Household consumption and demand for bean in Uganda: Determinants and implications for nutrition security

Catherine Larochelle, Enid Katungi, and Zhen Cheng

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Catherine Larochelle

Virginia Tech

Enid Katungi

International Center for Tropical Agriculture (CIAT)

Zhen Cheng

Virginia Tech

Abstract: Pulses are vital for nutrition security and considered a cost-effective option for improving the diets of low-income consumers in developing countries. Sub-Saharan Africa has the highest proportion of people living in extreme poverty and highest per capita pulse consumption in the world. Most studies on pulse demand have largely depended on aggregated data at regional level and there is little information on household level consumption patterns across sub-population groups within the same geographical location. This study uses the most recently collected LSMS-ISA data in Uganda, which is nationally representative, to analyze household food demand, with a focus on bean (*Phaseolus vulgaris* L.) consumption in order to unmask differences between poorer and better-off households in urban and rural areas. An augmented Quadratic Almost Ideal Demand System (QUAIDS), accounting for censoring, is used to estimate household food demand, where bean is included as its own food group. Household spending on bean increases with wealth but food budget share spent on bean declines with wealth. As household expenditure increases, demand for bean increases, however the magnitude of this increment decreases as income rises and is of smaller magnitude in urban areas; an indication that urbanization has led to changes in consumer preferences. Demand for bean among rural and urban poor households is more responsive to changes in price compared with urban non-poor households, making the former more vulnerable to price volatility.

1. Introduction

Pulses are vital for nutrition security and a cost-effective option for improving the diets of low-income populations in developing countries (Garden-Robinson 2013). By providing proteins and micronutrients, mostly B vitamins, iron, calcium and zinc (IIe de Jager, 2013)[1], pulses are of particular importance in the diets of the poor around the world (Akibode and Maredia, 2011; Sigh and Sigh, 1992) whose major sources of proteins are from non-animal products. Moreover, pulses have several potential health benefits, which include reducing cardiovascular, diabetic, and cancer risks (Heller, 2011) and are increasingly grown to complement household income (Gowda et al 2009). They, thus, offer a tremendous potential to contribute towards achieving the new sustainable development goals on food security, nutrition, health, and poverty reduction among small landholders in developing countries who often grow them.

Although pulses are increasingly being recognized for their nutritional importance in human diets, relatively little research has been done on their consumption patterns and demand. Consequently, there is a paucity of information on their consumption by different categories of households in developing countries and how each category adjusts its demand when faced with higher prices or changes in income levels. Such information is important for evaluating investment alternatives aimed at promoting pulses for mitigating malnutrition in the context of growing economies and urbanization.

Pulses form part of the traditional diets in developing countries and--thus their consumption has generally been driven by population growth and supply side constraints (Akibode and Maredia, 2011; Neduman et al., 2015). Akibode and Maredia (2011) used a time series data from 1994 to 2008 and found that per capita bean consumption had increased at a rate of 1.67% per year in Sub-Saharan African (SSA) while declining at a rate of 0.3% in Latin America. The positive per capita bean consumption growth in SSA reflects growth in availability, mainly attributed to growth in land area (3.4%) since yield grew slowly, at a rate of 0.3% annually. The author also found that the trend in pulse availability has not been equal across SSA—with East Africa sub-region where production has increased significantly, also recording a higher annual growth in per capita bean consumption compared to the Central and Southern Africa sub-regions.

Overall, global pulse trade has also grown over the last years, but prices have been more volatile and increasing faster than traded volumes (Gowda et al. 2009; Akibode and Maredia, 2011; Neduman et al., 2015). Prices are volatile because the international pulse markets are still thin and unable to sufficiently absorb supply shocks (Minot, 2014). On the other hand, the increasing price trend of pulses reflect growing global demand relative to supply. Although the

[1] Their protein content, mainly in the form of phaseolin, has balanced amino acid that complements that of cereals, roots and tubers when eaten together, which greatly improves the protein quality of the combined food, especially when eaten in balanced ratios (Broughton et al., 2003; Hillocks et al., 2006)

secular increase in commodity prices due to the increasing demand of emerging market economies opens a window of opportunity to increase pulse production and productivity, and improve food access conditions, the response for accelerating pulse productivity growth has been slow -- which some authors blame on lack of favorable policies to encourage investment in external inputs, such as chemical fertilizers, and improved seeds (Gowda et al., 2009; Akibode and Maredia, 2011; Neduman et al. 2015). In order to prioritize public interventions that favor pulse productivity growth, the research community, donors, and policy makers need information on how demand for pulses responds to changes in price and how consumers of different groups are affected. For example, policy makers need to know the nutritional security risks that may occur when production is significantly reduced and/or whether increased trade reduces availability for own consumption in order to make appropriate decisions.

Previous studies on pulse consumption mainly used data aggregated at regional or country level which are based on the supply of the commodity for the whole region or country as opposed to actual consumption, and thus fail to account for post-harvest losses, nor provide information on the distribution of consumption among households distinguished by location (urban vs rural) and economic status. While the authors acknowledge these limitations, they were unable to address them due to lack of reliable and extensive household survey data at the time. This study contributes towards closing this gap in the literature by using a nationally representative household survey data collected under the Living Standards Measurement Study-Integrated Surveys on Agriculture (LSMS-ISA) in Uganda to analyze the consumption demand for common bean.

Common bean (*Phaseolus vulgaris* L.) is the most important pulse in human diets (Jones, 1990) and over 200 million people in SSA depend on it as a primary staple (CIAT 2015). Uganda is among the top bean producers in SSA and a major net sellers of common bean in the East African regional markets (FAO statistics, 2013). With more than 40 percent of stunting among children under the age of five, prevalence of malnutrition in Uganda is high (Ilse de Jager, 2013), thus common bean is a strong option for overcoming malnutrition.

This study makes three major contributions in the literature. First, this study considers different population income groups in urban and rural locations and determines the importance of bean in household food expenditures and for rural households, the source of beans consumed (i.e. from purchases, own production and in-kind) by each income group. Secondly, the study identifies factors that explain variation in bean consumption patterns across households, and estimates unconditional expenditures and price elasticities of demand for consumer of different wealth categories. The literature has identified a variety of economic and socio-demographic factors that are potential determinants of food consumption but very few studies have been focused on the behavior of pulse consumers in SSA. Besides, households may adjust their consumption patterns way from traditional foods such as pulses towards more convenient processed foods as they experience changing life styles that come with urbanization and general economic growth (Delisle, 1990). Finally, this study performs simulations to predict the future bean consumption demand by different wealth categories of households in rural and urban areas under different price changes to inform the design of interventions that aim to reduce malnutrition. The next section presents an overview of common bean in Uganda in terms of consumption, production, and trade and their relative importance. This is followed by the description of the data used in the analysis in section three while section four discusses the econometric estimation of the demand food system. Results are presented in section five while the report conclusions and policy implications come last.

2. Common bean relative importance in Uganda

In 2014, Uganda had a population growth rate of 3.3%, one of the fastest growing nations worldwide, and a population of 37.8 million people; 84 percent of which live in rural areas and largely depend on agriculture as a livelihood (World Bank, 2016). Food supply in Uganda is estimated to average 2,279 kilocalories per day per person, slightly above the requirement for a healthy life, and is thus considered a food secure country (FAO, 2016). More than 90 percent of calories come from vegetarian sources, an indication that consumption of animal products in Uganda is still very low (FAO, 2016) About 19.5 percent of the Ugandan population lives below the national poverty line or 22.4% and 9.6% of the rural and urban population respectively live in poverty (World Bank 2016)[2].

Common bean is the most important legume crop grown and consumed in Uganda. Aproximately, 1,060,000 hectares of land are planted yearly producing about 425,400 tons of beans (FAOSTAT, 2016). Per capita bean consumption is about 9.8kg annually, contributing, on average, 12% of total protein and about 4% of total calorie intake consumed per person (FAOSTAT, 2016). The majority of Ugandan farming households grow beans twice a year i.e. during March to June and September to December cropping seasons. The Uganda census on Agriculture of 2008/2009 established that out of the total beans produced during the 2008/2009 seasons, 32% of the production was sold (UBOS-UCA, 2010), an increase from 16% in 2005/06 and 9% in 1999/00 (PMA, 2008 in Kilimo Trust 2012).

Common bean exports from Uganda have grown over the last decade (Figure 1), due to favorable policies, such as regional integration, promotion of non-traditional export commodities, and demand deficit in the neighboring countries. In particular, Kenya, DRC and South Sudan have been major markets for beans produced in Uganda. Bean trade from Uganda to her neighboring countries involve both formal and informal trade but the latter is usually unrecorded, which underestimates the export volumes reported as between 25,000 and 30,000 tons during the 2006-11 period; equivalent to 6.3 percent of the production (Figure 2). On the

[2] These poverty statistics are for 2012, which are the most recent available data, and computed using the LSMS-ISA used in this study.

other hand, bean imports into Uganda are very minimal, making the country a net exporter of beans.

However, the increasing demand in neighboring countries, resulting in greater trade, has not yet stimulated significant growth in productivity meaning that demand is being met through area expansion both at the household level and geographical coverage. Using household survey data collected in 1999/2000 and 2005/2006, Kraybill et al. (2012) estimated a 151 percent expansion in average household land area allocated to bean, while output had grown by only 34 percent as yield declined by 64 percent during the same period. According to the FAO data, the national bean production in Uganda dropped from 478,000 tons in 2005 to 425,400 tons in 2012 despite an expansion in area of 28 percent (Figure 2).

The low agricultural productivity in Uganda is a problem observed across most major crops and emanates from low use of land productivity enhancing inputs given that the farm gate prices for major crops are low and uncertain (Kraybill et al., 2012; Minot, 2014). The majority of households who grow and sell common bean in Uganda are small-scale farmers, who resort very minimally to external inputs. These farming households also depend on bean for their own nutritional security--thus growth in bean trade with minimal yield gains could have negative consequences on the nutritional status of the poor who produce and now sell the crop.

3. Data

This study uses the most recently data collected in Uganda under the LSMS-ISA project led by the Development Research Group at the World Bank in collaboration with the Uganda Bureau of Statistics (UBS). The data collection is implemented on an annual basis and ran from November 2011 to December 2012. The household survey is nationally representative as well as representative of rural/urban areas and of the main four regions of Uganda (North, West, and East, and Central). This study mainly uses the survey data from the sections on household consumption expenditures and household socio-economic characteristics. The household consumption expenditures section covers food expenditures (7-day recall period) and non-food and services expenditures (30-day or 365-day recall period depending on the nature of the item). Food expenditures include food consumed at home (from purchases, own production, and gifts and in-kind payments), and food consumed away from home (FAFH).

Due to the large number of food items reported, an aggregation into food groups is necessary in order to obtain an estimable household food demand system[3]. Since there is no economic theory to guide the grouping of food items, we follow approaches used in previous studies of household food demand in developing countries to perform the aggregation (Adbulai and Aubert, 2004; Boysen 2012; Ecker and Qaim, 2011). Food items are grouped into the

[3] Including all food items would result in heavy censoring and likely incomputable demand system.

following eight food groups: 1) Cereals and cereal products, 2) Starches, 3) Beans, 4) Other pulses, nuts, and seeds, 5) fruits and vegetables, 6) Meat, egg, fish, and dairy products 7) Oils, fats, sweets, spices, and condiments, and 8) Beverage and food consumed away from home[4]. Bean is considered its own food group being the focus on the analysis, which is also justified given its importance in the diet of poor households in Uganda (Boysen, 2012). Other food groups include food items that are relatively similar in terms of nutritional value and expected demand response associated with price and income changes. Descriptive statistics on the percentage of households consuming each food group and their corresponding share in food expenditures by rural and urban areas are reported in table 1.

Starches represent the largest food expenditure share in both rural and urban areas (table 1). However, rural households spend 30% of their food budget on starches compared to 21% for urban households. Urban households spend proportionally more on cereals than rural households (17.0 vs. 15.6%), cereals being the third (second) most important food group in terms of expenditure share for urban (rural) households. Meat, fish, and dairy products rank third and second for food share expenditures in rural and urban areas respectively, representing on average 15.3% and 18.3% of the food budget in each respective area. Despite the high food budget share, consumption of these items is likely relatively low due to their high unit cost. Fruits and vegetables rank fourth in terms of food expenditure share in rural areas while in urban areas, fruits and vegetables rank sixth. Urban households devote a greater share of their food budget on beverage & food consumed away from (rank 4th vs. 6th) and oils, fats, sweets, spices, & condiments (rank 5th vs. 7th) than rural households. Bean expenditures represent 9.1% of the food budget among rural households, ranking 5th in terms of expenditure share, compared to 6.7% of the food budget for urban households (rank 7th). Last, other pulses[5], nuts, & seeds represent the smallest food expenditure share, i.e. about 4% and 4.6% in rural and urban areas.

In developing countries, consumption expenditures are considered a better proxy of household well-being than income because incomes are seasonal, difficult to measure for several reasons, and are more likely to be under-reported than expenditures in household surveys (Deaton, 1997). For these reasons, consumption expenditures are used as the measure of household economic status in this study. Consumption expenditures considered to contribute to household well-being and included in the analysis are expenditures on food and non-food items, expenditures on education, and flow of services derived from durable good and housing (Deaton, 1997). A Paasche price index is computed and applied to our measured household consumption expenditures, such that household expenditures can be compared across regions. Lastly, measured household consumption expenditures are adjusted by household size, to give a measure of per-capita well-being. To provide comparison across households of different economic status, per capita household consumption expenditures are divided into quintiles, separately for urban

[4] A reason to separate food eaten at home and outside the home is that expenditures on food eaten outside includes the cost of service (Boysen, 2012).

[5] Beans represent the majority of the expenditures on pulses, i.e. 88% and 73% of the pulse expenditures in rural and urban areas respectively.

and rural households. The first quintile represents the poorest 20 percent of the wealth distribution while the fifth quintile denotes the better-off 20 percent.

Summary statistics on bean consumption

Over 80 percent of Ugandan households consumed beans over the 7-day recall period, in both rural and urban areas (table 1). However, significant differences exist across households of different economic status (table 2). In rural areas, only 75% of households in the poorest quintile consumed beans over the recall period compared to 89% of those in the fourth quintile. In urban areas, the greatest percentage of households consuming beans is among those in the third wealth quintile (92%). Households belonging to the poorest wealth quintile in both rural and urban areas have lower per capita bean expenditures than those in the other wealth quintiles while at the same time having higher food expenditure share on bean. This finding confirms the importance of bean in the food consumption patterns of the poor, but constrained access. As a general rule[6], per capita bean expenditures increase for each additional wealth quintile in both rural and urban areas. On the other hand, the share of the food budget devoted to beans decreases in quintile; bean expenditures represent 11.5% (10.0%) of the food budget for the poorest rural (urban) households, which go down to 5.5% (3.9%) for the richest households.

For rural households, we further investigate the source of bean expenditures i.e. whether beans consumed were purchased, obtained from own production, or as in-kind payment or gift, by household wealth quintile. There is a U-shape relationship between wealth quintile and share of beans that is purchased (Figure 3). For the poorest 20 percent of households, 45 percent of beans consumed were purchased. This proportion decreases to 40% for households in the second wealth quintile and reaches its lowest (31%) for households belonging to the third wealth quintile. Then, the share of bean consumed that was purchased increases for households in the fourth and fifth wealth quintiles. In sum, a greater share of bean consumed by the poorest 20 percent is purchased compared to any other wealth quintile, making the poorest more vulnerable to bean price fluctuations and food insecurity. Moreover, the origin of the beans consumed (i.e. from purchased, own production, or in-kind) fluctuate greatly throughout the months in line with the production seasonality of bean production (Larochelle et al. 2015).

4. Model

In order to assess food demand in Uganda, a two-stage budgeting approach is used. In the first stage, households decide how to allocate expenditures between food and non-food commodities. In the second stage, households allocate food expenditures across the eight food groups defined earlier. This two-stage approach is based on the assumption of weak separability between the consumption decisions. A Working-Leser model is estimated in the first stage while a Quadratic Almost Ideal Demand System (QUAIDS) model is used in the second stage. This econometric

[6] At the exception of urban households in the third wealth quintile.

approach to a multi-stage budgeting has been previously applied (for example, see Edgerton, 1997; Boysen, 2012; and Ecker and Qaim, 2011).

First stage: Working-Leser Model

The Working-Leser model denotes that the Engel curve relationship can be modeled by the share of the budget spent on food as a linear function of the natural logarithm of household per capita expenditure (Deaton 1997). We also include a food price index and expand the model to include the squared of the logarithm of household per capita expenditure and household demographic variables:

$$w_f = \alpha_F + \gamma_F lnp_f + \beta_F lnM + \lambda_F (lnM)^2 + \sum_{k \in K} \delta_k z_k \tag{1}$$

w_f is the share of the total expenditures spent on food and p_f is an aggregate food price index; M represent per capita household expenditures, and z is a vector of k household socio-demographic variables including age and sex of the household head, education of the spouse[7], whether the household head is a present member, the number of children between 0-5 years old and between 6 and 14 years old, and the number of adults (15 years old and older). Regional dummy variables are also included and models are estimated separately for rural and urban areas. Conditional expenditure elasticity and Marshallian own-price elasticity of food are computed as in Leser (1963).

Summary statistics of the variables entering the Working-Leser model are presented in tables 3a and 3b. Data indicate the rural households in Uganda allocate on average 66% of their expenditures on food, a share that ranges from 70% for rural households belonging to the poorest quintile compared to the 57% for those in the wealthiest quintile (table 3.a). In urban areas, the average food expenditure share is 53% and averaging 63% for those in the first quintile and 40% for households in the fifth quintile (table 3.b).

Second stage: Quadratic Almost Ideal Demand System

The second-stage consists of modeling household food demand, defined by the eight food groups, given household food expenditures. The food demand system is modeled using a QUAIDS specification, as proposed by Banks et al. (1997), which is an extension of the Almost Ideal Demand System (AIDS) model (Deaton and Muellbauer, 1980). The quadratic specification allows the demand curves to be non-linear in the natural logarithm of total expenditures. This means that the same commodity can be considered a luxury or a necessity depending on household expenditure level (Boysen, 2012). The expenditure share equation of the QUAIDS model is specified as follow:

[7] Based on the assumption that women more frequently make the food purchases for the household.

$$w_i = \alpha_i + \sum_{j=1}^{k} \gamma_{ij} \ln p_j + \beta_i \ln\{\frac{m}{a(p)}\} + \frac{\lambda_i}{b(p)}\left[\ln\{\frac{m}{a(p)}\}\right]^2, i = 1,...,k \quad (2)$$

Where w_i is expenditure share for food group *i*, p_j the price of food group *j*, *m* is household food expenditure, *ln(a(p))* is a transcendental logarithm price index corresponding to:

$$\ln(a(p)) = \alpha_0 + \sum_{i=1}^{k} \alpha_i \ln p_i + \frac{1}{2}\sum_{i=1}^{k}\sum_{j=1}^{k} \gamma_{ij} \ln p_i \ln p_k \quad (3)$$

b(p) is the Cobb-Douglas price aggregator:

$$b(p) = \prod_{i=1}^{k} p_i^{\beta_i} \quad (4)$$

and

$$\lambda(p) = \sum_{i=1}^{k} \lambda_i \ln p_i \quad (5)$$

In order to satisfy demand theory, adding up (6), homogeneity (7), and symmetry (8) are opposed:

$$\sum_{i=1}^{k} \alpha_i = 1, \sum_{i=1}^{k} \beta_i = 0, \sum_{j=1}^{k} \gamma_{ij} = 0, \sum_{i=1}^{k} \lambda_i = 0 \quad (6)$$

$$\sum_{j=1}^{k} \gamma_{ij} = 0 \quad (7)$$

$$\gamma_{ij} = \gamma_{ji} \quad (8)$$

The standard AIDS model is nested in the QUAIDS model and is recovered when all of the $\lambda_i = 0$. This gives an opportunity to test whether the QUAIDS provides a better fit than the original AIDS.

In addition to depend on prices and expenditure levels, food demand is also expected to vary with household demographics. These variables are represented by the z vector, which includes the same household demographic characteristics and regional dummy variables as in the first-stage model. Demographics are introduced into the demand system following Ray (1983), which leads to expenditure share equations defined as in Poi (2012):

$$w_i = \alpha_i + \sum_{j=1}^{k} \gamma_{ij} \ln p_j + (\beta_i + \eta_i' z) \ln\{\frac{m}{\overline{m_0}(z)a(p)}\} + \frac{\lambda_i}{b(p)c(p,z)}\left[\ln\{\frac{m}{\overline{m_0}(z)a(p)}\}\right]^2, i = 1,...,k \quad (9)$$

Where $\overline{m_0}(z) = 1 + \rho' z$ (10)

and $c(p,z) = \prod_{j=1}^{k} p_j^{\eta''_j z}$ (11)

Censoring

Non-consumption of certain food items for reasons such as preferences, unavailability, and unaffordability, is not uncommon, which can result into zero expenditure on certain groups for some households. This is referred to as censoring and will result in bias estimates of the food demand system if not controlled for. The extend of this censoring can be observed in Table 1. For example, only 74% and 78% of rural and urban households consume meat, fish, and dairy products.

In order to address the censoring issue, we follow the approach proposed by Shonkwiler and Yen (1999), which produces consistent estimates. This is, households make their consumption decisions in a two-step manner. In the first step, households decide on whether on not to consume a food group, and conditional on a positive consumption decision, they decide on the food expenditure share to allocate to this food group. This two-step process can be represented as follow:

$$d_{ih}^{*} = \theta_i z_{ih} + \nu_{ih} \tag{12}$$

$$w_{ih}^{*} = f(z_{ih}, \beta_i) + \varepsilon_{ih} \tag{13}$$

$$d_{ih} = \begin{cases} 1 & \text{if } d_{ih}^{*} > 0 \\ 0 & \text{if } d_{ih}^{*} \leq 0 \end{cases} \tag{14}$$

$$w_{ih} = d_{ih} w_{ih}^{*} \tag{15}$$

where d_{ih} and w_{ih} represent household *h* observed dependent variables for the binary consumption decision on food group *i* and its budget share respectively, and d_{ih}^{*} and w_{ih}^{*} are their unobserved latent counterparts; z is a vector of exogenous variables, such as household demographic and geographic dummy variables. Therefore, the first step consists of modeling the consumption decision in Equation (12) using a Probit model. Then, the estimates of the probit model are used to predict the cumulative distribution $\widehat{\Phi}_i$ and probability density functions $\widehat{\phi}_i$, which are used in the second step to correct for censoring. More specifically, in the second stage, the w_i specified in equation (2) is replaced by the following expression:

$$w_i = \widehat{\Phi}\left(z'_{ih}\widehat{\theta}_i\right) w_i^{*} + \delta_i \widehat{\phi}\left(z'_{ih}\widehat{\theta}_i\right) \tag{16}$$

This model accounting for censoring is referred to as the augmented QUAIDS.

Elasticities

The price and expenditures elasticities for the QUAIDS model with demographics are derived following Poi (2012). These elasticities represented the conditional elasticities (conditional on the first stage budgeting). Having a two-stage budgeting demand system, we are interested in the unconditional expenditures and price elasticities of the different food groups, which we derive following the procedure developed by Carpentier and Guyomard (2001). The unconditional food group expenditure elasticities are obtained by multiplying the conditional food group expenditure elasticity (obtained in the second stage) by the food expenditure elasticity (obtained in the first stage). The unconditional uncompensated price elasticities are obtained as follow:

$$\varepsilon_{ij}^{U} = \varepsilon_{ij} + w_j \left(\frac{1}{\eta_j} + \varepsilon_F\right) \eta_i \eta_j + w_F w_j \eta_F \eta_i (\eta_j - 1) \tag{17}$$

i and j are indices that represent commodities in the second stage (here food groups) and F, commodity in the first stage (here food only). Consequently, $\varepsilon_{ij}^{U}$and ε_{ij} represent the unconditional and conditional price elasticities for food group i, w_j and w_F are the food group expenditure share and food expenditure share, ε_F is the price elasticity of food, $\eta_i \eta_j$ are the conditional food group expenditure elasticity while $\eta_F$is the food expenditure elasticity. We focus on the uncompensated (or Marshallian) price elasticity as opposed to the compensated (Hicksian) price elasticity given that the majority of households in Uganda are income constrained. Hicksian price elasticities are derived keeping the level of utility constant while Marshallian price elasticity assumed constant income level. For example, an increase in the price of bean would reduce consumer real income, which is captured in the Marshallian price elasticities. On the other hand, Hicksian price elasticities are derived assuming a positive compensation in the consumer income occurs as a result of higher price.

The unconditional expenditure elasticities, which indicate the percentage change in demand associated with a one percent change in household expenditures, are expected to be positive, indicating that the food commodities are normal goods. Unconditional expenditures elasticity greater than one indicates that the food item is a luxury, meaning that the quantity demanded increases more than the increase in total expenditures. Food commodities with unconditional expenditures elasticities between zero and one are considered necessities. Quantity demanded will increase as expenditures increases but in smaller proportion than the increase in expenditures. Expenditures on these necessity goods will augment in absolute terms as total expenditures increase, but will decrease in relative terms. For an inferior good, the unconditional expenditures elasticities would be negative, indicating the demand for this good decreases as total expenditures raise. The unconditional uncompensated own price elasticity measures the percentage change in quantity demanded associated with a one percent change in the price of that good. Own price elasticities are normally negative, indicating that quantity demanded decreases as price increases. A good is considered to have an elastic demand if its own price elasticity, in absolute value, is greater than one and an inelastic demand when its own price elasticity, in absolute value, is between zero and one.

5. Results

At each budgeting stage, models are estimated separately for rural and urban areas. For both rural and urban specification, the lambda coefficients in the QUAIDS models are jointly significant supporting a quadratic specification over a linear one. Also, the demographic coefficients are jointly significant in explaining food expenditure patterns in both specifications[8]. Selected expenditures and uncompensated price elasticities are reported in tables 4a and 4b. Food group elasticities are unconditional, meaning that first-stage elasticities have been incorporated.

Expenditure elasticities

The expenditure elasticity of food in Uganda is high; 0.951 in rural areas and 0.820 in urban areas (tables 4a-b). This means that a large share of additional income will be spent on food, and reflects the food shortage faced by many households. While large, these food expenditure elasticities are in line with previous studies. For example, Ecker and Qaim (2011) reported expenditure elasticities with respect to food of 0.89 and 0.75 in rural and urban Malawi. Food group expenditure elasticities in rural areas fluctuate between 0.648 (Fruits and vegetables) and 1.118 (Meat, fish, and diary products) and in urban areas, between 0.607 (Beans) and 1.159 (Beverages and FAFH), indicating that all of the food groups are normal goods. Items considered luxuries are beans, other pulses, nuts and seeds, meat, fish & dairy products, and beverages & food away from home for rural households, and beverages & food away from home for urban households. The proportional increase in demand for these food items will be greater than the increase in income. For example, a 10% increase in household expenditures (our proxy for income), will increase demand for meat products, fish & dairy products by about 12% among rural. The magnitude of these estimates are consistent with the current low level of consumption of animal products in Uganda.

Price elasticities

The unconditional uncompensated own-price elasticities of food and food groups reveal that food demand in Uganda is general highly responsive to price changes (tables 4a-b). The uncompensated own-price elasticity of food (first stage) is, in absolute value, 0.982 in rural areas and 1.011 in urban areas. In both locations, demand for cereal product is the most responsive to change in its own-price. In fact, demand for cereal products is elastic in urban areas, meaning that quantity demanded will decrease proportionally more than the increase in its own price. Demand for beverages & food away from home among urban households is also inelastic. Other food groups have inelastic demand, with own-price elasticity ranging, in absolute values, in rural (urban) areas from a low of 0.569 for Oil, fat, spice, sugar & condiments (0.664 for Other pulses,

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[8] The joint significance of the lambda coefficients and demographic variable coefficients was tested using a Wald test. In all cases, the variables are jointly significant with a p-value of zero.

seeds, and nuts) to a high of 0.966 for meat, fish & dairy products (0.886 for Oil, fat, spice, sugar & condiments).

Focus on bean and Simulation

The remaining of the discussion focuses on bean demand and how it varies depending on household location and wealth. Having estimated a QUAIDS model, which allows elasticity estimates to differ in household expenditures, unconditional expenditure and uncompensated price elasticities are estimated at each wealth quintile mean expenditure level[9]. This allows us to obtain the responsiveness of food demand to changes in price and household income for households of different wealth status. These elasticities take into consideration how the first stage estimated parameters also vary within wealth quintile (tables 4a-b). This is important since food expenditure elasticity differs significantly according to household economic status, averaging 1.008 (0.881 for rural (urban) households in the poorest wealth quintile compared with 0.865 (0.726) for the better-off 20 percent in rural (urban) areas.

Demand for bean is expected to grow considerably as income raises in rural areas. Bean is considered a luxury good for rural households of all wealth quintiles. A 10% increase in household expenditures among the poorest 20% of the income distribution would increase demand for bean by 10.5%. Increase in demand for bean as a result of income growth is more modest in urban areas and especially among the better-off households. Demand for bean among urban households will increase in absolute value as income grows but its relative importance will decrease. Expenditure elasticity for bean is 0.703 for urban households in the poorest wealth quintile, which represents a smaller income response than among rural households of any wealth quintile. This is an indication that food preferences are changing with urbanization, since urban households in the first quintile are poorer than rural households in the third, fourth and fifth quintiles, as indicated by per capita household expenditures (tables 3a and 3b). In fact, urban households in the first quintile have on average similar per capita expenditure level to rural households in the second wealth quintile. However, an increase in income will generate a smaller response in demand for bean among urban households compared with rural households of similar wealth status.

Demand for bean is more responsive to the change in its own price in rural than urban areas. In addition, in urban areas, there is a greater difference in the responsiveness of demand to price change (as for the income) between households in the worst and better-off quintiles, as indicated by the different own-price elasticity for bean across wealth quintiles. A one percent increase in the price of bean would decrease the quantity demand by 0.89% among the poorest urban households compared to 0.69% among the richest 20%. In rural areas, the own-price elasticity is very stable across wealth quintiles, averaging in absolute value 0.957.

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[9] Variables other than household expenditures and food expenditures are computed at sample mean for each quintile to ensure that difference in elasticities are only attributed to change in household wealth status.

Poor households in Uganda rely heavily on beans to meet their nutritional needs, as indicated by the large share of their food budget devoted to beans (table 2). Therefore, food security among poor households could be threaten by bean price volatility. To investigate the impact of higher bean price, for example as a result of production shocks or greater demand in neighboring countries, on household bean consumption, we consider the implication of a 20% increase in the price of bean on actual quantity consumed and then corresponding calorie and protein intakes. The predicted change in quantity demanded is obtained using consumption data[10] and elasticities estimates for rural and urban at the different wealth quintiles. Calories and protein compositions are derived from the conversion factors of the World Food Dietary Assessment System (FAO, 2010).

Among rural (urban) household in the poorest wealth quintile, current bean consumption is estimated to 54 (51) grams per day per capita (table 5). For these rural (urban) households, bean provides 11.1% (10.3%) and 25.6% (23.0%) of the daily calorie and protein intakes respectively. While per bean capita consumption tends to increase with household wealth, the relative contribution of bean to calorie and protein intakes decreases. For rural (urban) households in the fifth wealth quintile, bean consumption represents 8.1% (6.7%) and 18.2% (14.2%) of the daily calorie and protein intakes Assuming a 20% increase the price of bean, the quantity of bean consumed would decrease by 19.3% among the poorest households in rural areas. This corresponds to an average reduction in the quantity of bean consumed of 10.4 grams per capita per day, resulting in a reduction of 30 calories and 2 grams of proteins intakes per capita per day. Given that rural households in the poorest quintile consume on average 36.5 grams of proteins per capita per day, this represents a protein intakes loss of about 5.5%, which can have negative repercussion on health and productivity.

However, to get the net nutritional effect of an increase in the price of bean, one would have to consider how households substitute between food groups. Cross-price elasticities provide the answer by indicating the change in the quantity demanded for other food groups due to a one percent increase in the price of bean. Two commodities are substitutes when their cross-price elasticity is positive, while negative cross-price elasticities indicate that the goods are complements. Cross-price elasticities are generally small. In rural areas, pulses, nuts & seeds are considered complements to bean. In urban areas, starches are complements to bean while oil, fat, sugar, spices, and condiments are considered substitutes to beans. The other cross-price elasticities with respect to the price of bean are insignificant.

6. Conclusion

In recent years, consumption of legumes such as common bean in sufficient quantities has been depicted as a strategic remedy for hidden hunger and healthy eating. SSA where bean consumption is the second highest in the world also has one of the highest prevalence of

[10] All local units used to indicate quantity consumed were transformed into kg.

undernutrition problems. This calls for a deeper understanding of disaggregated demand and how it is affected by changes in prices and income in order to inform evaluation of interventions that aim to minimize the nutritional risks that come with production shocks in the context of increasing trade and urbanization. This study analyses household demand for beans by different wealth strata in rural and urban population using the most recent survey data from a nationally representative sample of households. Based on a Quadratic Almost Ideal Demand System model for the specification of the food demand system with demographic effects and controlling for censoring, the study contributes to the understanding of the interaction between demand and food prices, demand and income growth and possibly policy measures to overcome the malnutrition problem.

Results reveal high importance of bean in the food budgets of the poorer in urban and rural areas. Nevertheless, their absolute expenditure on beans is about two times less than that of the upper stratum, suggesting that the poor have lower bean consumption either because are limited by low purchasing power or production constraints. Indeed, income elasticity is very high in rural areas and high among urban households in the bottom wealth quintile, which means that as the country's economy improves, the demand for bean will also grow, requiring accelerated increases in production to be able to feed the population. Own price elasticity for bean among rural households and the poorer urban households is close to one, which implies that these households are currently highly sensitive to price changes, which have been volatile in last years; and thus negatively affecting their nutritional security.

The estimated elasticities can inform important policy deliberations. Bean seems to be a normal good for all the income strata implying that if the current economic growth rates are sustained, future demand for beans will not only be about feeding additional people but also greater quantity for the current consumers. Hence, improvements in household incomes may lead to better nutrition. However, if the current bean productivity growth trend remains modest, prices might increase and bean consumption gap between the upper and lower income strata may be sustained. It is therefore critical that interventions in bean production do not only aim to stabilize yields but also seek to accelerate productivity growth in order to boost production and be able to meet the higher future growth in demand.

The study findings reveal differences in the behavior of urban and rural bean consumers. While both urban and rural poor are very sensitive to prices changes, there is divergence in behavior between urban and rural upper quintile with latter being more sensitive to prices than the former. Since, some of the rural consumers are also producers who benefit from higher prices, our results suggest that increases in price might induce a trade-off between marketed surplus and own consumption. The implication for nutritional security depends on whether the income from sales is used to support nutrition or not. It is therefore, critical that initiatives aiming at commercialization of bean production, integrate in the promotion of diversified diets and nutritional education programs.

Tables

Table 1: Summary statistics of food group consumption and budget shares, by rural/urban

	HH consuming (%)		Expenditure share (%)	
Food group	Rural	Urban	Rural (rank)	Urban (rank)
Cereals products	81.2	91.7	15.6 (2)	17.0 (3)
Starches	92.9	89.1	30.3 (1)	20.5 (1)
Bean	82.2	80.6	9.1 (5)	6.7 (7)
Other Pulses, nuts and seeds	55.1	65.0	4.0 (8)	4.6 (8)
Vegetables and Fruits	95.2	97.0	9.6 (4)	8.9 (6)
Meat products, fish, and dairy products	73.8	78.2	15.3 (3)	18.3 (2)
Oil, Fats, Spices, and Sugar	99.2	99.2	7.2 (7)	9.3 (5)
Beverages and food outside	77.7	91.0	8.8 (6)	14.7 (4)

Table 2: Bean consumption, by wealth quintile, and rural/urban

	Share of HH consuming bean		Per capita bean expenditures (UGX/week)		Share of bean expenditures in food expenditures	
	Rural	Urban	Rural	Urban	Rural	Urban
Quintile 1	74.63	78.90	470.87	527.44	11.54	9.99
Quintile 2	83.31	87.12	715.62	686.55	11.03	7.14
Quintile 3	84.98	91.69	886.79	986.94	9.62	8.21
Quintile 4	89.28	76.12	981.80	734.46	7.84	4.97
Quintile 5	81.56	78.22	1203.09	1017.36	5.47	3.90

Note: HH= Households

Table 3a: Summary statistics (mean) of per capita expenditures, food share, and household demographics, for rural households

	Quintile 1	*Quintile 2*	*Quintile 3*	*Quintile 4*	*Quintile 5*	*Average Rural*
Per capita consumption expenditures (UGX/year)	313474	486390	699297	1081781	2585367	1031955
Food share	0.70	0.70	0.69	0.64	0.57	0.66
HH head present (1=yes)	0.93	0.91	0.91	0.90	0.95	0.92
HH head age	43.91	43.31	44.06	45.69	40.16	43.43
HH head sex (1=male)	0.65	0.71	0.63	0.71	0.68	0.68
Education of the spouse						
None	0.37	0.27	0.28	0.19	0.14	0.25
Primary	0.61	0.68	0.61	0.63	0.45	0.60
Secondary and higher	0.02	0.05	0.11	0.18	0.41	0.16
Nb of children (0-5)	1.48	1.38	1.16	0.93	0.62	1.12
Nb of children (6-14)	2.00	1.76	1.59	1.55	0.72	1.52
Nb of adult (15 & +)	2.72	2.79	2.52	2.63	2.24	2.58

Note: HH=Household, Nb=Number

Table 3b: Summary statistics (mean) of per capita expenditures, food share, and household demographics, for urban households

	Quintile 1	*Quintile 2*	*Quintile 3*	*Quintile 4*	*Quintile 5*	*Average Urban*
Per capita consumption expenditures (UGX)	511539	863542	1242916	1913019	3654174	1626366
Food share	0.63	0.60	0.54	0.46	0.40	0.53
HH head present (1=yes)	0.93	0.88	0.94	0.91	0.92	0.92
HH head age	50.10	39.13	41.83	40.38	42.21	42.68
HH head sex (1=male)	0.47	0.76	0.61	0.62	0.64	0.62
Education of the spouse						
None	0.34	0.03	0.03	0.06	0.03	0.10
Primary	0.51	0.52	0.60	0.41	0.27	0.46
Secondary and higher	0.15	0.45	0.37	0.53	0.71	0.44
Nb of children (0-5)	1.36	1.13	0.73	0.73	0.39	0.88
Nb of children (6-14)	1.85	1.71	1.23	1.03	0.54	1.28
Nb of adult (15 & +)	3.00	2.63	2.61	2.62	2.50	2.67

Note: HH=Household, Nb=Number

Table 4a: Rural households: Expenditure and selected uncompensated price elasticities for food and food groups

	Overall	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
1st Stage						
Expenditure elas.	0.951***	1.008***	0.979***	0.958***	0.928***	0.865***
	(0.013)	(0.019)	(0.014)	(0.012)	(0.015)	(0.028)
Uncompensated price elas.	-0.982***	-0.983***	-0.983***	-0.983***	-0.982***	-0.980***
	(0.045)	(0.043)	(0.043)	(0.043)	(0.046)	(0.052)
2nd Stage						
Unconditional expenditure elasticity						
	Overall	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
Group 1	0.888***	1.008***	0.930***	0.894***	0.842***	0.747***
	(0.040)	(0.044)	(0.040)	(0.038)	(0.039)	(0.052)
Group 2	0.924***	0.986***	0.954***	0.932***	0.899***	0.825***
	(0.029)	(0.032)	(0.030)	(0.028)	(0.030)	(0.040)
Group 3	1.026***	1.047***	1.037***	1.028***	1.038***	1.005***
	(0.042)	(0.045)	(0.038)	(0.038)	(0.048)	(0.060)
Group 4	1.037***	1.175***	1.076***	1.047***	0.975***	0.907***
	(0.061)	(0.070)	(0.058)	(0.065)	(0.054)	(0.070)
Group 5	0.648***	0.686***	0.667***	0.635***	0.627***	0.611***
	(0.062)	(0.062)	(0.062)	(0.066)	(0.066)	(0.061)
Group 6	1.118***	1.430***	1.174***	1.123***	1.043***	0.949***
	(0.031)	(0.058)	(0.033)	(0.031)	(0.029)	(0.036)
Group 7	0.932***	1.039***	0.970***	0.936***	0.891***	0.821***
	(0.080)	(0.096)	(0.098)	(0.079)	(0.070)	(0.071)
Group 8	1.089***	0.867***	1.131***	1.162***	1.178***	0.993***
	(0.059)	(0.102)	(0.098)	(0.079)	(0.067)	(0.044)
Unconditional uncompensated own-price elasticity						
	Overall	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
Group 1	-0.968***	-0.984***	-0.972***	-0.969***	-0.962***	-0.949***
	(0.029)	(0.029)	(0.029)	(0.028)	(0.028)	(0.035)
Group 2	-0.957***	-0.964***	-0.960***	-0.959***	-0.954***	-0.938***
	(0.020)	(0.020)	(0.020)	(0.020)	(0.021)	(0.027)
Group 3	-0.957***	-0.963***	-0.964***	-0.961***	-0.947***	-0.933***
	(0.041)	(0.033)	(0.033)	(0.037)	(0.052)	(0.067)
Group 4	-0.852***	-0.850***	-0.864***	-0.840***	-0.869***	-0.833***
	(0.043)	(0.045)	(0.040)	(0.047)	(0.038)	(0.048)
Group 5	-0.709***	-0.741***	-0.718***	-0.691***	-0.684***	-0.702***
	(0.049)	(0.043)	(0.048)	(0.053)	(0.054)	(0.051)
Group 6	-0.966***	-0.959***	-0.966***	-0.963***	-0.964***	-0.967***
	(0.031)	(0.050)	(0.032)	(0.031)	(0.028)	(0.026)
Group 7	-0.569***	-0.559***	-0.494***	-0.576***	-0.605***	-0.594***
	(0.084)	(0.089)	(0.099)	(0.083)	(0.076)	(0.078)
Group 8	-0.959***	-0.925***	-0.926***	-0.946***	-0.966***	-0.992***
	(0.028)	(0.047)	(0.046)	(0.037)	(0.031)	(0.021)
Cross-price elasticities w.r.t. Group 3						
	Overall	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
Group 1	0.002	0.001	0.002	0.003	0.003	0.004
	(0.021)	(0.021)	(0.021)	(0.020)	(0.020)	(0.025)
Group 2	-0.005	-0.003	-0.004	-0.005	-0.007	-0.010
	(0.012)	(0.010)	(0.011)	(0.011)	(0.012)	(0.017)
Group 4	-0.078*	-0.082*	-0.072*	-0.083*	-0.068*	-0.086*
	(0.044)	(0.047)	(0.041)	(0.048)	(0.039)	(0.049)
Group 5	-0.027	-0.021	-0.025	-0.029	-0.032	-0.032
	(0.027)	(0.024)	(0.026)	(0.029)	(0.030)	(0.028)

Group 6	0.005	0.006	0.005	0.006	0.005	0.003
	(0.017)	(0.029)	(0.018)	(0.017)	(0.015)	(0.014)
Group 7	-0.004	-0.005	-0.004	-0.003	-0.004	-0.004
	(0.052)	(0.055)	(0.062)	(0.051)	(0.047)	(0.048)
Group 8	0.019	0.051	0.038	0.026	0.014	0.003
	(0.024)	(0.040)	(0.040)	(0.032)	(0.025)	(0.013)

Note: Group numbers denote 1) Cereals, 2) Starches, 3) Beans, 4) Other pulses, seeds, and nuts, 5) Fruits and vegetables, 6) Meat, fish, and dairy products, 7) Oil, fat, spice, and sugar, 8) Beverages and FAFH

Table 4b: Urban households: Expenditure and selected uncompensated price elasticities for food and food groups

			1st Stage			
	Overall	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
expenditure elas.	0.820***	0.881***	0.838***	0.836***	0.782***	0.726***
	(0.038)	(0.052)	(0.044)	(0.035)	(0.043)	(0.065)
Uncompensated price elas.	-1.011***	-1.009***	-1.011***	-1.010***	-1.013***	-1.014***
	(0.139)	(0.115)	(0.137)	(0.128)	(0.156)	(0.174)
			2nd Stage			
			Unconditional expenditure elasticity			
	Overall	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
Group 1	0.755***	0.852***	0.785***	0.755***	0.707***	0.615***
	(0.076)	(0.077)	(0.073)	(0.084)	(0.083)	(0.114)
Group 2	0.752***	0.803***	0.771***	0.764***	0.719***	0.665***
	(0.077)	(0.076)	(0.074)	(0.081)	(0.079)	(0.103)
Group 3	0.607***	0.738***	0.635***	0.601***	0.578***	0.346**
	(0.099)	(0.081)	(0.096)	(0.105)	(0.098)	(0.166)
Group 4	0.748***	0.808***	0.681**	0.763***	0.705***	0.712***
	(0.170)	(0.113)	(0.311)	(0.199)	(0.221)	(0.174)
Group 5	0.663***	0.685***	0.661***	0.697***	0.624***	0.610***
	(0.095)	(0.102)	(0.101)	(0.087)	(0.101)	(0.102)
Group 6	0.915***	1.071***	0.952***	0.936***	0.860***	0.775***
	(0.083)	(0.130)	(0.095)	(0.087)	(0.079)	(0.087)
Group 7	0.650***	0.535***	0.708***	0.678***	0.614***	0.596***
	(0.073)	(0.125)	(0.063)	(0.070)	(0.075)	(0.078)
Group 8	1.159***	1.765***	1.335***	1.092***	1.068***	0.924***
	(0.171)	(0.433)	(0.253)	(0.133)	(0.146)	(0.120)
			Unconditional uncompensated own-price elasticity			
	Overall	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
Group 1	-1.236***	-1.179***	-1.206***	-1.268***	-1.256***	-1.330***
	(0.143)	(0.104)	(0.124)	(0.163)	(0.156)	(0.206)
Group 2	-0.732***	-0.774***	-0.758***	-0.711***	-0.729***	-0.643***
	(0.155)	(0.126)	(0.139)	(0.168)	(0.159)	(0.216)
Group 3	-0.832***	-0.885***	-0.840***	-0.822***	-0.834***	-0.689**
	(0.155)	(0.108)	(0.148)	(0.165)	(0.152)	(0.287)
Group 4	-0.664***	-0.832***	-0.410	-0.604***	-0.528*	-0.588**
	(0.192)	(0.096)	(0.335)	(0.226)	(0.270)	(0.237)
Group 5	-0.642***	-0.660***	-0.627***	-0.678***	-0.606***	-0.630***
	(0.106)	(0.100)	(0.110)	(0.095)	(0.117)	(0.110)
Group 6	-0.849***	-0.776***	-0.831***	-0.832***	-0.863***	-0.889***
	(0.180)	(0.267)	(0.201)	(0.193)	(0.168)	(0.142)
Group 7	-0.886***	-0.865**	-0.920***	-0.890***	-0.872***	-0.861***
	(0.255)	(0.422)	(0.181)	(0.237)	(0.272)	(0.254)
Group 8	-1.174***	-1.393***	-1.248***	-1.140***	-1.170***	-1.136***
	(0.203)	(0.412)	(0.277)	(0.162)	(0.195)	(0.172)
			Cross-price elasticities w.r.t. Group 3			
	Overall	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
Group 1	0.058	0.039	0.050	0.065	0.065	0.087
	(0.082)	(0.061)	(0.071)	(0.092)	(0.089)	(0.116)
Group 2	-0.176***	-0.139***	-0.155***	-0.194***	-0.180***	-0.252***
	(0.059)	(0.048)	(0.053)	(0.064)	(0.060)	(0.082)
Group 4	0.065	0.039	0.112	0.073	0.086	0.070
	(0.154)	(0.075)	(0.273)	(0.183)	(0.218)	(0.192)
Group 5	0.133	0.129	0.139	0.119	0.145	0.135

	(0.087)	(0.081)	(0.090)	(0.078)	(0.096)	(0.090)
Group 6	-0.074	-0.126	-0.085	-0.080	-0.064	-0.045
	(0.068)	(0.104)	(0.077)	(0.073)	(0.063)	(0.049)
Group 7	0.294***	0.471***	0.213***	0.275***	0.314***	0.298***
	(0.112)	(0.179)	(0.081)	(0.105)	(0.120)	(0.114)
Group 8	-0.017	-0.067	-0.030	-0.010	-0.011	-0.002
	(0.062)	(0.142)	(0.088)	(0.047)	(0.056)	(0.044)

Note: Group numbers denote 1) Cereals, 2) Starches, 3) Beans, 4) Other pulses, seeds, and nuts, 5) Fruits and vegetables, 6) Meat, fish, and dairy products, 7) Oil, fat, spice, and sugar, 8) Beverages and FAFH

Table 5: Bean consumption in terms of quantity and share of calories and protein intakes, per capita, per day, by wealth quintiles, Rural and Urban Uganda

	Quantity (g)/day/per capita	Calories/day/per capita	Calories share in diet	Protein (g)/day/per capita	Protein share in diet (%)
Quintile 1	54.1	155.2	11.1%	10.3	25.6%
Quintile 2	67.8	198.8	10.9%	13.1	24.4%
Quintile 3	87.1	245.9	10.8%	16.2	25.2%
Quintile 4	84.9	239.4	8.5%	15.8	20.8%
Quintile 5	101.6	285.6	8.1%	18.9	18.2%
Total Rural	79.1	224.9	9.9%	14.9	22.9%
Quintile 1	51.3	159.6	10.3%	10.6	23.0%
Quintile 2	59.7	185.1	9.4%	12.2	21.9%
Quintile 3	69.0	206.5	9.3%	13.7	21.7%
Quintile 4	89.7	268.9	10.9%	17.8	24.0%
Quintile 5	76.1	230.8	6.7%	15.3	14.2%
Total Urban	69.0	209.7	9.3%	13.9	21.0%

Figures

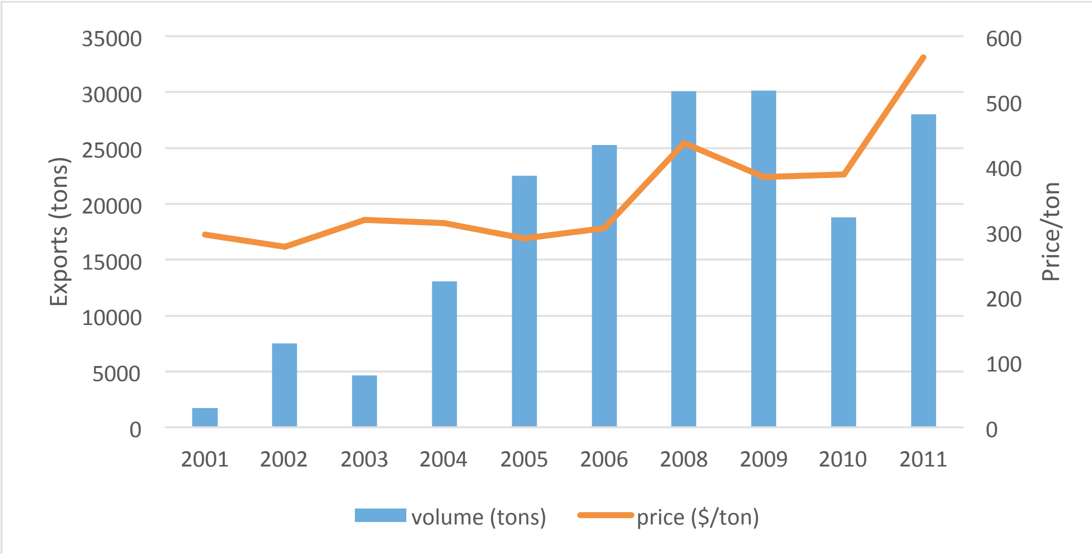


Figure 1: Volumes (tons) of common bean exports from Uganda and respective unit value ($/ton)

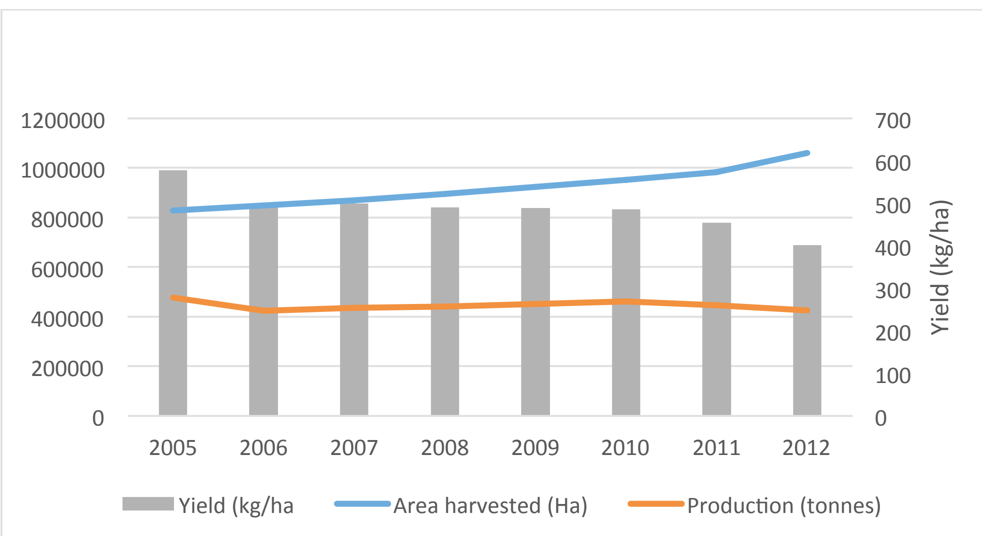
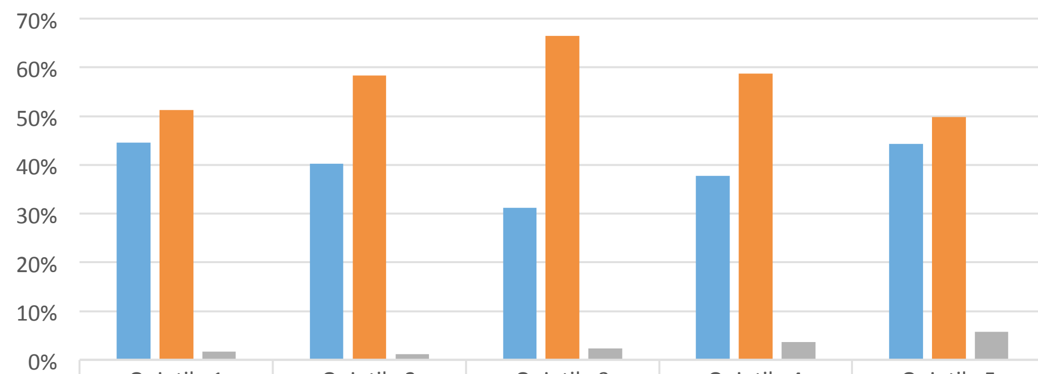


Figure 2: Bean yield, area harvested, and production in Uganda, between 2005-2012



	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
Purchased	45%	40%	31%	38%	44%
Own production	51%	58%	66%	59%	50%
In-kind	2%	1%	2%	4%	6%

Figure 3: Source of bean consumed by wealth quintile, Rural Uganda

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