

**QUADRATIC ALMOST IDEAL DEMAND SYSTEM (QUAIDS) ESTIMATION
FOR COMMON BEANS DEMAND IN DAR ES SALAAM, TANZANIA**

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**A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE
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ABSTRACT

Beans production and consumption is common and form an important historical food and nutrition security in many parts of the world. In Tanzania, the availability of beans ensures food security because it mitigates or reduces hidden hunger since some families consider it as a dependable and complete meal during periods of food shortage. Due to its importance, the inquiry into production and consumption patterns is paramount. This paper contributes some insights in the consumption side. The overall objective of this study was to analyze the responsiveness of bean consumers in Dar es Salaam Region to changes in price and income. Based on monthly food expenditures for five types of common beans grouped as yellow, red, soya supa, kombati and mottled red, the sample size of 681 respondents were used. The Quadratic Almost Ideal Demand System model was used to estimate common bean demand in Dar es Salaam. Also, expenditure, own and cross price elasticities for five types of common beans under study were computed. The red, yellow, kombati and soya supa beans were found to be normal goods while mottled red was an inferior good. Own and cross price elasticities were less than one except for yellow beans with own price elasticity of about one, which implies that a change in price would lead to less than proportionate change in the quantity. Therefore, it is recommended that traders and beans farmers increase price to raise more revenues. Also, since expenditure elasticities are higher than price elasticities, policies towards the beans subsector should take into consideration influence of consumers' income rather than beans prices. This is because price related policies will be less effective compared to income policies. However, rational consumers' changes in preferences as income change must always be considered.

DECLARATION

I, **RAMECK THEOPHIL RWAKALAZA**, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution of any kind.

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Date

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DEDICATION

This work is dedicated to my parents, the late Mzee Theophil Rwakalaza and Ma Paulina Theophil for their support and encouragement during earlier days of schooling. Also, this work is dedicated to my beloved brother Bernard Buhoma for his moral and financial support in all years of my academic journey.

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LIST OF ABBREVIATIONS

AIDS	Almost Ideal Demand System
ASDS	Agricultural Sector Development Strategy
BTC	Belgium Technical Cooperation
CAADP	Comprehensive Africa Agriculture Development Program
CGE	Computable General Equilibrium
EA	Enumeration Area
EMH	Efficient Market Hypothesis
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
HBS	Household Budget Survey
IITA	International Institute of Tropical Agriculture
IMR	Inverse Mills Ratio
LA/AIDS	Linear Approximate Almost Ideal Demand System
MT	Metric Tons
NBS	National Bureau of Statistics
PABRA	Pan - Africa Bean Research Alliance
PADEP	Participatory Agricultural Development and Empowerment Project
PIGLOG	Price-Independent Generalized Logarithmic
QUAIDS	Quadratic Almost Ideal Demand System
TAFSIP	Tanzania agriculture and food security investment plan
URT	United Republic of Tanzania

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Common bean (*Phaseolus Vulgaris L.*) is an edible legume crop and ranks second in nutritional value after soybean (Katungi *et al.*, 2011). Common beans are widely produced and consumed in many parts of the world (Buruchara *et al.*, 2011) and are important for income generation and food security in developing countries (Margaret *et al.*, 2014; Mishili *et al.*, 2009). The beans are vital for supplementing caloric balance in a typical Tanzanian's diet (Mfikwa and Kilima, 2014). According to Larochelle *et al.* (2016) and Birachi (2012) and IITA (2012), most of the beans produced by smallholder farmers are consumed locally. Thus, the availability of beans especially in developing countries such as Tanzania ensures food security because it mitigates or reduces hunger. Consequently, some families consider it as dependable and complete meal during periods of food shortage (Birachi, 2012). Beans are consumed at different stages as leaves, fresh pods and dry beans. Dry beans are consumed as sauce mixed with rice, stiff porridge or maize and there is a wide range of other recipes of this product in Eastern and Southern Africa.

Owing to its high nutritional value, food security importance and potential to generate income; the Government of Tanzania (GoT) has identified common beans as one of the priority food crop (URT, 2016a). To improve the performance of bean subsector and other food and cash crops various policies, strategies and programs have been implemented to ensure food and nutrition security, create wealth and reduce poverty. These include the Agricultural Sector Development Program II (ASDP II), Tanzania agriculture and food security investment plan (TAFSIP) and Value Chain Roadmap for Pulses. The ASDP II and TAFSIP identifies common beans as the priority crop in enhancing agricultural sector

growth and improving incomes and livelihoods of beans growers in the country (URT, 2016a) while the Value Chain Roadmap for Pulses intends to achieve the development of pulses sub sector through strategies that enhance its competitiveness and chain organization (URT, 2016b).

These policies have attracted several scientific studies on the performance of common beans subsector in Tanzania (Baltazari, 2014; Ronner and Giller, 2012; Stahley *et al.*, 2012; Birachi, 2012; BTC, 2012; Akibode, 2011; Fivawo and Msolla, 2011). Since all policies aims at improving production and productivity for income generation and food security, many studies (Baltazari, 2014; Ronner and Giller, 2012; Birachi, 2012; Fivawo and Msolla, 2011; Hillocks *et al.*, 2006) have mainly assessed productivity, inputs availability, attributes that shapes producers' decisions, marketing constraints and roles of beans in nitrogen fixation.

In contrast, consumption side studies have generally been rare. Beans consumption studies in Tanzania include Mishili *et al.* (2009), which assessed how grain quality characteristics affect bean market price. The other study is Mfikwa and Kilima (2014) which analyzed factors influencing the consumption of pulses in rural and urban areas in Tanzania. None of the two studies analyzed consumer's behavior when there are changes in income and market prices thereby precluding some instantaneous policy analysis and forecasts. Sánchez (2004) and Sadoulet and Janvry (1995) reveal that policy analysis has ever been challenging task owing to unavailability of relevant, high quality and sufficient data in most developing countries because commodity markets in these countries tend to be informal and undeveloped (URT, 2016a; BTC, 2012).

Unreliable data on consumption has often limited rigorous analysis of policy issues because calibration has been the only alternative to obtain elasticities and functional parameters during the estimation of econometric models (Wobst, 2001; Balsvik and

Brendemoen, 1994). This approach is perceived to be subjective because results are influenced by modelers' intentions and intellect levels when they make intelligent guesses. Lack of reliable approach to generate robust elasticities and functional parameters makes the models unreliable tools for analysis of economic policies (Sánchez, 2004).

1.2 Problem Statement and Justification

Agricultural market information is important for all actors within the commodity chains and relevant stakeholders. In Tanzania, demand side information on common beans has generally been rare. According to BTC (2012) and URT (2016b) markets for common beans are predominantly informal, underdeveloped, poorly organized and lack good flow of information. These market imperfections have often limited the prospect to generate reliable estimators of income and price elasticities as well as budget shares for consumers. Income and price elasticities are useful to understand consumers' responses to changes in prices and or income levels while budget shares help to identify the proportions of income spent on different goods that has important ramifications on consumers' welfare.

Lack of sufficient data on demand for common beans forces modelers to calibrate available information thereby making models for policy analysis unreliable. The calibration process normally involves the use of elasticities from different published sources for countries with similar production and consumption patterns. In practice, the calibrated elasticities and parameters are used to establish baseline indicators for the estimation of similar parameters in subsequent years with a maintained assumption that the economy is in equilibrium (Sánchez, 2004). Despite the fact that calibration has been widely used, the method is considered to be deterministic. According to Thissen cited by Sanchez (2004), calibrated parameters may be unreliable due to the arbitrary choice of the bench-mark period.

Therefore, this study aimed at estimating actual demand so as to make information on common beans available for food policies modelling. Demand side parameters and elasticities derived from empirical studies are more realistic for use in various policy analysis such as the consumer general equilibrium (CGE) and multimarket models. Findings of this study will be useful to policymakers, marketers and beans processors to develop effective policies and market strategies. This awareness is expected to help policy architects pinpoint policy interventions that are ideal for the bean industry.

1.3 Objectives

1.3.1 Overall objective

The overall objective of this study was to analyze the responsiveness of bean consumers in Dar es Salaam Region to changes in price and income.

1.3.2 Specific objectives

- i. To assess effect of bean price and household's socioeconomic variables on budget shares for common beans.
- ii. To estimate prices and expenditure elasticities of selected common beans.

1.4 Hypotheses

Ho: Bean prices and household's socioeconomic variables have no effect on budgets for common beans.

Ho: All varieties of selected common beans are normal goods

1.5 Organization of the Thesis

This thesis comprises five chapters namely; introduction, literature review, method, results and discussion and conclusion and recommendation. The first chapter explains briefly the

importance of common beans, the need to use real data for various food policy analyses. It then presents the problem statement and justifies the study and it states study objectives and hypotheses. The second chapter defines key terms and describe methods that can be used for demand analysis. Also the chapter analyses consumption trends, reveals the importance of common beans and reviews other consumer studies. Chapter three describes the location of the study, sampling design, nature of data and methods of data analysis. Chapter four presents and discusses results while chapter five offers concluding remarks and recommendation.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

This chapter presents literature on beans and demand system estimation. Firstly, it defines key terms and describes beans consumption in Tanzania. Secondly, it offers a brief discussion of factors underlying the consumption of beans and; lastly it reviews potential techniques for the estimation of demand while highlighting applications and implications of results and avenues for improvement.

2.2 Definition of the Terms and Concepts

2.2.1 Common Beans

Common bean along with soybean, pigeon pea and cow pea are edible legume crops that belong to *Fabaceae* family. Common beans are widely grown because are cheap source of protein and starch (Hillocks *et al.*, 2006). Literature shows that these beans originated from Southern America and were introduced in Tanzania three centuries ago (Fivawo and Msolla, 2011).

2.2.2 Goods

Goods are tangible things that can be consumed to satisfy consumers' desires (Varian, 2010). Economists are normally interested in the so called "economic goods". These are scarce consumable items which yield satisfaction when consumed but requires some efforts (e.g. ability to pay) to access the goods (Menger, 1976). The interest of this study is on dried common beans, herein simply referred to as beans.

2.2.3 Price

The price of a good signals the value of that good. In a well-structured market, forces of demand and supply determine the price of a particular good or service. Price can assume different forms such as payments in form of cash, rent, interest and wage (Varian, 2010). However, Menger (1976) define price as the amount of compensation paid by one party to another in return for agreed amount (in a specific unit of measurement) of goods and services. This compensation can be in form of hard cash, electronic money or other economic goods such as gold and silver. In this study, price is defined as the currency in Tanzanian shilling paid by consumers when purchasing one kilogram of beans.

2.2.4 Income

There has been a sustained debate on the proper definition of income. To date, many economists argue that income is related to welfare as the former is perceived to influence the later (Tom *et al.*, 2017; Komlos, 2016; Aguiar and Bils, 2015; Todaro and Smith, 2011; Ximing, *et al.*, 2002 and Haig, 1921). Income is a subjective term related to existing and prospective gain that an individual receives in exchange of a service rendered (Hicks, 1939; Simons, 1938 and Haig, 1921). In this study income is defined as the money that a consumer earns in a month from providing goods and or services.

2.2.5 Demand

In the conventional consumer theory, demand is defined as the amount of goods and or services that a consumer is willing and able to purchase at different market prices (Nicholson and Snyder, 2008; Varian, 2010). Whelan and Msefer (1996) define demand as the rate at which a consumer wants to buy a product. Want (wish) is an expression of consumer's desire to buy a particular product (*Ibid.*). Furthermore, Whelan and Msefer (1996) and Chongela *et al.* (2014) reveal that desire determines one's willingness to make

a purchase. Ability means that a consumer must have sufficient income to buy goods and or services and the ability is influenced by market price and other determinants. For normal goods, the amount purchased tend to increase as income increases but decrease as price increases. Literature reveals that less satisfaction is derived from a consumption of an extra amount of a good¹. As a result, demand is limited by taste (which influences willingness to buy) even when price is low. The demand curve (Figure 1) shows a relationship between price and quantity of a product.

2.2.6 Consumption

Individuals, households, businesses and Governments require various goods and services to meet their needs. The process of using the goods and services is called consumption, which is the end-point of a series of economic activities that start with evaluation of available resources, production and distribution of goods and services (Goodwin *et al.*, 2008). In his famous article, the wealth of Nations, Smith (1909) argues that consumption is the end and purpose for all economic activities that intend to add value so as to benefit a consumer. The consumer is, therefore, an individual or any entity who/which optimally utilizes a bundle of final goods and services to satisfy their wants depending on income level and market prices.

¹ This situation is explained by the law of diminishing marginal utility. The law states that when a person increases the consumption of a product while maintaining the consumption of other products, there is a decline in the marginal utility derived from consuming each additional unit of that product (Msefer, 1996).

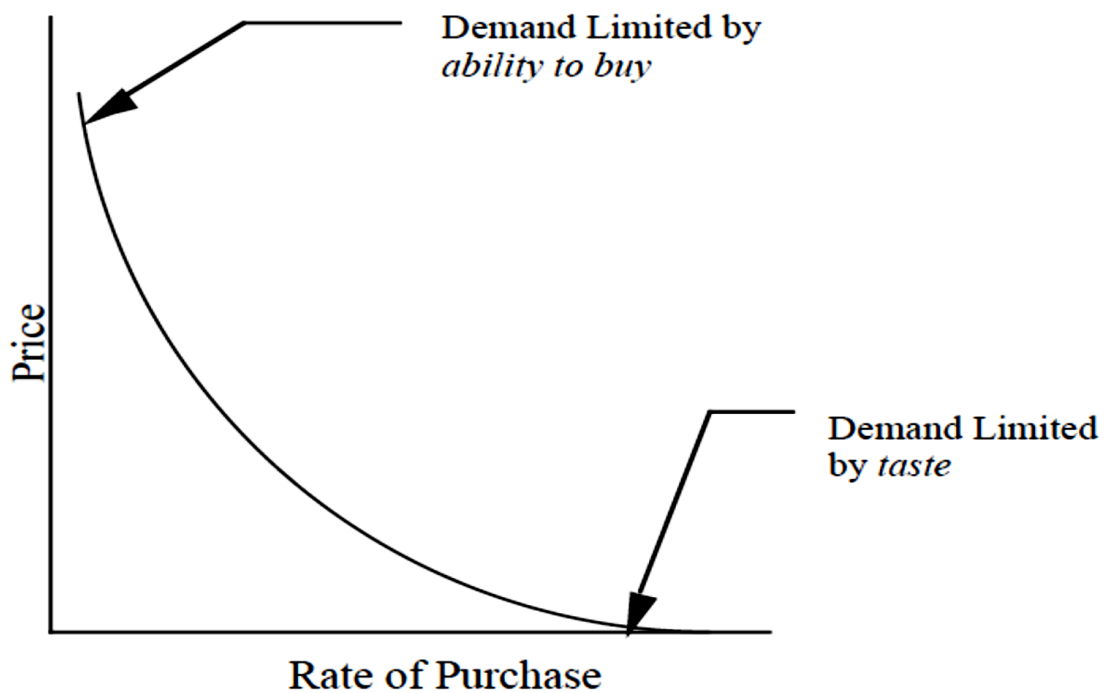


Figure 1: The Demand Curve

2.2.7 Elasticity

Elasticity is a useful measure of the degree of sensitivity or responsiveness of one variable to a change in another variable (Nicholson and Snyder, 2008; Varian, 2010). This study focused on estimating price elasticity and expenditure elasticity which is a proxy of income elasticity. Expenditure (income) elasticity is therefore, a measure of the extent to which the quantity bought changes as household expenditure changes. In terms of elasticity, goods are categorized as giffen, inferior, normal, neutral, necessity or luxury goods, gross complements or gross substitutes depending on sign and magnitude of own income and cross price elasticities (Sadoulet and Janvry, 1995; Nicholson and Snyder, 2008; Varian, 2010).

A particular good is called a giffen good, if its own price elasticity is greater than zero; inferior, if its income elasticity is less than zero; neutral, if its income elasticity is zero and normal, if its income elasticity is greater than zero. Normal goods can be further classified

as luxury goods if income elasticity is greater than one and as necessary goods if income elasticity is between zero and one. Furthermore, normal goods are considered gross complements if cross price elasticity is less than zero and gross substitutes if cross price elasticity is greater than zero (Sadoulet and Janvry, 1995; Nicholson and Snyder, 2008; Varian, 2010).

2.2.8 Demand analysis

Demand analysis entails an investigative procedure to uncover consumer reactions in various situations. A rational consumer is expected to behave differently when variables that shape consumption decisions change. These variables include factors that influence the level of demand such as price of a good and its attributes; ones' real income, education level, sex, household size and; extent of urbanization (Sadoulet and Janvry, 1995). The main objective of this analysis is to expound the level of demand for goods and services given a structure of these factors. Policy analysts always seek to explain how these changes will in turn affect the purchase of a particular commodity or group of commodities. The changes could be in terms of foods purchased in a certain location or by social class, income group (low or high income) or the whole society (*Ibid.*).

2.3 Consumption of Beans in Tanzania

Common beans form an important dietary component of many household in Tanzania (Mkenda *et al.*, 2014; Tryphone *et al.*, 2013; Hillocks *et al.*, 2006). When compared to other sources of protein such as meat and seafood, beans are widely grown and low cost source of protein and other nutrients (Margaret *et al.*, 2014). There is evidence that many smallholder farmers consume most of the beans produced as they sell the produce only when they have pressing financial needs (Birachi, 2012). Thus, beans are important for

food and nutritional security because production is predominantly on a small scale and producers are poor to afford other sources of protein (Margaret *et al.*, 2014).

In terms of consumption, data show that per capita consumption of beans has been decreasing over time. For instance, it declined from 15.5 kg per year in 2009 to 13.02 kg in 2013 (FAO, 2016). The decline is a reflection of changes in consumers' preference (FAO, 2003). Some analysts actually associate this phenomenon with the on-going changes in life styles and the modest increase in income by some consumers implying that beans could be perceived as an inferior food (Chongela *et al.*, 2014).

2.4 Factors Affecting Consumption of Beans

Studies on consumption reveals that consumers' decision to consume the beans is a function of many factors including; income level, household size, extent of urbanization, availability of other foods and attributes of common beans such as cooking time (Larochelle *et al.*, 2016; Mfikwa and Kilima, 2014; Mishili *et al.*, 2009; Leterme and Muñoz, 2002).

A study on bean consumption in Uganda established that the consumption was higher in rural than in urban areas and among middle income than rich and poor consumers (Larochelle *et al.*, 2016). These findings imply that relationship between consumers' income and bean consumption levels cannot be taken for granted. However, Leterme and Muñoz (2002) found that the consumption of beans by poor households in Latin America was 20 percent higher than rich households. Also, Mfikwa and Kilima (2014) found that poor households in Tanzania consumed more beans than rich households.

Also, urbanization has been reported to be associated with some changes in food preferences leading to changes in the composition of foods that are consumed. It has been

established that urban people consumed less quantities of beans compared to rural people (Larochele *et al.*, 2016; Mfikwa and Kilima, 2014; Leterme and Muñoz, 2002). Cited reasons for the low consumption have been: more diversified food choices in urban than rural areas; time constraint by urban dwellers to cook foods that require more time; higher cost of cooking energy along with availability of fast foods and more diversified income portfolios to afford other sources of protein in urban than rural areas.

Household size is among the factors that shape beans consumption decisions. Large families consume more beans when compared to smaller ones (Larochele *et al.*, 2016; Mfikwa and Kilima, 2014; Leterme and Muñoz, 2002). It has been argued that large families consume more beans because they cannot afford other protein alternatives.

Other factors include the own and cross prices and attributes of beans (Larochele *et al.*, 2016; Mfikwa and Kilima, 2014, Chirwa, 2007). For instance, Chirwa, (2007) revealed that forty percent of traders consistently mentioned grain colour, cooking time and taste as major factors influencing buyer's decisions to choose one variety over the other.

2.5 Consumer Studies

Consumer studies are based on a consumer theory, which is primarily concerned with how a rational consumer with a fixed budget makes consumption decisions to attain a certain level of satisfaction (utility) (Lancaster, 1966; Becker, 1962 and Simon 1954). The level of satisfaction reflects preferences that a consumer place on different bundle of goods and services (Lancaster, 1966). Demand system estimation is a method that has been adopted to analyze consumer behavior (Becker, 1981; Deaton and Muellbauer, 1980). Marshallian and Hicksian frameworks are alternative approaches that are used to analyze demand systems (Parikh *et al.*, 2016; Boer and Missaglia, 2006). Various econometric techniques

have been extensively used to estimate demand systems and derive own price elasticities, cross price elasticities and income elasticities of different commodities (*Ibid.*).

Several studies on demand system estimation have been conducted. Some studies have been specific on certain types of foods such as rice, common beans, meat and fish (Lazaro, 2014; Gould and Villarreal, 2006; Caps, 1989). Others have concentrated on some food categories such as grain, meats and pulses (Zheng and Henneberry, 2010; Liu and Chern, 2003). Also, other studies analyzed food demand system in which all food categories were included (Chern *et al.*, 2003; Mafuru and Marsh, 2003; Deaton and Muellbauer, 1980 and Abdulai and Aubert, 2004).

In Tanzania, there have been relatively fewer studies on demand system than in other countries. These studies include Lazaro (2014), Mafuru (2003), Weliwita *et al.* (2003), (Chongela *et al.*, 2014) and Kaliba (2008). Lazaro (2014) analyzed the consumer side of the rice market in Tanzania. Mafuru (2003) analyzed the effect of subsistence consumption of food in rural and urban areas of Lake Zone in Tanzania. Weliwita *et al.* (2003) estimated price and food expenditure elasticities of demand for twelve food groups while Chongela *et al.* (2014) used household budget survey (HBS) of 2007 to estimate consumer demand system of agri-foods. Moreover, Kaliba (2008) estimated demand flexibilities for beef, small ruminant (sheep and goat) meat, pork and poultry in Tanzania. To date there is no study has estimated a demand system for common beans. This study estimated the demand system for beans to get reliable elasticities.

2.6 Methods for Analyzing Demand Systems

There are two approaches in estimating consumer demand. The first approach is the use of single equation model where a researcher does not rely on a consumer demand theory. The

second approach is through the use of demand theory as a basis for the choice of functional forms and variables to be included.

2.6.1 Single equation model

A single equation model may be described as;

$$\ln q_i = a_i + \sum_j E_{ij} \ln \frac{p_j}{P} + \eta_i \ln \frac{m}{P} + \sum_k b_{ik} \ln z_k, \quad i, j, k, \dots, n \dots \dots \dots (1)$$

Where;

q_i = quantity of the good i purchased per capita,

p_i = price of the good i

p_j = price of good j which are close substitutes or complements

m = total expenditure per capita,

a_i = is the constant

P = consumer price index,

E_{ij} = direct and cross-price elasticities,

Z_k = household characteristics, time and other exogenous variables,

b_{ik} = elasticities of demand with respect to Z_k ,

η_i = expenditure elasticity.

The relative prices ($\frac{p_i}{P}$) and real income ($\frac{m}{P}$) warrants absence of money illusion because

the demand equation becomes homogeneous of degree zero in income and prices. The single equation model of demand estimation is simple but weak. The first weakness is that the choice of functional form and variables depends on the researchers' own understanding, elasticities to be estimated, simplicity of estimation procedure and

goodness of fit criteria. It is therefore difficult to establish whether the estimated equation is derived from consumer behavior (Sadoulet and Janvry, 1995).

Secondly, the model suggests that elasticities are constant for all values of independent variables. This assumption may not apply to all categories of goods such as luxurious goods because elasticities changes when income change. Thirdly, estimated equations lead to predictions which do not satisfy the budget constraint that limits total expenditure because the model doesn't require the estimated parameters to satisfy theoretical restrictions (adding up conditions) as required by the demand theory (Sadoulet and Janvry, 1995; Deaton and Muellbauer, 1980).

2.6.2 Multiple equations demand models

There are several other models that have been developed to address the shortcomings of the of the single equation demand model. These models rely on the demand theory to specify functional forms and exogenous variables to be included in a model and have been used to estimate demand systems since 1950s (Parikh *et al.*, 2016). These models have been estimated as Linear Expenditure System (LES) (Geary 1950, Stone 1954); Almost Ideal Demand System (AIDS) (Deaton and Muellbauer, 1980); Price Independent Generalized Logarithmic model (PIGLOG) (Muellbauer, 1976); exactly aggregable Translog Model (Jorgenson *et al.*,1982); and Quadratic AIDS (QUAIDS) (Banks *et al.*, 1997). All functional forms except QUAIDS conform to Engel law because are linear in log of total expenditure (Parikh *et al.*, 2016).

Unlike the other forms, AIDS has been extensively used by economists because it has many desirable properties and hence the most flexible functional form (Deaton and Muellbauer, 1980; Moschini, 1998; Chern *et al.*, 2003). According to Deaton and

Muellbauer (1980) who introduced the AIDS the model satisfies the aggregation restriction with simple parametric restrictions while homogeneity and symmetry can be imposed. Also, AIDS have non-linear Engel curves meaning that as income increases, the income share allocated to a particular commodity decreases.

2.6.3 The Quadratic version of the AIDS

The Quadratic version of the AIDS (QUAIDS) model was proposed by Banks *et al.* (1997). In QUAIDS, a new variable is simply added to the AIDS model. This new variable represents expenditure shares of the commodities. Expenditure shares are quadratic in the logarithm of income. It therefore, maintains all the relevant properties of its linear counterpart, the AIDS, thus allowing for exact aggregation over households and is more flexible (Abdulai, 2002). Unlike the AIDS and LA/AIDS, QUAIDS has more attractive property as it allows some goods to become luxurious at level of income and necessities at higher income levels (Molina and Gil, 2005). This property makes the QUAIDS model more relevant to low income countries including Tanzania.

The QUAIDS model has proven to be appropriate in modeling consumer preferences in developed and developing countries. Example of studies which employed QUAIDS model to estimate demand system in developed countries are Abdulai (2002), Moro and Sckokai (2000), Banks *et al.* (1997) and Blundell and Robin (1999). Studies done in the developing world include Abiodun *et al.* (2009), Abdulai and Aubert (2004), Larochelle *et al.* (2016), Maganga *et al.* (2014), Molina and Gil (2005) and García-Germán *et al.* (2016).

2.7 Conclusion

Most of the reviewed literature shows that own prices, household income, family size and other consumer's characteristics have significant effects on food demand. The author

identified six previous publications on consumer demand in Tanzania and established that none of the publications estimated demand for beans. In general, most of the previous studies support the view that food budget share decrease when income rises. Moreover, existing literature (from both Tanzania and other countries) suggest that beans are inferior to meat although some of the empirical studies from Tanzania suggest otherwise. There is a need to reconcile these arguments using relevant comparative statics that are computed from data that are sourced directly from consumers. To achieve this objective, this study adopted multiple equations demand models that are superior to single equation models to estimate bean demand in Dar es Salaam using survey data that was sourced directly from consumers. Specifically, the study adopts the QUAIDS model that has many of the desirable properties and hence the most flexible functional form than the AIDS and its variants.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Sampling Design and Data

This study used secondary data that were collected in Dar es Salaam in 2015 during the bean consumption survey conducted by the Bean Value Chain Research Network, which was funded by the Legume Innovation Lab (Project SO2.2) through the USAID. Data were collected by Researchers from Sokoine University of Agriculture in collaboration with the National Bureau of Statistics (NBS). Dar es Salaam was purposely selected because is the largest bean market in the country and there is high cultural diversity of consumers.

A two stage sampling design was used to select respondents. The first stage was stratification of the enumeration areas (EAs) of Dar es Salaam into high, middle and low income consumers. The second stage involved a proportionate sampling of 100 Enumeration Areas (EA) from three strata in which eight households were randomly selected from each of the 100 EAs making the sample size to be 800 households. However, due to data problems such as incomplete information some of observations were dropped during the analysis. Thus, the working sample size was 681. Data were based on monthly food expenditures for five types of common beans grouped as yellow, red, soya supa, kombati and mottled red.

3.2 Theoretical Framework

Theoretical foundation of the model

The microeconomic theory of demand postulates that individual satisfaction is derived from consumption of goods and services. Utility maximization is always associated with cost minimization, forming a dual problem.

The objective function is algebraically defined as:

$$\text{Minimize expenditure } m = \sum_{i=1}^n p_i q_i ; \text{ Subject to utility } U = U(q) \dots\dots\dots(1)$$

Where; q is a vector of “ n ” goods demanded, q_i is the quantity demanded of good i , p_i is the price of good i , and m is total expenditure. Manipulating the expenditure function by the use of Lagrangian method, the cost function is obtained, which is the function of prices and utility, $m = C(U, P)$. Given that utility is being maximized, total expenditure is equal to total cost.

The household expenditure behavior can be analyzed by using Engel curve (Sadoulet and Janury, 1995). In estimation of Engel curves, total expenditure is commonly used as a proxy of income owing to reasons such as unwillingness of consumers to reveal their true income. Thus, total expenditure elasticities are calculated instead of income elasticities. The expenditure elasticities of demand for goods are derived from the relationship between demand and total expenditure. Expenditure elasticity is used to classify commodities whether are necessity or luxuries.

3.3 Conceptual Framework

The consumer behavior theory assumes that a consumer is a rational economic agent whose objective is to maximize his/her utility. The agent attains great satisfaction from consuming a good or bundle of goods of which decisions to consume depend on many factors including commodity’s attributes, prices, consumer own characteristics as well as socio-cultural, biological and geographical factors (Parraga, 1990, Lancaster, 1966). Figure 2 present a relationship between these factors and beans demand. It suggests that an increase in consumer’s income may result into substitution of beans for meat and vice

versa. Also, an increase in price of one type of beans may trigger some changes as a consumer may contemplate shifting to a cheap type. Apart from prices and income shocks consumer's preference for beans are also likely to be influenced by attributes such as cooking time, bean color and gravy quality.

This study focuses on budget shares spent on foods especially common beans although the food basket comprises cereals, legumes, fruits and vegetables, fish and sea foods, roots and tubers and animal products.

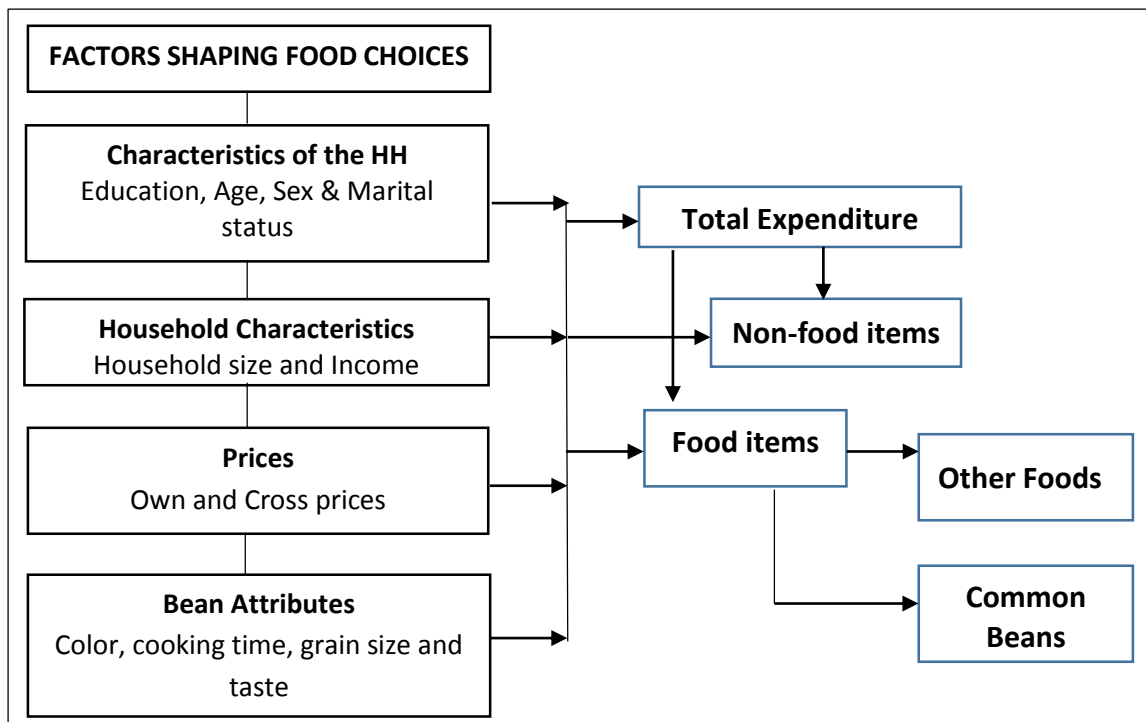


Figure 2: Conceptual framework

3.4 Analytical Framework

This section presents the framework used to address objectives of this study. To address the first objective, the demand system was estimated to assess the effect of income and price changes as well as household characteristics on households' budget share for

different types of common beans. The second objective was addressed using income and price elasticities computed from the estimated demand systems of five types of beans.

3.4.1 Estimation of the demand system

The demand functions for a consumer buying n goods can be generalized as;

$$q_i = q_i(p_1, p_2, \dots, p_j, \dots, p_n, m); \quad i = 1, 2, \dots, n \dots\dots\dots(1)$$

Where; q_i is the quantity demanded; p is the price, the subscript i denotes the i^{th} commodity; and m is income. There are “ n ” equations which can be estimated a single equation or systems of equations. In this study, equation (3) is estimated as a system of equations in form of budget shares. It is assumed that, the commodities included in the demand system are weakly separable from all other commodities excluded from the demand system.

The quadratic AIDS model of Banks *et al.* (1997), is based on the indirect utility function,

$$\ln V(p, m) = \left[\left\{ \frac{\ln m - \ln a(p)}{b(p)} \right\}^{-1} + \lambda(p) \right]^{-1} \dots\dots\dots(4)$$

Where:

$\frac{\ln m - \ln a(p)}{b(p)}$ is the indirect utility function of a PIGLOG demand systems and the

extra term λ is a differentiable, homogenous function of degree zero with prices p . λ is independent of prices, the indirect utility function reduces to a form equivalent to the PIGLOG class (Banks *et al.*, 1997), which includes the Almost Ideal model and the translog model of Christensen *et al.* (1975)

$\ln a(p)$ is the transcendental logarithmic function expressed as;

$$\ln a(p) = \alpha_0 + \sum_{i=1}^k \alpha_i \ln p_i + \frac{1}{2} \sum_{i=1}^k \sum_{j=1}^k \gamma_{ij} \ln p_i \ln p_j \dots\dots\dots(5)$$

In this function, p_i is the price of good i for $i = 1, \dots, k$;

$b(p)$ is the simple Cobb-Douglas price aggregator expressed as;

$$b(p) = \prod_{i=1}^k p_i^{\beta_i} \dots\dots\dots(6)$$

And
$$\lambda(p) = \sum_{i=1}^k \lambda_i \ln p_i \dots\dots\dots(7)$$

The budget share demand equations using the QUAIDS model is derived from the indirect utility function in (4) above by using Roy's identity. The expenditure share equation is written as;

$$w_i = \alpha_i + \sum_{j=1}^k \gamma_{ij} \ln p_j + \beta_i \ln \left\{ \frac{m}{a(p)} \right\} + \frac{\lambda_i}{b(p)} \left[\ln \left\{ \frac{m}{a(p)} \right\} \right]^2, \quad i, j = 1, \dots, 5 \dots\dots\dots(8)$$

Where;

$$w_i = \text{is the budget share of good } i, \text{ that is, } w_i = \frac{p_i q_i}{m}, \quad 0 \leq w_i \leq 1$$

m = is the household's total expenditure on food,

p_j = is price of commodity j , and

α_i , β_i and γ_{ij} are parameters to be estimated.

When $\lambda_i = 0$, the quadratic expenditure term drops out and the equation turns out to be the normal AIDS equation.

In order to conform to demand theory, some theoretical restrictions are imposed as follows:

Adding-up: $\sum_i^k w_i = 1, \sum_i^k \alpha_i = 1, \sum_i^k \beta_i = 0, \sum_i^k \gamma_{ij} = 0, \dots\dots\dots(9)$

Homogeneity, for all $j \sum_j^k \gamma_{ij} = 0 \dots\dots\dots(10)$

Symmetry condition is satisfied by; $\gamma_{ij} = \gamma_{ji} \dots\dots\dots(11)$

These restrictions are automatically imposed by the QUAIDS command. This is among the advantages of using QUAIDS commands suite compared to AIDS where these restrictions are imposed manually.

Effects of household characteristics

The theoretical demand equation is a defined mathematical relationship between quantity demanded, income of the buyer (household) and the set of market prices both own and cross prices. However, different households have different age groups, sex composition, religion, race and originality. These different characteristics affect demand pattern (Sadoulet and Janvry, 1995). It is therefore imperative to gauge the impact of these characteristics on the observed household-specific consumption levels (*Ibid.*).

There are many approaches used to incorporate demographic characteristics in demand equations, popular ones being translating approach and scaling approach (Pollak and Wales, 1981). This study adopts the scaling approach introduced by Ray (1983), since it uses indirect utility. Poi (2012) incorporated this approach into the QUAIDS which makes it relatively easier to handle.

To incorporate demographic characteristics (Z) in the model, Ray (1983), expressed the expenditure function for each household as;

$$e(p, z, u) = m_0(p, z, u) \times e^R(p, u) \dots\dots\dots(12)$$

Where $e^R(p, u)$ denote the expenditure function of a household.

$m_0(p, z, u)$ scales the expenditure function to account for the household characteristics.

Ray (1983) further decomposes the scaling function as;

$$m_0(p, z, u) = \overline{m_0}(z) \times \phi(p, z, u) \dots\dots\dots(13)$$

The first term $\overline{m_0}(z)$ measures the increase in a household's expenditures as a function of z , not controlling for any changes in consumption patterns. It implies that a household with four members will have higher expenditures than one with a single member, even though it ignores the fact that the composition of goods consumed may vary across households. The second term $\phi(p, z, u)$ controls for changes in relative prices and the actual goods consumed; a household with two adults and two infants will consume different goods than one comprising four adults (Poi, 2012).

Poi(2012) uses QUAIDS to parameterize $\overline{m_0}(z)$ as;

$$\overline{m_0}(z) = 1 + \rho' z \dots\dots\dots(14)$$

Where ρ is a vector of parameters to be estimated. According to Poi (2002), QUAIDS parameterize $\phi(p, z, u)$ as;

$$\ln \phi(p, z, u) = \frac{\prod_{j=1}^k p_j^{\beta_j} (\prod_{j=1}^k p_j^{\eta_j z} - 1)}{\frac{1}{u} - \sum_{j=1}^k \lambda_j \ln p_j} \dots\dots\dots(15)$$

η_j represent the j^{th} column of $s \times k$ parameter matrix (η). The expenditure share equations take the following form;

$$w_i = \alpha_i + \sum_{j=1}^k \gamma_{ij} \ln p_j + (\beta_i + \eta_i' z) \ln \left\{ \frac{m}{m_0(z)a(p)} \right\} + \frac{\lambda_i}{b(p)c(p, z)} \left[\ln \left\{ \frac{m}{m_0(z)a(p)} \right\} \right]^2 \dots\dots(16)$$

Where:

$$c(p, z) = \prod_{j=1}^k p_j^{\eta_j' z} \dots\dots\dots(17)$$

Table 1: Definition and summary statistics of variables in the QUAIDS model

	Variable	Description	Mean	Std. Dev.
Independent	<i>WYel</i>	Budget share for yellow beans	0.4403	0.3652
Variables	<i>WRed</i>	Budget share for red beans	0.0206	0.0812
	<i>WKomb</i>	Budget share for kombati beans	0.1181	0.2173
	<i>WMot</i>	Budget share for mottled red beans	0.1175	0.2454
	<i>WSoya</i>	Budget share for soya supa beans	0.3035	0.3405
Dependent	<i>PYel</i>	Price for yellow beans	2166.76	451.65
Variables	<i>PRed</i>	Price for red beans	1949.83	179.61
	<i>PKomb</i>	Price for kombati beans	2095.70	247.82
	<i>PMot</i>	Price for mottled red beans	2186.41	277.76
	<i>PSoya</i>	Price of soya supa beans	2194.24	280.44
	<i>HH_0to4</i>	Household members who are 0-4 years	0.7606	0.9330
	<i>HH_5to12</i>	Household members who are 5-12 years	0.8341	1.1883
	<i>HH_13to17</i>	Household members who are 13-17 years	0.4787	1.1440
	<i>HH_adult</i>	Household members who are 18+ years	2.8678	1.5597
	<i>HHSize</i>	Total Household size	4.7577	2.2716
	<i>Sex</i>	Sex of household's head (HH), Dummy; 1=Female , 0=Male	0.8590	0.3482
	<i>Marital</i>	Marital status (HH), Dummy; 1=Married, 0= Otherwise	1.0103	0.6762
	<i>sec_ed</i>	HH edu, Dummy; 1=Secondary ed. or more, 0=None or primary ed.	0.3216	0.4674
	<i>BeansEXP</i>	Total expenditure on beans	26375.48	56833.92

3.4.2 Estimation of price and income elasticities

The second objective of this study was to estimate prices and expenditure elasticities of common beans varieties. The Marshallian, Hicksian and expenditure elasticities were computed. It is important to note that the Marshallian (uncompensated) elasticities take into consideration income and substitution effect due to price changes. Hicksian (Compensated) elasticities consider only substitution effect. A consumer has to be compensated positively or negatively to remain with the same level of happiness (utility).

3.4.3 QUAIDS Elasticities

In this study, Marshallian², Hicksian³ and expenditure elasticities⁴ were computed. According to Poi (2012), the QUAIDS Marshallian, expenditure and Hicksian elasticities featuring households' demographics are defined in equations (18), (19) and 20, respectively.

$$\epsilon_{ij} = -\delta_{ij} + \frac{1}{w_i} \left(\gamma_{ij} - \left[\beta_i + \eta_i' z + \frac{2\lambda_i}{b(P)c(P, z)} \ln \left\{ \frac{m}{m_0(z)a(P)} \right\} \right] \times \left(\alpha_j + \sum_i \gamma_{jl} \ln pl \right) - \frac{(\beta_j + \eta_j' z) \lambda_j}{b(P)c(P, z)} \left[\ln \left\{ \frac{m}{m_0(z)a(P)} \right\} \right]^2 \right) \dots\dots\dots(18)$$

$$\mu_i = 1 + \frac{1}{w_i} \left[\beta_i + \eta_i' z + \frac{2\lambda_i}{b(P)c(P, z)} \ln \left\{ \frac{m}{m_0(z)a(P)} \right\} \right] \dots\dots\dots(19)$$

The Compensated price elasticities are obtained from the slusky equation;

$$\epsilon_{ij}^C = \epsilon_{ij} + \mu_i w_j \dots\dots\dots(20)$$

²The Marshallian demand curve, named after Alfred Marshall, is the demand for a good when income is held constant and utility derived from the good varies (Nicholson and Snyder, 2008)

³The Hicksian demand curve, named after John Hicks, is the demand for a good when the utility derived from the good is held constant and income varies (*ibid*).

⁴Elasticities refers to the degree to which individuals, consumers or producers respond by changing quantity demanded or supplied as the income and or price of a particular good or related good.

CHAPTER FOUR

4.0 EMPIRICAL RESULTS AND DISCUSSION

4.1 Introduction

This is a chapter where key findings of this study are presented and discussed on the basis of the theory guiding the study. The discussion is backed by both descriptive statistics and econometric results to blend in experiences and comparisons of empirics from similar studies in Tanzania and abroad.

4.2 Descriptive Analysis

4.2.1 Demographic characteristics of a decision maker

Characteristics of the main decision maker, household's composition and other factors such as income have important implications on consumption decisions at the household level. In this study, the characteristics of the decision maker include sex of the respondent, marital status and education level. Female respondents were a majority (85.9 percent) compared to males (14.1 percent). About 71.1 percent of all respondents were married compared to 16.7 percent of single respondents, 6.6 percent of divorced and 5.6 percent of widows. There were 62 (9.1 percent) respondents who never attended any formal class while a majority 400 (58.7 percent) attained primary education (Table 2).

Table 2: Summary of demographic characteristics of the decision maker

Socio-economic characteristics	Income Strata						Overall	
	Low Income		Middle Income		High Income		N	%
	n	%	n	%	n	%		
Sex								
Male	35	5.1	40	5.9	21	3.1	96	14.1
Female	260	38.2	241	35.4	84	12.3	585	85.9
Total	295	43.3	281	41.3	105	15.4	681	100
Education level								
None	36	5.3	16	12.3	10	1.5	62	9.1
Primary	191	28.0	169	24.8	40	5.9	400	58.7
Secondary	57	8.4	61	9.0	29	4.3	147	21.6
Vocational/Technical	2	0.3	9	1.3	5	0.7	16	2.3
College/University	9	1.3	26	3.8	21	3.1	56	8.2
Marital status								
Single	40	5.9	50	57.3	24	3.5	114	16.7
Married/Cohabiting	208	30.5	204	30.0	72	10.6	484	71.1
Divorced/Separated	29	4.3	12	1.8	4	0.6	45	6.6
Widow	18	2.6	15	2.2	5	0.7	38	5.6

4.2.2 Household characteristics

Household characteristics include the household size, age of household members and income (Table 3). In this study, the sampled households had an average of 4.8 persons per households similar to the national average. Low, middle and high income strata had a size of 5, 4.6 and 4.7 respectively. With regard to age distribution, about 52.5 percent of all family members were children of which 15.1 percent were under five.

The mean monthly income for the entire sample is TZS 2 845 798.86. However, there is huge variation within and between strata. The mean monthly income for the middle stratum is larger than the mean monthly income for the low income strata by 2 353 049.55 and less than that of high income stratum by 1 553 248.94 while the range is 3 906 298.49 meaning that high income stratum members earn as much as 6 times of the income received by low income stratum.

Table 3: Summary of household characteristics

Socio-economic characteristics	Income Strata			Overall
	Low Income	Middle Income	High Income	
Age distribution				
Under 5 Years	222(6.5%)	212(6.2%)	80(2.4%)	514(15.1%)
5-12 Years	299(8.8%)	218(6.4%)	81(2.4%)	598(17.6%)
13-17 Years	178(5.2%)	118(3.5%)	36(1.1%)	332(9.8%)
18+ Years	888(26.1%)	761(22.4%)	304(8.9%)	1953(57.5%)
Total	1587(46.7%)	1309(38.5%)	501(14.7%)	3397(100%)
Household size				
Mean	5.0	4.6	4.7	4.8
Maximum	11	11	11	11
Minimum	1	1	1	1
Standard deviation	2.2562	2.2286	2.3339	2.2716
Household income (TZS)				
Mean	759 349.57	3 112 399.12	4 665 648.06	2 845 798.86
Maximum	1 938 000.00	3 956 000.00	6 820 000.00	6 820 000.00
Minimum	238 000.00	487,000.00	982 000.00	238 000.00
Standard deviation	670 921.17	1 809 159.28	2 952 195.21	3 314 554.11

4.2.3 Beans consumption

In order to understand beans consumption patterns, respondents were asked various questions including the question on whether they consumed beans or not and the frequency of specific varieties of beans. The results in Table 4 show 662 (97.2 percent) of all respondents consumed beans while the rest 19 (2.8 percent) respondents did not. Beans are preferred much by the low and middle income strata who jointly accounted for 85.2 percent of all respondents. Such results are not surprising since in most developing countries, common beans are still regarded as poor man's meat (Leterme and Muñoz, 2002). This means as income rise, households substitute beans with other protein rich foods such as fish and meat.

Table 4: Response on whether respondents consume beans

Response	Income Strata			Overall
	Low Income	Middle Income	High Income	
Yes	291(42.7%)	270(39.6%)	101(14.8%)	662(97.2%)
No	4(0.6%)	11(1.6%)	4(0.6%)	19(2.8%)

In the entire sample, the minimum and maximum amount of beans consumed in a typical month were 1 kg and 40 kg respectively (Table 5). Household with male decision makers consumed more beans (9.6 kg) than their female counterparts. This fact is attributed to the male's preferences for high calorie foods in their meals (Leterme and Muñoz, 2002; Lucier *et al.*, 2000). With regard to education, households with decision makers of various education levels consumes more or less the same quantity of beans, the range being 7.4 kg to 9.3 kg. This result is contrary to the known fact that uneducated people consumes less beans/pulses compared to the educated people (Mitchell *et al.*, 2009). The factors behind such controversy might be the result of healthy feeding campaigns, change in consumer preferences by educated people due to their ability to afford substitutes of beans. Marital status influenced beans consumption as households with married/cohabiting couples consumed more beans (8.6 kg) compared to unmarried, widows and those who were separated. Folayan and Bifarin (2013) obtained similar result in Akure South Local Government Area of Ondo state, Nigeria.

Table 5: The amount of beans consumed in kg per month disaggregated by characteristics of household's head

Characteristics	Mean	Minimum	Maximum	Standard deviation
Sex				
Male	9.6	1	40	8.0152
Female	8.2	1	40	6.8872
Education level				
No education	8.6	1	33	6.7689
Primary education	8.8	1	40	7.5497
Secondary education	7.4	1	40	6.1876
Technical education	9.3	1	22	6.4778
College/University	7.6	1	28	5.8958
Marital status				
Never married	7.9	1	40	6.7475
Married/cohabiting	8.6	1	40	7.3863
Separated	8.2	2	22	5.1181
Widowed	7.2	1	25	5.6957

With respect to the frequency of consumption, yellow, soya supa and kombati varieties were more preferred. Yellow bean variety was the most preferred with 519 (76.2 percent) respondents reporting that they consumed it once or more in a week. Soya supa was the second most preferred variety with 417 (61.2 percent) of all respondents reporting that they consumed it once or more in a week while followed by kombati variety with 42.4 percent response. Red and mottled red were the least consumed beans varieties as presented in Table 6.

Table 6: Frequency of specific beans variety consumption per month per stratum

Common bean variety	Income Strata						Overall	
	Low Income		Middle Income		High Income			
	n	%	n	%	n	%	n	%
Mottled red	42	6.2	33	4.8	4	0.6	79	11.6
Red	50	7.3	42	6.2	14	2.1	106	15.6
Yellow	217	31.9	216	31.7	86	12.6	519	76.2
Kombati	136	20.0	119	17.5	34	5.0	289	42.4
Soya supa	185	27.2	167	24.5	65	9.5	417	61.2

4.2.4 Foods budget shares

Legumes budget share was high in low income stratum than in medium and high income strata meaning that, legumes (dominantly beans) take a significant portion of food budgets of consumers from low income stratum. The overall legumes budget share is 11 percent of food expenditure (Table 7). This is justified by the fact that beans are low cost sources of protein compared to other sources of protein such as meat (Margaret *et al.*, 2014). The budget shares for fish and sea foods, fruits and vegetables did not vary significantly across these categories of foods.

The budget share for cereals which is a main dish in Tanzanian was about 32 percent of all food expenses (Figure 3). However, as expected, consumers from low income stratum spend much on cereals compared to those from middle and high income strata. The budget share for animal products was approximately 14 percent of food budget where consumers from high income stratum spent more on products such as milk and meat compared to consumers from low income stratum. The reason is that these products tend to be relatively expensive to be afforded by people with limited financial means.

Table 7: Food expenditure shares

Food category	Low Income	Medium Income	High Income	Overall
Legumes	0.123	0.107	0.088	0.111
Fish, seafood	0.155	0.155	0.166	0.157
Fruits, vegetables	0.111	0.112	0.114	0.112
Cereals	0.330	0.308	0.294	0.316
Roots and tubers	0.053	0.062	0.062	0.058
Animal products	0.134	0.151	0.161	0.141
Other foods	0.101	0.102	0.096	0.101

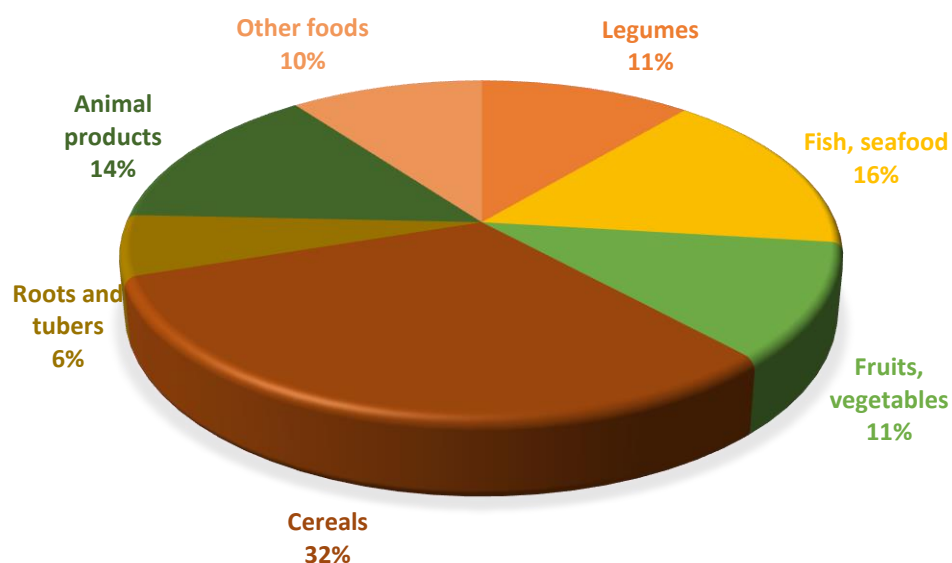


Figure 3: Food budget shares

Among five common bean varieties, yellow and soya supa varieties are preferred more than other varieties of beans. The budget share for these two varieties was about 70 percent of all the money spent on legumes (Table 8). Kombati variety share decreases as income increases implying that it is an inferior product. The red variety was the least preferred with a budget share of less than 4 percent.

Table 8: Strata based budget shares on legume and total food expenditures

Variety	Budget shares for legume				Budget shares for all foods			
	Low	Middle	High	Overall	Low	Middle	High	Overall
Mottled red	0.138	0.140	0.071	0.129	0.034	0.027	0.009	0.027
Red	0.048	0.027	0.030	0.036	0.004	0.002	0.002	0.003
Yellow	0.355	0.448	0.506	0.416	0.062	0.062	0.050	0.060
Kombati	0.159	0.124	0.058	0.129	0.026	0.014	0.006	0.018
Soya supa	0.299	0.261	0.335	0.289	0.048	0.048	0.033	0.043

4.3 Econometric Results

4.3.1 QUAIDS model results

QUAIDS model results that are presented in Table 9 show how households' income, beans variety prices, household size and location affect budget shares for yellow, red, kombati, mottled red and soya supa. The income coefficients for the red, kombati and soya supa are significant while the coefficients for yellow and mottled red are insignificant. A 100 percent rise in income reduces budget share for red, kombati and soya supa by 8, 18.2 and 14.2 percent respectively. The quadratic expenditure term was significant in all budget share equations.

Out of 25 price coefficients, 15 are significant. A 100 percent increase in price of yellow beans decrease the budget share for mottled red by 29.3 percent but increase the budget share for soya supa by 13.5 percent. Increase in the price of red by 100 percent increases the budget share for kombati and soya supa by 13.5 and 9.1 percent respectively while decreasing the budget share for mottled red by 33.1 percent. Increase in the price of kombati by 100 percent increases budget share for red by 13.8 percent and its own budget share by 38.2 percent suggesting that this variety is a giffen good but decrease budget share for mottled red by 79.1 percent. For the case of mottled red variety, a 100 percent increase of its price decreases own budget share by 21.8 percent, budget share for yellow, red, kombati and soya supa by 29.3, 33.1, 79.1 and 75.6 percent respectively. Furthermore, an increase in the price of soya supa by 100 percent decrease budget share for yellow by 75.6 percent but increase budget share for yellow and red by 13.5 and 9.1 percent respectively.

Demographic characteristics of household size, location, sex, marital status and education of the respondent shows significant effects in some budget shares. Household size is the

only variable identified to have significant effect on the kombati budget share equation. An increase in a household size by 100 percent reduces budget share for this variety by 0.36 percent. Also, it was observed that location affected budget shares in different ways as shown in Table 9. Residents in low income strata consumed less amount of red, kombati and soya supa varieties than residents in high income strata by 0.5, 1.6 and 1.3 percent respectively. Residents in middle income strata consumed less amount of red and kombati than their counterparts in high income strata by 0.4 and 1 percent respectively while consuming high amount of mottled red than those in higher income strata by 2.2 percent.

Sex of the respondent was found to exert significant effect on mottled red and soya supa. Education of the respondent was also identified to have significant effect on kombati variety such that having education level of secondary level or higher increased the consumption of the variety by 0.37 percent. Marital status was found to have significant effect on yellow and red varieties. Being married raised the budget share of yellow by 0.5 percent but reduced the budget share of red by 0.03 percent. The significance of these demographics implies that it is imperative to consider various demographic factors when pursuing consumer demand related policies.

Based on the results, the hypothesis that income of the household, prices, location and household characteristics do not have significant effect on budget share of common beans was rejected because some of the coefficients were found to be significant.

Table 9: QUAIDS model coefficients

Variable	Model Coefficients				
	Yellow	Red	Kombati	Mottled red	Soya supa
Constant	0.9034*** (0.3431)	-0.2598 (0.2165)	-0.6732** (0.3380)	0.6230*** (0.1880)	0.4065 (0.4113)
LnFoodexp	-0.0147 (0.0447)	-0.0801** (0.0381)	-0.1819*** (0.0554)	0.4187 (0.0335)	-0.1421** (0.0641)
LnPYel	0.0323 (0.0470)	0.0379 (0.0289)	0.0882 (0.0641)	-0.2934** (0.1266)	0.1349** (0.0616)
LnPRed	0.0379 (0.0289)	0.0697 (0.0854)	0.1349** (0.0616)	-0.3311** (0.1399)	0.0906* (0.0492)
LnPKomb	0.0882 (0.0641)	0.1328** (0.0571)	0.3816** (0.1772)	-0.7907*** (0.2269)	0.1880 (0.0925)
LnPRedMot	-0.2934** (0.1266)	-0.3311** (0.1399)	-0.7907*** (0.2269)	-0.2176*** (0.2891)	-0.7564* (0.3429)
LnPSoya	0.1349** (0.0616)	0.0906* (0.0492)	0.1880 (0.0925)	-0.7564* (0.2471)	0.3429 (0.1807)
(lnFoodexo) ²	-0.0039*** (0.0018)	-0.0047*** (0.0018)	-0.0104*** (0.0027)	0.0309*** (0.0019)	-0.0119*** (0.0031)
Lnhhsize	0.0029 (0.0021)	0.0002 (0.0007)	-0.0036*** (0.0011)	-0.0026 (0.0022)	0.0030 (0.0019)
Low Income	0.0008 (0.0046)	-0.0052*** (0.0017)	-0.0158*** (0.0033)	0.0328*** (0.0081)	-0.0127** (0.0056)
Middle Income	-0.0022 (0.0043)	-0.0038** (0.0018)	-0.0103*** (0.0032)	0.0227** (0.0089)	-0.0064 (0.0055)
Sex (Dummy, 1 if Female)	0.0058 (0.0013)	0.0016 (0.0013)	0.0012 (0.0035)	-0.0213** (0.0089)	0.0127** (0.0060)
Marital (Dummy, 1 if Married)	0.0054** (0.0022)	-0.0003** (0.0004)	0.0012 (0.0013)	-0.0030 (0.0021)	-0.0033 (0.0022)
Education (Dummy, 1 if Sec educat or more)	-0.0018 (0.0022)	0.0004 (0.0005)	0.0037*** (0.0013)	-0.0007 (0.0021)	-0.0016 (0.0022)

Key: Numbers in brackets are robust standard errors; * means statistically significant at 10%, ** =Statistically significant at 5% and *** = Statistically significant at 1%.

4.3.2 Expenditure elasticities

All expenditure elasticities in table 10 are positive except for mottled red variety. The yellow, red and soya supa are normal goods while mottled red is an inferior good. For this

stage, kombati may be regarded as normal good but price elasticities suggest that it is a giffen good. This suggest that as income increase, also expenditure on yellow, red, kombati and soya supa increase but expenditure on mottled red variety decrease. The degree of responsiveness is high on soya supa (4.4623) and kombati (3.0906) compared to yellow (1.4033) and red (1.2367). This means consumption of these varieties will increase with the increase in income but by more than the proportionate change in income. On the other hand, the consumption of mottled red will decrease with the increase in income but by less that the proportionate change in income.

Table 10: Expenditure elasticity

Variety	Expenditure elasticity
Yellow	1.4033
Red	1.2367
Kombati	3.0906
Mottled red	-0.3764
Soya supa	4.4623

4.3.3 Price elasticities

The uncompensated own price elasticities (Table 11) were found to be negative except for kombati variety. The elasticities for yellow, red, mottled red and soya supa varieties were consistent with the law of demand. The same trend is observed when compensated own price elasticities are considered (Table 12). Thus the kombati variety is a giffen good as its sign is contrary to the theory of consumer behavior. Many compensated elasticities are less than uncompensated as expected since from the theoretical standpoint, the compensated demand considers only the substitution effects while uncompensated demand considers both income and substitution effects.

Table 11: Uncompensated (Marshallian) Price elasticities

Variety	(1) Yellow	(2) Red	(3) Kombati	(4) Mottled red	(5) Soya supa
Yellow	-0.5708	0.3591	1.6876	0.1820	2.9407
Red	0.0667	-0.6311	0.1971	0.0287	-0.6442
Kombati	0.2749	0.1743	2.0328	-0.0734	-2.0296
Mottled red	-0.2808	0.0608	-2.0359	-0.6994	0.0192
Soya supa	0.5100	0.0369	-0.8816	0.5621	-0.2860

Table 12: Compensated (Hicksian) Price elasticities

Variety	(1) Yellow	(2) Red	(3) Kombati	(4) Mottled red	(5) Soya supa
Yellow	-1.2511	-0.0322	0.3685	0.4377	-0.5175
Red	0.0455	-0.9050	0.1674	0.0517	-0.6793
Kombati	0.1255	0.0217	1.6164	0.0286	-2.1705
Mottled red	-0.3881	-0.0734	-2.1783	-0.7829	-0.1064
Soya supa	0.0649	-0.2478	-3.0645	0.6412	-0.9886

The fact that the signs of some Hicksian elasticities are different from those of the Marshallian elasticities suggests that the effect of real income (expenditure) on consumer demand is significant. According to the Hicksian framework, red and soya supa varieties have own elasticities close to unity meaning that a one percent increase in price of red or soya supa brings approximately one percent decrease in the quantity demanded. Many own elasticities in compensated and uncompensated demands are less than unity except for kombati variety in uncompensated demand as well as kombati and yellow varieties in compensated demand indicating that there is relatively low response in demand to price changes. This means that for most households in Dar es Salaam, common beans are necessity goods.

In the case of cross prices, yellow variety is a complement to mottled red and a substitute to the all other varieties. In the Marshallian framework, the rise in the price of yellow

beans by 100 percent results into decrease in demand of mottled red by 28 percent, increase in demand of red by 6.7 percent, kombati by 27.5 percent and soya supa by 51 percent. According to the Hicksian framework, a change in the price of yellow variety brings about less effect on demand of these beans compared to that of Marshallian.

On basis of Marshallian framework an increase in price of red variety by 100 percent leads to increase in demand of yellow variety by 36 percent, kombati by 17.4 percent, mottled red by 6 percent, and soya supa by 3.7 percent. This means the change in the price of red variety is associated with small effect on demand of other varieties. Also, in the Hicksian framework, the price of red variety has little effect on the demand for other varieties. Changes in the prices of kombati and soya supa varieties brings about bigger effects on others varieties. Further, results show that kombati is a compliment to mottled red and soya supa and a substitute to yellow and red in both the Marshallian and Hicksian frameworks. Also, results suggest that mottled red is a compliment to kombati in Marshallian framework and substitute to all other varieties in the Hicksian framework. The soya supa is a compliment to red and kombati varieties and substitute to yellow and mottled red varieties in the Marshallian framework and substitute to all other varieties in the Hicksian framework.

Basing on the nature of the study which assumed constant monthly incomes of the respondents while allowing the utility to vary depending on the type and amount of beans or a bundle of beans types, the conclusions of this study focuses on the Marshallian framework.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Common beans form an important dietary part and a staple food in Tanzania. Despite its importance a detailed empirical analysis of consumption has generally been insufficient. This study is a first attempt to estimate common beans demand in Tanzania. The overall objective of this study was to analyze the responsiveness of consumers in Dar es Salaam Region to changes in prices of beans and income. Specifically, the study aimed at achieving two objectives. The first specific objective was to assess the effect of bean price and household's socioeconomic variables on budget shares for common beans while the second was to estimate prices and expenditure elasticities of selected common beans.

The chosen location for the study was Dar es Salaam. Dar es Salaam, being the major consumer center and most populated city in Tanzania to serve as a pool of diverse consumers from all areas of the country. The working sample size was 681. Data are based on monthly food expenditures for five types of common beans grouped as yellow, red, soya supa, kombati and mottled red.

A Quadratic Almost Ideal Demand System (QUAIDS) was used to model demand for the five varieties (dried beans). Budget shares, price and expenditure elasticities were computed for the same. Two null hypotheses were tested. First null hypothesis was stated as follows; bean prices and household's socioeconomic variables have no effect on budgets for common beans. The second hypothesis was stated as; all varieties of selected common beans are normal goods.

All the two null hypotheses were rejected. All expenditure elasticities were found to be positive except for mottled red variety. The yellow, red and soya supa were found to be identified to be normal goods while kombati was a giffen good and mottled red an inferior good. Most own and cross price elasticities are less than one implying that a change in price would lead to less than a proportionate change in terms of demanded for that commodity. This study conforms to the literatures that common beans is a necessity.

5.2 Recommendations

- i. Increase common beans production. Due to higher expenditure elasticities, beans subsector participants can increase beans production to respond to the country's growing income as consumers are readily available.
- ii. Due to inelastic demand, common beans producers and traders may increase prices to increase their revenues.
- iii. Since expenditure elasticities are higher than price elasticities, policies towards the beans subsector should take into consideration influence of consumers' income rather than beans prices. This is because price related policies will be less effective compared to income policies.

However, with due to rational behaviors of consumers, an increase in income may result into changing of food allocation patterns whereby more income may be spent on meats and other side dish varieties.

5.3 Recommendation for Further Research

- i. This study employed the QUAIDS model based on its ability to produce best estimates compared to other forms of AIDS and other demand estimation functional forms. However, best conclusion can be drawn from results of all strong regarded functional forms based on the same data set. Therefore, more studies on consumers'

behavior especially using demand estimation while employing a mix of more than one functional form are recommended for comparable results.

- ii. It was observed that more demand studies are mainly about food demand estimation despite the fact that demand estimation is applicable to all goods and services. It is recommended that the scope should be widened to analyze demand patterns of various goods and services. More studies will help the country to make informed forecast in the short and long term where the country is expected to join the middle income group.

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