ANALYSIS OF CONSUMER DEMAND FOR SUGAR IN KENYA (1981 - 2010)

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DECLARATION

This research paper is my original work and has not been presented for the award of a Degree in any other University.

Signature:é é é é é é é é é é Date:é é é é é é é ...

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This research paper has been submitted for examination with our approval as University Supervisors

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DEDICATION

To my loving wife Elizabeth and children; Michelle, Valarie and Carey**.**

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ABSTRACT

This research estimated sugar demand for Kenyan households by using time series data of 1981 ï 2010 which is taken from the Kenya sugar board. In this paper, the independent and dependent variables of householdsô sugar demand model are chosen based on the literature review and the theory of demand. Utility maximization and expenditure functions have also been used to show that demand for sugar is indeed a function of income and its own price. Sugar demand is then estimated by OLS technique and linear regression.

The results of this study are consistent with theory and show that sugar demand in Kenya is associated with the household expenditure, real price of sugar and policy interventions in the sector. With an income elasticity of 0.7 and price elasticity of - 0.07 sugar can therefore be considered as an essential good for Kenyan households and is inelastic to price. However, as indicated by the value of the R ï squared, there are other factors apart from the ones considered in this study that also have an effect on the demand for sugar. Such factors might consist of: taste of the consumer, price of an alternative commodity, Political interference in the sector, international treaties, smuggling and hoarding of the commodity.

The paper finally recommended that policy makers should formulate policies that would regulate the sub sector so that the amount of sugar demanded by consumers is predictable for planning purposes. To design such policies, it is necessary to take into account the position of the commodity in the basket of households and be familiar with householdsô sugar demand or consumption behaviour.

LIST OF ABBREVIATIONS

ACP	Africa, Caribbean and Pacific
AIDS	Almost Ideal Demand System
ASDS	Agricultural Sector Development Strategy
CAP	Common Agricultural Policy
COMESA	Common Market for Eastern and Southern Africa
EAC	East Africa Community
EU	European Union
FTA	Free Trade Area
GDP	Gross Domestic Product
ISO	International Sugar Organization
KIHBS	Kenya Integrated Household Budget Survey
KSA	Kenya Sugar Authority
KSB	Kenya Sugar Board
LDCs	Least Developed Countries
SADC	Southern Africa Development Community
USA	United States of America
WTO	World Trade Organization

CHAPTER ONE

1.0 INTRODUCTION

This section provides brief background information on the sugar industry in Kenya. It also presents the statement of the problem, the objectives of the paper, the rationale of the study and lastly, the organization of the paper.

1.1 Background Information

1.1.1 Historical Background of the Sugar Industry

The development of the sugar industry in Kenya dates back to 1922, when Miwani Sugar Company was established. This was followed by the subsequent construction of the following factories: Muhoroni Sugar Company (1966), Chemelil Sugar Company (1968), Ramisi Sugar Company (1973), Mumias Sugar Company (1973), Nzoia Sugar Company (1978), South Nyanza Sugar Company (1979), West Kenya (1981), Soin (2006) and lately Butali (2011).

Most of the sugar companies were established by the Government having been driven by the national desire to (i) accelerate social economic development; (ii) address regional economic imbalance; (iii) increase Kenyan citizensô participation in the economy; (iv) promote indigenous entrepreneurship; and (v) promote foreign investments through joint ventures. This desire was expressed in the sessional paper No. 10 of 1965 on African socialism and its application to planning in Kenya (Kenya Sugar Board Strategic Plan, 2007 - 2012).

Sugar as a product can be derived economically from two products *viz* sugarcane and sugar beets. The former is cultivated in the temperate and the latter is a tropics product. In Kenya only sugar cane is grown. The Kenya sugar industry produces two thirds of the domestic sugar requirement hence finding its place as a significant player in the countryôs economy. In

the earlier years of establishment, the industry made substantial contribution to the countryôs import substitution strategy. In 1997, for instance, the sugar sales recorded Kshs. 6.64 billion at prevailing market prices making it the third largest agricultural commodity after tea and coffee. The country also delivered 4.66 million metric tonnes of sugar cane to milling factories in 2004, yielding 512,835 metric tonnes of processed sugar with an estimated local market value of Kshs. 2.4 billion (Kenya Sugar Board Statistical Year Book, 2010).

1.1.2 The importance of the sugar sub sector to the Kenyan economy

According to the Kenya Sugar Board (2011), the sugar industry plays an important role in the socio-economic development of Kenya. The sector directly supports 250,000 small scale farmers who supply over 85 percent of the cane milled by the sugar companies. An estimated six million Kenyans derive their livelihood directly or indirectly from the sugar industry and is therefore a key contributor to poverty reduction and national development.

It also provides an effective check to rural urban migration and acts an engine for rural development through spillover effects e.g. construction of roads, health centres, schools and trading centres. Sugar is an essential raw material in the processing of food and beverages, and in the manufacture of soft drinks and pharmaceutical products. The production of these products saves the country in excess of US $ 250 million in foreign exchange annually.

1.1.3 Government involvement in the sugar sub sector

The sugar industry had been dominated by the private sector in the colonial Kenya, in fact among the first companies to be established, Miwani was owned by individuals. After independence, the government of Kenya started playing a central role in the ownership and control of sugar companies. To foster the development and efficient management of the sugar

industry, the government in 1973 established the Kenya Sugar Authority (KSA) which was later changed to Kenya Sugar Board (KSB) in 2002 as the apex body responsible for regulating, developing and promoting the sugar industry in Kenya (Kenya Sugar Research Foundation Strategic Plan 2005 - 2010).

Due to the importance of the sector in the economy, the government of Kenya for the first time came up with a national policy on sugar industry (2001). The objectives of the policy included:

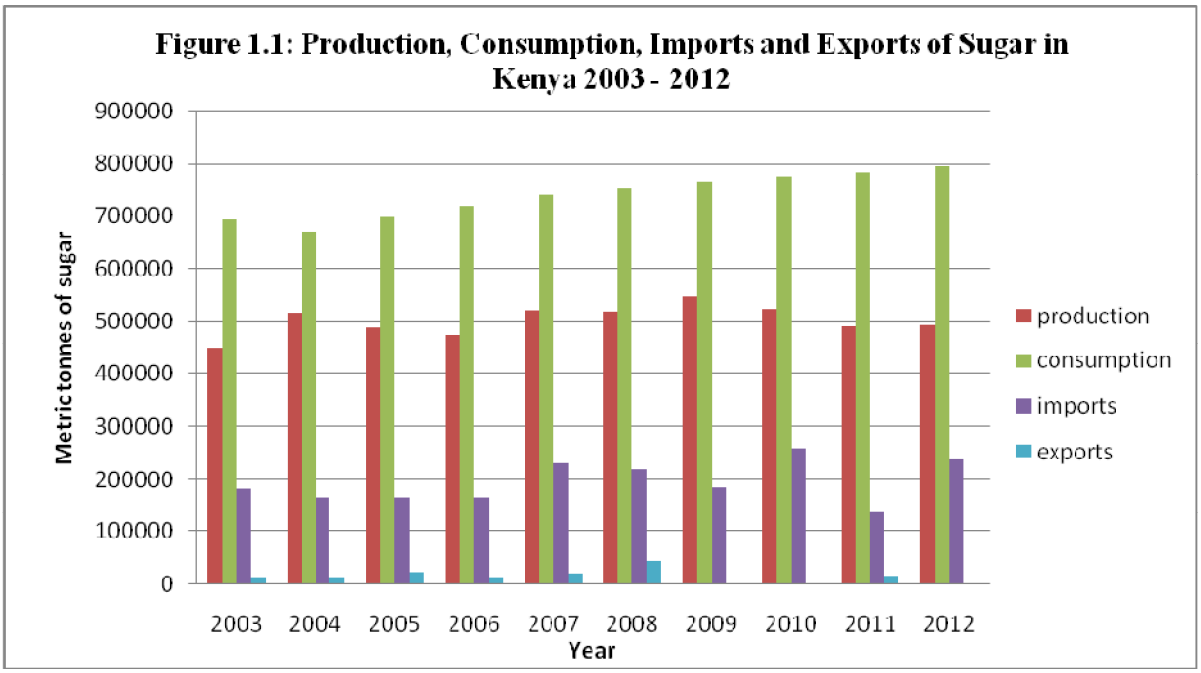
i. To achieve self ï sufficiency in the most cost effective and efficient manner with the ultimate goal of becoming a sugar exporting country;
ii. To provide direct and indirect gainful employment for Kenyaôs growing labour force;
iii. To provide raw materials for processing beverages, soft drinks and pharmaceuticals, among other products as this would contribute to savings and earn the much needed foreign exchange through exports; and
iv. To promote rural development through direct participation of rural families in sugar producing areas in order to alleviate the problem of rural urban migration

1.1.4 Production, Consumption and Import of Sugar in Kenya

Despite the investments made in the industry, self sufficiency in sugar has over the years remained elusive as consumption continues to outstrip supply. For instance, total sugar production grew from 368,970 tonnes in 1981 to an all time high of 548,207 tonnes in 2009. Domestic sugar consumption, on the other hand, increased even faster, rising from 324,054 tonnes in 1981 to 762,027 tonnes in 2009.

Consequently, Kenya has remained a net importer of sugar with imports rising from 4,000 tonnes in 1984 to 238,589 tonnes in 2012. The country on average imports 200,000 tonnes of sugar per annum to bridge the deficit between domestic production and consumption.

The sugar market in Kenya was liberalized in the early 1990s which meant that price controls and tariffs that helped to protect the domestic sugar market were removed. Conversely, sugar imports from the COMESA region increased while exports remained negligible.



Adopted from the Kenya Sugar Board Statistical Abstract 2013

1.1.5 Why imported sugar is cheaper in Kenya

Local sugar cannot compete with imported sugar because of high production costs and low productivity witnessed at both the farm and factory levels. The low productivity is due to inadequate extension and research services, poor sugar cane management and the use of obsolete machines for processing sugar at some of the local factories (Agricultural Sector Development Strategy 2010 - 2020).

Kenya being a signatory of the COMESA free trade agreement is thus bound by the provisions of the FTA protocol that allows duty and quota free access of sugar from the COMESA FTA countries into its market. This in effect reduces the effectiveness of using

tariffs in protecting the domestic sugar industry. The challenge for the industry is to competitively produce sugar to meet the local demand and have surplus for export in order to enjoy favourable trade, as is the case with other commodities. However, the country has taken a protectionist[1] stand on international trade of sugar due to the conjecture that liberalizing the industry will adversely affect the local sugar.

Borell and Ronald (1992) opined that protectionist agricultural policies have distorted world market. They argue that market interventions have affected both the level and the variability of world sugar prices. Control on domestic prices, demand and supply have created an inefficient pattern of world production, consumption and trade.

1.1.6 International trade of sugar

The international sugar market is largely defined by preferential trade agreements in which sugar producing countries enjoy access to the higher priced domestic markets of the EU or USA through preferential access. Trade under preferential agreements is very important to the sugar sector of many developing countries (Krugman, 2000).

There are four regimes under which sugar is traded; first, a preferential and quota regime offered by developed countries notably the USA and the European Union (EU preferential sugar arrangement, where maximum supply needs are met through the African Caribbean and Pacific (ACP) countries sugar protocol). Kenya is a signatory to this trade agreement and so it has a privilege of exporting sugar to these countries. In the delivery period 2004/2005, the country exported a total of 20,168 metric tonnes of sugar under this arrangement.

Generally, Africaôs weak competiveness is mainly due to poor performance in key sectors such as manufacturing and agriculture for exports. Africaôs exports represent about 0.5 per

[1]Protectionism is an economic policy of restraining trade between nations through high tariffs on imported goods, restrictive quotas and a variety of restrictive Government regulations designed to discourage cheaper imports and dumping in an attempt to protect domestic industries from foreign take over or competition (Edward, 2002).

cent of the total amount of sugar traded worldwide (COMESA Strategic Plan, 2007- 2010). Secondly, free trade arrangements like East Africa Community (EAC), COMESA and Southern Africa Development Community (SADC). Kenya is a signatory to the COMESA free trade agreement and a member of EAC. Consequently, it is bound by the provisions of the free trade area protocol that allows duty and quota - free access of sugar from the COMESA FTA countries into its market. However, the country has negotiated a delay in the free trade of sugar to allow Kenyaôs sugar sector to adjust and become competitive. The trade restriction will be lifted in 2014. Over 37 percent of total exports to COMESA countries (e.g. tea and industrial products) are of Kenyan origin. Kenya is therefore a significant beneficiary of the COMESA arrangement. It is only in sugar, rice and wheat that Kenya suffers a drawback.

Finally are the trading under the World Trade Organization and the international sugar agreement. Other than the stated measures, the tariffs, levies and duties applicable to all sugar imports are:

Table 1: Taxes on sugar imports from COMESA FTA countries, 2011

	Mill white sugar	**Brown sugar**	**Raw sugar**	**Industrial sugar**
Customs duty	0%	0%	0%	0%
Value Added Tax	16%	16%	16%	16%
Sugar Development Levy	7%	7%	7%	7%
Total	**23%**	**23%**	**23%**	**23%**

Table 2: Taxes on sugar Imports from non COMESA FTA countries, 2011

	Mill white sugar	Brown sugar	Raw sugar	Industrial sugar
Customs duty	100%	100%	100%	100%
Value Added Tax	16%	16%	16%	16%
Sugar Development Levy	7%	7%	7%	7%
Total	**123%**	**123%**	**123%**	**123%**

Source: Kenya Sugar Board Statistical Abstract, 2011

Most of the sugar producing countries protect their industries from lower cost producers. They also have policies that provide for direct and indirect subsidies that insulate their domestic markets from world dumping markets. In the world, 70 percent of the production of the commodity comes from sugar cane with Brazil producing 20.3 million metric tonnes, 19.9 million tonnes from India and the European Union contributing 15.5 million metric tonnes (Kenya Sugar Board Statistics Year Book, 2003).

1.1.7 Challenges facing the sugar sector in Kenya

The performance of the industry faces several challenges. Firstly, the productivity of both the countryôs cane (from farms) and the milled sugar (from factories) is low. The national average cane yield currently stands at 75 tonnes per hectare which is far below the potential yield of 100 tonnes per hectare under rain feed conditions. This translates to an average of 7.35 tonnes per hectare of mill white sugar, against a potential of approximately 10 tonnes per hectare. A

cane yield of 130 tonnes per hectare has been recorded under irrigation in the Nyando (Muhoroni, Chemelil) zone, yet only 63 tonnes per hectare is realized in that area.

Secondly, the production cost of the Kenyan sugar is high. Kenya has the highest sugar production cost in the Eastern and Southern Africa (COMESA) region. It is estimated that it costs upto US$ 600 to produce a tonne of Kenyan sugar, while a tonne of sugar from neighbouring countries like Zambia, Malawi, Swaziland and South Africa would cost US $ 300, US $ 290, US $300, and US $ 290 respectively to produce.

Other challenges that bedevil the sector stem from; liberalization under the COMESA and WTO protocols, poor state of some sugar factories, poor supply chain management, and inadequate research, development and extension services (Kenya Sugar Board Statistical Abstract, 2011).

1.2 Statement of the research problem

Sugar is one of the most important sources of food energy in the human diet. The global consumption of the commodity has continued to expand over the years, averaging between 1.5 to 2 percent, driven largely by rising incomes, population growth and shifting dietary patterns. Locally, despite the high level of poverty incidence witnessed among Kenyans, the growth rate of per capita consumption of sugar has kept rising at a rate faster than that of domestic production. This calls for the filling of the demand gap by importation of the commodity from a world market in which prices are largely determined by trade agreements and policy interventions instead of being controlled by the óinvisible handsô of the market mechanism.

Faced with low purchasing power and in order to maximize utility derived from consumption of sugar, Kenyan consumers need to optimize the expenditure on the commodity subject to its price in the market and the budget constraint. This study therefore, contributes to the literature on sugar consumption, production and importation by analyzing the factors that affect its demand in Kenya.

1.3 Objectives of the study

Based on the problem stated above, the aim of this paper is to study some of the major factors that influence the demand for sugar by the Kenyan consumers. Specifically, the paper will seek to:

i. Identify the major determinants of demand for sugar by consumers in Kenya during the period under review;
ii. Estimate the income and price elasticities of demand for sugar in Kenya;
iii. Determine the degree at which policy interventions and trade agreements affect demand for sugar in the country, and lastly;
iv. Based on objectives (i) and (ii) above, derive policy recommendations on ways of improving affordability of the commodity to the Kenyan consumers.

1.4 Rationale of the study

Given the high per capita consumption of sugar among households in Kenya and the lack of its close substitutes, sugar remains one of the strategic commodities in a typical Kenyan householdôs basket. Generally, knowledge on any essential food itemôs demand in a country is useful in designing policies that benefit householdsô welfare.

For instance, it helps to identify appropriate policy interventions in improving the nutritional status of individuals and households. It can also inform the designing of various food subsidy/

tax strategies to be pursued by the Government. Lastly, a study on demand behaviour for food items like sugar can be essential in conducting macroeconomic policy analyses (Sadoulet and de Janvry, 1995).

Borrell and Pearce (1999), however argue that it is because of the political economy, trade structures, and production characteristics of sugar that are so different from those found in most agricultural markets that make it warrant special consideration. Chief among these differences are:

i. The degree to which international markets are dominated by policy interventions and the effects of preferential trade agreements;
ii. The inherent tension between mills and growers created by sugarôs joint production characteristics;
iii. The local monopoly-monopsony relationship between growers and mills;
iv. The effect of that relationship on community incomes, assets and profitability

This study intends to benefit policy makers by suggesting ways of; enhancing production of local sugar to meet the consumption requirements and ensuring affordability of the commodity to local consumers. Academicians will also use the information in this paper to carry out further analysis on the subject matter so as to develop more ideas and insights for better management of the sugar sub sector.

1.5 Limitations of the study

This paper will not take into account distinctive characteristics of sugar consumers in the country. For instance, there are categories of consumers who possess varied ability in terms of purchasing power e.g. the poor both in urban and rural areas and large households.

The study will also focus only on documented data of sugar produced, consumed, imported and exported. In reality, though, there is sugar that is smuggled into the country and also sugar that is destined to other countries like Uganda but is diverted into the local market. So the volume of sugar available locally is likely to be higher than the official figures and is always expected to rise as demand increases. Lastly, the study assumes that sugar is mainly used in householdsô consumption in Kenya. Industrial consumption is a small proportion of the total amount consumed.

1.6 Organization of the paper

The research paper will be organized as follows: Chapter 2 provides the literature review, both theoretical and empirical; Chapter 3 will present methods and procedures to be used in the study, while; Chapter 4 presents a discussion of the results; and finally chapter 5 provides the conclusions, limitations and recommendations of the study.

CHAPTER TWO

2.0 LITERATURE REVIEW

This part is divided into two sections: the theoretical literature and empirical literature review. The former gives an outline of the theoretical foundation onto which the subject matter of the study is based while the latter presents other studies that have been carried out on the same or related subjects. The chapter also presents an overview of the literature reviewed.

2.1 Theoretical literature

The basic idea of consumer demand theory is traced back to Pigou (1910) who thought that the responsiveness of consumer demand for a commodity to price changes is likely to be related to its responsiveness to changes in income. This suggestion was followed up by Friedman (1935) and finally incorporated into demand theory by Houthakker (1960) which has evolved to become the neoclassical theory of consumer choice (Fishburn, 1988).

According to the demand theory, demand is the number of goods bought at a particular place and time with the current price and time. An item in demand is affected by its own price, incomes level, the price of other commodities and taste and preferences.

$$Q = b_o . P^{b1}. P_0^{b2}.Y^{b3}\text{é é é é é ..é é é é é é é é é é é é . (1)}$$

This abstract economic relationship of demand can be represented mathematically as:

$$\ln Q = b_o + b_1 \ln P + b_2 \ln P_0 + b_3 \ln Y + u \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where: Q = Quantity demanded of a particular commodity

P = Price of the commodity

P_0 = Price of other related commodity

Y = Income

u = Error term

b_o, b_1, b_2, b_3, are the coefficients of the demand equation.

The error term, *u*, is added to represent other factors that might affect demand as witnessed in real economic life. The invention of a new product, changes in law, institutional changes, changes in income distribution, are examples of such factors. Furthermore, human behaviour is inherently erratic, they are influenced by rumours, dreams, prejudices, traditions and other psychological and sociological factors that make human beings behave differently even though the conditions in the market (prices) and income remains the same (Koutsoyiannis, 1979).

Fishburn (1988) identified three axioms that underpin the neoclassical theory of consumer choice as; (i) every good in the market belongs to a weaker order meaning consumers are indifferent (ii) the ordering of any two goods is independent of the other goods available, and (iii) preferences are considered to be continuous.

Mc Fadden (2001) is of the view that individuals consume goods because such goods provide satisfaction or enjoyment, i.e. Utility. The goods they choose to consume out of all possible goods are the ones that provide the most utility, subject to constraints such as budget and time. People choose a good from a choice set because it is preferred in some way. According to him classical economic theory postulates that consumers seek to maximize their self ï interest and an object can have no value unless it has utility.

Since Stoneôs exposition of 1954 in which he estimated a system of demand equations derived from consumer theory, there has been a continuing investigation for alternative specifications and functional forms. A lot of models have been proposed, but the most important in current use include; The Linear Expenditure System, the Rotterdam model (Theil 1965), the Translog

model (Christensen, 1975) and an Almost Ideal Demand system (Deaton and Muellbauer, 1980). These models have mostly been used to test homogeneity and symmetry restrictions of demand theory.

The Linear Expenditure Model

This model was first formulated by Stone in 1954 and it begins with a general linear demand equation:

$$p_i q = \text{ɓ}_{ix} + \sum_{j=1}^{n} \beta ij p j \quad \text{é é é é é é é é é é é é é é é .(3)}$$

with the theoretical restrictions of adding up, homogeneity, and symmetry imposed. The form that satisfies these restrictions is the linear expenditure model.

$$p_i q_i = p_i \gamma_i + \text{ɓ}_i (x - \text{Ɇ} p_k \gamma_k) \text{é é é é é é é é é é é .é é ...(4)}$$

The direct and indirect utility functions for the linear expenditure system are:

$$v(q) = \Pi (q_k - \gamma_k)^{\text{ɓk}} \text{é é é é é é ..é é é é é é é é é .é (5)}$$

$$\text{ɓ}(x,p) = (x - \text{Ɇ}\, p_k \gamma_k)/\text{Ʊé é é é é é é é é é é é é é é (6)}$$

with Ɇ $\text{ɓ}_k = 1$ and the vectors γ and ɓ are the parameters of the system. The ɓôs are interpreted as the marginal shares while the ɔôs have the dimension of quantities. The committed expenditures are bought first, leaving a residual, $x - \text{Ɇ} p_k \gamma_k$ which is allocated between the commodities. Although the model is linear in variable, it is not linear in parameters ɓ and ɔ. The linear expenditure system is very restrictive in the selection of functional form.

The Rotterdam model

According to Deaton and Muellbauer (1980), this model was first proposed by Theil (1965) and Barten (1966). The model makes it possible to apply constraints explicitly within the model and more so most of the constraints are linear. The Rotterdam model takes the form of:

ŭ log q_1 = e_i *d* log x +Ɛe_{ij} *d* log p_jé é é é é é é é é é .é é é é .(7)

Where q represents the vector for quantities of each commodity and p is the vector for price. The term *d* log x is an index number of the change in real income.

Adding up requires that the marginal propensities to spend on each good sum to unity and that the net effect of a price change on the budget be zero. The adding up restrictions on the Rotterdam model; for all j, are: Ɛb_k = 1; Ɛc_{kj} = 0

The Direct Addilog System

This model was proposed by Houthakker in 1955. It may be derived from the utility function;

U (q) = ƐŬ$_k$$q_k^{ƃ_k}$é é é é é é é é é é é é é é é é é é é (8)

Where Ŭand ƃ are the parameters. To derive a demand function, a lagrangian is formed:

ū = ƐŬ$_k$$q_k^{ƃ_k}$ + ə(ε ï p^1q), ...é é é é é é é é é é é é é (9)

An Almost Ideal Demand System (AIDS)

This model was put forward by Deaton and Muellbauer in 1980. The model preserves the generality of both the Rotterdam and translog models. Like the Rotterdam model, the theoretical restrictions apply directly to the parameters. Adding up requires that for all *j,*

Σα_k = 1, Σƃ$_k$ = 0, Σ ɔ$_{kj}$ = 0

Homogeneity is satisfied if and only if, for all *j,*

Σɔ$_{jk}$ = 0

While symmetry is satisfied provided,

ɔ$_{ij}$ = ɔ$_{ji}$

All these equations are implied by utility maximization. The ƃ parameters of the Almost Ideal Demand System determine whether goods are luxuries or necessities. With ƃ$_i$ > 0, w_i increase with x so that good x is a luxury; similarly, ƃ$_1$ < 0 for necessities. The ɔ$_{ij}$ parameters measure

the change in the *i*th budget share following a unit proportional change in p_j with (x/p) held constant.

Although the models discussed above *viz* The Linear Expenditure System; The Rotterdam model; the Translog model and; An Ideal Demand System (AIDS) have their shortcomings, their functional forms are flexible. That is, they do not put apriori restrictions on the possible elasticities at a point. The Ideal Demand System and the Rotterdam models can be estimated in a linearized form with theoretical restrictions easily imposed and tested (Barnett and Ousmane 2007).

2.2 Empirical literature review

Schultz (1938) pioneered a theoretical exposition in the field of time series analysis using demand for particular agricultural products such as sugar wheat and cotton in the U.S. For such basic agricultural commodities, taste probably does not change over time and production typically does not change rapidly over time and also production takes place within a short period of time. Static demand theory, in which delayed adjustments are ignored, is therefore liable to give a reasonably good description of facts.

Stone (1953), in his book, The Measurement of Consumersô Expenditure and Behaviour in the United Kingdom, replaced the real household incomes by estimates of it taken from surveys on British household budgets. This is because of the fact that income and prices tend to move together over time, with the result that it becomes difficult to get statistically significant estimates of both income and prices.

In the analysis of Family budget (1955), Prais and Houthakker adopted the use of non- linear functions in order to obtain better description for commodities whose consumption depends

on the level of income. For instance there exists a level of income below which some commodities are not consumed and in many cases, there is also a saturation level which acts as an upper limit, whatever the level of income. The study concludes that semi ï logarithmic functions give better results, as far as food items are concerned. The semi- logarithmic form makes it possible for a commodity to appear as a luxury at low income levels and as a necessity (income elasticity below one) at higher income levels.

Ramasubban (1983) estimated demand for sugar in Tanzania using time series data from 1964 ï 1979. In his model, the independent variables included the sugar price index and income, which were fixed by the 1969 index. The regression results indicated that at 1% and 5% significant levels, income elasticity is 1.5 and price elasticity is ï 0.8 which means in Tanzania demand is highly affected by changing income but is inelastic in respect to price.

Kumar et al (2011) explained food demand behavior using a set of demand elasticities corresponding to major food commodities in India. The demand elasticities were estimated using multi stage budgeting with quadratic almost ideal demand system (QAIDS). The study revealed that estimated income elasticities vary across income classes and are lowest for cereals group and highest for horticultural and livestock products. The analysis of price and income effects based on the estimated demand system suggested that with increase in food price inflation, the demand for staple foods (rice, wheat and sugar) may not be affected adversely but, that of high value food commodities is likely to be affected negatively.

Babakhani and Suleimani (2012) estimated the demand for sugar in Iranian households using ordinary least square (OLS) technique and linear regression model. With an income elasticity of 0.8, the study showed that like in many other countries, sugar is a necessary good in the

Iranian householdôs basket. The results also gave a price elasticity of - 0.2 indicating that changes in price make a little change in demand for sugar in that country. The study concludes that sugar demand in Iranian associated with household expenditure, relative price of sugar and family size.

Kipruto (2012) used the arc elasticity of demand and the partial equilibrium model to estimate the elasticity of demand for sugar imports and the efficiency of the sugar sector in Kenya. At 1.68, the results from the study indicate that the demand for sugar imports in Kenya is elastic, meaning that a change in price of imports will result to a higher proportionate change in quantity of imported sugar demanded. This therefore suggests that participation in the world market exposes a country to competition stimulating efficiency.

The study observes that protectionism has a negative impact on the efficiency of the industry in Kenya and should be done away with. It estimates that on average since the introduction of protectionist policies, Kenya has lost 7.77 percent per annum of its GDP due to the inefficiency resulting from inappropriate allocation of resources in the sugar industry. It concludes by proposing that opening up of trade will reduce prices of sugar and save the consumer income which could be directed to other areas.

Odada (1982) examined the role of sugar industry in the Kenyan economy. He observed that Kenya desperately needed foreign exchange in her efforts to effect high rate of economic growth and being self reliant in sugar production would save the country the foreign exchange that has since been spent on sugar imports.

However, production in his view is much of an economic phenomenon and to set production goals without providing appropriate production incentives at the farmland is to get priorities

wrong. In order to revitalize the sugar industry, the country needs a carefully formulated factor pricing policy that can increase labour and the relative share of labour in total cost. Sustaining self ï sufficiency in sugar production in Kenya will depend on how farmers view the relative profitability of the sugar cane crop enterprise in relation to alternative crop enterprises.

Coughlin et al (1986) compared the total cost of production per hectare and the net returns per hectare and concluded that the sugar industry then had an inappropriate price structure which rewarded middlemen more than farmers and millers. The price structure, they suggested, should be overhauled to reward the actual producers of sugar. The margins allowed for farmers and millers should be increased to reflect their relative importance in the industry, encourage production and diminish the importation of sugar.

In their view, high cane transportation costs depressed the returns much more. Alternative modes of transport should be tried. For example, in Indiaôs Maharashtra state, animal drawn carts carrying about 2.5 tonnes of cane per trip in the zone near factories transported cane, this should be tried here, they suggested. It could significantly reduce transport costs, create additional income earning opportunities for cane growing households and reduce the foreign exchange costs associated with tractors.

Grossman and Helpman (1991) argue that the high level of inefficiency in the sugar industry could have been brought about by lack of competition in this industry, resulting in continual use of obsolete and costly technologies. New growth theorists also argue that increased competition and exposure to foreign markets is also linked to the adoption and diffusion of improves technologies.

Obange et al (1994) investigated market supply and demand factors causing high pricing which influences performance of the locally manufactured sugar in Kenya. This study showed that the local market has a deficit of locally produced sugar that falls below the market demand. Sugar manufacturing firms in Kenya for example, experienced closing sugar stocks estimated at 28,113.3 metric tonnes per annum for the period 1996 ï 2005.

The study observed that with the progress of the COMESA and liberalization of member countriesô economies, Kenyaôs sugar manufacturing firms have remained uncompetitive in both local and regional markets. It concluded that price related factors significantly contribute to poor performance of local sugar manufacturing firms under the prevailing imperfect market conditions.

In his paper, Imbalances Between Supply and Demand Drives Sugar Prices, Geoff (2009) asserts that policies of multilateral corporations play a key role in determining sugar prices like the dominance of Tate and Lile which import most of the sugar into the European Union. He observes that the international sugar market is one of the most highly distorted agricultural commodity markets. Sugar markets are characterized by domestic support and trade distorting policies such as guaranteed minimum payment to producers, production and marketing controls (quotas), state regulated prices, tariffs, export subsidies and import quotas.

Innes (2010), observes that sugar industries in Africa embrace a wide range of production systems over a large spectrum of climatic, social and economic conditions and ownership structures. They range from irrigated beet sugar production in North Africa e.g. Morocco and Egypt to rainfed and irrigated cane in Sub-Saharan region, from corporate owned plantation to extensive small grower schemes. He reiterates that sugar in Africa has a very strong

developmental impact in terms of employment and income generation, wealth creation, foreign earnings (or savings) and the fiscal contribution to the national economies.

The study however observes that Africa still remains a sugar deficit continent: it consumes more than it produces ï consumption is estimated at around 16 million metric tonnes compared to production at 11 million metric tonnes. The study concludes by affirming that sugar should continue to play its key role in the development of the agricultural sector of sugar producing LDCs, many of which have attracted capital investments in either expansion of current farm gate production, refining capacity or green fielding sugarcane refineries.

Karekezi S. et al (2002) estimate that sugar factories in the COMESA region have the potential of producing electricity in the range of 2500 to 5500 GWH annually. The electricity if sold to the national utility grid can generate income for the sugar industry. This can help in settling some of the costs and debts that they have accumulated. They point out that the drought that affected majority of the countries in the region during the 1997 ï 2000 period, should have served as a wakeup call for urgent diversification of the regionôs source of electricity generation.

2.3 Literature Overview

It is evident from the literature reviewed that a lot of research has been carried out on demand theory analysis especially on essential food commodities in several countries. Linear Expenditure System (Stone, 1954) and Almost Ideal Demand System (Deaton and Muellbeaur, 1980) are the demand models that have been extensively used because they are flexible and because they satisfy all the general restrictions of the demand theory. Results from most of the studies indicate that sugar is a necessary good and is price inelastic.

Most of these studies are however concentrated in the U.S A., Europe and the Asian countries. Only a few studies of this nature have been done in the developing countries. Two reasons can explain this; first, there is a serious data collection and analysis problem in these countries due to the cost factor and secondly, Governments in developing countries barely anchor their policy interventions on well researched and analyzed information and so research is not properly funded.

Studies from Kenya concentrate on the supply of sugar. They place considerable prominence on factors contributing to low productivity at the farm and factory levels and on the high production cost in the country. Although that is an equally important area for research because of the myriad challenges experienced by the local sugar industry, issues influencing the demand of the commodity should also be focused on so as to assist in developing discreet policy interventions for the sub - sector.

This is the gap that this paper intends to fill so that as the country approaches the lifting of the restriction imposed against importation of sugar from other COMESA countries, strategies geared towards protecting the welfare of the consumer will have been formulated.

CHAPTER THREE

3.0 METHODOLOGY

This chapter is divided into three parts; the theoretical framework, which explains theoretical foundation upon which this study is based; the analytical framework, out of which the model is derived and; the methods of data collection and the tools of analysis employed in the paper.

3.1 Theoretical framework

Consumer behaviour is usually presented in terms of preferences and possibilities. Emphasis is however placed on preferences, on the axiom of choices and on utility functions and their properties. Opportunities for choice are often directly observable so that, to the extent that variations in behavior can be traced to variations in opportunities, there is a straightforward and objective explanations of observed phenomena (Phlips, 1983).

Consumer demand analysis is built on the assumption of a simple linear budget constraint of the form:

$$x = \sum_{k} pkqk \quad \text{é é} \quad (10)$$

with total expenditure x, price P_k and quantities q_k. The equation rules out non linearity, indivisibilities, uncertainties and interdependence of goods.

According to the Marshallian demand function, the consumer has rules for deciding how much of each good to purchase faced with given prices and total expenditure.

$$q_i = g_i\,(x, p) \text{é é} \quad ...(11)$$

The fact that the demand function satisfies the budget constraint places a constraint on the function g_i.

$$Ep_k g_k\,(x, p) = x \text{é é} \quad ...(12)$$

This is referred to as the adding up restriction. There is also the homogeneity restriction which implies that if the total expenditure and prices are twice as high, the constraint remains the same. Every demand equation must be homogenous of degree zero in income and price. In other words, if all prices and income are multiplied by a positive constant *k*, the quantity demanded must remain unchanged.

$$g_i(kx, kp) = g_i(x, p) \quad \text{é é é é é é é é é é é é é é ..(13)}$$

This is also called the absence of money illusion since the units in which prices and income are expressed have no effect on purchase. This restriction is the direct result of utility maximization.

$$\frac{\frac{\partial u}{\partial xi}}{\frac{\partial x}{\partial xi}} = \frac{\mathbf{pi}}{\mathbf{pj}} \quad \text{é é é é é é é é é é é é .é é é é (14)}$$

An assumption about behavior has been made: that price and income play no role in choices other than in determining the budget constraint, so that the units in which prices and individualôs income are measured have no effect on the consumerôs perception of opportunities. However, one case that violates this assumption occurs when the quality of a good is judged by its absolute price.

It is sometimes useful to express the two equations of restrictions on the derivatives of the demand function, rather than on the functions themselves. The adding up and homogeneity restrictions imply that, for i = 1,é é é é ., n

$$\sum_k pk\frac{\partial gk}{\partial xi} = \mathbf{1} \quad \text{é é é é é é é é é é é é é é é é é .(15)}$$

So that changes in x and in p cause rearrangements in purchases that do not violate the budget constraint. The two parts are referred to as the Engel and Cournot aggregation, respectively.

$$\sum_k pk\frac{\partial gi}{\partial pk} + x\frac{\partial gi}{\partial xi} = \mathbf{0} \quad \text{é é é é é é é é é é é é é é ...(16)}$$

Meaning that a proportionate change in *p* and *x* will leave purchases of goods *i* unchanged,

If we denote the budget shares with $w_{i,}$ then it would be defined by $w_i = p_1q_1/x_i$ and the fractions will be the total expenditures going to each good. The logarithmic derivatives of the Mashallian demand are the total expenditure elasticities and price elasticities;

For the former e_i, i = 1,é é é é é é ., n

$$e_i = ŭ \log g_i (x_i, p_k)/ ŭ \log x_i é é é é é é é é é é é é ..(17)$$

While for the latter, e_{ij}, i, j = 1,é é é é é , n

$$e_{ij} = ŭ \log g_i (x_k, é é é é é é é é é é é é é é é é é é (18)$$

The diagonal elements e_{ii} are the own price elasticities, while the off ï diagonal e_{ij} terms are cross price elasticities. These Marshallian elasticities are also known as uncompensated or gross elasticities. According to Engel, goods can be classified into luxuries, necessities and inferior goods. Luxuries are goods that take up a larger share of the budget of better ï off households and vice versa for necessities.

It is assumed that the household has an exogenous budget outlay or total expenditure x, which is to be spent within a given period on some or all of n commodities. These can be bought in nonnegative quantities q_1 at given fixed price, p_i.

Duality in the theory of demand

Duality approach is about a change of variables. Preference and utility are defined over quantities as the object of choice formulated as utility in terms of quantities. However, if the consumer faces a linear budget constraint, then price and consumer expenditure determine the maximum attainable utility so that utility can be regarded as a function of price and consumer income ï This is the indirect utility function, or inversely expenditure regarded as a function of utility and prices (the cost function).

C (u,p) and φ (x,p) can be converted into demand functions by simply differentiating or use of Royôs identity. Sheppardôs lemma states that the demand for a good for a given level of utility and a given price equals the derivative of the expenditure function with respect to the price of the relevant good

$$h_i(p,u) = \frac{\partial e(p,u)}{\partial pi} \quad \text{é é é é ..é é é é é .é é é é é é é ...(19)}$$

Where h_i (p,u) is the Hicksian demand for good i and e (p,u) is the expenditure function

Price and income elasticity of demand

The own price elasticity of demand for Q_1 ($\mathring{U}_1$) is the proportionate rate of change of q_1 divided by the proportionate rate of change of its own price with the price of the alternative commodity and income constant. The consumerôs expenditure on Q_1 is p_1q_1 and;

$$\mathring{U}_1 . \quad \frac{\partial(ln\mathbf{q1})}{\partial(ln\mathbf{p1})} = \frac{\mathbf{p1}\partial\mathbf{q1}}{\mathbf{q1}\partial\mathbf{p1}} \quad \text{é é é é é é ..é é é ..é é é é .é (20)}$$

$$\frac{\partial(\mathbf{p1q1})}{\partial\mathbf{p1}} = \mathbf{q1} + \mathbf{p1}\frac{\partial\mathbf{q1}}{\partial\mathbf{p1}} = \mathbf{q1}\left(1 + \frac{\mathbf{p1}}{\mathbf{q1}}\frac{\partial\mathbf{q1}}{\partial\mathbf{p1}}\right)$$

$$\text{é é é é .é é é é .. (21)}$$

Commodities which have high elasticities ($\mathring{U}_1$ > -1) are luxuries whereas those with elasticities ($\mathring{U}_1$< 1) are called necessities.

The consumerôs expenditure on Q_1 will increase with P_1 if $\mathring{U}_1$ > -1, remains unchanged if $\mathring{U}_1$ = -1 and decreases if $\mathring{U}_1$< -1

A cross- price elasticity of demand for the ordinary demand function relates the proportionate change in one quantity to the proportionate change in other price.

$$\mathring{U}_{21} = \frac{\partial(\ln q2)}{\partial(\ln p1)} = \quad \text{é ...é é é é é é é é é é é é é é ..(21)}$$

Counout aggregation condition can be used to evaluate the cross- price elasticity of demand for Q_2 if the own price elasticity of demand for Q_1 is known.

An income elasticity of a Marshallian demand function is defined as the proportionate change in the purchase of a commodity relative to the proportionate change in income with price constant.

$$q = \frac{\partial(\ln q1)}{\partial(\ln y)} = \frac{y}{q1}\frac{\partial\phi(\mathbf{p1}, \mathbf{p2}, \mathbf{y})}{\partial \mathbf{y}} \quad \text{é é é é é é é é é é é ..(22)}$$

It can be positive, negative or zero and gives rise to the Engel aggregation condition,

$$\check{U}_1 q_1 + \check{U}_2 q_2 = 1 \text{é é é é é é é é é é é é é é é é é .....(23)}$$

The sum of the income elasticities weighted by total expenditure proportions equals unity.

Dummy variables

According to Gujarati and Porter (2009), Analysis of Covariance (ANCOVA) can be used to assess the statistical significance of the relationship between a quantitative regresand and a qualitative or dummy regressor. Dummy variables take the value of 1 or 0 and classify data into mutually exclusive categories. The coefficients attached to the dummy variables are known as the differential intercept coefficient because they tell us by how much the value of the category that receives the value of 1 differs from the intercept coefficient of the benchmark category.

3.2 Model Specification

The dependent and independent variables chosen for the analysis of the consumer demand for sugar in this study are based on the literature review and theory of demand. The model adopted for estimation will be the linear expenditure system which is based on the assumption that preferences determine the market behavior of consumers.

Assuming that the consumer is rational and strives to maximize utility from the consumption of sugar (Q_1) and a composite of other goods (Q_2), the rational consumer will desire to purchase a combination of Q_1 and Q_2 from which he derives the highest level of satisfaction. The consumerôs utility function is assumed to be continuous, strictly quasi ï concave and that the partial derivatives of the function are strictly positive. The consumer is also assumed to have a well defined preference over bundles of those two goods and the preferences can be represented by the direct utility function.

The consumerôs income is limited and is not able to purchase unlimited amount of the commodities. With an income level of Y_d, Price of sugar P_{Q1} and price of the other commodities, P_{Q2}, the utility function for an individual consumer is given as:

$U= u (Q_1^{\beta}, Q_2^{\alpha})$ and budget constraint as $P_{Q1}Q_1+ P_{Q2}Q_2 = Y_d$, which means that income must be equal to the cost of spending for both the commodities.

Utility maximization function is: Max $U = u (Q_1^{\alpha}, Q_2^{\beta})$é é é é é é é é é é é é é ... (24)

Subject to: $Y_d = P_{Q1}Q_1 + P_{Q2}Q_2$ é é é é é é é é é ...é é ... (25)

Where Ŭand ß are utility elasticities for Q_1 and Q_2 respectively

The consumerôs Hicksian demand function for Q_1 and Q_2 will be:

$$Q_1^h = Q_1^h (u, P_1, P_2)$$é é é é é é é é é é é é é ...é é é .(26)

$$Q_2^h = Q_2^h (u, P_1, P_2)$$é é é é é é é é é é é é é ..... (27)

These equations show that the Hicksian demand function is a function of utility and price contrary to Marshallian demand function in which quantity of goods purchased is a function of income and prices.

Where Q_1^h is the amount of Q_1 the consumer would purchase to achieve utility levels u, given the prices P_{Q1} and P_{Q2}. Hicksian demand functions are the solutions to a cost minimum problem.

Duality implies that if u (Q_1, Q_2) and E (u, $P_{Q1,}$ P_{Q2}), then;

u (Q_1, Q_2) and P_{Q1} and P_{Q2} = » E (u, $P_{Q1,}$ P_{Q2}), and E (u, $P_{Q1,}$ P_{Q2}) = » u (Q_1, Q_2)

Using Shephardôs lemma, we can derive a direct utility function from the expenditure function and get,

$$u = E^{-1}(E, P_{Q1}) \text{é} \quad \text{...é é é é é é é é é é é é é} \quad \text{....(28)}$$

$$u = v(E, P_{Q1}) \text{é} \quad \text{é é é é é é é é é é é é é é} \quad \text{... (29)}$$

v (E, P_{Q1}) identifies maximum utility of sugar, u ,as a function of prices P_{Q1}, and the levels of expenditures, E. If we set the level of expenditure equal to income Y_d, then

$$u = v(Y_d, P_{Q1}) \text{é} \quad \text{.é é é é é é é é é é é é é} \quad (30)$$

v (Y_d, P_{Q1}) identifies maximum utility as a function of income and prices. It is the direct utility function:

$$Q_1(Y_d, P_{Q1}) = -\frac{\partial v(Y, \mathbf{PQ1})}{\partial \mathbf{PQ1}} \Big/ \frac{\partial v(Y, \mathbf{PQ1})}{\partial \mathbf{Y}} \text{é é é é é é é é é é é} \quad (31)$$

Q_1 (Y_d, P_{Q1}) is the demand function for sugar. This is the Royôs identity which relates the Marshallian demand function to the derivatives of the indirect utility function. Royôs identity reformulates Shephardôs lemma in order to get a Marshallian demand function for an individual and a good from some indirect utility function.

$$\frac{\partial v[e(u, \mathbf{PQ1}), \mathbf{PQ1}]}{\partial Y} \frac{\partial e(u, \mathbf{PQ1})}{\partial \mathbf{PQ1}} + \frac{\partial v[e(u, \mathbf{PQ1}), \mathbf{PQ1}]}{\partial \mathbf{PQ1}} \text{é é é é é é é .....é} \quad (32)$$

$$\frac{\partial e(u, \mathbf{PQ1})}{\partial \mathbf{PQ1}} = \frac{\partial v[e(u, \mathbf{PQ1}), \mathbf{PQ1}]}{\partial \mathbf{PQ1}} \Big/ \frac{\partial v[e(u, \mathbf{PQ1}), \mathbf{PQ1}]}{\partial Y} = Q_1(Y, P_{Q1}) \text{é é é é é ..} \quad (33)$$

The model to be estimated will be:

$$\ln Q_1 = \check{U} + ß_1 \ln Y + ß_2 \ln P_{Q1} + ß_4 \text{dumPOINT} + ε \text{é é é é é é .} \quad (34)$$

Where:

Q_1 = Per capita amount of sugar demanded in Kenya

Y_d = Per Capita gross domestic product

P_{Q1} = Real retail price of sugar

POINT = 1, if Policy Intervention affect demand for sugar in Kenya

= 0, if policy interventions do not affect demand for sugar in Kenya

ε = Other factors affecting demand for sugar not included in the model

Policy intervention (POINT) has been included as a qualitative variable to assess its effect on the demand for sugar in Kenya. If policy interventions affect demand for sugar in Kenya

E (dumPOINT =1) then;

$\ln Q_1 = Ŭ + ɓ_1 \ln Y_d + ɓ_2 \ln P_{Q1} + ɓ_4 + ε$

If policy interventions do not affect demand for sugar E (dumPOINT = 0) then;

$\ln Q_1 = Ŭ + ɓ_1 \ln Y_d + ɓ_2 \ln P_{Q1} + ε$

3.3 Data Source and Methods of Analysis

Data that was used in this paper are secondary time series data for the period 1981 up to 2012. They are data collected by the Kenya National Bureau of Statistics (KNBS) through its periodic integrated household budget surveys. Additional information was extracted from the Kenya Sugar Board statistical abstract.

The analysis of the data was done in relation to the objectives of the study which are to establish the direction and strength of the relationships that exist between: per capita demand for sugar $\{Q_1\}$ by consumers in Kenya (the dependent variable) and; the per capita gross

domestic product $\{Y_d\}$, the deflated price of sugar $\{P_{Q1}\}$ and policy intervention (POINT) as a dummy variable (the three being the independent variables).

Linear regression analysis was used to estimate the demand model for sugar in Kenya. Independent and dependent variables of sugar demand model have been chosen according to the literature review and theory of demand and were estimated by ordinary least square technique (Soleimany and Babakhani, 2012).

3.4 Definition of the variables and prior expectations

The per capita demand for sugar was calculated by dividing the aggregate consumption of sugar in Kenya by the total population for each of the years under review.

The per capita household final consumption expenditure was also used in the study to represent income. It was preferred over per capita income because it excludes components of total household income like personal savings which if used would give inaccurate results. Per capita household final consumption expenditure is expected to be positively related to the quantity of sugar demanded.

The study also used real prices of sugar which were deflated using the GDP deflator. It was expected that real price would have to have a negative effect on the per capita amount of sugar demanded locally.

Lastly, a dummy variable was included in the model to capture the influence of policy interventions in the demand for sugar in the local market. It was expected that policy interventions would have positive effect on demand for sugar from the time such policies were implemented.

Stationarity, coitegration and diagnostic tests

Dicky Fuller test was performed to test for stationarity (constant mean and variance of the disturbance term over time) of the equation. The Durbin ï Watson *d* value test was used to detect if the regression is spurious, that is, has a high R^2 even though there is no meaningful relationship between variables. If $R^2 > d$, then the estimated regression is spurious. Engel ï Granger test of co- integration, which is also thought of as a pre-test for avoiding spurious regression situation, was performed. This test checks if there is a long term relationship between the variables. Lastly, the error correction model was used to check if there is short run disequilibrium among the variables.

Specification test was performed to detect; omission of relevant variables, inclusion of an irrelevant variable or wrong functional form. Hausman test was carried out to check if the model is correct. The null hypothesis for Hausman test in the specification test is that the specified model is the correct model (no misspecification) and the alternative model is the alternative hypothesis. To detect the presence of multicollinearity, the variance inflation factor (VIF) was used. If the VIF of a variable exceeds 10, which happens if R^2 exceeds 0.9, that variable is said to be highly collinear.

CHAPTER FOUR

4.0 DATA ANALYSIS AND RESULTS

This paper employed the use of time series data for the period 1981 ï 2010 to form a data set of 29 observations for all the variables studied *viz* per capita quantity of sugar demanded (in metric tonnes), retail price of sugar (in tonnes) and per capita household final consumption expenditure (in Kenya shillings) . The data on the amount and real retail prices of sugar were obtained from the Kenya Sugar Board statistical year books while those of per capita Gross Domestic Product (GDP) were extracted from the World Bank Development Indicators.

4.1 Correlation of variables

A correlation matrix was used to test the linear relationship between the explanatory variables. The matrix shows the strength and direction of variables. It is not only important in showing correlation but also multicollinearity in the explanatory variables. Pearson correlation coefficient of over 0.8 between explanatory variables is considered multicollinear (Gujarati, 2007).

Table 3: Correlation of Variables

	lndemand	lngdp	lnreal~e	pointd~e
lndemand	1.0000			
lngdp	-0.1348	1.0000		
lnrealprice	0.3843	-0.0028	1.0000	
pointdummy~e	0.4643	0.5187	0.2525	1.0000

Table 3 shows that most of the variables have a low correlation with each other. High correlation leads to multicollinearity problem. However, the problem of multicollinearity is solved when variables are differenced to make them stationary. A VIF value of 1.12 confirmed that the variables are non collinear.

4.2 Stationarity analysis

In order to avoid spurious regression associated with non-stationary variables, the study ensured that the model is in a stable equilibrium by testing the time series properties of the variables using the Dickey-Fuller test. Table 4 shows the unit root test results before differencing while tables 5 and 6 show unit root test results after differencing.

Table 4: Unit root test results

Variable	Test statistic	1% critical value	5% critical value	10% critical value	Stationary
lnper capita demand	-1.024	-3.723	-2.989	-2.625	Non ï stationary
lnper capita GDP	-0.941	-3.723	-2.989	-2.625	Non ï stationary
lnrealprice	-0.166	-3.723	-2.989	-2.625	Non ï stationary

Table 5: Unit root test results after 1st differencing

Variable	Test statistic	1% critical value	5% critical value	10% critical value	Stationary
lnper capita demand	-4.300	-3.730	-2.992	-2.626	Stationary
lnper capita GDP	-3.667	-3.730	-2.992	-2.626	Non - stationary
lnreal price	-5.717	-3.730	-2.992	-2.626	Stationary

Table 6: Unit root test results after 2nd differencing

Variable	Test statistic	1% critical value	5% critical value	10% critical value	Stationarity
lnper capita GDP	-8.151	-3.736	-2.994	-2.628	Stationary

From table 4 it is clear that all the variables were non stationary when they were tested for stationarity using the Dickey Fuller test. This is because the test statistic was greater than the critical values at 1%, 5% and 10%. To make them stationary, the variables were differenced and tested using the DF test. Whereas ódlnper capita demandô and ódlnreal priceô attained stationarity after the first difference, lnper capita GDP was stationary after the 2nd difference as shown in table 5 and 6 respectively. The results in table 5 show that the test statistic was lower than the critical values at 1%, 5% and 10%.

4.3 Autocorrelation, Cointegration and model specification tests

The analysis gives a Durbin Watson statistic of 2.446 reflecting no serial correlation between the dependent variables and the residual of the estimated equations. This therefore means the residuals are independent and identically distributed as N (0, ŭ). With a p value of 0.9055, the null hypothesis that the model had not omitted some variables was accepted. Non stationarity of data series may result in spurious relationship. The study therefore used cointegration methodology by using OLS to estimate a long run equation with the variables except per capita GDP integrated of order 1.

Table 7: Result of the long run relation of the model

```
      Source |       SS       df       MS              Number of obs =      28
-------------+------------------------------           F(  3,    24) =    6.63
       Model |  .000804514     3  .000268171           Prob > F      =  0.0020
    Residual |  .000970122    24  .000040422           R-squared     =  0.6533
-------------+------------------------------           Adj R-squared =  0.5850
       Total |  .001774636    27  .000065727           Root MSE      =  .00636

------------------------------------------------------------------------------
d1lnpercap~s |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
d1lnsugarp~g |  -.0956414   .0121777    -3.75   0.001    -.070775    -.0205078
d2lngdpper~u |   .7563961   .0159612    -4.03   0.315    -.0493384    .0165462
pointdummy~e |  -.2151145   .0026617     3.92   0.067    -.000379     .010608
       _cons |  -.021298    .0023725    -0.98   0.000    -.0261945   -.0164014
------------------------------------------------------------------------------
```

4.4 Discussion of the results

According to the regression results, the equation for the relationship between consumerôs demand for sugar to per capita GDP and real price is therefore expressed as:

$$\ln Q_1 = -0.021298 + \ln 0.756 Y_d \ï\ \ln 0.095 P_{Q1} \ï\ 0.021298 \text{pointdummy} + u$$

The results also indicate that all the coefficients represent meaningful t- value except the intercept which is not statistically significant. These variables can explain 65.33 per cent fluctuations in sugar demand as measured by R ï squared which is the overall measure of strength of association.the price elasticity is -0.095 per cent which indicates price inelasticity and it means that changes in price make a little change in the demand for sugar; this is true to theoretical postulation that an increase in price gives rise to a decrease in the quantity demanded of a good. In this case, holding per capita GDP constant, an increase in the price of sugar by one per cent gives rise to decrease in the quantity demanded by 0.095 per cent.

On the other hand, income elasticity 0.756, which means sugar is a necessary good in the Kenyan consumersô basket and it means that a one per cent increase in Per capita GDP leads to 0.756 per cent increase in the amount of sugar consumed by Kenyan households. Per

capita GDP has been used in this study as a proxy for individual consumer income and was expected to be positively related to the amount of sugar. Economic theory states that the quantity demanded of a necessary good increases as the income of a consumer goes up. Lastly, policy interventions have been found in this study to have had negative effects on the amount of sugar consumed in Kenya.

It is therefore concluded that per capita income and price of sugar contribute to the determination of consumer demand for sugar in Kenya. The value of the R^2 proves that there are other factors other than the ones considered in this study that have an effect on the quantity of sugar demanded by Kenyan consumers. These can possibly include: International trade agreements and distortion of market mechanism through sugar smuggling from neighbouring countries. The local demand and supply of the commodity could also be affected by flooding of sugar from other countries with which Kenya has signed trade agreements.

The demand response of sugar to the two variables has considerable policy implications for a country like Kenya in respect of its sugar production, pricing, the logistics of marketing and distribution. The results conclusively establish that sugar consumers do to changes in retail prices, income and policy directions. Income elasticity is positive, meaning that sugar is a necessary good in Kenyan householdsô basket. The price elasticity is -0.095 which indicates price inelasticity and it means changes in price make a little change in demand of sugar.

CHAPTER FIVE

5.0 CONCLUSION AND POLICY RECOMMENDATIONS

5.1 Summary

The study aimed at analyzing the factors that determine consumersô demand for sugar in Kenya during the period between 1981 - 2010. In the study, demand was a function of two factors that are theoretically postulated to affect demand of any commodity, that is, own price of a commodity and the income of the consumer. In addition, policy intervention was considered to be a factor that could also affect the demand for the commodity in the country. In effect the study considered liberalization of the Kenyan market as a major structural change in the market mechanism that could have an affect the demand of sugar as a commodity. It has been found out that the demand for sugar was stable and predictable during the pre ï liberalization era as opposed to the period after prices were decontrolled in which case sugar prices became volatile and vulnerable to international market conditions.

The estimation results from this study show that the price of sugar, income of consumers and policy interventions in the sub sector have significant influence in the demand for the commodity. The coefficients of price and income were as per theoretic postulation. However, according to the study policy interventions have had a negative effect on the demand for sugar contrary to the belief that policies are meant to add value and lead to growth in any sector.

The findings arrive at as per the regression results indicate that demand for sugar in Kenya is not only affected by the conventional market fundamentals but also by other factors such as taste of the consumer, Political interference in the sector, international treaties, smuggling and hoarding of the commodity.

5.2 Conclusion

The study concluded that Kenyan consumers, like consumers in other countries consider sugar as a necessary good which is inelastic to price changes. The study findings indicate that the countryôs demand for both industrial and consumer sugar has a rising trend and has ever been more than production. This has led to persistent importation of the deficit to fill the gap which in effect interferes with the countryôs international trade balances. There is need to come up with economically viable and efficient marketing and distribution strategies so that all the sugar supplied in the market reaches all the consumers in the country.

However, it is imperative to note that the sugar demand in Kenya does not fully observe market fundamentals because of distortions in the price mechanism of the commodity. For instance, Government policy and international trade agreements play a critical role in determining the amount of sugar at the disposal for local consumers. Besides, the Kenya black market for sugar is so elaborate due to porous borders. However, the analysis suggests that the price of sugar and the income of the consumers play a major role in determining the quantity of the commodity that the consumers demand.

5.3 Policy recommendations

This study, though limited in scope, can indicate the magnitude and direction of pursuing some policy measures. It establishes the importance of the price of sugar in influencing its consumption. Price on the other hand is determined by among other things: i) the extent of domestic production and marketing and distribution along with their related costs; ii) the price of the commodity in the international market and the consequent import/ export policies to be adopted by Kenya consistent with its international obligation; and iii) the price structure formulated by the government from time to time.

Government should therefore formulate policies that would realign the sugar sub sector to respond to market forces especially after the liberalization of the market. All the sugar that is imported into the country should be accounted for to avoid over or under supply of the commodity that leads to distortion of the prices. The domestic production of sugar should also be expanded so as to minimize the imbalance in the commodityôs international trade.

It is hypothesized that one of the reasons for both the low cane productivity and the high cost of producing sugar in Kenya is the use of inefficient production methods at every step of the production chain- farm and factory. Clearly, the sugar industry in Kenya must develop and embrace modern and efficient production technologies if its production costs have to come down and its productivity increase to the level where its sugar can compete favourably with those from neighbouring states.

In order to realize the goals of self sufficiency in sugar and produce surplus for exports, new sugar factories have to be established and the capacities of some of the existing ones expanded. The sugar industry should undertake product diversification in order to become more competitive through power co-generation and production of alcohol, animal feeds, yeast, confectionaries and pharmaceutical drugs. In order to protect the industry against the dumping of cheap sugar, Kenya should apply the safeguard measures under the WTO articles agreement on safeguards.

The country should also find ways of taking advantage of preferential trade arrangements with minimal negative consequences. It should also encourage and finance research and other activities with common benefit of increasing the competitiveness of the locally produced sugar. Lastly, the government should identify practices that facilitate equitable, sustainable

privatization, and determining the relationship between sugar market reforms and markets in land, credit and other inputs.

5.4 Limitations of the study

The main weakness of the study is that it did not include several other factors that might influence demand for sugar in Kenya. For instance, taste and preference, different age groups of consumers and availability of a complementary or supplementary good. Due to the limited scope of the study, important explanatory variables might have been left out; this situation can lead to biased results.

5.5 Areas for further research

In view of the above limitation, it is suggested that a study be carried out that considers all the determinants that might influence the demand for sugar. Demographic factors such as the size of the household, education of the household head, age of the household members have been found in other studies to behaving an influence in the demand for household commodities.

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APENDIX I: Per capita demand for Sugar, Real Price of Sugar and GDP Per Capita, 1981 - 2010

Year	Per capita demand for Sugar (Kgs.)	Per capita GDP (Kshs.)	Real price of sugar (Kshs./ kg)
1981	19.1	3669	5.75
1982	18.69	4000	5.75
1983	18.25	4363	6.30
1984	17.9	4711	6.90
1985	17.2	5127	7.20
1986	16.8	5760	7.55
1987	16.5	6204	8.15
1988	16.2	6772	8.40
1989	15.7	7518	9.70
1990	15.4	8378	13.65
1991	15.2	9252	16.70
1992	14.9	10562	25.55
1993	14.6	12911	34.40
1994	14.3	15042	43.00
1995	13.9	16969	46.00
1996	13.6	14409	45.00
1997	13.5	26614	40.50
1998	13.2	28645	45.00
1999	12.9	29756	42.50
2000	12.6	30936	55.50
2001	12.5	31757	53.80
2002	12.5	31734	44.94
2003	12.3	33380	46.90
2004	12.1	36582	51.63
2005	11.8	39651	64.80
2006	11.5	44142	64.40
2007	11.2	48566	71.22
2008	11.1	54353	69.35
2009	10.8	59435	89.35
2010	10.5	62424	97.43

Appendix ll: Production, Consumption, Imports and Exports of Sugar (in metric tonnes), 1981 – 2010

Year	Production	Consumption	Imports	Exports
1981	368,970	324,054	0	69,054
1982	308,019	328,236	0	18,200
1983	326,329	332,973	0	3,880
1984	372,114	3486,78	4,000	4,001
1985	345,641	373,980	33,000	0
1986	365,796	381,394	142,500	0
1987	413,248	400,700	115,00	0
1988	411,296	462,207	42,000	0
1989	441,261	489,544	80,000	0
1990	431,836	537,999	64,050	0
1991	433,713	493,967	21,288	0
1992	371,225	552,000	124,463	0
1993	381,211	560,000	0	0
1994	303,292	560,000	174,049	0
1995	384,171	560,000	24,440	17,220
1996	389,138	570,000	65,816	24,478
1997	401,610	580,000	52,372	25,050
1998	449,132	587,134	186,516	0
1999	470,788	609,428	57,701	0
2000	401,984	632,100	118,011	2,088
2001	377,438	644,495	249,336	3,600
2002	494,249	680,490	129,966	12,040
2003	448,489	691,563	182,225	11,300
2004	516,803	669,914	164,020	11,580
2005	488,997	695,622	167,235	21,760
2006	475,670	718,396	166,280	13,533
2007	520,404	741,190	230,011	20,842
2008	517,667	751,523	218,607	44,332
2009	548,207	762,027	184,531	1,952
2010	523,652	772,731	258,578	47