Factors Influencing the Consumption of Pulses in Rural and Urban Areas of Tanzania

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Abstract
Pulses are important/sole sources of some dietary protein and energy, especially for the vegetarian population and poor people who are less able to afford the cost of other sources of protein. Despite its nutritional and economic importance, its consumption trend in Tanzania has been decreasing over time and factors underlying this change are not well established. This study investigated factors underlying market participation and its consumption to inform policy and chain actors about ideal means to address the challenge. A two-step model following the double hurdle specification was adopted to identify factors underlying the decision to consume pulses and its extent of consumption. Model results revealed that household sizes and education levels of the decision makers residing in rural areas had significant effect on the decision to consume pulses while the extent of consumption was influenced by their education levels, household sizes, households' total expenditure on food and non-food and prices of pulses and meat. Household sizes, levels of education and sex of the main decision makers were found to have significant effects on the decision to consume pulses whereas the age and education levels, household sizes and household's total expenditure were the main factors that influenced the extent of consumption in urban areas. In summary, the model showed that participation in pulses' market was lower in rural than that in urban areas. However, the overall consumption was lower in urban than that in rural areas, implying that the prospect for increasing its consumption is higher in urban than that in rural areas. To increase the market share of pulses, traders should devise effective strategies to tap into the growing demand for pulses in urban areas. This strategy should be founded on thorough understanding of desired attributes of these products and purchasing power of different consumer groups.

Key words: Pulses consumption, urban and rural areas, Tanzania and double hurdle model

Introduction

The production and consumption of pulses [1]are important in maintaining food security and reducing poverty as these crops have high potential to increase earnings of farmers and traders. Consumers, especially poor people and vegetarians in urban and rural areas, derive proteins from pulses that are normally cheaper sources of these macro-nutrients than meat, fish, milk and other animal products (Akinbode, 2011). The consumption of pulses may be part of a healthy lifestyle that prevents abnormal weight gain and reduces the risk of diseases that are associated with uptake of foodstuffs that are rich in carbohydrates, cholesterol and fats (Curran, 2012).

While pulses are widely consumed, the consumption is normally higher in places where the majority are vegetarians or animal protein is scarce and expensive for ordinary people (Weliwita *et al.,* 2003). Production and consumption data reveal that common beans, pigeon peas, chickpeas, cowpea, bambara nuts and peas are widely cultivated and consumed in Tanzania as human food (TL II, 2011). Despite its nutritional and economic importance, the consumption of pulses in Tanzania is generally below the FAO recommended level. The average per capita consumption in 2007 was only 6.8 gm/day while the recommended intake is at least 30 gm/day (Leterme, 2002; TNBS, 2010). Moreover, the consumption trend has been declining over time. Statistics show that between 2000 and 2009 per capita consumption decreased

[1]*Pulses is a general term for legumes (crop with a pod) such as dry peas, dry beans, lentils and chick.*

by 1.4% and the decrease was almost two folds (3.5%) after two years (FAOSTAT, 2014). This trend reflects changes in consumer preferences and failures by suppliers to align pulses attributes to consumer preferences[2] (FAO, 2003).

Moreover, data show that Tanzanian children below five years of age, pregnant and lactating mothers are mostly affected by protein-energy malnutrition (PEM) or protein-calorie malnutrition. Survey results show that about 9 to 21% of children are born with low birth weight mainly due to high PEM in pregnant women (Mazengo *et al.,* 1997; TNBS, 2011). Ideally, pulses would be the best alternatives for this group of consumers because they are richer in protein than any other grain and are cheaper than animal source protein.

There have been several interventions to address challenges related to low productivity and utilization of pulses in Tanzania, but these initiatives have largely been tailored to improve agronomic performance (e.g. through breeding) as well as processing and preservation. Many of the previous studies in Tanzania have mainly focused on improving agronomic practices or addressed specific production and marketing constraints (Mussa *et al.,* 2012; Nyoki and Ndakidemi, 2013; Hella *et al.,* 2013). This focus has not been effective in generating appropriate knowledge to address unique consumers' demand or preferences for pulses, overcome value chain constraints and improve actors' welfare. Thus, entrepreneurs engaged in the pulses production and marketing have inadequate knowledge about factors underlying the consumption of this commodity to devise appropriate production and marketing strategies. The focus of this study was to understand factors underlying the consumption of pulses in Tanzania and the spatial significance of these factors as a basis to inform policy about the prospect to increase the portion of pulses in Tanzanians' regular diet and improve health and earnings of chain actors. The aim of this paper was to identify factors influencing the market participation and extent of bean consumption as an entry point to leverage bean development and utilization initiatives in Tanzania.

Literature Review

Consumer Behaviour

The consumer behaviour theory assumes that a consumer is a rational economic agent and aims at attaining the highest possible satisfaction derived not only from the good itself but also from its attributes (Lancaster, 1966). Empirical studies have established that consumer behaviour is mainly influenced by socio-economic and demographic factors such as education level, knowledge on nutrition and age along with sex of the main decision maker (Leterme, 2002; Mitchell *et al,* 2009; Reddy, 2004). Other factors hypothesized to influence this decision making are households' earnings and size; product attributes (e.g. taste, quality and safety) as well its own price and price of substitutes (Banterle *et al.,* 2013; Begum *et al.,* 2010; Drichoutis *et al.,* 2005; Kormawa *et al.,* 2000; Mmakola *et al.,* 1997; Nayga, 2000; Revoredo-Giha *et al.,* 2011; Salama, 1995; Schneider, 2002). Moreover, food availability, parental influence on eating (including culture and religion of the family), beliefs and preferences may also influence food choices (Sztainer *et al.,* 1999). Also spatial variation of people's life style along with differences in their earnings can shape their food consumption behaviour (Vu, 2008).

Most of the contemporary and recent studies on food consumption in Tanzania have attempted to associate food consumption with several parameters of the potential consumers. Some of these studies have assessed the variation in composition of foodstuffs consumed by people in different age groups across locations such as rural and urban (e.g. Mazengo *et al.,* 1997). Abdulai and Aubert (2004) have assessed the role of income and other socioeconomic characteristics on calorie demand. However a commodity-specific focus to identify spatial differences in the consumption of such commodity has so far not been reported.

While factors underlying food choices and intake are well documented in economic literature, there is evidence suggesting that there could

[2] *Literature that associates changing diet behaviour with changes in family structures along with increased proportion of middle income earners and lifestyle exist (Chongela et al., 2014; Msangi and Rosegrant, 2012; Verbeke, 2005)*

be marked spatial differences in consumers' response to changes in these factors. One important distinction of this nature is between consumers in urban and rural areas. It has been established that differences in household characteristics such as ownership of assets, food habits, household's size and access to resources, markets and vital support services can potentially lead to differences in their living standards and reactions to changes in economic variables (Bopape and Myers, 2007; Garret and Ruel, 1999; Minot *et al.,* 2006; Rout, 2009; Tafere *et al.,* 2010; Vu, 2008).

Consumers in rural areas of Tanzania are mainly smallholder farmers who tend to be net sellers during the harvest and net buyers in subsequent periods (Ivanic and Martin, 2008; Jayne *et al.,* 2006, Jayne, 2012; Mghenyi, 2011). Thus, their decision whether to consume own-produced or purchased food must be conditioned on their unique economic considerations and the overall food production and prices. Moreover, a majority of both rural and urban population are poor consumers whose expenditure on food exceeds 50% of their disposal income (Poulton *et al,* 2006). The overall food intake for this group of consumers may decrease significantly if prices of food rise sharply.

Literature also shows that the consumption of pulses might be higher in rural than in urban areas owing to low incomes that limit the consumption of expensive sources of proteins and geographical constraints (e.g. poor infrastructure and access to crucial support services) that limit exchanges and favour consumption of locally produced foods (Schneider, 2002; Leterme and Carmenza Muñoz, 2002). Thus, low-income consumers including farmers who are producers and consumers at the same time are likely to consume more pulses than those with greater income like those with professional /white collar jobs (Bentley and Griffiths, 2003; Lucier *et al.,* 2000; Mitchell *et al.,* 2009).

In additional to the spatial differences in the consumption of pulses there are other differences that should be recognized. Previous studies have established that adults between the age of 18 and 59 tend to be the main consumers of pulses, especially beans whereas children tend to eat fewer pulses than adults (Leterme and Carmenza Muñoz, 2002; Lucier *et al.,* 2000). Some studies argue that younger males tend to consume more beans arguably due to their larger caloric intake, and this consumption tends to be fairly stable for male than female consumers at old age (Leterme and Carmenza Muñoz, 2002; Lucier *et al.,* 2000).

Literature also reveals that the consumption of pulses is particularly high when the decision maker is female and married (Folayan and Bifarin. 2013). There is evidence suggesting that larger households require more food than smaller households. Thus, the consumption of pulses is expected to rise with adult equivalents (Rehman *et al.,* 2014).

With respect to education level, there is evidence to support that uneducated people tend to consume less pulses than those who are educated implying that higher education of the main decision makers, can significantly increase the consumption of pulse (Mitchell *et al.,* 2009; Reddy, 2004). The effect of price of a normal/ ordinary good on the consumption is to increase it when it falls and vice-versa. Where substitution is possible, the consumption falls as the prices of substitutes rise (Andreyeva *et al.,* 2010; Tucker, 2014).

Therefore, an accurate analysis of determinants of food consumption is needed to account for the all potential differences in consumer behaviour. Unlike other papers that focused on specific consumer attributes (e.g. food intake vis-à-vis age or sex only) this paper recognizes all the attributes that are discussed in this section. These attributes are accounted for in the empirical model. Note that other approaches that have been adopted to associate food consumption with consumers' socio-economic variables are also discussed.

Modelling Food Consumption

Several studies have analyzed the relationship between socio-economic factors and food consumption. Some of the studies adopted censored regression following Tobin (1958) specification to estimate the relationship (Cox *et al.,* 1984; Fabiosa, 2008; Lawrence, 2010).

However, this modelling approach has been criticized as it reduces the consumption to a one step process implying that variables and parameters that determine the probability of consumption also determine in the same way the level of consumption (Akinbode and Dipeolu, 2012; Brent *et al.,* 2010; Wooldridge, 2009; Yimer, 2011). Furthermore, its estimation requires the error term to follow a normal distribution with a constant variance, which in many applications, seems to be unrealistic. It is important to note that this assumption may not apply when cross-sectional data are used. Literature shows that when the assumption is relaxed the maximum likelihood estimators will be inconsistent (Arabmazard and Schmidt 1982; Aristei and Pieroni, 2008; Newman *et al.,* 2003).

Other studies have adopted the Heckman model to control for self-selection bias because some potential consumers may not consume the product at all. The Heckman model entails two estimation steps: the first estimates the probability of observing positive outcome i.e. the participation equation; while the second estimates the level of participation conditional on observing positive values of consumption (Ayo *et al.,* 2012; Bedeke, 2012; Dow and Norton, 2003; Moon *et al.,* 2005; Oni and Fashogbon, 2012). The Heckman model suffers from two practical problems: Firstly, the probability of having a well-identified selection model is influenced by its functional form (Cameron and Trivedi, 2010). Secondly, the model is sensitive to violation of the homoscedasticity and normality assumptions of the error terms. When these assumptions are relaxed the estimates are biased and inconsistent (Silva and Tenreyro, 2006).

Other analysts have improved the Tobit model by relaxing the assumption of equivalence between zero demand and a corner solution. These models accommodate consumer's zero value of purchase as an outcome of a decision. Several models that differentiate true corner solutions (e.g., zero consumption) and zero expenditure resulting from infrequent purchase have been used to estimate food demand (Angulo *et al.,* 2001; Yen and Huang, 1996). Empirical evidence reveals that these models can be estimated jointly when the decisions on whether to purchase a food item and how much to purchase are made at the same time. The models can also be estimated sequentially, especially when consumer's decision on whether to purchase a product affects the quantity purchased and not vice-versa. Special forms of sequential models that are known as dominance models have been applied when the two decisions are independent of each other (Joesch and Hiedemann, 2002; Martínez-Espiñeira, 2006; Smith, 2003). Separate models could be estimated when the decisions on whether and how much to purchase are independent of each other. In summary different approaches could be adopted to estimate these models based on the assumptions made with respect to the market participation and consumption decisions. However, many of the previous studies on food demand support the view that these decisions are independent and should be modelled separately (Gould, 1992; Jones, 1992; Moffatt, 2005; Smith, 2002).

Therefore, a robust model is the one that explicitly incorporates the participation decisions in an equation that is separate from consumption intensity decision. This model is known as a double hurdle model and it allows consumers to make participation and consumption decisions independently (Akinbode and Dipeolu, 2012; Cragg, 1971). These two decisions are separated because the participation decision might be influenced by factors other than those captured in the consumption decision. The first-hurdle differentiates between users and non-users where zero values are assigned for non-users only. It is important to note that there might be zero values in the second hurdle. These values may be a result of abstinence, misreporting and infrequency of purchases (Yen, 2005). Thus these values are not only affected by the participation decision but also by consumption decision implying that potential consumers may have zero expenditure (Aristei and Pieroni, 2008).

Methodology

Test for Mean Difference

A preliminary test involving all quantitative regressors hypothesized to influence the consumption of pulses was performed to test for mean differences between consumers in urban and rural areas. These differences are evaluated further using a bivariate model that tests whether the extent of market participation and consumption of pulses varies across these locations.

Estimation of Market Participation and Consumption of Pulses

In the context of this study the double-hurdle model is used to identify factors underlying market participation and consumption of pulses among rural and urban consumers. The assumption underlying the use of this model is that households make separate decisions on whether to consume the pulses and how much to consume. This decision making process is mathematically described as:

$$Y_i = \begin{cases} Y^* \text{ if } Y^* > 0 \text{ and } D_i > 0 \\ 0 \quad \text{Otherwise} \end{cases} \qquad (1)$$

$$Y^* = X_i\beta + \varepsilon_i$$

$$D_i = Z_i\varphi + \mu_i \qquad (2)$$

Where:

In equation (1) Y_i is the actual/observed consumption of pulses while Y^* is a latent variable representing optimal level of consumption; D_i is the zero-one discrete decision on whether to participate in the pulses markets. This specification allows a vector of explanatory variables (X_i) to impact on the positive observations. Note that Z_i is a vector of variables hypothesized to influence market participation. Both Y* and D_i must simultaneously be greater than zero to observe positive Y_i with the zeros indicating either optimal consumption decisions (corner solutions) or discrete decisions.

Yimer (2011) and William (2009) reveal that the log likelihood function (L) corresponding to equation (1) is computed as:

$$L = \prod_0 \left[1-\theta\left(\frac{X'_i\beta_1}{\sigma}\right)\right] \prod_1 \left[1-\theta\left(\frac{X'_{1i}\beta_1}{\sigma}\right)\right] \frac{1}{\sigma}\varphi\left(\frac{Y_{21}-X'_{2i}\beta_2}{\sigma}\right) \quad (3)$$

Empirically, the two decisions described in equation 1 involved the quantities of pulses consumed as a function of age, sex, marital status and education level of the main decision maker, household size, price of pulses, weighted price of meat, weighted price of fish and total expenditure as a proxy variable for household's earnings. Equation 2 involved all variables that were included in the first equation except the prices and total expenditure. Two separate double-hurdle models are estimated to compare and contrast the consumption of pulses in urban and rural areas.

Multicollinearity and heteroscedasticity are common problems in cross-sectional data. Thus independent variables were tested for multicollinearity and heteroscedasticity using variance inflation factors (VIFs) and Breusch Pagan tests prior to the estimation (Green, 2000). Results revealed that there was no multicollinearity problem. However, heteroscedasticity problem was detected, but necessary specification adjustments were made in the STATA software to produce consistent parameter estimates. Moreover, post estimation procedures were performed to compute expected values and probabilities that are needed to gauge the extent of market participation and pulses consumption as per details in Annex 1 (Burke, 2009).

Data

The data used in this study are secondary data obtained from the Tanzania National Panel Survey (TZNPS) which were collected by the National Bureau of Statistics (NBS) in 2010/11. The survey covered 21 regions in Tanzania Mainland and five regions in the Tanzania Island (Unguja and Pemba). A total of 3,846 households were interviewed of which 2,583 were randomly selected from rural and 1,263 from urban areas. The survey solicited detailed information from the household rather than households' heads to allow a comprehensive assessment of households' consumption taking into account their socio-economic characteristics. A brief description of variables that were fitted in the double hurdle model is provided in Table 1.

Results and Discussion

A preliminary assessment of the sampled households shows that 67.2% of the households lived in rural areas and 32.8 % in urban areas. In terms of headship, 1,983 of the households in the rural areas were headed by males and 600 households were headed by females while 912

Table 1: Description of variables

Role in the model	Variable name	Description	Type and value labels	Anticipated impact on the dependent variable
Dependent variable	PULSESQ	Quantity of pulses consumed (Kg/per month)	Continuous	NA
Independent variables	AGE	Age of the household head (years)	Continuous	Positive
	SEX	Sex of household head	Binary Male=0 Female=1	Negative or positive
	HOUSEHOLD SIZE	Size of the household (adult equivalent)	Continuous	Positive
	EDUCATION	Education level of household's head	Continuous	Positive
	MARITAL	Marital status of household's head	Binary 0=Married 1=Single	Positive
	$PRICE_1$	Price of pulses	Continuous	Negative
	$PRICE_2$	Weighted price of fish	Continuous	Positive
	$PRICE_3$	Weighted price of meat	Continuous	Positive
	EXPENDITURE	Total household expenditure as a proxy variable of household's earnings	Continuous	Positive/negative

Note: NA means not applicable

of the households in urban areas were headed by males and the remaining (351 households) were headed by females. According to Tables 2 and 3, the proportion of unmarried people in both rural and urban areas was higher than that of those who were married. The mean age of household heads located in rural and urban areas were 47.6 and 42.7 years with standard deviations of 16.05 and 14.7, respectively. Further analysis of the survey data revealed that the literacy[3] rate of household heads was 69.1% in rural areas and 87.8% in urban areas. The national average adult literate rate is estimated to be 73% (TNBS, 2013). Overall, people in urban areas have better access to education than people in rural areas. Other important variables that characterize the sample are presented in Tables 2 and 3.

According to results presented in Tables 2 and 3 the consumption of pulses and adult equivalent in the households were higher in rural than urban areas. Similarly decision makers in rural areas were older than those in urban areas. In contrast, the decision makers in the rural spent fewer years in school than those who were in the urban. However total expenditure of the households in urban areas was higher than those in rural areas whereas the foodstuffs considered were generally more expensive in urban than rural areas. Table 4 shows t-tests for mean difference between variables hypothesized to influence market participation and consumption of pulses in these areas.

Results of the t-test show that mean values of

[3] *Literacy is the ability to identify, understand, interpret, create, communicate and compute, using printed and written materials associated with varying contexts (Kirsch and Jungeblut, 1986)*

Table 2: Statistics for important socio-economic variables in rural areas

Variable name	N	Minimum	Maximum	Mean	Standard deviation
Continuous variables					
Quantity of pulses consumed per month (Kg)	2583	0.00	112.00	5.60	7.60
Age of main decision maker (years)	2583	16.00	105.00	47.64	16.05
Adult-equivalents in the household	2583	0.72	42.16	4.48	2.61
Number of years the main decision maker spent in school	2583	0.00	21.00	4.96	3.96
Total household expenditure per month (TZS)	2583	10,050.75	1,591,026.83	217,538.19	168,309.62
Pulses price (TZS/Kg)	2583	347.06	3,393.00	1,367.86	221.78
Weighted price of meat (TZS/Kg)	2583	600.00	9,000.00	3,763.85	773.61
Weighted price of fish (TZS/Kg)	2583	142.86	14,705.88	2,668.34	1,329.30
Binary variables					
Whether consumed pulses	N	%			
No	683	26.4			
Yes	1900	73.6			
Total	2583	100.0			
Sex					
Male	1983	76.8			
Female	600	23.2			
Total	2583	100			
Whether married					
Yes	599	23.2			
No	1984	76.8			
Total	2583	100.0			

family sizes (adult equivalent), consumption of pulses and age of main decision makers are significantly lager in rural than in urban areas while mean values for total expenditure on food and non-food items, years of schooling and prices of pulses, meat and fish are significantly larger in urban than in rural areas ($p<0.01$). Experience from previous studies shows that the consumption of- and expenditure on pulses are normally higher in the rural than urban areas (Bentley and Griffiths, 2003; Leterme and Carmenza Muñoz, 2002; Lucier *et al.,* 2000; Mitchell *et al.,* 2009; Schneider, 2002).

The finding reveals that the overall consumption is higher in urban than rural areas, implies that part of the consumption in rural areas comes from own-production. However, the fact that total expenditure is higher in urban than in rural areas implies that the prospect for market growth is higher in urban than in rural areas. These implications are evaluated further as the findings of the double hurdle model for rural and urban areas are compared. The results are discussed in sequence starting with the maximum likelihood estimates for the two stages followed by the assessment of the impact of regressors on the dependent variables of the double hurdle model.

Table 3: Statistics for important socio-economic variables in urban areas

Variable name	N	Minimum	Maximum	Mean	Standard deviation
Continuous variables					
Quantity of pulses consumed per month (Kg)	1263	0.00	84.00	4.40	5.41
Age of main decision maker (years)	1263	16.00	99.00	42.70	14.66
Adult-equivalents in the household	1263	0.72	18.40	3.83	2.30
Number of years the main decision maker spent in school	1263	0.00	21.00	7.15	4.52
Total household expenditure per month (TZS)	1263	10,045.00	4,789,759.00	362,353.72	335,242.67
Pulses price (TZS/Kg)	1263	405.05	3,746.00	1,476.77	242.69
Weighted price of meat (TZS/Kg)	1263	400.00	8,500.00	4,274.82	765.91
Weighted price of fish (TZS/Kg)	1263	300.00	15,000.00	3,268.20	1,524.87
Binary variables					
Whether consumed pulses	N	%			
No	297	23.5			
Yes	966	76.5			
Total	1263	100.0			
Sex					
Male	912	72.2			
Female	351	27.8			
Total	1263	100.0			
Whether married					
Yes	455	36.0			
No	808	64.0			
Total	1263	100			

It is worth noting that the dependent variable in the first hurdle was whether the household decided to participate in the market or not whereas in the second hurdle the dependent variable was the quantity of pulses consumed.

The results presented in Table 5 show that sex and education level of the main decision maker and adult equivalent are significant variables underlying market participation in urban areas at 1%, 10% and 1% levels of significance, respectively. The model shows that age and education level of the main decision maker along with adult equivalent and household's expenditure are significant variables in the consumption equation at 5%, level of significance. The Wald statistic shows that the decision variables fit the model at the ($p<0.01$).

These findings are consistent with the prevailing evidence. Experience from other African countries reveals that the decision to participate and the extent of market participation could vary between males and females based on whether the purchase activity is perceived as males' or females' obligation (Alene *et al.,* 2008; Zamasiya *et al.,* 2014). The level of education has been acknowledged to shape choices of food and other products as it creates awareness that plays a pivotal role in the adoption of healthier food habits (Worsley, 2002).

Table 4: Test for mean difference of continuous variables between urban and rural areas

Variable	Location	N	Mean	Std. Error Mean	t-test
Adult-equivalents	Rural	2583	4.48	0.05	7.79***
	Urban	1263	3.83	0.06	
Quantity of pulses consumed per month (TZS)	Rural	2583	5.60	0.15	5.61***
	Urban	1263	4.40	0.15	
Total household expenditure per month (TZS)	Rural	2583	217,540.00	3,311.67	14.49***
	Urban	1263	362,350.00	9,433.17	
Age of main decision maker (years)	Rural	2583	47.64	0.32	9.52***
	Urban	1263	42.70	0.41	
Number of years the main decision maker spent in school	Rural	2583	4.96	0.08	14.67***
	Urban	1263	7.15	0.13	
Pulses price per kg	Rural	2583	1,367.86	44.40	0.91
	Urban	1263	1,476.77	111.38	
Weighted price of meat	Rural	2583	3,763.90	15.22	19.37***
	Urban	1263	4,274.80	21.55	
Weighted price of fish	Rural	2583	2,668.30	26.16	11.94***
	Urban	1263	3,268.20	42.91	

NB: *** means significant at p=0.01

The link between adult equivalent in the households, participation in market and extent of consumption has been established in economic literature as larger households normally need more food than smaller households (Rehman *et al.,* 2014). Moreover, age has been found to be associated with market participation because it influences one's ability to comprehend and use market information (Gebremedhin and Hoekstra, 2007).

The results presented in Table 5 also show that adult equivalent and education level of the main decision maker are significant variables that influence market participation in rural areas ($p<0.01$). The table shows that adult equivalent ($p<0.01$), education level of the main decision maker ($p<0.05$), household's expenditure on food and non-food items ($p<0.1$), price of pulses ($p<0.05$) and weighted price of meat ($p<0.05$) are significant variables that influence the consumption of pulses in those areas. The Wald statistic reveals that the decision variables fit the model at the ($p<0.01$). Authors of this manuscript have already pin-pointed the evidence linking marketing participation and consumption with many of factors as previously discussed. However, there is evidence to suggest that low-income consumers might be more sensitive to price changes than other consumers within the population. Thus the total budget for food and food prices will always influence what one buys (Bentley and Griffiths,2003; Lucier *et al.,* 2000; Mitchell *et al.,* 2009).

The likelihood of rural and urban people participating in pulses' market was about 0.73 and 0.76, respectively. The expected consumption for people in rural and urban areas who consume pulses on a regular basis was estimated to be 7.5 kg and 5.5kg per month, respectively. The model predicted the overall pulse consumption to be around 5.5 kg per month in rural areas and about 4.4 kg per month in urban areas. Effects of regressors that were included in the market participation equation on the probability of actual participation of rural and urban people are presented in Table 6. The relative importance of the regressors is discussed in the light of statistical significance.

The results presented in Tables 5 show that

Table 5: Factors Influencing Pulse Consumption in Urban and Rural Areas

Variable	Urban		Rural	
	Coefficient	Z	Coefficient	Z
Participation equation				
Age	0.005 (0.005)	0.89	0.002 (0.003)	0.53
Sex	0.261*** (0.096)	2.71	0.023 (0.066)	0.34
Marital status	0.167 (0.160)	1.04	0.021 (0.104)	0.20
Adult Equivalent	0.0216*** (0.031)	7.01	0.039*** (0.012)	3.30
Education level	0.018* (0.009)	1.90	0.049*** (0.007)	6.57
Constant	-0.533 (0.333)	-1.60	0.129 (0.199)	0.65
Consumption equation				
Age	0.178** (0.086)	2.07	0.187 (0.208)	0.90
Sex	0.706 (1.474)	0.48	-2.453 (4.421)	-0.55
Marital status	-1.557 (2.387)	-0.65	9.201 (8.003)	1.15
Adult Equivalent	2.062** (0.947)	2.18	2.515*** (0.609)	4.12
Education level	-0.357* (1.87)	-1.91	-2.739** (1.225)	-2.20
Total expenditure	5.619** (2.439)	2.30	22.454* (11.192)	2.01
Price of pulses	0.379 (3.599)	0.11	-36.830** (15.415)	-2.39
Weighted price of meat	6.609 (4.834)	1.37	-30.551** (14.600)	-2.09
Weighted price of fish	-1.809 (1.328)	-1.36	1.750 (3.272)	0.53
Constant	-135.904* (75.196)	-1.81	163.168* (82.775)	1.97
Sigma				
Constant	9.456*** (2.788)	3.39	21.496*** (5.242)	4.10

NB: *** means significant at p=0.01; ** means significant at p=0.05; * means significant at p=0.1
Figures in brackets are robust standard errors

adult equivalent and education level were the only significant variables that influenced market participation in the rural areas while these two variables along with sex of the main decision maker were the significant variables in the urban areas. Table 6 reveals that a unit increase in adult equivalent and being more educated are likely to increase the likelihood of market participation in the rural areas, although the resulting changes in probabilities are generally small (less than 0.1). In addition to these two factors, having a female decision maker increases marginally the likelihood of market participation. Overall, the combined effect of these factors seem to be higher in urban than in rural areas implying that the prospect for market development could be

Table 6: Partial Effects of Regressors on Actual Market Participation

Variable	**Rural**		**Urban**	
	Mean	**Std. Dev**	**Mean**	**Std. Dev**
Adult-equivalents	0.01	0.02	0.06	0.02
Age	0.00	0.00	0.00	0.00
Sex	0.01	0.00	0.07	0.02
Marital status	0.01	0.00	0.05	0.02
Education level	0.02	0.00	0.01	0.00

Table 7: Partial Effects of Regressors on Actual Consumption of Pulses

Variable	Rural		Urban	
	Mean	**Std. Dev**	**Mean**	**Std. Dev**
Adult-equivalents	0.26	0.18	0.47	0.30
Age (years)	0.02	0.01	0.04	0.03
Sex	-0.26	0.18	0.16	0.10
Marital status	0.96	0.66	-0.35	0.23
Education level	-0.29	0.19	-0.08	0.05
Total expenditure (TZS/annum)	2.35	1.61	1.28	0.83
Price of pulses (TZS/Kg)	-3.86	2.64	0.09	0.06
Weighted price of meat (TZS/Kg)	-3.20	2.19	1.50	0.97
Weighted price of fish (TZS/Kg)	0.18	0.13	-0.51	0.27

higher in urban areas, although the consumption of pulses was lower in urban than in rural areas. These findings are consistent with the literature (Louw *et al.,* 2004; NNBS, 2012).

The partial effects of specific regressors on the expected consumption for those people who consume pulses are presented in Table 7. The results from the double hurdle model suggest that age and education level of the main decision maker, adult equivalent, total expenditure as well as prices of pulses and meat were significant variables in influencing the consumption in the rural areas. With respect to people in urban areas; adult equivalent, education level of the main decision maker, total expenditure and price of pulses and meat were significant variables that influenced the consumption.

Table 7 reveals that a unit change in adult equivalent is likely to increase the average consumption of pulses by 0.26 kg in rural and 0.47 kg per month in urban areas. An additional year of schooling may decrease consumption by 0.30 kg in rural and 0.08 kg per month in urban areas. However, when expenditure increases by one unit the overall consumption of pulses is likely to increase by 2.35 kg and 1.28 kg per month in rural and urban areas, respectively. The effect of prices of pulses and meat was prominent in the rural areas where a unit change in the price of pulses might decrease the average consumption of pulses by 3.86 kg per month. Though unexpected, a unit increase in the price of meat seemed to be associated with a decrease of 3.20 kg per month in the consumption of pulses in rural areas. The unexpected sign of this coefficient could be attributed to their relatively lower rate of market participation owing to the consumption of own-produced pulses. Moreover, previous studies (e.g. Poulton *et al.,* 2006) found that many consumers in these areas are poor, and their budget share of food items is more than 0.5. While substitution is possible, its effect may be negligible as the income effect resulting from an increase in price may particularly be huge as their limited income is normally spread across a wide range of consumables leading to an overall decrease in quantities purchased. The implication of these findings is that there are more factors affecting the consumption of pulses in rural than in urban areas, and the effect of the common and unique factors seem to be more severe in rural than in urban areas implying that the extent of change in consumption of pulses is likely to be more drastic in rural than in urban areas.

The partial effect of regressors that are hypothesized to influence both market participation and consumption on expected consumption for the entire sample is presented in Table 8. This table shows that a unit change in adult equivalent might increase the overall consumption by 1.33 and by 0.41 kg per month in urban and rural areas, respectively. An additional year of age is likely to increase the average pulse consumption in urban areas by 0.05 kg per month while an additional year of schooling might increase the average consumption by 0.06 and 0.01 kg per month in urban and rural areas,

Table 8: Partial Effects of Regressors on the Expected Consumption of Pulses

Variable	Rural		Urban	
	Mean	Std. Dev	Mean	Std. Dev
Adult-equivalents	0.41	0.25	1.33	0.95
Age	0.02	0.01	0.05	0.04
Sex	-0.07	0.08	1.28	0.88
Marital status	0.83	0.58	0.44	0.27
Education level	0.06	0.06	0.01	0.01

respectively. Overall the effect of these factors seems to be huge in urban than in rural areas.

Summary and Conclusion

The main focus of this study was to investigate factors influencing market participation and the consumption of pulses among urban and rural Tanzanians. The results show that there are common and unique factors underlying the market participation and consumption of pulses. In terms of market participation, the results show that it is lower in rural than in urban areas implying that the prospect for increasing its consumption is higher in urban than in rural areas.

Thus, traders should devise effective strategies to tap into the growing demand for pulses in urban areas to increase their market share. This strategy should be founded on thorough understanding of desired attributes of these products and purchasing power of different consumer groups.

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Annex 1: Computation of expected values and probabilities

Statistic calculated	Equation	Details	No.
Probability of participating in the market	$p(y_i > 0 \mid x_{1i}) = \Phi(x_{1i}\gamma)$	y_i = Outcome that one will actually participate in the market Φ = Standard normal cumulative distribution function x_{1i} = Vector of regressors in the market participation equation γ = Vector of coefficients	(7)
Average consumption of pulses by a person who is actually consuming it	$E(y_i \mid y_{1i} > 0, x_{2i}) = x_{2i}\beta + \sigma\lambda(\frac{x_{2i}\beta}{\sigma})$	y_i = Consumption for a person who consumes pulses σ = St. Dev. of error for each observation in the consumption equation x_{2i} = Vector of regressors in the cumption equation β = Vector of coefficients λ = Inverse Mills ratio	(8)
Conditional average consumption of pulse	$E(y_i \mid x_{1i}, x_{2i}) = \Phi(x_{1i}\gamma)\left\{x_{2i}\beta + \sigma\lambda\left(\frac{x_{2i}\beta}{\sigma}\right)\right\}$	y_i = Pulse consumption for a person Note that other variables are as defined in equations 7&8	(9)
Partial effect of a specific regressor on the probability that people will actually participate in the market	$\frac{\partial p(y > 0 \mid x_{1i})}{\partial x_j} = \gamma_i \varphi(x_{1i}\gamma)$	y = Outcome that people will actually participate in the market φ = Standard normal probability distribution function Note that other variables are as defined in equations 7& 8	(10)
Partial effect of a specific regressor on the expected pulse consumption by a person who consumes pulses	$\frac{\partial E(y_i > 0 \mid y_{1i} > 0, x_{2i})}{\partial x_j} = \beta_j\left[1 - \lambda\left(\frac{x_{2i}\beta}{\sigma}\right)\left\{\frac{x_{2i}\beta}{\sigma} + \lambda\left(\frac{x_{2i}\beta}{\sigma}\right)\right\}\right]$	y_i = Quanity of pulse consumed by a person who is actually consumes it Note that other variables are as defined in equations 7&8	(11)
Partial effect of a specific regressor on the expected pulse consumption by all	$\frac{\partial E(y > 0 \mid x_{1i}, x_{2i})}{\partial x_j} = {}^{3}_{i}Æ(x_{1i}{}^{3})\left\{x_{2i}{}^{2} + \tilde{A}»\left(\frac{x_{2i}{}^{2}}{\tilde{A}}\right)\right\}$ $+¦\ (x_{1i}{}^{3})\ {}^{2}{}_{j}\left[1 - »\left(\frac{x_{2i}{}^{2}}{\tilde{A}}\right)\left\{\frac{x_{2i}{}^{2}}{\tilde{A}} + »\left(\frac{x_{2i}{}^{2}}{\tilde{A}}\right)\right\}\right]$ $if\ x_j \in x_1, x_2$	y_i = Quanity of pulse consumed by a all people β_j = Coefficient on x_j for regressors in the consumption equation γ_j = Coefficient on x_j for regressors in the market participation equation x_1 = Matrix of regressors in the market participation equation x_2 = Matrix of regressors in the consumption equation Note that other variables are as defined in equations 7&8	(12)