

DETERMINANTS OF SUGAR DEMAND IN KENYA

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DECLARATION

This research project paper is my original work and has not been presented for any partial fulfilment of the award of degree in any other university

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This research project is submitted to the School of Economics as a partial fulfilment for the award of Master of Arts Degree in Economics, The University of Nairobi, with my approval as the University Research Supervisor.

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LIST OF ABBREVIATIONS

AFFA	Agriculture and Food Authority
ASAL	Arid and Semi-Arid (ASAL)
COMESA	Common Market for East and Southern Africa
EACCMA	East African Community Customs Management Act
KALRO	Kenya Agricultural Research Organization
KNBS	Kenya National Bureau of Statistics
KSD	Kenya Sugar Directorate
WTO	World Trade Organization

ABSTRACT

This study examines the factors affecting the aggregate demand for sugar in Kenya using time series data dating from 1981 to 2018. The specific objectives of this study are: firstly, analyze the factors influencing the demand for sugar in Kenya, secondly, estimate the income and price elasticity of demand for sugar in Kenya, and lastly draw policy implications from the findings of the study. The study used multiple linear regression analysis methodologies in which the Vector Error Correction Model (VECM) was employed. The VECM revealed that the aggregate demand for sugar in Kenya has a long-run positive relationship with the independent determinants (aggregate demand for sugar in Kenya) variables at a 1 % level of significance. The R-squared for the model is 0.7515 and is significant at the 1% level of significance. The price of sugar and quantity of sugar produced locally also has a long negative relationship with the aggregate demand for sugar at a 1 % significance level. The findings demonstrate that the own-price elasticity of sugar is -0.031 and the income elasticity is 0.453, implying that sugar is both price and income inelastic. The inelasticity of the price of sugar and income is an indication that sugar is an essential commodity in Kenyan households and the economy in general. The study established an aggregate demand for sugar that outstrips the local production of sugar. The local supply of sugar is hindered by the use of outdated milling machines in factories and demotivated farmers who shift from sugar cane farming to other crops because they are untimely remunerated for cane delivered to the factories. The study proposes the implementation of appropriate policy measures that will rejuvenate the local production of sugar for the shortage caused by rising aggregate demand to be bridged consistently and reliably.

CHAPTER ONE: INTRODUCTION

1.1 Background

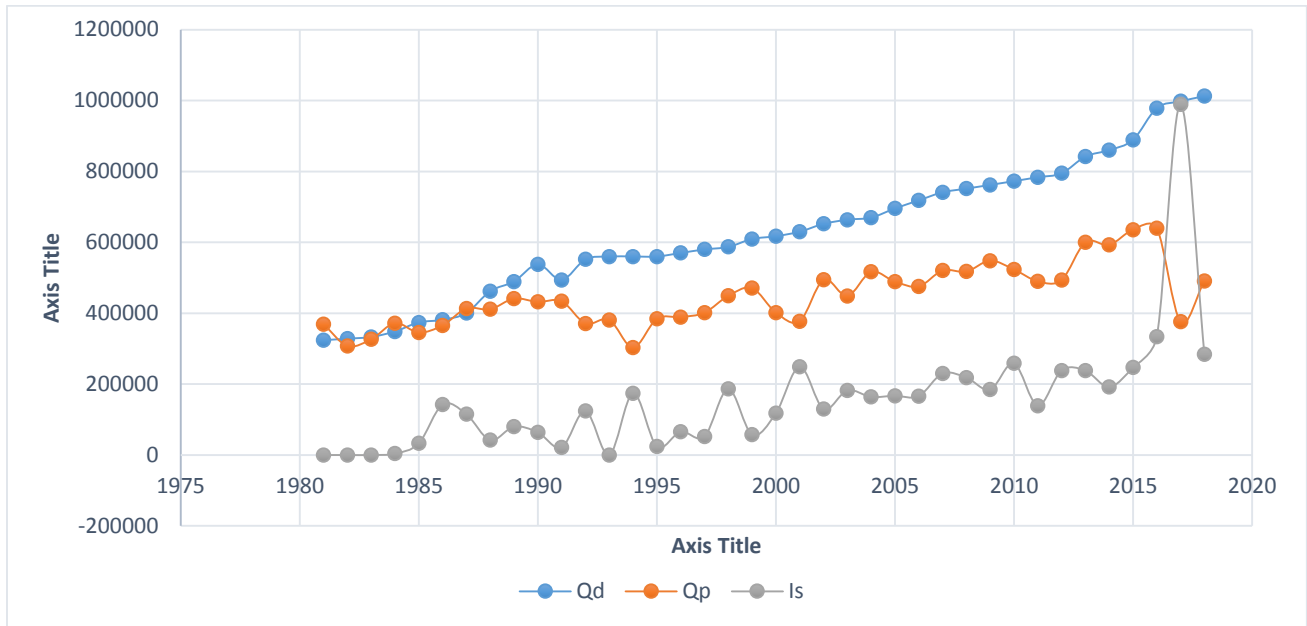
The sugarcane industry is an integral player in the Kenyan economy. The sugarcane industry contributes 15% to the Agricultural Domestic Product (AgGDP) in Kenya (KSD,2019). The annual demand for sugar in Kenya as of 2018 was estimated to be 1,012,399 metric tons while the production was at 491,097 metric tons and the 51.49 % discrepancy arises due to the inefficiencies in sugar production in the country (Kenya Sugar Directorate, 2019). The inefficiencies in the sugar sector often emanate from the challenges facing the factories' management and farmers. The challenges include; accidental fires that cause considerable losses to the farmers and factories, frequent and uncontrolled import of cheap sugar from foreign countries like Brazil and Uganda, and the frequent delays in harvesting that lead to the decline of tonnage thereby leading to a reduction in the income of the peasant farmers. The companies that were once flourishing such as Ramisi and Miwani have closed down, leading to unemployment and deprivation of income for the farmers. The factories use outdated milling technology that has made production decline. As a result, they cannot meet the requirements of the ever-increasing local demand for sugar in the country. Even though the sugarcane industry has been going through economic turmoil, it still employs nearly 250,000 small-scale farmers directly and over 6 million Kenyans indirectly (Kenya Sugar Directorate, 2014). The challenges facing the sugar industry have had visible economic impacts such as the decline in productivity and the loss of jobs since 1999. The sugar industry employs many people in Western Kenya's sugar belt region. It is estimated that the sugar sector contributes over 15 % of the yearly agricultural products. It is, however, evident that it is an industry that is experiencing a host of political, social and economic challenges that have led to most of its viable factories like Sony Sugar Company, Mumias Sugar Company, Nzoia Sugar Company, and many others to stall or not operate at the expected full capacity that would lead to the achievement of self-sufficiency.

The import of sugar in Kenya has continued to skyrocket because of the vested interests of politicians who exploit loopholes in the law to the detriment of farmers. According to the Kenya Sugar Directorate (2019), the importation of sugar increased by 130 per cent in the first four months of the year 2019 as compared to the imports that were registered in the same period in

2018 (see Fig.1). The main reason behind the increase in the importation of cheap foreign sugar is the glaring reduction in the production of sugar by the local companies. The KSD (2019) indicates that there was an increase in sugar imports between January and March 2019 which amounted to 113,516 tons, a figure that is far much higher than the 49,445 tons that were imported in the same period in the year 2018 (KSD, 2018). The rise in imports of sugar, given the existing local production, is a signal that the demand for sugar in Kenya is experiencing an upward trajectory. The escalation of import of cheap sugar hurts the local sugar production in Kenya as the sugar deficit is often readily filled by foreign sugar which seems to be a more comfortable option instead of an increase in productivity and efficiency of the local sugar industries. The increase in sugar demand in Kenya results from the diverse range of uses of sugar which are outlined as follows: sugar is an essential ingredient in the manufacture of various confectionaries, e.g. bread and biscuits. It is consumed as a sweetener in numerous types of foods and beverages; sugar is equally utilized as a significant raw material in the manufacture of industrial alcohol, for example, ethanol; sugar is also used as a preservative for jellies and jams and sugar provides colour and flavour in food ingredients when cooked.

The graph in Fig.1 illustrates the sugar consumption and production trend in Kenya for the last three decades. The graph reveals that sugar demand has always exceeded its local production. The sugar deficit resulting from insufficient local production given the high demand has always been bridged by sugar importation from the COMESA member countries and the rest of the world (Republic, 2018).

Figure 1: Graph of Local Sugar consumption and Production for the period 1981 to 2018



Source: **Kenya Sugar Directorate Data (2019)**

1.1.1 An Overview of History of Sugar Industry in Kenya

The demand for sugar in Kenya has partly been met by the supply from the local sugar industries that have a long history dating back to 1922. The performance, productivity, and efficiency of the local sugar industries is paramount when it comes to meeting the ever-increasing demand. The production of sugar was started in Nyanza's Kibos area, where the Miwani Sugar Mills was constructed and initiated its operations in the year 1922 (AFFA, 2018). The building of the company which is located in the Miwani in the current Kisumu County was a clear sign that the demand for sugar was a major issue in the country and it needed a sustainable and secure industry that would catapult the economic development of the country to greater heights. In 1927, the Associated Sugar Company Limited built the subsequent sugar factory in Ramisi in the current Kwale County which is in former Coast Province. Ramisi sugar factory was operated by the Madhvani Group International, a company based in India. The two initial firms were operated by Asians who introduced sugar cane farming in Kenya in the colonial era.

The Kenyan State took an interest in the sugar industry because of its strategic value towards economic growth. The post-colonial government engaged vigorously in the sugar industry to meet the rising demand through consistent as well as reliable supply. The aspect of achieving self-sufficiency in the sugar production in the country was a primary strategic option that would lead to the satisfaction of the local demand and need to export locally manufactured sugar to earn foreign exchange and subsequently reduce the trade imbalance. It was, therefore, against this backdrop of information that the policy documents such as the Sessional Paper No.10 of 1965 were formed to articulate the need for self-sufficiency in Kenya furthermore the sugar industry was given keen attention through investment and setting up of new factories.

1.1.2 Kenya Agricultural Policy and Sugar Production

The government of Kenya grasps the reality that the sugar subsector contributes to the forward and backward linkages to the economy (Vision 2030: The Third Second Term Plan 2013-2017). It is evidenced by the subsector's provision of raw materials to the manufacturing industries and the employment opportunities for the citizens. The strategic significance of the sugar subsector has led to numerous policy formulation and implementations that are aimed at improving the production and export while at the same time setting limitations or caps on the amount of sugar that is imported from the COMESA member countries.

The government policymakers recognize that the entire agricultural sector creates employment opportunities, earn the country foreign exchange via exports, and ensures that food security is achieved. The Vision 2030 policy framework, under the second Medium Term Plan (2013-2017) stipulates the significant policies that forecast the achievement of the transformation of the agricultural sector from the current subsistence farming to a fully-fledged commercial production via value addition. The Vision 2030 policy document gives priority to environmental protection through the restoration of forest lands and major water catchment areas as a foundation for revitalizing sustainable agricultural production in Kenya.

The strategic plans are intended to address the desire for the country to gain complete departure from over-reliance on rain-fed agricultural production to the incorporation of irrigation that will grant continual bountiful harvests in all seasons. The Vision 2030 blueprint in the same fashion

appreciates the critical role played by the private sector as a stimulant for invigorated agricultural growth. There are concerted efforts by the government to avail a conducive and enabling business environment for private investors, both local and foreign. The ease of doing business in the country is continuously worked on through the digitization of government services to facilitate service delivery and eliminate corruption which thrived previously.

Six vital goals are being fast-tracked by government The Ministry of Agriculture and Irrigation has identified six thematic areas that will fast-track the boosting of agricultural sector activities which are; the enactment of Consolidated Agricultural Bill which gave life to the Kenya Agricultural Research Organization (KALRO) and Agriculture, Fisheries and Food Authority, reduction and subsidizing the cost of fertilizers for farmers, creating livestock Disease Free Zones in the arid and semi-arid (ASAL) Regions, streamlining the land registry for faster solutions for land disputes to be realized because these squabbles and protracted court battles often derail agricultural activities and by extension, the overall performance of farmers to decline. The penultimate thematic goal is to install a Land Use Master Plan, which will ensure that community lands are protected and utilized appropriately for posterity purposes. Finally, the sixth strategy is the implementation of the Arid and Semi-Arid (ASAL) development projects that will see 600,000-1000,000 hectares of land being irrigated in the pioneering areas (Vision 2030: The Second Medium Term Plan 2013-2017).

The government is improving sugarcane production by addressing the challenges facing it daily. Sugarcane farmers have endured insurmountable risks from unpredictable climate, unreliable rainfall, pests, and frequent arsons on sugar plantations due to unhealthy competition or protracted land disputes. The delayed payments for deliveries of sugarcane to the financially broke and poorly managed companies dates back to the year 2014, and this situation has compounded the problems faced by the peasant sugarcane farmers. The government has shown intention made efforts to save the millers such as Sony Sugar, Mumias, Muhoroni, Miwani, Chemilil, and Nzoia Sugar companies that collectively owe farmers Kshs 2.7 billion in non-payment of delivered sugar (Kenya Sugar Directorate, 2018). The timely payment of sugarcane farmers is at the core of the undertaking by the government to salvage the industry that is on the brink of collapse.

The government aims at reducing the cost of fertilizer for farmers via bulk purchase and blending. The government signed a strategic partnership deal with Toyota Tsusho Corporation that would yield low-cost fertilizer through bulk purchase as well as blending and this had been enabled under the auspices of Public-Private Partnership (Republic of Kenya Vision 2030: The Third Medium Term Plan 2018-2022). The sugarcane production will gain from this partnership via the fertilizer cost reduction strategy. The fertilizer cost reduction and provision of subsidies to cane farmers are anchored in the Big Four Agenda's fourth pillar, which is *Food Security*. The government is also partnering with private insurance companies with the primary goal of educating sugarcane farmers on the significance of insurance policies on the future of sugar farming.

1.1.3 Kenya Trade Policy and Sugar Trade

The Kenyan economy began to liberalize in the year 1980s moreover was revamped in the 1990s. The liberalization of the economy brought with it immense challenges to the sugar trade and has led to the near-collapse of the infant sugar industries. Since Kenya entered into the multilateral trade agreements such as COMESA, EAC Common Market, and the World Trade Organization, there has been an influx of cheap sugar import into the country. The sugar imported is occasionally zero-rated or has a negligible tariff imposed, a situation that has hurt the local sugar industry as it cannot compete fairly because the cost of local production is high. The high cost does not allow the local sugar price to be at the level prevailing for the imported cheap sugar. Kenya has tried to restrict sugar import through tariff and non-tariff measures to protect its local sugar farmers and factories. In the COMESA, Kenya has been invoking the Article 61 Safeguard Clause that has protected it from low-priced sugar import from the 19 member countries for the last ten years. The application of the COMESA Treaty Safeguard is stipulated in Article 61. The article states that the member country should notify the Secretary-General and the rest of the Member states of its intention to invoke the *Safeguard Clause*¹. The member state must provide sufficient proof that justifies the application for the safeguard, which then evaluated by the Council. Upon determination that it is non-discriminatory and is not ill-intentioned to hurt the other member countries, the Council grants the safeguard for one year. The one year is often reviewed, upon

¹*Safeguards* are restrictions on import of certain specified commodities into a country in the interim to offer protection for domestic industries from upsurge in imports which often threatens the growth of domestic factories that produce the same product (Hartigan, 2011)

application, if the country views the initial one year granted to be insufficient and has not achieved its objective. Kenya has successfully sought renewal of the safeguard for the last ten years, and the most recent one was a two-year extension ending in the year 2020.

The Common Market for Eastern and Southern Africa has been instrumental in the bridging of the gap that exists between the supply and demand for sugar in Kenya. As the consumption of sugar increases, while local production plummets, there is a consistent increase of sugar import from COMESA countries due to the steep import tariff from the non-COMESA countries (Tumwebaze, & Ijjo, 2015). It is, however, essential to note that Kenya has been applying for the extension of sugar import safeguards to protect the local industries that seem to be failing due to the increase in the importation of cheap sugar. The table below shows the sugar production, import, and export trend in Kenya. It can be observed that the sugar export has been ranging from 434 metric tons in the year 2012 to 1966 metric tons in the year 2018. The export figures demonstrate that the local production of sugar is insufficient, leading to Kenya losing foreign exchange earnings running in billions due to the mismanagement and use of outdated sugar mills. Table one demonstrates that the sufficiency was high 71.98 % in the year 2015, which had an import dependency ratio of 28.01% (Kenya Sugar Directorate, 2018). The self-sufficiency declines to 63.50 % in 2018, with a sugar import dependency ratio of 36.74%. Sugar is categorized under sensitive products in the East African Common Tariff. The East African Community imposes an import tariff of 25% subject to a quota limit of 70,000 metric tonnes (EAC Gazette Notice No. 8, June 30 2018). The 25% import tariff rate and the quota limit are aimed at protecting the local industries within the EAC member states (East African Community, 2017). The tariff imposed is meant to provide ample time and a conducive business environment in which the local sugar millers can achieve maximum sugar production for local consumption and export.

Table 1: Sugar production and trade statistics (2012-2018).

Year	2012	2013	2014	2015	2016	2017	2018
Production	493937	600179	592668	635677	639741	376111	491097
Import of Sugar	238589	238046	192121	247389	334109	989619	284169
Export of Sugar	434	104	356	54	98	406	1966
Self-Sufficiency Ratio (%)	67.46	71.61	75.55	71.98	65.69	27.54	63.50
Import dependency ratio (%)	32.59	28.40	24.49	28.01	34.31	72.48	36.74

Source: **Kenya Sugar Directorate Statistics data (2012-2018)**

1.2 Statement of the Problem

Consumption of sugar has been consistently outstripping the local production in the last two decades (KSB, 2018). In the year 2018, the annual consumption of sugar was estimated to be 101, 2399 metric tons, while the local production was 491097 metric tons (Kenya Directorate, 2019). The balance of the sugar deficit emanating from the inadequate local sugar production had to be supplemented by the import of 521,302 metric tons of sugar. The increase in demand for sugar results from the determinants of the demand for sugar which include a change in the population, emergence of new firms that manufacture sugar-sweetened beverages, lack of close perfect or close substitute of sugar in the Kenyan economy and the changing GDP per capita. The increase in the factors and fluctuations in inflation directly influence the demand for sugar in Kenya.

The purchasing power of the consumers of sugar has continued to increase. Thus the firms and the government need to continuously watch for the growth trajectory of the determinants of demand for sugar for the pursuit of self-sufficiency in the local sugar production front be realized. It is evident from the empirical data as revealed by the Kenya Sugar Directorate that from the year 1981 to 2018, the consumption of sugar and its local production has been on the rise. The demand for sugar has always exceeded the local sugar production in Kenya (KNBS, 2019). Proper understanding of the determinants of demand for sugar would help policymakers in the sugar production sector to have an accurate forecast of the sugar market. Sugar is also an essential ingredient for beverages in Kenyan households, and it lacks a close substitute, hence making it a critical commodity in the Kenyan household basket. The study will, therefore, contribute to the

literature on demand for sugar and providing a proper understanding of how the gap between consumption and production can be bridged in the foreseeable future.

1.3 Research Questions

The study tries to address the following questions:

- i. What factors influence the demand for sugar in Kenya?
- ii. What are the levels of income and price elasticity of demand for sugar in Kenya?

1.4 Objectives of the Study

The general objective of the study is to determine the factors that influence the demand for sugar in Kenya. The paper will specifically aim to:

- i. Analyze the factors influencing the demand for sugar in Kenya.
- ii. Estimate the income and price elasticity of demand for sugar in Kenya.
- iii. Draw policy implications from the findings of the study.

1.5 Significance of the Study

The information on the nature of the demand for food in any country, like Kenya, is crucial for the government because it offers the right and actionable knowledge and data for combating existing and emerging policy issues hindering sustainable food production. Policymakers will find the findings of this study useful as it will inform their decisions with regards to employment, income, and nutritional quality value required by individual households. The results of the research work can also be applied in the process of identification of the befitting subsidy programs that would lead to the resuscitation of the sugar industry so that the local production sustainably increase for posterity purposes. Lastly, researchers in macroeconomic policy analysis will find the results of this study to be significant in improving the sugar sector.

1.6 Organization of the Study

The remaining parts of the study will be arranged in the following patterns: Chapter 2 contains the theoretical literature, empirical literature, and overview of the literature. Chapter 3 expounds on the methodology and procedures relevant to empirical analysis.

CHAPTER TWO: LITERATURE REVIEW

2.0 Literature Review

This chapter is divided into two segments: the theoretical and empirical literature review. The theoretical literature review gives an outline of the theoretical bedrock upon which the research is anchored. The empirical literature, on the other hand, furnishes an outline of similar or related past studies on the research topic. The chapter equally administers a critical overview of the literature reviewed.

2.1 Theoretical Literature

The demand and supply of goods and services are crucial macroeconomic variables. Demand has a direct impact on the supply of goods through the price mechanism. A high level of demand for a product would increase the price of the commodity; hence the supply is expected to increase. The consumers often show interest in purchasing goods and services and, in some instances, deplete the available supply, which portends an increase in demand.

2.1.1 Theory of Demand

John Locke is one of the earliest economists to have written extensively on the theory of demand (Locke, 1993). The work explained demand and supply theory from the perspective of fluctuations in interest rates in the mid-17th Century England. It argued that when banks lowered interest rates, the demand for loans increased, and vice versa. The book published demonstrated that the price of any commodity tends to rise or fall by the proportion of the number of buyers and sellers (Locke, 1691). The increase in the loan uptake led to the improved purchasing power of consumers, thereby resulting in more products being purchased.

James Steuart is credited with the literature on supply and demand in which he focused on their impact on labourers (Steuart, 1767). The literature displayed that when the supply of products in the market exceeded their demand, prices were substantially reduced, thereby leading to a decline in the profits accrued by the merchant.

According to Smith (1767), the *invisible hand*, which is an unseen market force that assists the demand and supply of products in a free market to attain equilibrium naturally, guides the economy. He explained that suppliers provide products that meet the needs and wants of the consumers.

Three unique axioms elucidate the neoclassical theory of consumer demand (Fishburn, 1988). The first axiom is that a product in the market is categorized under a weaker order which implies that consumers are indifferent. The second axiom states that the ordering of any two goods is mutually exclusive of the other products available in the market. Lastly, all preferences are considered to be continuous.

The demand theory provides the relationship that exists between the demand for commodities and their prevailing prices in an economy. The demand for the products directly impacts the price formation in the market, and this is elaborated by the demand theory (Friedman, 1957). The demand for sugar, in this case, is the quantity of sugar bought by consumers at a specific place and a particular period and a given set of prices. The demand theory postulates that the quantity demanded of a product is affected by its price, the level of income of the consumers, and the price of a close substitute.

Consumers demand goods such as food, clothing, and shelter to satisfy their needs. They assign price value to the products that they purchase (Deaton & Muellbeuer, 1980). The degree of satisfaction that is derived from the consumption of any good is referred to as a utility. The number of goods demanded at a specific price show the level of utility that is acquired by the consumers. Utility tends to differ from one consumer to the other.

The consumer demand for commodities is affected by their tastes and preferences. Tastes and preferences exhibited by a consumer can only be observed in the choices that they make when purchasing goods and services in the market. They refer to the conscious decisions made by consumers to purchase particular goods over others (Annunziata, & Scarpato, 2014). Consumer tastes and preferences tend to change over time which leads to an increase or decline in the demand for the good depending on the direction that their perception takes.

2.1.2 Population Growth and Food Production

In the book entitled: Principle of Population, as it affects the Improvement of Society, Malthus (1978) enunciates that the pressure of rising population on food production would impair perfection and the result would be inevitable misery on earth. The book demonstrates that the fundamental trait of man's desire to maintain life is seen in the need for food and the passion that exists between the sexes. Malthus, therefore, opined that population increases in geometric progression and food production grows in an arithmetic manner. The implication is that food population size tends to surpass food supply.

The population growth and food production ideas put forward by Malthus have their weaknesses as can be deduced from his critics like Karl Marx. He pointed out that widespread poverty and misery of the working-class population cannot be entirely attributed to the eternal law of nature (Petersen, 1988). When the society is well organized, and resources are allocated at a near-optimal level, sustainable food production is achieved, and the ever-increasing population will have enough provision.

Population growth is a significant factor that alters the demand for food. High population growth rates within a country dictate that new innovative means of food production be realized through government investment in agricultural research financing. The government can also collaborate with developed countries to enable the outsourcing of new and efficient technical knowledge transfer in the agricultural sector.

2.2 Empirical literature review

Soleimany & Babakhani (2012) approximated the demand for sugar by Iranian households using the time series data of 1984-2008. They used linear regression and OLS technique. The outcome of the study indicated income elasticity of 0.8, which is below unity, thereby confirming that sugar is a necessary good in Iranian households. The price elasticity was -0.2 pointing out to the reality that sugar demand is inelastic. The research concluded that household expenditure, the relative price of sugar, and family size are the major factors influencing the demand for sugar.

Gemmil (1980) carried out a study on sugar demand and utilized time series data collected from 73 countries from 1950 through 1979. A dummy variable was applied for the right estimate to be deduced. The result of the study revealed that economic elements had direct and measurable impacts on the demand for sugar. The research also highlighted that social factors bore minimum influence on sugar demand. It concluded that price had a reverse effect on the quantity demand for sugar, while income had a direct impact on it. The analysis of elasticity demonstrated that the demand for sugar is inelastic in both price and income.

Hamulczuk & Szajner (2015) conducted an empirical examination of the sugar prices in Poland and established its determinants. The research utilized monthly prices of sugar in Poland, the European Union, and the rest of the world. The data collected was time series of 2000-2014, and it was used to gauge the correctness of the hypothesis. The result indicated that sugar production and its set of retail prices in Poland and Europe, in general, are influenced by the existing market regulation policies. It was also determined that the retail and selling prices of sugar are closely related and are nonlinear. The research is significant mainly because it gives information on the need for reforms in the sugar pricing strategies that would lead to supply and industrial use patterns.

Sugar demand is dichotomized into non-industrial and industrial demand in the United States of America. An investigation of the United States of American non-industrial sugar demand found out that income has no tangible impact on the demand for sugar. At the same time, the price elasticity proved to be inelastic at -0.16 (Lopez and Jorge, 1985). The imprint of substitute for sugar on its demand was tested in the research by Lopez and Jorge (1985) through the introduction of the High-fructose corn syrup, and the results showed that there is a negative relationship because of the demand for sugar declined as the demand for the HFCS increased. The nature of the behaviour of consumers was therefore revealed because a reduction in the price of HFCS while keeping the price sugar constant, would lead to an increase in the demand for HFCS.

A case study of food demand in India offers a reliable view of the structural deviation in the dietary systems of the citizens. The households have noticeable diversification in their dietary arrangement as revealed by the empirical study on data from the Indian Bureau of Statistics. Devi & Purnomosidi (2011) used the two-stage Quadratic Almost Ideal Demand System (QUAIDS)

econometric model that found out that the income elasticities tend to differ among the diverse range of income cadres- the lower-income earners, the middle-income earners, and the highest income earners. The analysis displayed income elasticity to be less than unity in rice, wheat, and sugar, among other cereal groups. The research also revealed that an upsurge in food price inflation does not reflect the visible impact on the demand for sugar and other food items that are categorized under the lower-income classes. The paper, however, concluded that sustained price inflation would result in the destabilization of the diversification of the food patterns thereby leading to the reversion to cereal products especially by the lower-income groups because of the strict budget constraint. Inflation, therefore, is a crucial factor in the demand for sugar and other food products if it is unabated for a protracted period.

According to Svatoš *et al.* (2013), sugar is mostly produced in Latin America, North America, and Southeast Asia from where the surplus is exported to the rest of the world. The study confirms that Southeast Asia, Europe, North America, and Latin America are the major largescale producers of sugar. The few companies that are located in these countries control the world market for sugar. The prices of sugar in the emerging African markets are directly impacted by sugar imported from the mentioned countries because they are cheaply produced with advanced milling and processing machines.

The population is a critical factor that has a direct impact on the demand for goods and services. The higher the population, the higher the demand pressure on the available products in the market. The world population growth rate exceeds food production and thereby leading to calls for sustainable and efficient ways of feeding the population, especially through innovation and scientific research. The population of the world is projected to be 9 billion by the year 2050 from the 7.5 billion people, which was recorded in 2018 (Fukase & Martin, 2017). The income person keeps on hiking resulting in an increased consumer purchasing power, thus leading to demand pressure for the available scarce food products. The level of gross national income (GNI) is expected to increase faster in developing countries than in the developed ones under the concept of income convergence. The population growth and gross national income have a direct link with the demand for sugar in Kenya.

Weliwita *et al.* (2002) adopted the linearized Almost Ideal system to investigate the characteristics of demand for food in Tanzania. In using the household survey data considering a sample of 12 groups of food, the results found that food items such as sugar, fruits, rice, maize, and other cereals are price inelastic. It was, however, noted that a majority of the food groups are income elastic. The results present that the salient sugar demand influencers are the household size and income.

The import of goods into a country has a negative impact on prices and subsequently increases demand. The empirical results of research by Lopez & Sepulveda (1985) on demand for sugar in the United States of America demonstrates that import restrictions are necessary to maintain the prevailing prices in the market. The study also indicates that imports of sweeteners and close substitutes of sugar downward pressure on sugar demand and the opposite is true where excess import of sugar tend to increase local demand for sugar by reducing its price. The researchers also found that the own-price elasticity of sugar was -0.15 to -0.04 , meaning that sugar is own-price inelastic.

In the paper, a study of factors affecting demand and supply of sugar in Indonesia, Rustan (2009) investigated the determinants of supply and demand and price elasticity for Sugar in Indonesia. Time series data of 1990-2006 extracted from the Indonesian Central Statistics Bureau and other institutions such as World Sugar Statistics and the Indonesian Sugar Firm Research were used in the research work. Two-Step Least Square Method and Double Logarithm Multiple Regression econometric models were found to be very instrumental in the analysis of the data. The results revealed that the main factors that had a significant impact on sugar demand and supply were the level of income of the consumers and the prevailing price of coffee which was considered as a complementary commodity for sugar. The study was conclusive that the demand for sugar was price inelastic. The range of elasticity was found to be -0.2159 to 0.8959 . It is a clear manifestation that the demand for sugar is inelastic for price and elastic for income.

2.3 Literature Overview

The literature review section contains essential information on the factors affecting the demand for sugar. Numerous researchers have delved into investigating the factors determining the demand for sugar, such as income, price, and family size. The models that have been extensively used by the authors are the linear regression, OLS technique, Two-Step Least Square Method, and Double

Logarithm Multiple Regression. The models offer the flexibility and accuracy that is required when one is applying the demand theory in analyzing the determinants of demand. The majority of the outcome of the research works indicate that the demand for sugar is relatively inelastic for income and price.

Few studies have been conducted in Kenya that have considered the relevance of income, price, and household size as the determinants of sugar. This research will try to bridge the existing gap in the research by including inflation and population

CHAPTER TWO: METHODOLOGY

3.1 Introduction

Numerous econometric methods can be used to figure out the nature of the demand for sugar in any economy or country. This chapter is partitioned into three major segments; the theoretical framework, which annotates the theoretical understructure upon which the study is anchored; the analytical framework, which is the root of the model's derivation and; the mechanism of data collection and the adopted methods for the analysis of the research.

3.2 Theoretical Framework

The demand for sugar in Kenya is quite intricate because of its numerous purposes. Sugar is generally demanded because it has nutritional significance in the manufacturing sector and household consumer as a sweetener for beverages and other delicacies. The consumer behavioural theory is the cardinal framework upon which the econometric model for the demand for sugar and its determinants can be uniquely established. The respective demand functions are generated from the assumptions all consumers are rational and always endeavour to maximize utility subject to their budget constraints. Since this study is based on the national demand for sugar (macro-level) and not the household level, it is appropriate that the conceptual structure is grounded on the aggregate demand for purposes of ease of analysis of the prevailing determinants for the product in focus.

The aggregate demand evaluation is generated based on the inference of elementary linear budget constraint outlined below:

$$Q_d = A(P_t^e)^{\beta_0} \sum_{i=1}^n X_{it}^{\beta_i} e^{\varepsilon_t} \dots\dots\dots (i)$$

Q_d represents the quantity demanded of the product.

P_t^e represents the price of the product.

X_{it} represents the explanatory variables in the period under study.

ε_t is the disturbance term

$A, \beta_0, \beta_1, \dots, \beta_n$ are parameters in the model

The Cobb Douglas economic model for demand represented in the equation (i) above can be rewritten in a linear form as follows:

$$\ln Q_d = \alpha + \beta_0 \ln P_t^e + \sum_{i=1}^n X_{it} + \varepsilon_t \dots\dots\dots (ii)$$

$$\alpha = \ln A$$

The other factors that influence the demand for goods like tastes and preferences, weather and climatic conditions and advertisement effects, among others are assumed to be constant for ease of analysis.

3.2.1 Empirical Model

The empirical model is developed from the demand theoretical framework. The study captures the variety of factors that influence the overall aggregate demand for sugar in Kenya.

3.2.2 Model Specification

The model that is applied for the study borrows heavily from Sessu (2016) because the multiple linear regression model allows for better analysis of numerous independent variables that explain the changes in the dependent variable. The model that postulates that the aggregate demand for sugar is a function of its current year price, the previous price year price, the total population, the level of inflation, the amount of export and import of sugar, and the gross domestic product will be used in this study. Natural logarithm will be employed to bring about the desired linearity in the parameters. The empirical model is designated as follows:

$$\ln Q_d = \alpha_0 + \alpha_2 \ln P_t + \alpha_3 \ln X_s + \alpha_4 \ln I_s + \alpha_5 \ln P_{opr} + \alpha_6 \ln Gdp + \alpha_7 \ln Inf + \varepsilon_t$$

Where

Q_d is the quantity demanded of sugar,

Q_p is the quantity produced of sugar,

P_t is the current year price of sugar,

P_{t-1} is the previous year price of sugar,

I_s is the sugar import and X_s is the sugar export,

GDP_{pc} is the GDP per capita,

Popr is annual population growth Rate

I_{nf} represents inflation.

3.2.3 Measurement of elasticity

The OLS multiple linear regression applied in this study is a log-log model where the individual raw variables are transformed into their natural log forms. The coefficients of the independent variables are used to assess their impact on the dependent variables. The coefficients exhibited in the log-log model serve as the elasticity of the criterion variable with respect to the predictor variables (Soleimany & Babakhani, 2012). The elasticities of own price of sugar (Pt) and the income (GDP) will be derived from the coefficients of the respective logged variables in the results of the target equation.

3.3 Description of Variables

Table 2: Description of Variables

Variable Name	Measure	Expected Sign	Source
Dependent Variable			
Sugar Demand (Q_d)	This will be measured by the total sugar consumed by individuals each year in metric tons.	N/A	KSD Yearbook of Statistics(2018)
Independent Variable			
Sugar production (Q_p)	Measured in metric tons and is the total sugar produced locally per year.	Positive	KSD Yearbook of Statistics(2018)
Current Year Price of Sugar (P_t)	This is the real price of sugar per year in Kshs.	Negative	KSD Yearbook of Statistics(2018)
Sugar Export (X_s)	This is the yearly export of sugar measured in metric tons.	Negative	KSD Yearbook of Statistics(2018)
Sugar Import (I_s)	This is the yearly import of sugar measured in metric tons.	Positive	KSD Yearbook of Statistics(2018)
population growth rate (Popr)	This is the annual total population growth rate.	Positive	World Bank
GDP (Gdp)	This is the annual GDP measured in KShs.	Positive	World Bank
Inflation (I_{nf})	It is the annual average inflation rate in the country measured in annual percentage (CPI)	Negative	

Author (2019)

3.4.0 Data Types and Sources

The data adopted for the study is secondary data from the KSD and the World Bank. The data from the World Bank that is in U.S. dollars will be converted to Kenyan currency using the average exchange rate. The dataset from the two sources is time-series data from 1981-2018. The entire variables of concern are accounted for, and they include; demand for sugar, GDP per capita, the real price of sugar, inflation, sugar production, import of sugar, and export of sugar.

3. 4.1 Estimation and Diagnostic Tests

The Vector Autoregressive (VAR) models will be applied as a prerequisite for carrying out the cointegration test as proposed by Granger (1978), Engle & Granger (1987), Johansen (1995) and applied by LÄutkepohl (2005). The purpose of carrying out the cointegration test is to deduce whether there is a long-run relationship between the variables. The outcome of the cointegration test would help in the selection of the Vector Error Correction model or ARDL model to be run having gauged their appropriateness. A model that has cointegration has to take into account the error correction term (Ect). If it is demonstrated that the variables in the model are integrated and co-integrated at the same time, the VECM will give the most reliable specification.

The Johansen cointegration test would be executed to find out the existence or absence of cointegration among the variables. The selection of the VECM instead of the VAR is a result of its evident advantages. The existence of the VECM in its reduced form enables all variables to link with each other even in the absence of a theoretical structure on the prevailing estimates. The examination of the integration properties of the time series will be performed before the estimation of the model. The tests carried out are stationarity tests and cointegration analysis. The OLS econometric technique will be applied to estimate the above equation (iii).

3.4.2 Stationarity Test

The macroeconomic data in a majority of developing countries are non-stationary. Non-stationarity implies that the time series dataset exhibits an unbounded behaviour and the mean keeps on fluctuating with time. It leads to the emanation of spurious regression problems, hence calling for the performance of unit root tests to test for the stationarity of each variable adopted in the study.

The unit root tests will be performed by the use of the Augmented Dickey-Fuller test, and the emerging results would be corroborated by conducting the Philip Peron test.

3.4.3 Normal Distribution Test

The verification of whether the data is symmetric and has a majority of its observations around the mean is done through the application of a normal distribution test. The research will adopt Kurtosis and Skewness coefficients to gauge if the dataset is normally distributed. The elimination of outliers will be done if the data is not found to be normally distributed. The Skewness coefficient is expected to be of the range -2 and +2 while the coefficient of Kurtosis is predicted to be in the range of -3 and +3 if the dataset is normally distributed.

3.4.4 Heteroscedasticity Test

Heteroscedasticity is exhibited in data analysis if the error terms alter across observations. The existence of heteroscedasticity changes the minimum variance, thereby leading to a void conclusion when the hypothesis testing is done. The Breusch-Pagan tests will be administered to capture the presence of heteroscedasticity. The robust standard error will be requested to fix the existence of heteroscedasticity.

3.4.5 Multicollinearity Test

The presence of multicollinearity indicates that two or more variables in the econometric model are linearly interconnected or correlated. The disadvantage of multicollinearity is that it instigates overestimation or underestimation whose outcome is erroneous interpretation and results. This challenge will be pinpointed out by the use of the Variable Inflation Factor (VIF). The lack of multicollinearity is certified if VIF coefficients are below 10, and $1/VIF$ coefficients are higher than 0.1.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 Introduction

This chapter outlines the descriptive statistics, the prevailing trend tests and scrutiny of the variables, inferential statistics, and the analysis of the findings.

4.2 Pre-Estimation Diagnostics

4.2.1 Descriptive statistics

The summary of the descriptive statistics of the variables that include their mean, the standard deviation, and frequency are exhibited in table 2 below. The variables analyzed are; the dependent variable which is the demand for sugar (Qd) and the independent variables which are; own price of sugar (Pt), the quantity of sugar imported (Is), quantity of sugar produced locally (Qp), export of sugar (Xs), inflation rate (Inf), gross domestic product (Gdp), and population growth rate (Popr).

Table 3: Descriptive Statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
Qd	38	629000	190000	324000	1010000
Inf	38	11.923	8.679	1.554	45.979
Qp	38	447000	86597.28	303000	640000
Is	38	156000	167000	0	990000
Xs	38	8555.184	14370.46	0	69054
Pt	38	36687.97	28175.16	5740	97451
Gdp	38	2.35e+12	1.00e+12	1.18e+12	4.79e+12
Popr	38	3.003	.465	2.306	3.865

Author (2019)

The mean of the demand for sugar (Qd) in Kenya from the year 1981 to 2018 was 629,000 metric tonnes with a standard deviation of 19,0000 metric tonnes. The Gross domestic product (GDP) recorded a mean of Kshs. 2,350 billion with a standard deviation of Kshs.1000 billion. The maximum GDP that was recorded in the 38 years was KShs.4790 billion with a minimum figure

of Kshs.1880 billion being posted. The data summary indicates that inflation was at an average of 11.923 % with a standard deviation of 8.679 %. The worst inflation recorded was a maximum of 45.979%, and the most favourable inflation rate was a minimum of 1.554%. The local production of sugar (Qp) was at a maximum of 640,000 metric tonnes while the minimum output was 303,000 metric tonnes. The mean of the local sugar production, on the other hand, was 447000 metric tonnes with a standard deviation of 86597.28 metric tonnes. Kenya's population has been increasing, as reflected in the period under study. The country had a mean population growth rate (Popr) of 3.003 % with a standard deviation of 0.465 per cent. The minimum population growth rate recorded during the 38 years was 2.306 per cent, while the maximum was 3.865 per cent.

The sugar importation has been increasing over the years with maximum import recorded as 990,000 metric tonnes. The minimum sugar imports (Is) were 0 metric tonnes and a mean of 156000 metric tonnes which contrasts greatly with the mean sugar export (Xs) which had a paltry mean of 8555.184 metric tonnes for the 38 years under study. The price of sugar per metric tonne exhibited a mean of Kshs. 36687.97 and a standard deviation of Kshs. 28175.16. The summary statistics provide an overview of the trajectory of the variables under study.

4.2.2 Stationarity Test

The Augmented Dickey-Fuller (ADF) test was used to assess the presence of unit root in each of the variables. The test is crucial in time series analysis because it assists in eliminating the chances of running a spurious regression. ADF also aides in the correct diagnosis of the econometric technique to be applied in the analysis. The 5 % significance level's critical value is used with the decision rule for ADF anchored on the comparison with the t-test statistics. The variable is deemed to be stationary if the test statistics is greater than the critical value.

Table 4: Augmented Dickey-Fuller Unit Root Test Results

Variable	Test Statistics	1% critical value	5% critical value	10% critical value	Remark on Stationarity Status
lnQd	-1.120	-3.668	-2.966	-2.616	Non-Stationary
lnGdp	2.454	-3.668	-2.966	-2.616	Non-Stationary
Inf	-2.966	-3.668	-2.966	-2.616	Non-Stationary
lnQp	-2.504	-3.668	-2.966	-2.966	Non-Stationary
Popr	-1.733	-3.668	-2.966	-2.616	Non-Stationary
lnIs	-2.669	-3.998	-2.966	-2.616	Non-Stationary
lnPt1	-2.449	-3.668	-2.966	-2.616	Non-Stationary
lnXs	-2.767	-3.668	-2.966	-2.616	Non-Stationary

Author (2019)

Table 5: Unit root test results after differencing

Variable	Test Statistics	P-statistics	1% critical value	5% critical value	10% critical value	Difference	Remark on Stationarity Status
D_lnQd	-6.977	0.000	-3.675	-2.969	-2.617	1	Stationary
D_lnGdp	-3.340	0.0132	-2.675	-2.969	-2.617	1	Stationary
D_Inf	-6.912	0.000	-3.675	-2.969	-2.617	1	Stationary
D_lnQp	-8.563	0.000	-3.675	-2.969	-2.617	1	Stationary
D_Popr	-6.456	0.000	-3.668	-2.986	-2.624	1	Stationary
D_lnIs	-9.840	0.000	-3.675	-2.969	-2.617	1	Stationary
D_lnPt	-5.908	0.000	-3.675	-2.969	-2.617	1	Stationary
D_lnXs	-6.137	0.000	-3.675	-2.969	-2.617	1	Stationary

Author (2019)

Table 6 gives the output results generated from the Augmented Dickey-Fuller test for stationarity which indicates that all the variables are non-stationary at level meaning that there is a need for carrying out a cointegration test to assess the existence of a long-run relationship. Table 7, however, demonstrates that after the first difference, all the variables become stationary.

4.2.3 Multicollinearity Test

Table 6: Variance Inflation Factor (VIF)

Variable	VIF	1/VIF
lnGdp	11.78	0.084860
Popr	10.73	0.093233
lnQp	2.88	0.347567
lnIs	2.84	0.351938
lnPt	2.21	0.453404
Inf	1.70	0.589649
lnXs	1.51	0.660627
Mean VIF	4.81	.

The formal test for multicollinearity using the Variance Inflation Factor (VIF) was applied. The outcome revealed a mean value of 4.81, which implies the absence of multicollinearity amid the variables in the research framework.

4.2.4 Lag Selection Criterion

Table 7: Lag Selection Criterion

Variable	lag	Criterion
lnQd	1	AIC
lnGdpc	2	AIC
Inf	1	AIC
lnQp	2	AIC
Popr	4	AIC
lnIs	0	AIC
lnPt	1	AIC
lnXs	1	AIC

(Author 2019)

4.2.5 Vector Error Correction Model

Tables 3 and 4 show the stationarity status of the variables before and after generating their differences, respectively. It can be deduced that all the variables are not stationary at level, but after being differenced once, they are all stationary. The Vector Error Correction Model is, therefore, applied to estimate the model after confirming the existence of a long-run relationship by the use of the Johansen cointegration technique.

Table 8: Vector error-correction model

Qd				
Variables	Long Run (L.R.)	Sig.	Short Run (S.R.)	Sig.
L._ce1			-0.161 (0.086)	*
LD.lnQd	1	-	0.411 (0.146)	***
LD.lnPt	0.016 (0.008)	**	-0.031 (0.008)	***
LD.lnXs	0.005 (0.002)	***	0.001 (0.001)	
LD.lnIs	-0.009 (0.002)	***	0.003 (0.002)	**
LD.lnQp	-0.142 (0.078)	*	0.108 (0.039)	***
LD.lnGdp	-0.720 (0.061)	***	0.453 (0.244)	*
LD.lnI	-0.007 (0.001)	***	0.001 (0.001)	
LD.Popr	-0.036 (0.036)		-0.265 (0.154)	*
Constant	9.313		-0.008 (0.016)	
No of observations	36		36	
R-squared	0.7515	***	0.7515	***

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

$ECT_{t-1}=[P_{t-1}-\eta_j Z_{t-1}-\xi_m K_{t-1}]$, the cointegration equation and long-run model.

$$ECT_{t-1} = [1.000lnQd - 0.016lnPt - 0.005lnXs - 0.0086lnIs - 0.142lnQp - 0.720lnGdp - 0.0067Inf - 0.036Popr + 9.313$$

The target variable is lnQ_d . The multiple regression equation derived from the Vector error-correction model is stated as follows:

$$\Delta lnQ_d_t = -0.008 - 0.411\Delta lnQ_d_{t-1} - 0.031\Delta lnP_{t-1} + 0.001\Delta lnX_{s_{t-1}} + 0.002\Delta lnI_{s_{t-1}} + 0.107\Delta lnQ_{p_{t-1}} + 0.453\Delta lnG_{dp_{t-1}} + 0.001\Delta Inf_{t-1} - 0.265\Delta Popr_{t-1} - 0.161ECT_{t-1}$$

Table 8 exhibits the results of the error correction model regression. The results indicate that the coefficient of the Error Correction Term is negative and statistically significant at a 10% significant level. The outcome implies that there is a long-run relationship between the dependent variable demand for sugar (Q_d) and all the independent variables which are; own price of sugar (P_t), quantity of sugar imported (I_s), quantity of sugar produced locally (Q_p), export of sugar (X_s), inflation rate (Inf), gross domestic product (Gdp), and population growth rate ($Popr$). The outcome implies that the ECT, which the adjustment term, is -0.160 meaning that the previous year errors or deviation from the long-run equilibrium in demand for sugar (Q_d) are perfectly corrected in the current year at a convergence speed of 16.1%. The R-squared for the model is 0.7515 and is significant at the 1% level of significance. The value of the R-squared demonstrates that 75 % of the variation in the aggregate demand for sugar can be attributed to the changes in the independent variables which are the factors influencing the demand for sugar in Kenya.

The result demonstrates that the price for sugar (lnP_t) has a significant impact on its demand at a 1% level of significance. A one per cent increase in the price of sugar leads to a 0.031 per cent increase in the demand for sugar when other variables are kept constant, and the *own-price elasticity* of sugar is 0.031. The less than one-unit price elasticity of sugar indicates that it is a necessary commodity. The results are in concurrence with the findings of Soleimany & Babakhani (2012), who determined that the demand for sugar is price inelastic because it is a necessary commodity. The export of sugar (lnX_s) was found out to have an insignificant impact on the demand for sugar in Kenya. The sugar import variable is significant in the model at the 5% level of significance. Keeping other variables constant, a one per cent increase in the sugar import leads

to a 0.001 percent increase in the quantity demanded of sugar. The importation of cheap sugar into the country lowers the local price, thereby leading to an increase in its demand.

The import of sugar (InIs) is significant at a 5% level of significance in the model and has a positive impact on the aggregate demand for sugar with a coefficient of 0.003. The results are in line with the findings of Lopez & Sepulveda (1985) that highlighted that sugar imports have a downward pressure on local price for sugar in the U.S. It implies that an increase in sugar import leads to an increase in its aggregate demand locally because of the prevailing lower prices.

On the other, the results for GDP, which is the proxy for income, demonstrate an insignificant impact on the demand for sugar in the country at the 5% level of significance. The *income elasticity* is 0.453, which displays that sugar demand is income inelastic. It implies that keeping all other factors such as; tastes and preferences, climatic conditions or political instability, constant, a one-unit increase in the income will lead to a 0.453 increase in the demand for aggregate demand for sugar in Kenya. The outcome concurs with the research of Purnomosidi (2011) which found out that sugar is an essential commodity in India and the proportion of income that is spent on sugar expenditure is less than unity thereby making it income inelastic.

The quantity of sugar produced locally (Qp) is crucial in the model because it is significant at a 1% level of significance with a coefficient of 0.108. The change in quantity demanded of sugar in Kenya by one unit is caused by 0.108 change in the quantity of sugar produced locally *ceteris paribus*. The quantity of sugar produced within a country has a direct impact on the price and hence influences the demand. The results align with the theory of demand and supply that explains that an increase in the supply of any commodity leads to a downward pressure on prices thus leading to the increased demand (Annunziata, & Scarpato, 2014).

The impact of inflation (Inf) on demand for sugar is insignificant at the 5% level of significance (p-value 0.116). Inflation reduces the purchasing power parity of consumers which leads to a decline in the demand for normal goods. In this case, sugar is a necessary commodity whose demand is insignificantly impacted by fluctuations in the inflation rate in the economy (Rustan 2009). The theory of demand and supply demonstrates that the quantity demanded of products

increase or decreases depending on the direction that the inflation rate takes in the economy.

The population growth is an important indicator of the exact pressure that the size of the population is exerting on the meagre supply of sugar due to increased demand. The outcome of the study presents a positive relationship between population growth and that the aggregate sugar demand that is significant at the 10% significance level. The result is consistent with the economic theory of demand and supply that shows that increase in the size of the population leads to increased demand for goods and services (Petersen, 1988).

4.3 Post Estimation Test

4.3.1 Normality Test of the Residuals: Jarque Bera Test

The normality test on the residuals was performed. The outcome illustrated in table 9 demonstrates that the measure of Chi-square, which is 0.5129 provides an acceptable probability that is higher than the critical value. The researcher, therefore, retained the null hypothesis, thereby concluding that the data series in the target equation is normally distributed.

Table 9: Normality Test results: Jarque Bera Test

Equation	chi2	Df	Prob > chi2
D_lnQd	1.335	2	0.51286

(Author, 2019)

4.3.2 Test for Autocorrelation

The Breusch-Godfrey test or the Lagrange-Multiplier test for serial autocorrelation was utilized to capture the null hypothesis that there exists no autocorrelation in the prevailing residuals. A lean p-value illustrates the existence of significant autocorrelation in the prevailing residuals. The results indicate that the p-values are larger at each of the two lag orders, i.e. 0.863 and 0.923 respectively leading to the retaining of the null hypothesis means that there is no presence of autocorrelation in the residuals. The results are indicated in Table 11 below.

Table 30: Lagrange-multiplier test

Lag	chi2	Df	Prob>Chi2
1	51.799	64	0.863
2	48.655	64	0.923

H0: no autocorrelation at lag order

4.3.3 Heteroscedasticity Test

The Breusch-Pagan test for heteroscedasticity was performed and the results generated are indicated in table 12 below.

Table 41: Breusch-Pagan/Cook Test for Heteroscedasticity

Chi-square	Prob. at(5%)
0.71	0.3978

Author (2019)

The result above indicates that the probability value of the Chi-square statistics (0.71) is more significant than 0.05 (0.3978). It means that we fail to reject the null hypothesis of constant variance at the 5 % level of significance, meaning heteroscedasticity is not a severe problem in the model.

4.3.4 Stability diagnostics test

The stability of the variables in the model was assessed using the CUSUM test. Appendix 8 shows that the plot of the test is enclosed by the critical bounds at a 5% level of significance, disclosing that the long-run model coefficients are structurally stable. The verdict on the report of the decision guidelines of the post estimation tests is that all residual diagnostic tests are up to the mark and propound that the model is admissible and handled adequately, thus the estimation model is stable and statistically robust.

CHAPTER FIVE: SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

5.1 Introduction

This section provides a summary of research findings, conclusions that are derived from the study findings, and the policy recommendations. The limitations of the study and areas for further research are also enumerated in this chapter.

5.2 Summary of the study findings

The study used annual time series data between 1981 and 2018 collected from the Kenya Sugar Board and the World Bank development indicators database (World Bank, 2019). The study demonstrated that the own price of sugar influences the level of aggregate demand for sugar in Kenya, the quantity of sugar produced locally, the gross domestic product, the quantity of sugar imported from other countries, the gross domestic product, and the population growth rate. The aggregate demand for sugar is consistently outstripping the supply because the variables such as population, gross domestic product, and import are on consistent increment. The Vector Error Correction Model results also showed the existence of a short-run and long-run relationship between the criterion variables and the predictor variables. The predictor variables explain seventy-five per cent of the changes in the criterion variable.

5.3 Conclusion

The main objective of the study has been achieved as it sought to find out the factors affecting the aggregate demand for sugar in Kenya. From the findings of this study, it is concluded that: The following factors determine the demand for sugar in Kenya; the export and import of sugar, the local production of sugar, the GDP, Inflation, and population growth rate. The above-listed variables are the determinants of demand for sugar in the Kenyan economy *ceteris paribus*.

The desire of Kenya to attain self-sufficiency in local sugar production is still a pipe dream, and the demand continues to exceed the local supply, thus making sugar importation inevitable. The import cheap sugar from foreign countries has significant negative impacts because they derail the increased capacity utilization and productivity of the local industries. The determinants of demand sugar in Kenya which are; population growth rate, gross domestic product, the quantity of sugar

produced locally and inflation among many other factors are necessary but not sufficient predictors of sugar demand in Kenya due to untamed political interests and unceasing corruption in the sugar importation business. The sugar importation quota restrictions are occasionally violated, hence making the application for COMESA safeguard redundant in enabling the infant industries to experience growth.

5.4 Policy Recommendation

According to the empirical results, the ensuing policy recommendations are required to bolster sugar supply to meet the ever-increasing sugar demand in Kenya:

The government needs to come up with the best policy measures that would reduce the overdependence on imported sugar by resuscitating local production to sustain the increasing demand for sugar.

- i. First, the policymakers must appreciate that sugar is a crucial and necessary commodity that supports the nutrient needs of households and an inalienable raw material for a majority of food-related factories in the country. The policymakers should strive to undertake policy initiatives that support local farmers and millers for local production of sugar to meet the ever-increasing demand for sugar. Increased local production of sugar would lead rise in sugar export leading to boosting foreign exchange earnings which provide the country with a favourable balance of payment.
- ii. The farmers should receive descent and timely payment for cane delivered to the factories. The farmers should also be educated on the best and modern farming techniques to improve their productivity. The achievement of transparency and accountability in the management and governance of the sugar factories will be vital to addressing the issues facing sugarcane farmers and by extension, lead to a better outcome in the sugar industry.
- iii. The government's application for extension of the COMESA sugar importation safeguards is not sustainable if the failing sugar companies cannot be revamped with new ultra-modern milling machines and a proper political environment created for sugar production to take place seamlessly for local supply to meet the increasing demand for sugar. Kenya should renegotiate the import tariff rates for sugar from COMESA and EAC regional economic blocs upwards

to ensure consistent protection of local sugar millers and sugar cane farmers from unfair prices.

5.5 Limitations of the Study

The major limitation of the study is linked to the sources of secondary data utilized in the research. While the secondary data may be economical and time-saving, its accuracy cannot be verified with certainty. The second weakness of the study emanates from the apparent lack of close or perfect substitute for sugar in Kenya. It is because of these limitations that some crucial independent variables might have been excluded in the model, thereby leading to possible biased results or wrong conclusions.

5.6 Recommendation for Further Research

The demand for sugar is affected by numerous factors, but this research has investigated only a portion of them while omitting out a majority of the variables. The model, therefore, does not exhaustively include all critical variables that have a significant impact on the target variable.

The impact of close substitutes of sugar such as honey and stevia should be investigated mainly by giving close attention to healthcare education on lifestyle education like diabetes and high blood pressure among many others.

The variable, quantity of sugar produced locally, is important because it captures Kenya's desire and economic efforts to be self-sufficient in sugar production within its borders. Research should be done to identify the regions in Kenya that are suited for sugar cane farming. The sugar agro-ecological zones' identification and proper education of the farmers on conventional sugarcane farming techniques will lead to an increase in sugar production.

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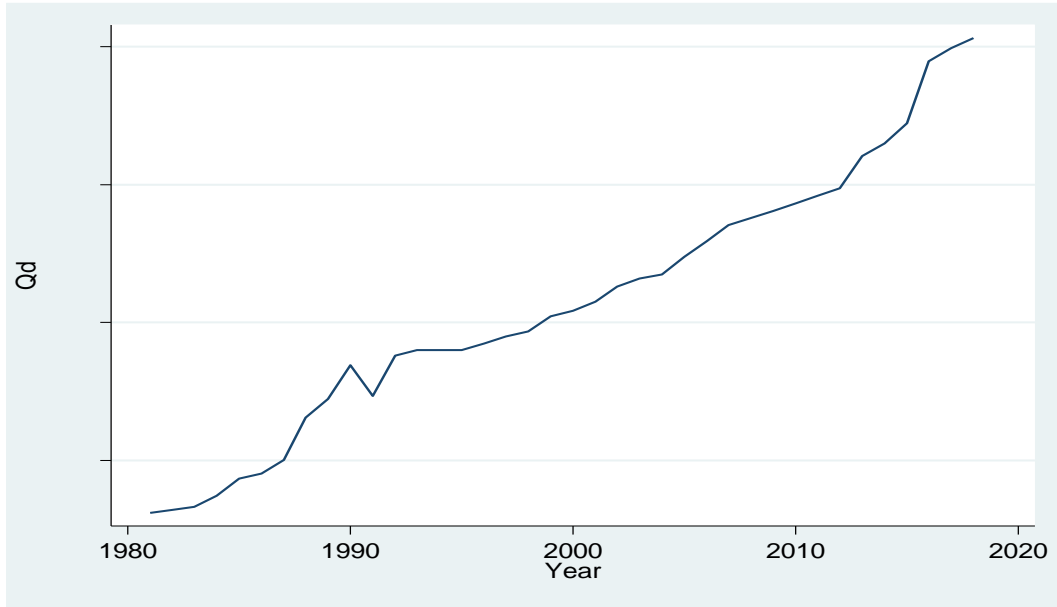
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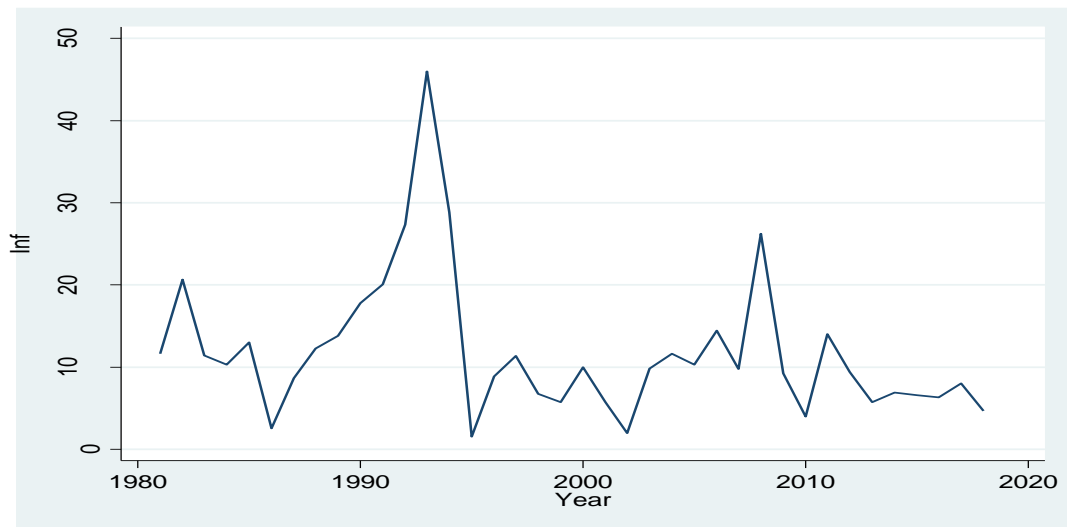
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Appendix 1: Time Series Trend Analysis at Levels

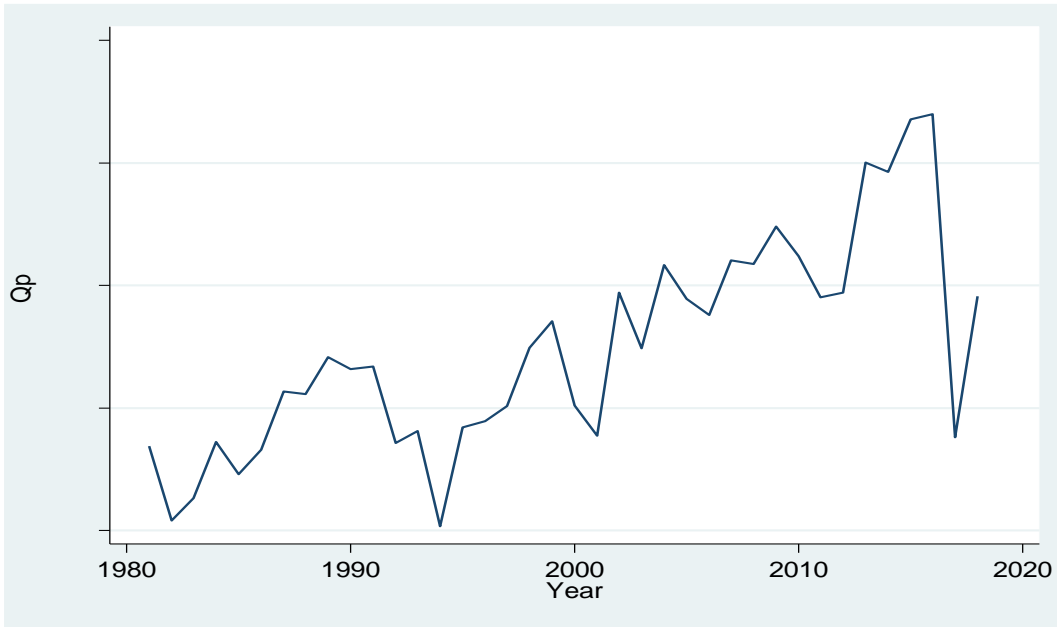
i) Quantity Demand of Sugar



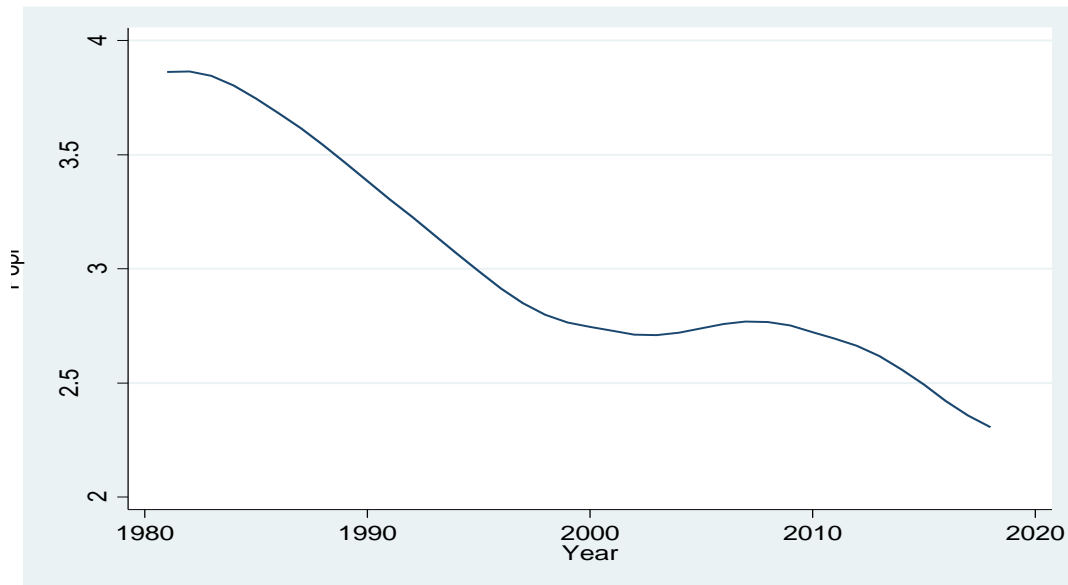
ii) Inflation



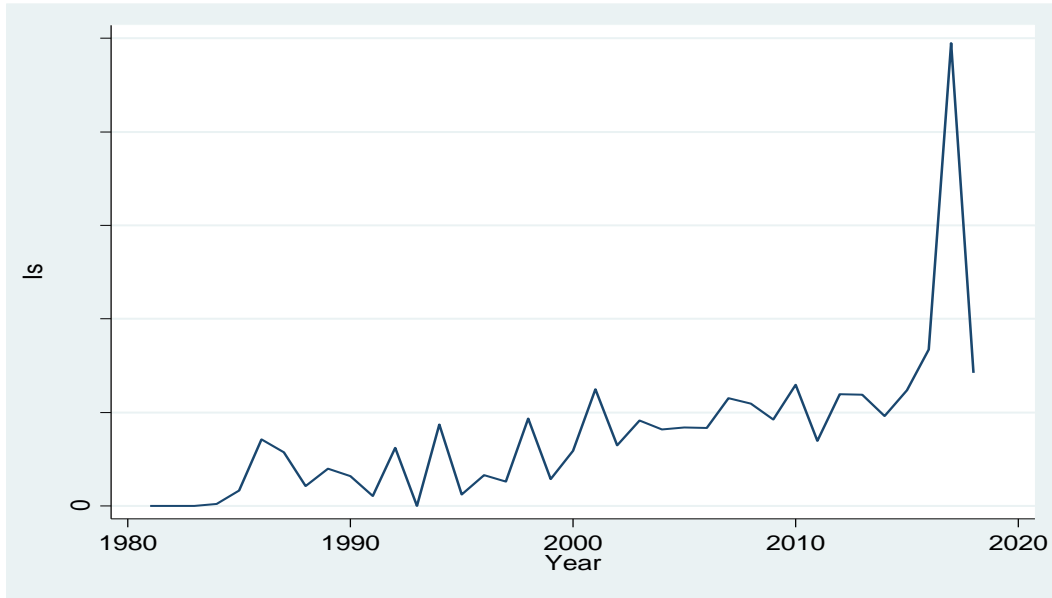
iii) Quantity of Sugar Produced Locally



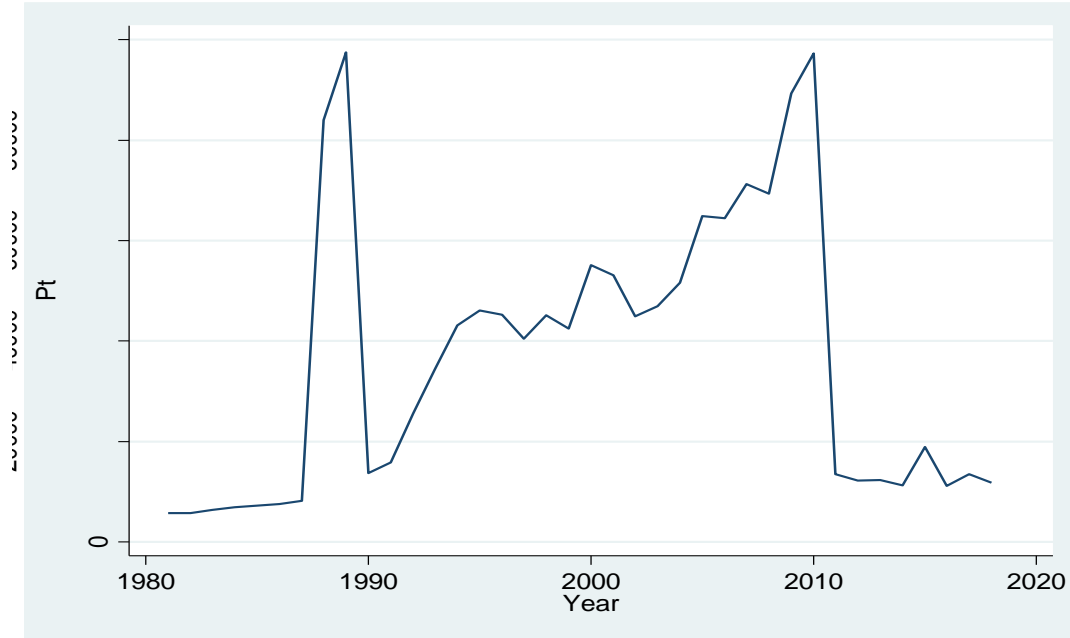
iv) Population growth rate



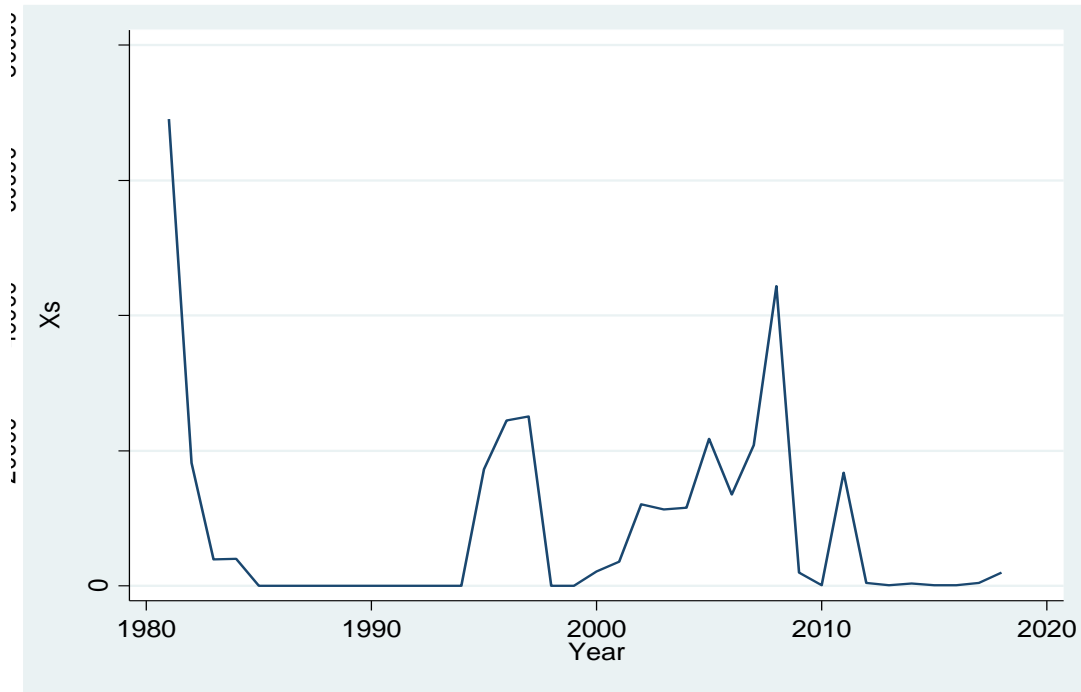
iv) Sugar Import



vi) Real Price of Sugar per Tonne



vii) Sugar Export



viii) Gross Domestic Product Appendix 2: CUSUM Test Results

