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Consumer demand system of agri-food in Tanzania

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This paper focused on consumer demand system of agri-food in Tanzania. The study investigated on the budget share of agri-food, estimated own price and income elasticities of demand of agri-food consumed by the households in Tanzanian context. The Almost Ideal Demand System (AIDS) was employed to estimate the consumer demand system of agri-food. The 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. Moreover, inelastic demand of own price elasticity of agri-food products informed the government intervention in terms of agri-food price stabilization policies and programmes. Furthermore, income elasticity of < 1 suggested that interventions of Tanzanian government in terms of 'income support policies' can be done by increasing the incomes of lower and middle class income earners in rural and urban areas as consumers' economic stimulus package to increase normal food consumption. In rural areas where majority of farmers dwell, this can be done by promoting the price of farm products through minimum support price so that farmers can earn much more incomes from their economic activities as a result they can use it for purchasing normal food from the business sector.

Key words: Almost ideal demand system (AIDS), agri-food, consumer demand system, income and own price elasticities.

INTRODUCTION

Consumer demand system is the aggregate desire for goods and services expressed by all consumers in the economy. The essential element to consumer demand consists of desire for consumption, with the second condition of ability to pay to such kind of consumption. The desire for consumption must contain the willingness to consume at the prices demanded for that consumption, this establishing the price schedule for goods and services. The willingness to consume diminishes as the price of such consumption increases, on the other hand, willingness to consume increases as price reduces. The consumer demand system of agri-food in Tanzania is characterized by low purchasing power, and most

consumers have a strong preference for traditional foods that are suited to their diverse social and ethnic backgrounds (Makweba, 2009). Despite this, the demand for processed and quality fresh food is growing, especially due to the recent increase in the middle class across the country. Both formal and informal food markets are changing constantly, driven by lifestyle changes brought about by urbanisation, income growth and changing of family structures. However, the transformation of agri-food markets in Tanzania has been characterised by different extents of supermarketisation, especially in the urban areas.

Panagiotis et al. (2011) estimated censored linear almost

almost ideal demand system of food in Pakistan, they revealed that all own-price elasticities but one are found to be negative and all total food expenditure elasticities are found to be positive. However, they suggested that the estimated elasticities can be used for policy analysis for international organizations and the national government to monitor the food security situation and to develop sound and proper intervention policies to mitigate the negative shock impact on food consumption and under nourishment. Taljaard et al. (2006) analysed a meat consumer demand in South Africa using Linearized Almost Ideal Demand System and Rotterdam models, they revealed that the Linearized Almost Ideal Demand System proved to fit better than Rotterdam model in South Africa meat demand market because of its flexibility to any form of utility function. Katchova and Chern (2004) examined a non-nested comparison between Quadratic Expenditure System (QES) and almost ideal demand system (AIDS) based on empirical data of food demand structure in China. They found that AIDS is the suitable model than QES for estimation of consumer demand system because of its unrestricting to any form of utility function.

The present study is focused on investigation of food budget share consumed by the households, to estimate own price and income elasticities of demand of agri-food consumed by the households in Tanzanian context.

METHODOLOGY

Types of data

Secondary data on 'agri-food consumer demand system' were collected from household budget survey (HBS) conducted in 2007 by the National Bureau of Statistics (NBS) of the United Republic of Tanzania.

Sampling technique

Households were selected from the National Master Sample (NMS) which is nation-wide covering both rural and urban areas. The sample size of 4680 households were selected by systematic sampling method, from 10466 households involved in HBS of 2007 for 21 regions included in the HBS namely; Dar-es-salaam, Arusha, Dodoma, Iringa, Mbeya, Morogoro, Kilimanjaro, Mwanza, Tabora, Tanga, Kagera, Pwani, Kigoma, Lindi, Mtwara, Mara, Shinyanga, Singida, Ruvuma, Rukwa and Manyara.

Agri-food categories

The 158 food items consumed by the households were categorized into 18 groups. Namely; cereals (paddy, rice, green maize cob, maize grain, maize flour, millet grain, millet flour, sorghum grain, sorghum flour, wheat grain, wheat flour, barley and other cereals). Cereal products (bread, biscuits, buns, cakes, chapatti, macaroni, spaghetti, cooking oats, and other cereal products). Roots and starches (cassava fresh, cassava dry, cassava flour, round potatoes, sweet potatoes, yams, cocoyam, cooking bananas / plantains and other starches). Sugar and sweets (sugar, honey, syrup, jams, ice cream, chocolate and sweets). Pulses (dry peas, green peas shelled

or in pods, dry beans, green beans shelled or in pods, lentils, red grams, green grams, and other pulses). Pulse products (bagia). Nuts (groundnuts in shell, groundnuts shelled, coconuts, cashew nuts, and other nuts). Vegetables (carrots, radishes, beets, turnips, garlic, onions, spinach, lettuce, cabbage, other leafy vegetables, tomatoes, bitter tomatoes, ladies fingers / okra, cauliflower, cucumber, pumpkins, brinjals/eggplant, fresh green pepper, other cultivated vegetables, other wild vegetables, dried vegetables and canned vegetables). Fruits (bananas, oranges, limes, mangoes, avocado, pawpaw, sugar canes, apples, pears, other wild fruits). Meat and poultry products (mutton, beef, mince sausages, pork, pork sausages, goat meat, bacon, other domesticated animals, wild animals, offal (liver, kidney), dried or salted meat, canned meat, and other meat products, chicken, eggs and other poultry.

Milk and dairy products (fresh milk, yoghurt, cream, cheese, canned milk and powder milk). Fish and shellfish (fresh fish, shell fish, fresh dried fish, dried or salted fish/ shellfish fillets, and canned fish / shellfish). Oil seeds and fats (cottonseed oil, groundnuts oils, sesame oil, sunflower oil, olive oil, butter, margarines cooking fat, and other cooking oil). Spices and other foodstuffs (red / black peppers, curry powder and other spices as well as salt, yeast, baking powder, and other foodstuffs). Raw materials for drinks (tea powder, coffee powder and cocoa powder). Soft drinks (coca-cola, fanta, pepsi, mirinda, juice, mineral water), tea, coffee, cocoa and other beverages. Alcoholic drinks (Kilimanjaro beer, Safari beer, Guinness beer, Castle beer, Ndovu beer, Serengeti beer, other canned / bottled beer, chibuku and other local brews). Tobacco-cigarettes (sportsman, sweet menthol, nyota, snuff, pipe tobacco and other cigarettes). The categorizations of the food items were done to rule out the substitutability and complementary effects in the consumer demand system model.

Model specification

The almost ideal demand system (AIDS)

The almost ideal demand system (AIDS) proposed by Deaton and Muellbauer (1980), was employed to study the 'consumer demand system' of agri-food in Tanzanian context. It can be depicted as:

$$\omega_h = \alpha + \Sigma \gamma In P_h + \beta In\left(\frac{M_h}{P_h^*}\right). \tag{1}$$

Where: ω_h = Food budget share of the household, α = food budget shares parameter when all prices and real expenditure are equal to one (intercept), γ = price parameter, P_h = prices of food commodities consumed at the household, β = expenditure share parameter, M_h = total expenditure share of the household on all commodities (real income), In = natural logarithm, P_h^* = price index. Price index can be defined as:

$$In P_h^* = \Sigma \omega_h In P_h. \tag{2}$$

The α parameter is the average food budget share when all prices and real expenditure are equal to one. The β parameter measures the change in the i th budget share with respect to a change in real income, all else factors held constant, and indicate whether goods are necessities or luxuries. If $\beta i < 0$, ωi decreases when real income (Mh) increases so that good i is a necessity. Conversely, if $\beta i > 0$, ωi increases with real income (Mh) so that good i is a luxury. The γ parameter measures the change in the i th budget share for a unit change in price (Ph) with real income held constant. The private household was represented as a single consumer. The rational consumer always aims to maximize utility subject to budget

Table 1. Parameter estimates of food consumer demand.

Variable	Adj R^2	Parameter	Parameter estimates	Standard error	t -Value	Pr	Food budget mean
Food budget share		α	0.03	0.03	1.00	0.3179	0.60
Food price	0.39	γ	0.07*	0.003	23.45	<.0001	
Real income		β	-0.03*	0.0007	-37.43	<.0001	

* Implies significant at 5% level of significance.

constraint for given prices and initial endowments.

Estimation of price and income elasticities of demand

The own price and income elasticities of agri-foods consumer demand system were calculated as:

$$\varepsilon_{ii} = -1 + \frac{\gamma_i}{\omega_h} - \beta i \tag{3}$$

$$\eta_i = 1 + \frac{\beta_i}{\omega_h} \tag{4}$$

Where: ε_{ii} = Own price elasticity of demand, ω_h = household food budget share, γ_i = price parameter, β_i = expenditure share parameter, η_i = income elasticity of demand.

Parameterization of the almost ideal demand system (AIDS)

The demand elasticities for the linearized AIDS model were computed on the basis of estimated parameters of its demand function. A stochastic element was introduced in the demand function to obtain the following equation model:

$$\omega_h = \alpha + \sum \gamma \ln P_h + \beta \ln\left(\frac{M_h}{P_h^*}\right) + \mu_h \tag{5}$$

Where: μ_h = Stochastic error term.

RESULTS

Estimation of almost ideal demand system (AIDS)

The empirical results for estimation of 'almost ideal demand system' are presented in Table 1. The results revealed that 39% of proportion of variation in food budget share of the household is explained by proportion of variation in food prices and real income jointly (Table 1). The empirical results for parameter estimates of the 'almost ideal demand system' of agri-food are presented in Table 1. The empirical results found that if food prices

spike by 1%, the food budget share would increase by 7% under ceteris paribus assumption. On the other hand, if real income increases by one percent, the food budget share is expected to shrink by 3% (Table 1). This has been influenced by limits to the extra money people spend on food when their incomes rise. Consequently, the proportion of total spending devoted to food declines as income increases (Samuelson and Nordhaus 2008).

Food budget share

The households' food budget share for disaggregated food products are presented in Figure 1. The results revealed that cereals are the leading food budget share (26.89%), followed by vegetables (10.05%), meat and poultry products (9.69%), roots and starch (8.41%), pulses (6.99%), sugar and sweets (6.52%), fats and oil seeds (5.39%), soft drinks (5.26%), cereal products (5.04%), alcoholic drinks (3.79%), fish and shellfish (2.67%), milk and dairy products (2.31%), cigarettes (1.19%), spices and other food stuffs (0.98%), raw materials for drinks (0.78%), nuts (0.38%), fruits (0.29%) and pulse products (0.10%) (Figure 1).

Estimation of own price and income elasticities of demand for aggregated food groups

The empirical results of own price and income elasticities of demand for aggregated food groups are presented in Table 2. The own price elasticity of demand is negative 0.86 whereas income elasticity of demand is 0.96.

Estimation of own price and income elasticities of demand for disaggregated food groups

The empirical results of own price and income elasticities of demand for disaggregated food groups are presented in Table 3.

DISCUSSION

Parameter estimates

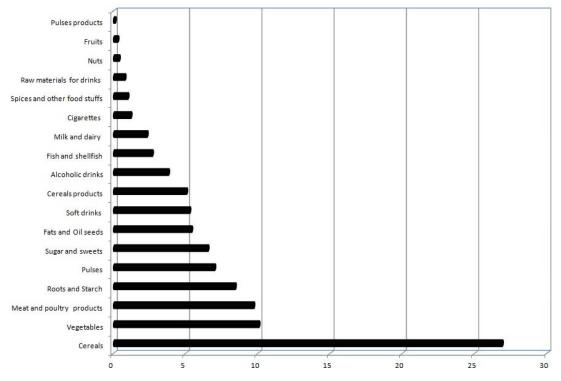The implication of the empirical results is that 39% of

Figure 1. Tanzania Mainland: Budget share of food products for Households Budget Survey (HBS), 2007 (%).

Table 2. Own price and income elasticities of demand of aggregated food groups.

Own price elasticity	Income elasticity
- 0.86	0.96

proportion of variation in the household food budget share is driven by food prices and real income under *ceteris paribus* (Table 1). However, the adjusted R^2 is the goodness of fit of the econometric model measures the proportion of variation in the households' food budget share accounted for by the food prices and the real incomes jointly. Under *ceteris paribus*, empirical results revealed that there was a robust positive relationship between food prices and food budget share. If food prices spike by 1%, the food budget share is expected to increase by 7% because as food price spikes, consumers used to allocate much more money on food to withstand the robustness of food inflation. On the other hand, empirical findings revealed that if real income hikes by 1%, the food budget share is expected to decline by 3% because as income increases, consumers used to shift to luxurious goods consumption. Furthermore, the empirical results confirmed that food prices and real incomes are primary determinants of food budget share of the households at probability value of less than 0.0001; hence, food prices and real incomes are significant determinants of food budget share at 5% level of

significance. If food prices and real incomes are minimal, the food budget share is expected to increase by 3% under ceteris assumptions (Table 1).

Food budget share

The empirical results found that households' food budget share is 60% on average for households' budget survey of 2007 (Table 1). The households' food budget share of 2007 declines by 5% from 65% of the 2000/2001 food budget share and shrink by 11% from 71% of the 1991/1992 food budget share. The implication of the findings is that household's budget devoted to food declines as the incomes of households rise. Similar findings have been reported by National Bureau of Statistics (2001) of the United Republic of Tanzania for households' budget surveys of 1991/1992 and 2000/2001. It reported that households' food budget shares for HBS 1991/1992 and 2000/2001 were 71 and 65% on average respectively which were consistent to incomes increase. However, households' budget devoted to food was expected to decline as incomes of households rose. The cereals are the leading food budget share (26.89%) because these are the main food staples consumed by the majority of food consumers in the country. The major consumed cereals include maize grain, green maize cob, maize flour, paddy, rice, sorghum grain, sorghum flour, wheat grain, wheat flour, millet grain,

Table 3. Tanzania mainland: Own price and income elasticities of demand of disaggregated food groups for households budget survey (HBS), 2007.

Food product	Own price elasticity (ε)	Income elasticity (η)
Cereals	-0.941	0.961
Cereal products	-0.786	0.946
Pulses	-0.956	0.987
Pulse products	-0.909	0.981
Fruits	-0.855	0.925
Vegetables	-0.971	0.982
Sugar and sweets	- 0.899	1.026
Roots and Starch	-0.828	0.988
Fats and oil seeds	- 0.802	0.967
Meat and poultry	- 0.990	1.070
Spices and other food stuffs	- 0.835	0.944
Milk and dairy products	- 0. 646	0.701
Tea, cocoa, coffee powders	- 0.524	0.844
Fish and shellfish	-0. 699	0.871
Soft drinks	- 0.823	1.028
Alcoholic drinks	-0.845	1.066
Cigarettes	- 0.985	1.031
Nuts	- 0.833	0.874

millet flour, barley and other cereals. The main consumed vegetables are tomatoes, other leafy vegetables, onions, pumpkin and cabbage. The major consumed meat and poultry products are beef, chicken, goat meat, pork meat, eggs, and other poultry (Figure 1).

The main consumed roots and starch are cassava flour, cooking banana / plantains, round potatoes, yam, cocoyam and sweet potatoes. The major consumed pulses are dry beans, broad beans, soya beans, peas, lentils and other pulses. The main consumed sugar and sweets are brown sugar, white sugar and sweets. The main consumed fats and oil seeds in the country are margarine, sunflower, groundnut, sesame, and other cooking oil. The major consumed soft drinks are mineral spring water, coca-cola, fanta, pepsi, tea without milk, tea with milk, fruit juice, mirinda and other soft drinks (Figure 1). Furthermore, the main consumed cereal products are bread, buns, chapatti and biscuits. The leading consumed alcoholic drinks are Safari beer, Kilimanjaro beer, Castle beer, Serengeti beer and local brew (chibuku and others). The major consumed fish and shellfish are dried sardines, fresh /chilled /frozen fish, dried / salted shellfish and dried fish. The main consumed milk and dairy products are fresh cow milk and yoghurt. The leading consumed cigarettes are sweet menthol, sportsman and nyota (Figure 1). The major consumed spices and other food stuffs are salt, other spices (masala), red and black pepper, other food stuffs, yeast and baking powder. The tea, coffee and cocoa powders are majorly consumed as raw materials for drinks. The groundnuts, cashew nuts, and coconuts are the main nuts consumed in the country. The major consumed fruits

are pawpaw, orange, banana, mango and other wild fruits (Figure 1).

Estimation of own price elasticity of demand for aggregated food groups

In Table 2, empirical results revealed that the own price elasticity of demand is (-0.86), falls between negative 1 and zero (-1 < εp < 0) which means that it is inelastic demand. The implication of inelastic demand is that food is a necessity good for life because as food price spikes the consumer expenditure share on food spikes as well, despite a decrease in consumers demand due to the fact that change in quantity demanded is smaller than change in price. The own price elasticity falls under demand curve which is negatively sloped (law of demand) implies that as price of food increases, consumer demand decreases due to increase in consumers expenditure share on food. The similar findings have been reported by Henderson and Quandt (2003) and Sadoulet and de Janvry (1995), they reported that as the price of a good increases, the consumer demand tend to shrink due to increase in consumers expenditure share on the particular good.

Estimation of income elasticity of demand for aggregated food groups

The empirical findings for income elasticity of demand for aggregated food groups are presented in Table 2. The

empirical results found that income elasticity of demand for aggregated food is 0.96, implies that food is a necessity good for life. Also, this result implies that as income increases consumers used to consume normal goods by shifting from inferior goods. The similar results have been reported by Annabi et al. (2006) for functional forms and parameterization of computable general equilibrium (CGE) models, 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 on the 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.

Estimation of own price elasticities of demand for disaggregated food groups

The empirical findings revealed that own price elasticities of demand for agri-foods were inelastic ($-1 < \varepsilon_p < 0$) which implies that as the agri-food price spikes, consumers expenditure share increases despite a decrease in consumer demand due to the fact that the proportionate change in quantity demanded is less than proportionate change in prices consumers are able to pay. Moreover, the own price elasticities of the agri-food is negative because the corresponding demand curve is downward sloping (law of demand curve) (Table 3).

Estimation of income elasticities of demand for disaggregated food groups

The income elasticities of demand for most of disaggregated food products were < 1, implies that food are normal goods which used to have income elasticity of < 1 meaning that as incomes of consumers increases the expenditure share devoted to food increases less than increase in incomes because foods are the necessity goods for life (Table 3). However, income elasticities of demand for sugar and sweets, meat and poultry, soft drinks, alcoholic drinks and cigarettes were > 1 attributed to increase in consumer demand more than proportionally increase in income; hence expenditure share of these foods increases higher than incomes increase (Table 3). The similar results have been reported by Panagiotis et al. (2011) for food consumer demand system in Pakistan, Taljaard et al. (2006) for meat consumer demand system in South Africa, Sarntisart and Warr (2005) for food consumer demand system in Thailand, Katchova and Chern (2004) for food consumer demand system in China, and Ananda et al. (2003) for food consumer demand pattern in Tanzania.

They reported that food own price elasciticties of demand tend to be inelastic because as price spikes willingness to consume tend to decline due to increase in consumers expenditure share whereas income elasticities for food tend to be < 1 because as income hikes the expenditure share devoted to food used to decline despite the fact that food is a necessity good for life as compared to luxury goods which used to have elasticities of > 1.

CONCLUSION AND POLICY IMPLICATIONS

The food consumption priority is for cereals, followed by vegetables, meat and poultry products, roots and starch followed by pulses, sugar and sweets. Moreover, cereal products, fats and oils seeds, and soft drinks are the next major products consumed in the country. However, pulses products consumption is meagre, which implies that value added in pulses is less. Therefore, the priority sectors may be encouraged to have perfect market competition so that fair and free competition exist, so as consumers can get the necessity products at reasonable price.

The inelastic demand of own price elasticity for food products informs the government intervention on food price stabilization policies and programmes which can be achieved through subsidizing the prices of staple food which have higher household budget shares such as maize, rice, sorghum, cassava, pulses, sweet potatoes consumed by the majority of lower and middle class income earners in rural and urban areas in the country. The high expenditure elasticities of milk and dairy, cereals, cereal products, pulses, fish, fruits, vegetables, roots and starches, fats, and oil seeds, suggest that income support programmes are likely to be good policy tools to promote consumption of these staple food items among urban and rural household consumers. Furthermore, income support policies can be done through increasing the income of lower and middle class income earners in rural and urban areas as consumers' economic stimulus package to enable them to increase consumption of normal foods by shifting from inferior foods.

The highest expenditure elasticity also suggests that the consumer demand for meat and poultry, sugar and sweets, soft drinks, alcoholic drinks, and cigarettes, is likely to expand as the economy develops.

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