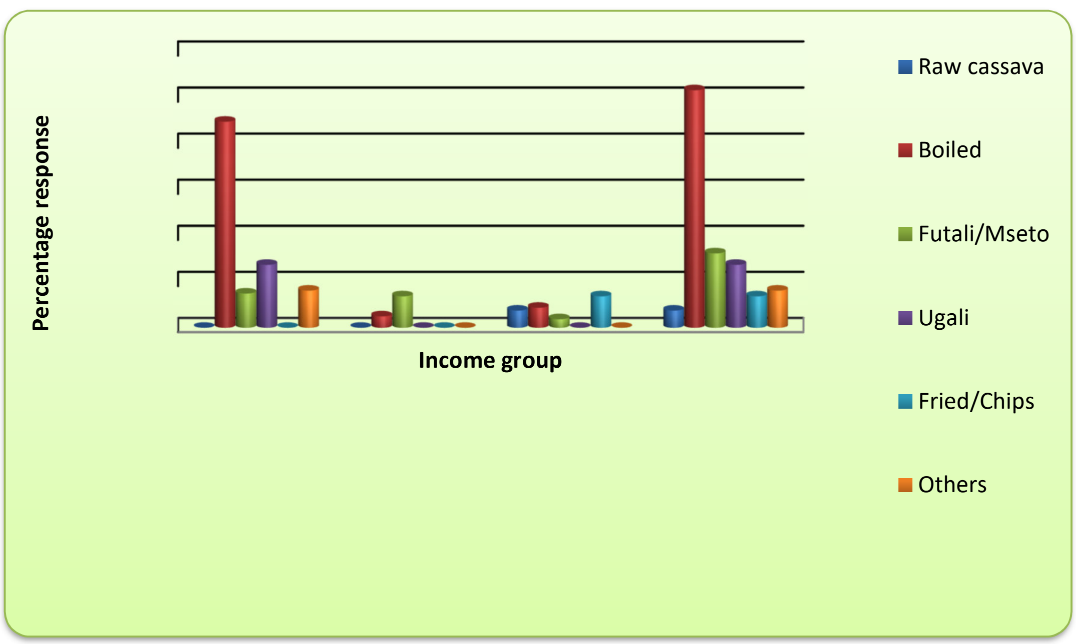

Figure 1: Preference for cassava products by income groups –all consumer locations

On the other hand, the results showed that average monthly household food expenditures are lowest in Dar es Salaam and highest in Coast Region. Households which lived in Dar es Salaam spent more on non-food items than the those living in Coast Region. For the pooled sample, 58% of the total household budget was spent on food. Further analysis indicated that while households in Dar es Salaam their food budget share formed 43.5% of total household budget, households in Coast Region spend 53.8% of their total household budget on food. On average, out of 58% share of monthly expenditure on food, households in all areas spent 3% on cassava. Cassava budget share was higher in Dar es Salaam (3.8%) and lower in Coast Region (2.6%) as depicted in Table 3.

Following the two-sample *t test* conducted, data provided enough evidence to reject the null hypothesis at 5% level of significance. Thus, households in Dar es Salaam spent more on cassava than households living in Coast Region. The implication of this finding is that, as income increases, total food spending also increases, although the increase is smaller than the increase in income. This pattern is consistent with Engel's law, which states that as income increases, food spending also increases but the proportion of income devoted to food declines. This finding is close to that of National Bureau of Statistics (2014) of the United Republic of Tanzania for households' budget surveys of 2011/2012 which reported food share of 43.7% for Dar es Salaam and 62.0% for rural areas in Tanzania Mainland. In addition to that households' food budget shares declined from 71.1% in the 1st deciles to 54.8% in 9th decile which were consistent to incomes increase.

Table 3: Monthly average households' cassava expenditure shares by consumer location (figures in percentages)

Item	Dar es Salaam (Urban)	Coast Region (Rural)	Pooled Sample
Cassava Ratio	3.75	2.63	2.91
Total Food Ratio	43.52	53.80	57.74
Non-Food Ratio	56.48	46.20	42.26

Two-sample t test (cassava expenditure share), t = 2.2399; Pr(|T| > |t|) = 0.0265

Similarly, the F-statistics for the budget share model was significant at the 1% level, implying that the independent variables, jointly, were important determinants of cassava consumption patterns in urban and rural areas under the study. Therefore, the hypothesis that none of the explanatory variables was related to cassava consumption pattern was rejected. The coefficient of determination for the budget share model for urban areas was 0.737, implying that 74% of the variation in cassava budget share was explained by changes in the independent variables combined. While that of rural areas was 0.8233 implying that 82% of the variation in cassava budget share was explained by changes in the independent variables combined.

Following the test for heteroscedasticity diagnostic conducted for all models (urban and rural) the results failed to find any evidence for heteroscedastic residuals (both at 1% and 5% level of significance), implying that variance of the error terms was similar across observations (homoscedasticity). The collinearity statistics in the table (tolerance and VIF) showed that there was a reasonably low level of multicollinearity among the independent variables in the model, implying that the estimated parameters were stable and thus could be used to draw inferences. The estimated parameters, although highly significant, have no direct economic interpretation and therefore are not reported.

The principal determinants of cassava expenditure in all the consumer locations were identified to include, age of household head, gender, household size, educational level and household income. All these variables were significant at 1% level with exception of household size which was found to be significant at 5% level (Tables 4 and 5). However, it is noteworthy that prices are also central in the theory of the consumer behaviour but in this study were ignored because the data used were cross-sectional and did not contain price variations.

Table 4: Regression model estimates for Coast Region (Rural areas)

Independent Variable	Coefficient(β_s)	Standard error (SE)	t-statistic	Tolerance Statistic	VIF
Age (0= <35, 1= Otherwise)	0.0398	0.011	3.62**	0.541	1.848
Gender (0= Male, 1= Female)	0.3870	0.215	1.80**	0.92	1.087
Number of years in school	-0.6453	0.1285	-5.02**	0.469	2.132
Adult equivalents	0.0784	0.0392	2.00*	0.881	1.135
Log of per capita household expenditure	-0.9911	0.2784	-3.56**	0.528	1.894
Log of per capita household expenditure squared	0.0144	0.0037	3.89**	0.782	1.277
Constant	0.258	0.4526	0.57**		
R-squared	0.8233				
F-statistics	58.72 (0.000)				

*Prob > F in parenthesis; ***= Significant at P < 0.001** = Significant at P < 0.01, * =Significant at P < 0.05*

Table 5: Regression model estimates for Dar es Salaam (Urban areas)

Independent Variable	Coefficient (β_s)	standard error (SE)	t-values	Tolerance Statistic	VIF
Age (0= <35, 1= Otherwise)	0.0614	0.0093	6.60**	0.429	2.333
Gender (0= Male, 1= Female)	-0.7552	0.2476	-3.05**	0.729	1.372
Number of years in school	-0.0663	0.0272	-2.44**	0.728	1.373
Adult equivalents	0.1505	0.0397	3.79*	0.485	2.064
Log of per capita household expenditure	-0.968	0.4137	-2.34**	0.434	2.304
Log of per capita household expenditure squared	0.0313	0.0141	2.22**	0.474	2.111
Constant	0.556	0.3519	1.58**		
R-squared	0.737				
F-statistics	86.92 (0.000)				

*Prob > F in parenthesis; ***= Significant at P < 0.001** = Significant at P < 0.01, * =Significant at P < 0.05*

Likewise, fresh cassava expenditure elasticity in the study areas for low, middle and high income groups in the two consumer locations (urban and rural areas) was computed as presented in Table 6. It could be inferred from the results that for low income households, cassava expenditure elasticity ranges from a low figure of 0.382 in Coast Region to a high figure of 0.905 in Dar es Salaam. For the middle income households, cassava expenditure elasticity ranges between a low figure of 0.343 in Coast Region and high figure of 0.809 in Dar es Salaam. For the high income group, however, expenditure elasticity was found to be lowest (0.271) in Coast Region and somehow low (0.764) in Dar es Salaam. The fresh cassava expenditure elasticities in all consumer locations are positive, indicating that fresh cassava is a normal good, consumption of which will increase with increased incomes.

Table 6: Fresh cassava expenditure elasticity by consumer location and income group

Rural/Urban Households	Expenditure elasticity by income groups		
	Low income	Medium income	High income
Rural households	0.382	0.343	0.271
Urban households	0.905	0.809	0.764

Expenditure Elasticity was evaluated using the formula provided in equation (6), coefficient estimates based on the estimated models for urban and rural households and relevant mean expenditure

From the Table, it could be seen that expenditure elasticity for each of the consumer location decreases with increasing income level. Thus, low income households are more responsive to changes in household income as opposed to high income households as far as cassava budget share is concerned. The reason attributed to this phenomenon is related to that pointed out by Chern *et al.,* (2003) that, for the reasons of survival, low income households tend to increase their food budget shares than high income households following increases in household income. This pattern suggests that poor households spend a greater proportion of their income on food consumption relative to wealthier households (Engel's Law).

However, in terms of magnitude, it may be observed from the table that the expenditure elasticity is lowest in Coast Region, thus, for low income households a 10% increase in household income (expenditure) will warrant 3.8% increase in cassava budget share. This could be attributed to the reason that rural households depend on relatively cheaper farm food, in addition, a significant proportion of rural cassava consumption is self-produced thus with increasing income, consumers may shift from cheap staples to costly food items like eggs, milk, fish and meat. This finding supports Bennett's law which posits that households switch from less to more expensive calorie consumption as their incomes increases (Hoddinott and Yohannes, 2002). In Dar es Salaam, cassava expenditure elasticity is greater than in Coast Region, thus, for low income households a 10% increase in household income (expenditure) will warrant 9.1% increase in cassava budget share, implying that households in Dar es Salaam respond more to income changes than households in Coast Region with respect to household cassava budget shares.

In all areas, expenditure elasticity show positive sign, though inelastic, thus expenditure elasticity does not exceed unit ($0 < \eta < 1$), suggesting that cassava is a normal food commodity, it is a necessity good for life. In addition, it implies that an increase in household income will cause household cassava budget share to increase. Thus, a one percent increase in income will cause consumers to increase the amount of fresh cassava they are willing to purchase although by less than one percent. The implication of this finding is that, as income increases, spending in cassava (fresh) also increases, although the increase is smaller than the increase in income. This pattern is consistent with Engel's Law, in his article entitled "the relations of production and consumption in the Kingdom of Saxony" as cited in Perthel (1975) were he found that, as income increases, food spending also increases but the proportion of income devoted to food declines. In that regard, the economist Houthakker (1957) stated that, "of all the empirical regularities observed in economic data, Engel's Law is probably the best established."

Also, this implies that as income increases consumers tend to consume normal goods by shifting from inferior goods. Similar results have been reported by Annabi *et al.,* (2006), they pointed out that increase in incomes of the households reduced the demand for inferior goods due to change of consumer preferences from inferior to normal and luxury goods. Samuelson and Nordhaus (2008) reported similar results that there are, however, limits to the extra money people will spend on food when their incomes rise. Consequently, the proportional of total spending devoted to food declines as income increases

Conclusions and Recommendations

The main target of this study was to examine major factors that drive changes in cassava consumption pattern across income groups and consumer characteristics among urban and rural households. The results show that there are cassava products which are more preferred than others and that some products were consumed with a number of compliments. This supported the hypothesis of independence between cassava product preference and income level. Also, the findings indicate that cassava products were consumed by almost all households from low, middle and high income levels.

In terms of monthly food expenditure, the results show that it was lower in urban than in rural areas. Implying that households in Dar es Salaam spent more on non-food items than the people living in Coast Region.

The study also revealed that the principal determinants of cassava expenditure in all the consumer locations were age of household head, gender, household size, educational level and household income. However, it is noteworthy that prices are also central in the theory of the consumer behaviour but in this study were ignored because the data used were cross-sectional and did not contain price variations.

Similarly, the results show that in all the study areas, expenditure elasticity was positive, though inelastic, suggesting that cassava is a normal food commodity (it is a necessity good for life). However, fresh cassava expenditure elasticity was generally higher for low income households as compared to high income households in all study areas.

Thus, income support programs are likely to be good policy tools to promote consumption of cassava among urban and rural household consumers. These programs should be particularly target lower and middle class income earners as consumers' economic stimulus package to enable them increase consumption of normal foods by shifting from inferior foods. Since the positive expenditure elasticity suggests that the consumer demand for fresh cassava is likely to expand as the economy develops, policy formulation should focus on measures to enhance sustainable productivity of the crop in the country through improved cassava production. In addition to production, policy measures should also be directed towards distribution of the crop and its products to the consuming urban areas. Improved cassava distribution system could be enhanced through improving road network leading to the hinterlands where cassava is produced.

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Appendix 1: Forms of cassava utilization in Rural and Urban, Tanzania

Plate 1: Fresh raw cassava

Plate 2: Smoked cassava

Plate 4: Stiff Porridge (Ugali)

Plate 3: Boiled cassava

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Plate 6: Peeled raw cassava


Plate 5: Fried cassava