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Analysis of the determinants of domestic maize prices in Kenya.

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ANALYSIS OF THE DETERMINANTS OF DOMESTIC MAIZE PRICES IN KENYA

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DECLARATION

I declare that this research project has not been previously submitted and approved for the award of a degree by this or any other University.

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Approval

The research project was reviewed and approved for examination with my permission as the assigned supervisor.

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DEDICATIONS

I dedicate this thesis to my lovely Mum Beatrice for raising me to believe that everything is possible.

And to my dear hubby Isaiah for making everything possible and for your overwhelming support that enabled me to complete this work.

And to our children; Rihanna, Ryan, Melisa and Melina; you have been my inspiration. Thank you so much.

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ABSTRACT

The pricing of maize in Kenya has been the subject of much discussion over previous years. Various stakeholders in the industry (farmers, millers, regulators) offer often conflicting ideas on the factors that are deemed pivotal to the determination of maize prices. The current study sought to analyse the determinants of domestic maize prices in Kenya. The research was grounded on the law of supply and demand theory. The research relied on a quantitative approach grounded on an explanatory research design. The study utilized time series from 1990 -2019. This study relied on secondary research data. The study relied on time series collected from secondary sources of data using data extraction forms to obtain the maize price in Kenya. The data collected was analysed using descriptive statistics and inferential analysis. The results were presented using bar graphs, charts, and tables as deemed adequate for this study. The study was able to obtain all the 210 observation from the Central Bank of Kenya, World Bank Data and Kenya National Bureau of statistics. The correlation tests showed that macroeconomic factors, maize import and export quantity, land acreage under maize cultivation and maize production had a positive and significant correlation with domestic maize prices. The results also showed that maize export quantity had a positive but insignificant correlation with domestic maize prices. Regression analyses was carried out to determine the relationship between the study variables. The regression results indicated that 80.28% of the domestic maize prices in Kenya were determined by GDP growth, exchange rate variations, maize import quantity, maize export quantity, annual land acreage and annual quantity produced. The research also found out that GDP growth and maize export quantity did not have a statistically significant influence on domestic maize prices. The study concluded that exchange rate variation, maize quantity produced and maize import quantity had a positive and significant influence, while land acreage under maize cultivation had a significant and negative influence on the domestic maize prices. The research recommends that the government should incentivize local farmers to improve their maize production and reduce reliance on maize imports. Further the study recommends that local farmers should improve their investment in modern agriculture which can translate most small-scale farmers to large-scale farmers which can enhance the maize yield and foster their competitiveness within the global maize market.

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CHAPTER ONE

INTRODUCTION

This chapter consists of a brief preview of the research factors that will be explored. It consists of the study background, the statement of the problem, the research objectives and questions, scope and concludes with the significance of the study to various stakeholders.

1.1 Background to the Study

Globally, maize production has been critical since it is central to human and animal consumption as well as raw material for production (Nyangena & Juma, 2014). The United States produces atleast 40% of the world maize production with China, Brazil, France, Argentina as well as Mexico being among the largest global maize producers (FAO, 2016). Locally maize is one of the largest components of the agricultural economy contributing to household income, food source and animal feed industry (Kamau, et al., 2011).

The biggest producers being the United States of America, China, and Brazil, respectively. The Republic of South Africa is the twelfth maize producer globally but the leading in Africa (Musaba & Bwacha, 2014). In the United States of America, there are 80 Million acres or 32million hectares of land set aside for corn cultivation, with 95% of United States of America's corn farmlands are owned by families with 90 families of farmers accounting for 55% of corn exports. Corn cultivation is majorly done under the un-irrigated condition, with only 11% carried out on irrigation (Daryanto, et al., 2016).

Maize is the main staple in Kenya, accounting for nearly 40% of cultivated area, 2.4% of Kenya's GDP, and 12.65% of agricultural GDP (Nyangena & Juma, 2014). More than 75% of the maize production is due to small farmers, although only 20% of what is produced by smallholders is sold in the market (Smale & Olwande, 2014). Kenya's per capita maize consumption is estimated to average 103 kg/person/yr. (average for 2012-2014), compared to 73 kg/person/yr. for Tanzania, 52 kg/person/yr. for Ethiopia and 31 kg/person/yr. for Uganda (FAO, 2016).

Determination of commodity prices is key to determining among other things production decisions, revenue targets and rewards to producers (Darmon & Drewnowski, 2015). Prices therefore, serve as an efficient means for seeking out production possibilities and potential, as well as allocating scarce resources within an economy. Despite the global effort and control measures taken over the years, there has been a steady upward trend in world food prices at a

modest rate (Bellemare, 2015). The available literature is however inadequate in determining price variations among the main agricultural products in the world. Being one of the key maize production countries in the world it is imperative to analyse the various determinants of maize prices in Kenya.

1.1.1 Determinants of Maize Price

Li, Takahashi, Suzuki, and Kaiser (2011) contend that decreasing maize supply as a result of poor yields would contribute to an increase in the maize price, which in turn induce farmers to foster their investments in maize production. Brown and Kshirsagar (2015) found out that global prices, level of domestic imports, exchange rate volatilities, production costs and level of production were significant predictors of maize price. Minot (2011) found out that the domestic price is influenced by the international price of the same commodity. Abdulai, Nkegbe, and Donkor (2017) assert that the price of the commodity in the local context presented as a function of the efficiency by which the grain is cultivated. Among the essential factors deemed pertinent to technical efficiency, as assessed by the authors, include experience, agricultural extension services, and gender of the farmers.

Musaba and Bwacha (2014) in a study conducted in Zambia pointed out the possibility of increased efficiency as an avenue to be leveraged in increasing output from small-scale farmers. Porteous (2012) opines that export bans can reduce domestic grain prices if export is profitable. However, there are diverging views on the impact of export bans on commodity market prices in Africa. In contrast, Diao, Kennedy, Mabiso and Pradesha (2013) found that the maize export ban in Tanzania reduced maize producer prices by 9 to 19%. The experiences of Malawi, Zambia and Kenya have indicated that imposing an export ban may create uncertainty in the grain market.

Jayne, Myers and Nyoro (2005) showed that NCPB activities had important effects on both maize price levels and variability, but the direction of the effect varied over different stages. Maziku (2015) that smallholder farmer's market participation increased with the increase in maize prices and farm resources. Shawiza (2016) indicates that maize is the vital food crop in Kenya, constituting 3 Percentage of Kenya's Gross Domestic Product (GDP), 12 Percentage of the agricultural GDP, and 21 Percentage of the total value of primary agricultural commodities. The researcher further indicates that the variations in maize prices have been a cause for concern because it adversely affects both the producers and consumers. Argent and Begazo (2015) observe factors such as import tariffs, nontariff barriers, potential

anticompetitive conduct by firms, and direct state intervention in markets conspire to drive grain prices to above-market rates. Maize is a staple food to a large proportion of people in rural Kenya. Nearly all agricultural households in Kenya do plant maize. Small scale production dominates maize production since about 80% of maize is supplied by smallholders (Mwangi & Kariuki, 2015). The current study focused on the effect of macroeconomic factors on the maize prices in Kenya. The research examined the effect GDP level, exchange rates, maize import level, maize export, annual land acreage under maize cultivation and maize production level on the maize prices in Kenya.

1.1.1 Macroeconomic factors

GDP can be defined as the total market value of all final goods and services produced within the country in a given period of time usually one year. The evaluation process also involves the sum of all final commodities produced within a country in a given period of time expressed in monetary terms. GDP is hence computed by adding up consumption, investments, government spending and net exports (Peter,2013).

Exchange rate is defined as the price at which one currency may be converted into another (Blumberg, Cooper, & Schindler, 2008). Exchange rates in Kenya have been fluctuating over the last few years with a rising trend. The exchange rates for the one shilling to one US dollars was 79.23 in 2010, 84.53 in 2012 and 87.92 in 2014 respectively. This trend indicates there is either an increase or decrease in exchange rates in Kenyan economy. These variations have a major impact on various aspects of the country's economy. Macroeconomic factors are key determinants of the prices of a country's imports and exports, therefore, playing a key part in determination of prices of different goods circulating within a particular country. They are also a measure of the country's financial capacity over time. This study sought to determine the relationship between changes in macroeconomic variables (GDP and foreign exchange rate) and maize prices in Kenya.

1.1.2 Maize Import and Export Quantity

Kenya usually has a deficit in maize since the quantity produced in the country is not enough for the consumption of each Kenyan. This deficit is filled by imports from across the border in Uganda and Tanzania. However, the deficit is so large that imports from the international market have been required. These imports are usually at a better and lower price than the country's maize prices. The study therefore sought to find out whether these imports have an effect on the price of maize in the country.

In Africa, most countries have enforced an export ban of maize and maize products due to the limited production. Kenya maize production is way less than the country's total consumption. This therefore does not allow for export of Maize out of the country. There has however been reports of informal cross border export of maize to neighbouring countries. This study sought to find out if exports or lack of them affects the prices of maize in Kenya. The quantity of maize imported of exported by a country determines the quantity of maize that will remain in circulation. This study seeks to determine whether the volume of maize imports and exports impact the overall prices of maize in the country.

1.1.3 Annual Land Acreage

The area under maize cultivation in Kenya is currently estimated at 1.5 million hectares, producing about 26 million bags of maize annually. This falls short of the annual domestic maize consumption estimated at 34 million bags. With the diminishing availability of arable land there is decreased production of maize (Kamau, 2019). This study sought to determine the impact of the volume of annual land acreage under maize production on maize prices in Kenya.

1.1.4 Level of Maize Production

Generally maize productions are geared towards meeting the household consumption and in some cases economic output (Ajibade, Ayinde, Abdoulaye, & Ayinde, 2018). However, throughout the Kenyan market and regionally poor soils, lack of infrastructure, poor modernization and poor utilization of agricultural farm inputs limits the level of production within farms (Bellemare, 2015). All these factors contribute to the low production of Maize in Kenya. The study sought to find out whether this low production of Maize in the country is a determinant of the maize prices in Kenya.

1.2 Statement of the Problem

Current maize pricing policy has a huge impact on the National Treasury, downstream industries as well as the farmer and consumer welfare. The increased volatilities in the maize pricing has been a major policy challenge for most farmers and trading organizations (Sitko, 2013). Overreliance on market determined pricing in Kenya has resulted producer and consumer prices often not reflecting the average cost of production (Onono, Wawire, & Ombuki, 2013). This has resulted in farmers within the country moving to other crop farming where there is attainable price stability (Wandaka, 2013). The complexities in maize pricing in the country have long been document as key challenge among policymakers (Grace, Brown, & McNally, 2014). Most of the available literature has not exhaustively reviewed the influence of macroeconomic factors on maize prices in Kenya. d'hôtel, Le Cottee and Jayne (2013) study

only focussed on effect of seasonal cycles, import tariffs and international prices on maize prices while Adamite, et al. (2016) examined productivity and profitability in maize farming. The study did not exhaustively review the influence of various macroeconomic factors on maize prices which create the gap that motivated the current research in Kenya.

The price fluctuation in maize crop has been a major issue of contention among a number of researchers. Unchecked prices of food staples such as maize can lead to inefficient agricultural production and definitely have detrimental effects on the economic, social, and political growth of any country (Ajibade, Ayinde, Abdoulaye, & Ayinde, 2018). Akpan et al. (2015) notes that commodity prices largely determine the farmers decision making. However, price instabilities have resulted in farmers not being able to manage their production as well as have stable revenue projections. Hence there is need for further examination of the determinants of the maize pricing and understand how better to manage the maize prices.

Locally, Owino, Alushula and Ngugi (2019) note that the cyclic nature in pricing has results in erratic production and availing of the product to the local market which has led to an increase in influx of foreign contaminated maize produce as witnessed in the recent past (Owino, Alushula, & Ngugi, 2019). Nyoro, Ayieko and Muyanga (2018) note that depsite the fluctuation in the pricing and lack of adequate trading policies to control the maize product price within the market there is contention among policymakers and farmers' union on the key factors influencing the price of maize products in Kenya. Therefore, this study sought to fill this empirical gap conducting an analysis of the determinants of maize prices in Kenya.

1.3 Objective of the Study

The main objective of this research is to analyse the determinants of domestic maize prices in Kenya. This research specifically examined;

i. To analyse the effect of macroeconomic factors on maize prices in Kenya.
ii. To establish the effect of maize import and export quantity on maize prices in Kenya.
iii. To determine the effect of annual land acreage under maize cultivation on the maize prices in Kenya.
iv. To analyse the effect of annual quantity produced/ number of 90kg bags produced on the maize prices in Kenya

1.4 Research Questions

i. What is the effect of macroeconomic factors on maize prices in Kenya?
ii. What is the effect of maize imports and export quantity on maize prices in Kenya?

iii. What is the effect of annual land acreage under maize cultivation on maize prices in Kenya?

iv. What is the effect of annual quantity produced/ number of 90kg bags produced on the maize prices in Kenya?

1.5 Scope of the Study

The contextual scope of this study focussed on the analysis of the determinants of maize prices in Kenya. The study examined how macroeconomic factors, maize import and export quantity, annual land acreage under maize cultivation and maize production level influence maize prices in Kenya. The geographical scope of this study was on the national examination of maize prices in Kenya. The unit of analysis of this study was the prevailing maize prices in Kenya between 1990-2020. The research relied on time series data collected from various institutional repositories.

1.6 Significance of the Study

1.6.1 To policy makers

The findings from this study will provide an elucidation of the essential across determinants of maize prices that can be considered in forming legislation to ensure an efficacious and stabilized pricing system for maize. The findings from this study will furthermore provide an across-industry perspective of the Kenyan context hence may be used to highlight industry-specific factors in the country. The findings of the research were vital in fostering policy formulation and stakeholder engagement on how to enhance decision making in setting maize price formulations.

1.6.2 To Farmers

The results will also be pivotal to farmers as they can help inform the main determinants of maize price in Kenya that can be relied upon to determine production patterns within the country.

1.6.3 To Research Theory

Researchers and students were presented with an avenue for future studies in this field. The suggestions for further studies will avail research gaps that need to be filled. As the prices of essential commodities continuously fluctuate, the findings of this study will be key in providing an in-depth review of the factors that determine these changes. Academicians and researchers in this field will find the findings and recommendations for further research to be helpful in their research. Further, the study is expected to become a valuable reference material in the future.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The purpose of this chapter was to provide insight into the current body of knowledge about the topic of study. This chapter thus provided a discussion of the theories considered, the literature pertaining to the constructs under assessment, the gap in research, the conceptual framework to be employed, the operationalization of variables and concludes with a summary of the chapter.

2.2 Theoretical Framework

A theoretical framework is an assortment of unified ideas instituted on philosophies. It accounts for or describes circumstances. The purpose of this section is to highlight the lenses through which the relationship between the variables considered in the study was assessed. One theory is discussed – the law of supply and demand.

2.2.1 The Law of Supply and Demand

The history of the law of supply and demand traces its roots to as early as 1691 with the seminal publication "Some Considerations of the Consequences of the Lowering of Interest: And Raising the Value of Money." Other notable crafters of the law include Sir James Stewart, who expounded on the theory in 1767 and is accredited with the first published authorship of the term "law of supply and demand" (Akhtar, 1978). Smith's (1776) "The Wealth of Nations" further contains an elaboration of the entails of the law of supply as well as the law of demand and their interrelation.

The essence of the law of supply and demand derives from the independent curves explaining demand and supply, respectively, as relates to the pricing of commodities. The law of demand, which results in the downward sloping demand curve, is explained by the substitution effect, income effect, and law of diminishing marginal utility (Beattie & LaFrance, 2006). The premise of the substitution effect is that decrease in price results in an attraction of purchasers. The income effect involves the increase in the purchase of a product on account of its relatively lower allocation of one's income (Gale, 1955).

The final founding principle of the law dictates that additional utilization of a product results in decreased additional satisfaction hence resulting in reduced incentive to purchase more of the product. Concerning supply, an increase in price results in an increase in quantity supplied (Gale, 1955). Also, of pertinence to the current study is the effect of government involvement

(e.g., through policies) as a shifter of the supply curve. As an example, policies deemed to negatively affect the ability of the producers to yield profits serve to decrease supply with the inverse being true (Beattie & LaFrance, 2006).

Various other authors have applied the theory in the creation of supply and demand models aimed at conceptualizing the various determinants of maize prices; Cleasby, Darroch, and Ortmann (1993) use the approach in a study conducted in South Africa whereas Awotide (2012) applies the law in the construction of a model assessing the pricing of maize, millet, and sorghum in Nigeria. This study further centres on the intervening effect of regulations as a shifting factor in assessing the relationship between price, supply, and demand of maize in Kenya. This approach derives from Mankiw's (1998) observation that policy interventions serve as shifters in the association between supply and pricing.

The law of supply and demand forms the basis of the current study as it allows for a systematic understanding of the various drivers of the price of maize in the local context. In applying the theory of supply and demand to the assessment of maize supply, Van Zyl (2010) highlights the dynamic relationship between supply and demand within the market given that the changing market conditions render the relationship between the constructs contradicting to the expectations of the supply and demand curve. This theory is essential to this study since demand and supply of goods in a country is determined by macroeconomic factors, which in turn determines the volume of imports and exports of goods. Further, demand for maize is determined by availability which is dependent on the volume of produce, which is in turn determined by the amount of land under cultivation annually. Hence, this theory was utilized in this study in analysing the several demand and supply factors that determine the maize prices in Kenya.

2.3 Empirical Review

The purpose of this section is to provide an exposition of current studies put forward concerning the variables under assessment. The review of empirical studies focused on Gross Domestic Product (GDP), Exchange rate variation, Maize import quantity, Exports, Annual land under cultivation and quantity of maize produced.

2.3.1 Macroeconomic Factors (Gross Domestic Product and Exchange rate variation) and Maize Prices in Kenya.

Based on data collected between 1987 and 2013, Tang and Zhou (2016) observe that there has been a proliferation in the production and prices of Maize in New China. The authors conducted an empirical evaluation of the factors that have been pivotal to the development of the maize

industry in the regions. Findings indicate five main factors as the most influential including resource endowment, GDP, market environment, technical conditions, and policies. Among the sub-variables considered in the assessment of the three primary constructs were per-capita GDP, multiple cropping index, and cost-benefit ratios, non-agricultural education levels, natural disasters and the utilization of scientific technology. These sub-variables were considered in the operationalization of supply factors and were thus deemed essential in determining maize prices. This study considers various variables and did not focus specifically on the GDP and how it affects the prices of Maize.

Idisardi (2010) employed a gravity model to study the determinants of agricultural prices in South Africa and found that the country's GDP had a positive and significant impact on the prices of agricultural products in South Africa. Helga (2005) on the other hand found that the GDP of the country does not affect its agricultural prices in the case of Iceland. Leite (2008) also found no evidence that the GDP of Colombia affects it prices of products. Eita (2009) indicated that increases in Namibia's GDP causes prices of exports to increase, while distance and importer's GDP per capita are associated with a decrease in prices of exports. These studies were conducted in various areas of the world while the current study focuses on Maize prices in Kenya

Abdulai, Nkegbe, & Donkor, (2017) conducted a study on the effect of Real per capita GDP on maize consumption in Ethiopia. The authors found that Maize is a basic commodity in Ethiopia and, therefore, as the maize price increases, consumers do not immediately alter their usual consumption of maize. Instead, they decrease their maize consumption moderately. The estimated income elasticity is 0.012, suggesting that a 10% increase in real per capita GDP would increase maize per capita consumption by 0.12%. This study did focus on maize consumption as opposed to maize prices

Yuksel, Kuzey and Sevinc (2012), conducted a study on the impact of exchange rate volatility, export prices and weighed GDP of trading partners in Turkey's aggregate. On employing OLS regression method to determine the relationship of the RER volatility and exports, the study applied appropriate tests for reliability and analysis of the data which included; time series data and cross correlation to determine the relationship between the pairs of variables was utilized. The results indicated the presented of a negative and insignificant relationship between

exchange rate volatility and prices. This study focused on exchange rate volatility while the current study considered the exchange rate variation.

Gautam et al (2013) analysed the effect of real exchange rate volatility of Indian rupee with Euro, US Dollar, UK pound and Japanese Yen on India's agricultural products such as Tea, Coffee, Cereals and Rice to Euro Area, UK, USA and Japan for the period 2002 to 2009. The study used a panel data fixed effect analysis and the results indicated the Real exchange rate and GDP were the important determinants of cereals exports while GDP was the only determining factor for Rice exports in India. The study found that real exchange rate was significantly influencing the exports of cereals, tea and coffee while for coffee and tea exchange rate volatility was also playing a significant role.

A study by Mwangi (2012) evaluated the magnitude and direction of the effects of exchange rate volatility on French beans exports from Kenya to major trading partners in the European Union using monthly data from January 1990 to December 2011. The study findings found a negative and significant short and long run effect of exchange rate volatility on French beans exported. However, this study focused on French beans exports and ignored the analysis of maize which was the leading staple food in Kenya at that time while establishing the effect of exchange rate volatility and its magnitude. It has been revealed that different studies have employed different models to look at the effect of exchange rate fluctuations on different performance sectors. Kiptui (2008) studied the impact of real exchange rate on the demand of Kenya's exports in an export demand framework which includes Kenya's agriculture major export coffee, tea, horticulture, and manufactured goods. A bound testing and auto-regressive distributed lag approaches to the analysis of long-run relationship and error correction modelling was applied. The existence of the long-run relationship is established for tea, coffee and horticulture export but rejected for manufactured goods exports. In short-run results show that the real exchange rate has a positive effect but found to be statistically insignificant.

Barret (2007) estimated effects of exchange rate volatility on export volumes using the multivariate generalized autoregressive conditional heteroscedasticity in mean model. The change in the expected exchange rate and change in industrial production of importing country jointly influence agricultural export volume and import prices but not in other sectors. In another study on exchange rate volatility influence on French beans export in Kenya by Mwangi et al. (2014), using the generalized autoregressive conditional heteroscedasticity (GARCH) model reported a negative relationship between exchange rate volatility and French

beans export. This study focused on French beans while the current study focuses on maize prices.

2.3.2 Maize Import and Export Quantity and Maize Prices in Kenya.

In studying determinants of rice prices in Bangladesh, Chowdhury et al. (2004) employed profit function approach using cross-sectional data. The study objective was to establish the importance of various factors that determine rice prices. The study found that imports and exports overall were insignificant determinants of rice prices. De Silva & Ratnadiwakara, (2010) conducted a study on the effects of import on the demand and supply of agricultural commodities and found that import has a significant effect on the prices of agricultural products.

According to Mwangi et al. (2014), The production of key food commodities and export products has declined thereby adversely affecting food security, reducing employment opportunities and increasing overall poverty in rural areas. Maize has been imported to bridge the ever-increasing gap between production and consumption in Kenya (Mwangi et al. 2014). The imported maize has been cheaper than that most of that locally produced thus created a perfect food price dilemma because high prices would have acted to stimulate supply response yet the high prices also impose a heavy cost on low-income consumers and rural producers who are net-food buyers and must pay more for food (Mwangi & Kariuki, 2015).

Jayne et al. (2011) conducted a study on the effects of production costs on import prices and found out that High domestic food production costs compared to imports penalizes consumers who have to pay high food prices and is also inconsistent with international and regional agreements such as the Common Market for Southern and Eastern Africa, Eastern African Cooperation. The high food prices also hinder the transfer of resources from food systems to other parts of the economy as it takes more resources from non-food sectors to purchase a unit of food (Jayne et al 2011). In addition, high food prices force consumers to demand cheaper products which are sourced for internationally.

In a study to analyse the determinants of agricultural exports in Nigeria, particularly on cocoa and rubber, Abolagba et al (2010) used Ordinary Least Squares regression (OLS)to analyse determinants of Nigeria's two agricultural exports; cocoa and rubber during the period 1970 to 2005. The findings revealed that for both crops, the main determinants of export growth were domestic or supply side factors. For rubber exports, he found that domestic output of rubber, interest rate, domestic producer price and domestic consumption were important determinants

of rubber exports in Nigeria. On the demand side, the real exchange rate was found to have a significant impact on export volumes of rubber. For cocoa, only supply side factors such as domestic consumption and rainfall were found to have a positive effect on export volumes.

Folawewo and Olakojo (2010) investigated determinants of Nigeria's agricultural exports using co-integration approach and found that domestic agricultural output was the most important factor that affected growth of agricultural exports. They also found that agricultural exports were significantly affected by the world price and the real income of the trading partners. Another study in Nigeria by Yusuf (2007) examined determinants of selected agricultural exports such as cocoa, rubber and palm-kernel post liberalization using co-integration and error correction approaches. The results revealed that export growth is dominated and significantly affected by supply side factors such as previous domestic price, GDP, relative prices and exports in the previous period.

Suresh and Neeraj (2014) applied the augmented gravity model to panel data covering the period 1992 to 2012 to analyse determinants of India's manufactured exports to two sets of countries; developing (southern) and developed (northern). They found that GDP, difference in per capita income and GDP similarity were significant and positively affected India's exports for both sets of countries. On the other hand, India's exports to the developing countries were negatively affected by distance. Teweldemedhin and Mbai (2013) used the extended gravity model that included variables such as the Gross Domestic Product of Namibia, the Gross Domestic Product per capita of Namibia, distance, exchange rates and dummy variables if the trading partner belonged to any regional organization. The focus of the study was to identify alternative markets for fresh farm products, maize and soy beans exports. His findings revealed that Gross Domestic Product per capita was found to be positively related and significant in Southern and West Africa for fresh farm products and maize. Fresh farm produce was found significant in all cases while maize and soy beans were only significant in East Africa. In Asian markets, per capita income was found to be significant and highly elastic, making these markets attractive export destinations.

2.3.3 Annual Land Acreage under Cultivation and Maize Prices in Kenya.

According to Muteti (2017), Maize production accounts for 58% of cereal production in Ghana; hence all factors affecting the yield of the product are of significant bearing to the national economy. Scheifele and Birner (2016) posit that fertilizer subsidy presented as a central theme in policy programs implemented to increase product yield in Africa. The authors, however, posit that the efficacy of the intervention has been varied, thus pointing to the need for

evaluation of possible intervening determinants. The study indicates that farms with yields of 1.5 metric tonnes per hectare showed profitable outcomes with subsidiary-program enrolment, whereas smaller farms did not. The difference in social profitability was viewed to be a result of the ineffective use of resources among smaller farms. The implication of these findings, therefore, is that the efficiency of the use of resources plays a pivotal role in determining the overall profitability of subsidiary programs.

In most African societies, land used for subsistence farming is not owned by individuals or by families, rather it is owned by the community (Karmapa, Okike, Okechukwu and Akande, 2003). Each family is allocated a section of land sufficient for producing the food needs of the family (Moyo, 2000). The relationships between land tenure, agricultural investment and production have been studied in Africa and there is ample evidence as a basis for the development of improved land policies in support of food security (Palmer, 2000). where land distribution structures are highly unequal, the negative food security trends are exacerbated (Quan, 2000). Given the importance of the rural sector in attaining food security and reducing poverty, there is recognition by policy-makers that a vibrant agricultural and rural sector, underpinned by land reform, will provide the catalyst for improving crop production in Africa (Kasanga, 2001).

The policy of community ownership of land is changing in some African countries to a system of private ownership (Stem, 2000). Some people are in favour of this new system since it provides security for the families farming the land (Sikoyo, Ochieng, and Kameri-Mobte, 2002). However, other people prefer the traditional system since it guarantees that all families in the community have access to land (Subarian, 2006). A study carried out by Karmapa et al., (2003) points out that when assured of their land holdings, farmers are willing to invest in that given land hence can adopt a given technology with ease. These translate to higher agricultural productivity.

2.3.4 Annual Quantity Produced and Maize Prices in Kenya

Li, Takahashi, Suzuki, and Kaiser (2011) analysed the impact of climate change on maize yields in the United States and China. The study focussed on the maize yields for the period 2008-2030 and focused on how climate change and precipitation affect production. The study notes that increasing economic and technology adaption has helped enhance maize yields. The study notes decreasing maize supply as a result of poor yields would contribute to an increase in the maize price, which in turn induce farmers to foster their investments in maize price production. The study focuses on maize yields in China and the United States. In contrast, the

current study sought to establish the influence of maize price fluctuations on production among Kenyan farmers. In a study focusing on maize production in Ghana, Abdulai, Nkegbe, and Donkoh (2013), focusing on panel data for the period 2011-2012. The results of the study were presented using descriptive and inferential statistics. Findings indicated that the efficiency in production was at 74% and was predicted by the level of mechanization, the cost of production, and the farmers' experience. The study, however, fails to indicate how maize production could influence maize prices in the local context, which is the focus of this research.

Hassan, Abdullah, Ismail, and Mohamed (2014) examined the factors influencing the total factor productivity growth of maize production in Nigeria. The study relied on secondary data for the period 1971-2010 with ordinary least squares adopted in the research. The results show that the cost of labor, price of fertilizer, research, and development spending, the net value of production, and government policies affected productivity. This study, however, was not focussed within the Kenyan context, which is the focus of this research. Nyamohanga (2017) analyzed the factors influencing maize crop production among small-scale farmers in Kuria East Sub-County. The study relied on key informant interviews and questionnaires in the data collection. The results show that household-level factors such as the size of farm, experience, and labor availability positively influenced production. The study also indicates that income received from the sale of crop yield was positively associated with an increase in crop production. The study, however, does not focus on small scale maize farmers who are the focus of this research.

Mwangi and Kariuki (2015) studied the factors determining the adoption of new agricultural technology by smallholder farmers in developing countries. The study employed a descriptive research design with the study data being collected from farms in Usain Gishu County. The findings indicate that technological, human-specific, and institutional factors influenced adoption levels. The study notes that the size of the firm, the cost of production, and the revenue generated from the agricultural activities enhanced agricultural technology adoption. The study, however, is not limited to maize farmers, which is the focus of this research. Simiyu (2014) examined the factors influencing maize production among small scale farmers in Kenya. The research utilized a descriptive research design with the population of the research consisting of the 18,850 small scale farmers in Bungoma County. The study indicates that the cost of fertilizers, access to credit services, extension services, and government support are critical to maize production. The research, however, fails to identify the link between the maize price fluctuation and volatility, which was the focus of this study.

2.4 Summary of Literature and Research Gaps

The below table 2.1 presented the various research gaps that have emanated from the review of the divergent and convergent empirical studies. The review of the previous studies indicated the various contextual gaps, conceptual gaps, and empirical gaps that the current study addressed. The summary of the various gaps is presented below.

Table 2.1 Research Gaps

Author	Title	Findings	Research Gap
Mukisu (2017)	Effect of input cost and previous years' farm gate price on the number of hectares under maize farming in Bungoma County.	The study revealed that there is a significant relationship between input cost and the area of land under farming	The study focused on Bungoma County only while current study focussed on the country
Folawewo and Olakojo (2010)	Determinants of Nigeria's agricultural exports	The study results found that exports were significantly affected by the world price and the real income of the trading partners.	The study was however not conducted in Kenya which is the focus of the current study
Muteti (2017)	Factors affecting the yield of the cereals in Ghana.	Maize production accounts for 58% of cereal production in Ghana hence factors affecting the yield of the product are of significant bearing to the national economy	This study focussed on determinants of Maize prices
Hassan, Abdullah, Ismail, and Mohamed (2014)	The factors influencing the total factor productivity growth of maize production in Nigeria.	The results show that the cost of labor, price of fertilizer, research, and development spending, the net value of production, and government policies affected productivity	The study failed to link maize production and maize prices

2.5 Conceptual Framework

According to Mugenda and Mugenda (2003), a conceptual framework provides a diagrammatic relationship between the variables of interest in a particular study. The variables defined how

the association is outlined or forecasted to be, which was further measured by the use of study indicators.

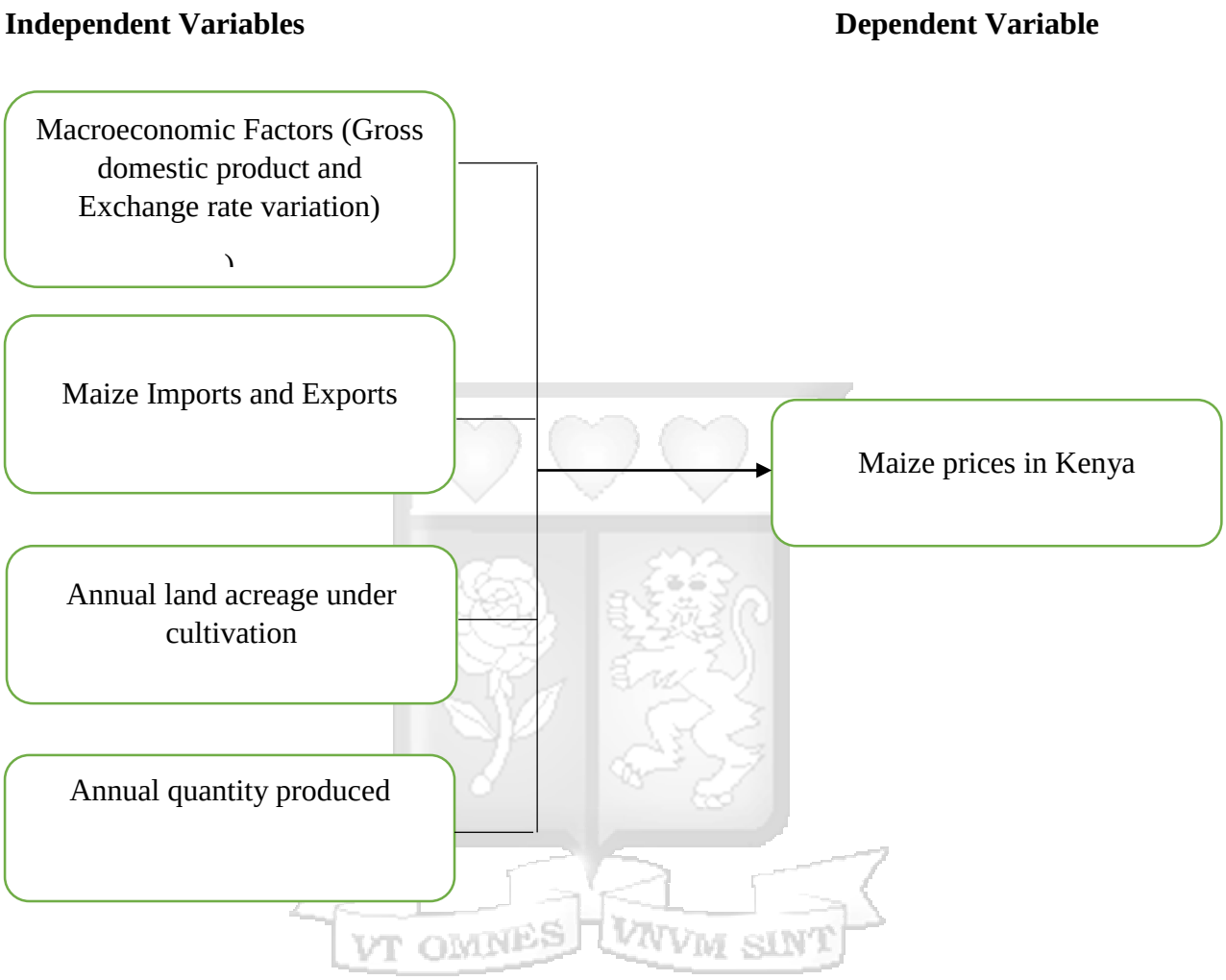

Figure 2.1 Conceptual Framework

The above conceptual framework presented the interaction between the selected determinants and the maize prices in Kenya. The study specifically examined how the GDP level, exchange rates, maize import level, maize export, annual land acreage under maize cultivation and maize production level influence maize prices in Kenya. The operationalization of the variables is presented in the table 2.1 below.

Table 2.2 Operationalization of variables

Variable	Construct	Measurement	Scale	Analysis
Maize Prices	• Annual maize price per kg	Price amount in Kshs	Ratio	Descriptive analysis
GDP	• Annual value of a country's productivity	Annual GDP growth rate	Ratio	Descriptive analysis
Exchange Rate Variations	• Annual exchange rate variations	Annual average exchange rate	Ratio	Descriptive analysis
Import	• Annual bags imported in the country	Number of bags	Ratio	Descriptive analysis
Exports	• Annual bags exported from the country	Number of bags	Ratio	Descriptive analysis
Land acreage under cultivation	• Farm size	Hectares	Ratio	Descriptive analysis
Maize Quantity produced	• Annual bags produced in the county	Number of bags	Ratio	Descriptive analysis

2.6 Chapter Summary

This chapter provided an insight into the current body of knowledge about the topic of study. The chapter presented the theoretical review, the empirical review of related studies, summary of literature gaps, the conceptual framework adopted and the operationalization of variables.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This study chapter presented the various methodological approaches that will guide the conduct of this research. The chapter contained the research philosophy, design of the study, the population, data collection instruments, procedures and the data analysis and presentation.

3.2 Research Philosophy

Research philosophy relates to the development of knowledge and the nature of that knowledge, and contains important assumptions about the way in which researchers view the world (Saunders, Lewis, & Thornhill, 2009). There are two extreme philosophical views regarding knowledge and reality schools of thought. These are positivism sometimes referred to as deduction research and phenomenology also known as induction research (Bryman & Bell, 2007). The most appropriate research philosophy for this current study was pragmatism. According to this view, the direction of the research is guided by the formulated research objectives that seek to answer various questions in the study (Biesta, 2010). This helped in directing the collection of research data as well as the conduct in testing for the association between the study variables.

3.3 Research Design

Research design is the plan and structure of investigation and how it is used to answer research questions, showing the relationship between study variables (Blumberg, Cooper, & Schindler, 2008). The research adopted a descriptive research design to examine the research problem. The research design was useful since the research objectives are focussed on establishing the degree to which one variable (independent) affect the other variable (dependent).

3.4 Population and Sampling

Target population refers to the total number of subjects or the total environment of interest to the researcher (Bryman & Bell, 2007). Ngechu (2004) defined target population as all real or hypothetical members, people, events or subjects that the researcher wishes to generalize the results. The study utilized time-series data for the period 1990-2019. Data was collected from reports from the Central Bank of Kenya, World Bank, Kenya National Bureau of Statistics and Herufi House library.

3.5 Data Collection Instruments

Biesta (2010) noted that data collection involves the technique of gathering data to achieve organizational goals. Additionally, Eriksson and Wiedersheim-Paul (2001) argued that for the researcher to have comprehensive knowledge of the study area, data has to be collected. The study will purely rely on time series collected from secondary sources of data. The main sources of the research data were annual statements from the Central Bank of Kenya, World Bank and the Kenya National Bureau of Statistics. The study employed a data extraction form to collect research data for the period 1990-2019.

3.6 Data Collection Procedures

The data collection procedures involved the various measures conducted before the main research as well as the technique utilized in the data collection process (Baxter & Jack, 2008). The study ensured that all relevant approvals are given by the Strathmore Business School. Further the study applied for a research permit from the National Commission for Science Technology and Innovation. The study accessed the relevant reports from the institutional websites.

3.7 Data Analysis and Presentation

Data was analysed using descriptive and inferential techniques for the quantitative data. The descriptive analysis included means, skewness, kurtosis, sum and standard deviation. The study utilized correlation analysis and ordinary least squares regression to estimate the association and strength of relationship between research variables. The regression models for the study took the following form;

Model 1

$$MP_t = \lambda_0 + \beta_1 GDP_t + \beta_2 ERV_t + \beta_3 MIQ_t + \beta_4 MEQ_t + \beta_5 ALC_t + \beta_6 AQP_t + \varepsilon_t$$

Where,

MP_t represented the maize prices in Kenya at time t

λ_0 represented the constant of the adopted model

β_{1-6} represented the coefficient of the predictor variables

GDP_t represented the gross domestic product in Kenya at time t

ERV_t represented the exchange rate variations in Kenya at time t

$\mathbf{MIQ_t}$ represented the maize import quantity in Kenya at time t

$\mathbf{MEQ_t}$ represented the maize export quantity in Kenya at time t

$\mathbf{ALC_t}$ represented the annual land under maize cultivation in Kenya at time t

$\mathbf{AQP_t}$ represented the annual maize quantity produced in Kenya at time t

The analysed data was presented using charts and tables as well as other info graphics deemed appropriate. The research further undertook statistical tests such as ANOVA and independent t-tests at a 95% Confidence level. The research conducted autocorrelation tests, collinearity tests, heteroscedasticity and stationarity tests prior to conducting regression analysis.

3.8 Ethical Considerations

The study ensured that appropriate ethical guidelines are adhered to throughout the conduct of the research. The researcher sought from Strathmore University, prior to undertaking the study. The ensured that a research permit is sought from the National Commission for Science Technology and Innovation. The researcher made sure that confidentiality was maintained within the research work and the results of the study were only applied in this academic work.

CHAPTER FOUR

PRESENTATION OF RESEARCH FINDINGS

4.1 Introduction

This fourth chapter presented the analysis of the collected research data. The study extracted time series from various sources for the period 1990-2019 and the analysis was conducted using descriptive analysis and panel regression analysis.

4.2 Research Observations

The study relied on time series from multiple sources; Central Bank of Kenya, World Bank and Kenya National Bureau of Statistics. The research period was 1990-2019 with 30 observations being considered for the 7-research variables. The study was able to obtain 210 observations across the study variables.

4.3 Summary of Descriptive Analysis

The study collected research data on the level of gross domestic product, the exchange rate, maize import quantity, maize export quantity, annual land acreage under cultivation, annual quantity produced and the maize prices in Kenya for the period 1990-2019. The summary statistics were computed using means, median, maximum, minimum, skewness and the kurtosis. The summary of the results is presented in this section. The key for the table is as follows; GDP – gross domestic product growth rate, ERV – exchange rate variation, MQ – maize quantity imported, XQ – maize quantity exported, LA – land acreage under maize cultivation, MP – maize produced, P/KG – maize price per kilogram.

Table 4.1 Summary Statistics for Determinants of Domestic Maize Prices

Variable	GDP	ERV	MQ	XQ	LA	MP	P/KG
Mean	3.89	73.28	357.83	25.37	1826.23	2886.60	18.56
Median	4.30	76.75	250.00	4.00	1760.50	2751.00	14.29
Standard Deviation	2.33	20.57	353.51	55.14	238.27	610.29	11.03
Maximum	8.41	103.20	1400.00	231.00	2338.00	4014.00	40.73
Minimum	-0.80	24.72	0.00	0.00	1351.00	1755.00	2.31
Kurtosis	-0.77	0.24	1.47	7.55	-0.77	-1.14	-0.90
Skewness	-0.36	-0.65	1.40	2.86	0.26	0.25	0.50

Source: Research Data (2020)

4.3.1 Maize Price Variations

The analysis of the maize pricing in Kenya showed that on average the prices were 18.56 per Kg which translates to 1,670Kshs. Per 90kg maize bag. The highest recorded maize price was 3,665.70 Kshs (40.73/kg).

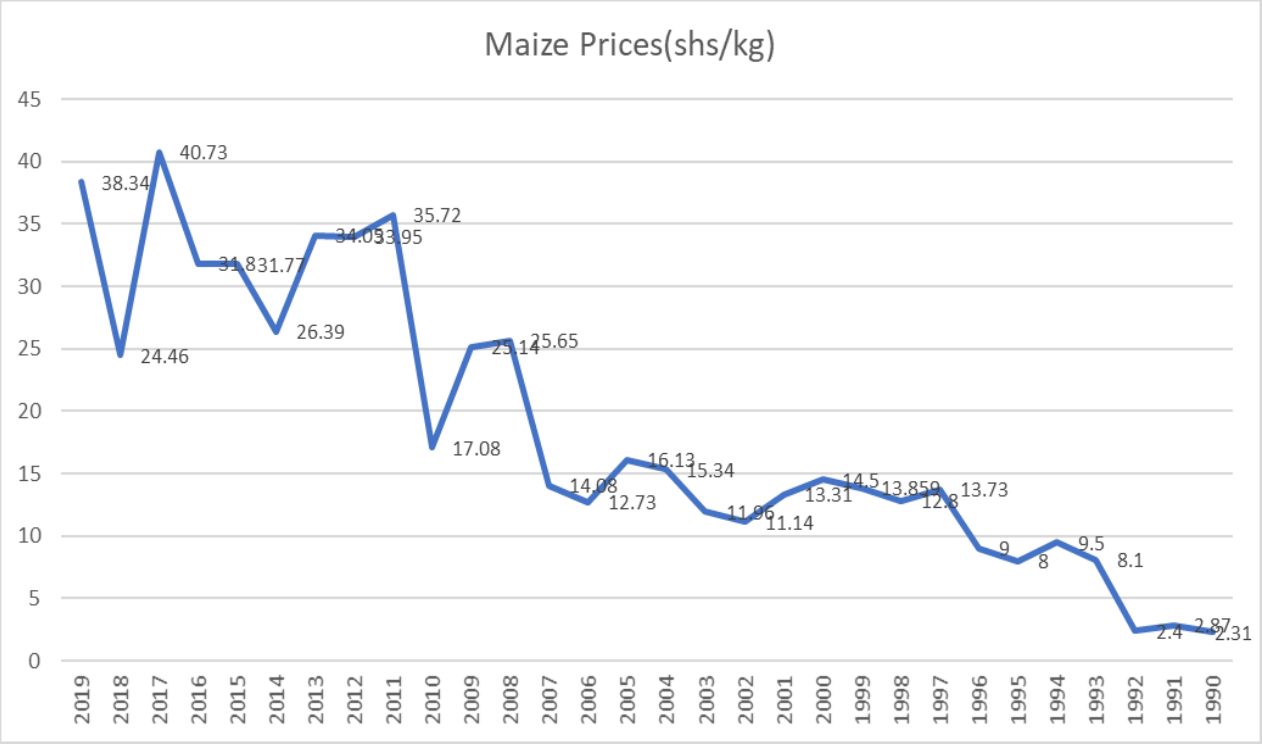

Figure 4.1 Maize Prices Per/Kg
Source: Research Data (2020)

4.4 Effect of Gross Domestic Product on Domestic Maize Prices

The study analysed the gross domestic product growth using the annual GDP (%) for the period 1990-2019 with both CBK and World Bank being the main sources.

Table 4.2 Summary of GDP Growth Results

Variable	GDP Growth
Mean	3.89
Median	4.30
Standard Deviation	2.33
Maximum	8.41
Minimum	-0.80
Kurtosis	-0.77
Skewness	-0.36

Source: Research Data (2020)

The results indicate that on average between 1990-2019, Kenyan GDP stood at 3.89% with the highest GDP of 8.41% being attained within the period.

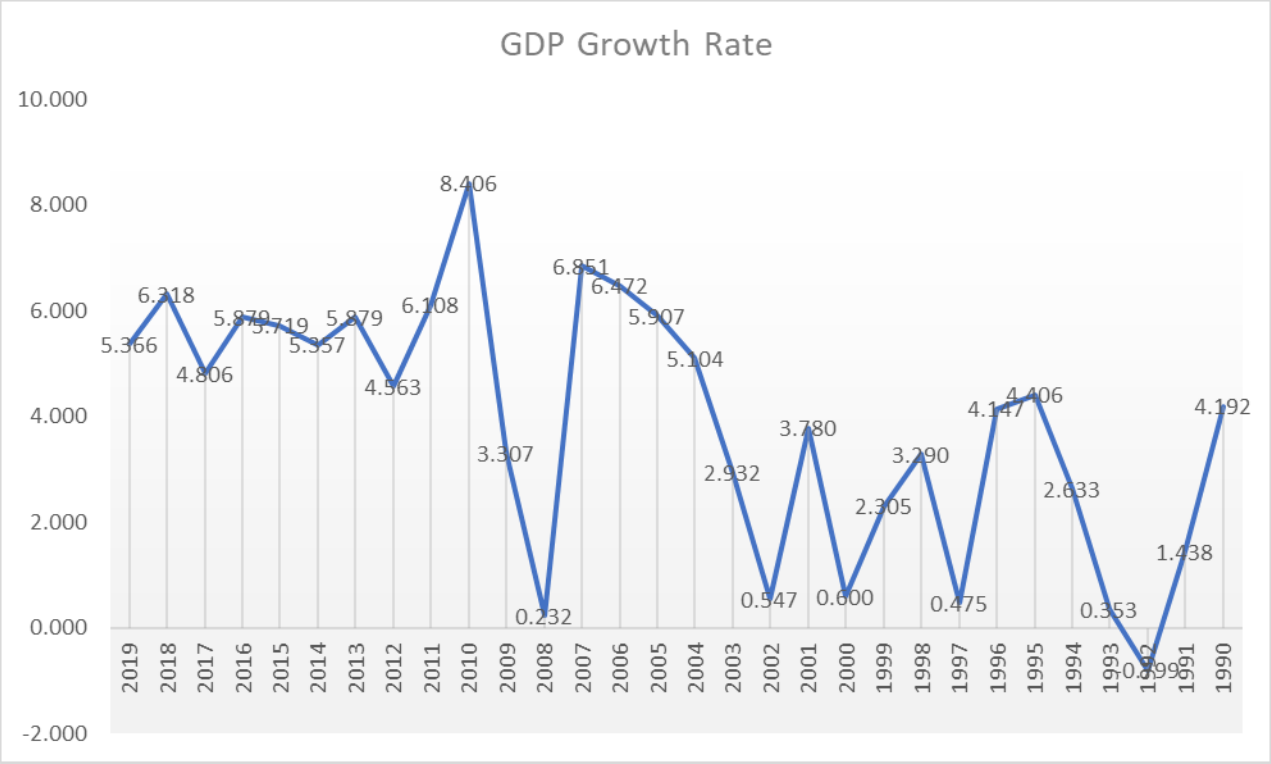

Figure 4.2 GDP Growth 1990-2019
Source: Research Data (2020)

4.4.1 Correlation between GDP Growth and Domestic Maize Prices

The study applied correlation analysis in seeking to establish the association between GDP Growth and Domestic Maize Prices and findings are shown below.

Table 4.3 Correlation Results for GDP Growth and Domestic Maize Prices

	GDP growth rate
GDP growth rate	1.000
	0.5097*
Maize price	0.0040

Source: Research Data (2020)

The study sought to establish the effect of GDP growth level on the domestic maize prices in Kenya; the results indicate there is a positive and significant effect of GDP growth rate on the domestic maize prices (P = 0.5097, Sig = .0040<.05).

4.5 Effect of Exchange Rate Variations on Domestic Maize Prices

The research analysed the exchange rate variations for the period 1990-2019 with CBK being the main sources of the research data.

Table 4.4 Summary of Exchange Rate Variations

Variable	Exchange Rate Variations
Mean	73.28
Median	76.75
Standard Deviation	20.57
Maximum	103.20
Minimum	24.72
Kurtosis	0.24
Skewness	-0.65

Source: Research Data (2020)

The study indicates that the mean exchange rate of the Kenyan shilling against the United States dollar was 73.28 shillings with an annual high of 103.20 shillings.

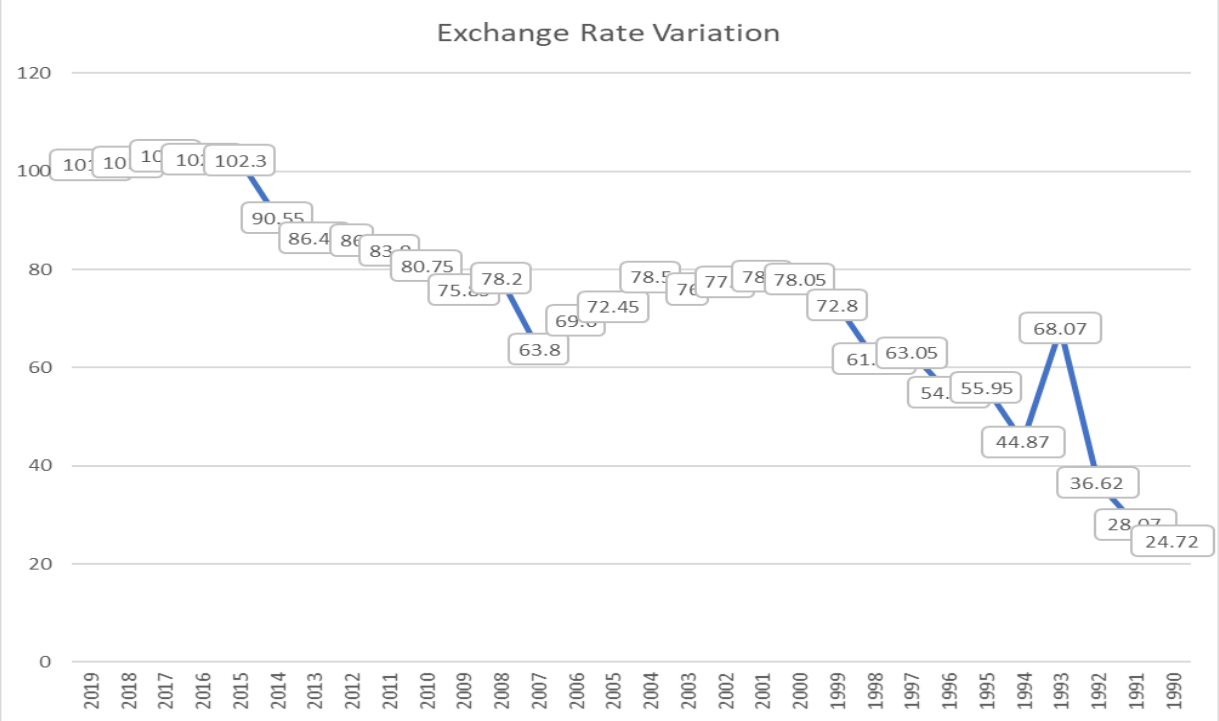

Figure 4.3 Exchange Rate Variations 1990-2019
Source: Research Data (2020)

4.5.1 Correlation between Exchange Rate Variations and Domestic Maize Prices

The study applied correlation analysis in seeking to establish the association between exchange rate variations and Domestic Maize Prices and findings are shown below.

Table 4.5 Correlation Results for Exchange Rate Variations and Domestic Maize Prices

	Exchange rate
Exchange rate	1.0000
	0.8794*
Maize price	0.0000

Source: Research Data (2020)

The research also sought to determine the effect of exchange rates on the domestic maize prices in Kenya. The findings revealed there is a positive and significant effect of exchange rates on the domestic maize prices (P = 0.8794, Sig = .0000<.05).

4.6 Effect of Maize Import Quantity on Domestic Maize Prices

The third objective of the research examined the effect of maize import quantity on the domestic maize prices in Kenya. The summary of the extracted observations is presented below.

Table 4.6 Summary of Maize Import Quantity

Variable	MQ
Mean	357.83
Median	250.00
Standard Deviation	353.51
Maximum	1400.00
Minimum	0.00
Kurtosis	1.47
Skewness	1.40

Source: Research Data (2020)

The results presented above reveal that on average Kenya imported 357,830 metric tonnes of maize within the period 1990-2019. This result goes to show in terms of maize production Kenya is lagging behind owing to the large quantities being imported.

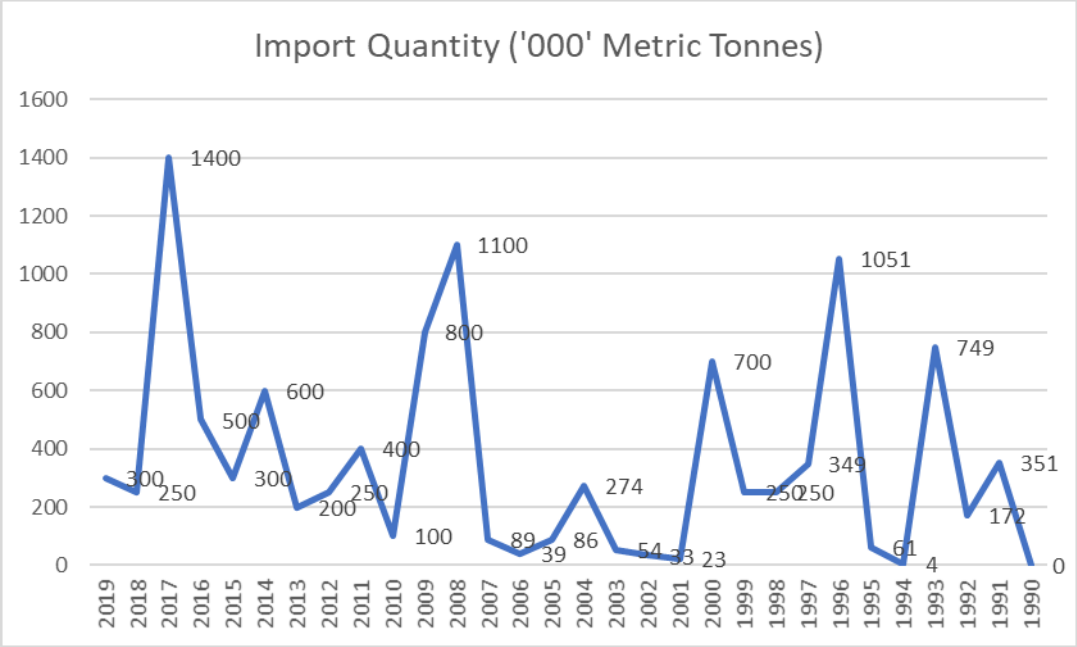

Figure 4.4 Maize Import Quantity in Tonnes
Source: Research Data (2020)

4.6.1 Correlation between Maize Import Quantity and Domestic Maize Prices

The study applied correlation analysis in seeking to establish the association between maize import quantity and domestic maize prices and findings are shown below.

Table 4.7 Correlation Results for Maize Import Quantity and Domestic Maize Prices

	Import quantity
Import quantity	1.0000
	0.4413*
Maize price	0.0147

Source: Research Data (2020)

The study examined the effect of import quantity on the domestic maize prices in Kenya; findings showed there is a positive and significant effect of maize import quantities on the domestic maize prices (P = 0.4413, Sig = .0147<.05).

4.7 Effect of Maize Export Quantity on Domestic Maize Prices

The fourth objective of the research examined the effect of maize export quantity on the domestic maize prices in Kenya. Below is the summary of the extracted observations.

Table 4.8 Summary of Maize Export Quantity

Variable	Maize Export Quantity
Mean	25.37
Median	4.00
Standard Deviation	55.14
Maximum	231.00
Minimum	0.00
Kurtosis	7.55
Skewness	2.86

Source: Research Data (2020)

The results presented above reveal that on average Kenya maize exports accounted for an average of 25,370 metric tonnes within the period 1990-2019. This result goes to show in terms of maize production Kenya is lagging behind owing to the large disparity between quantity imported and the exports within the country.

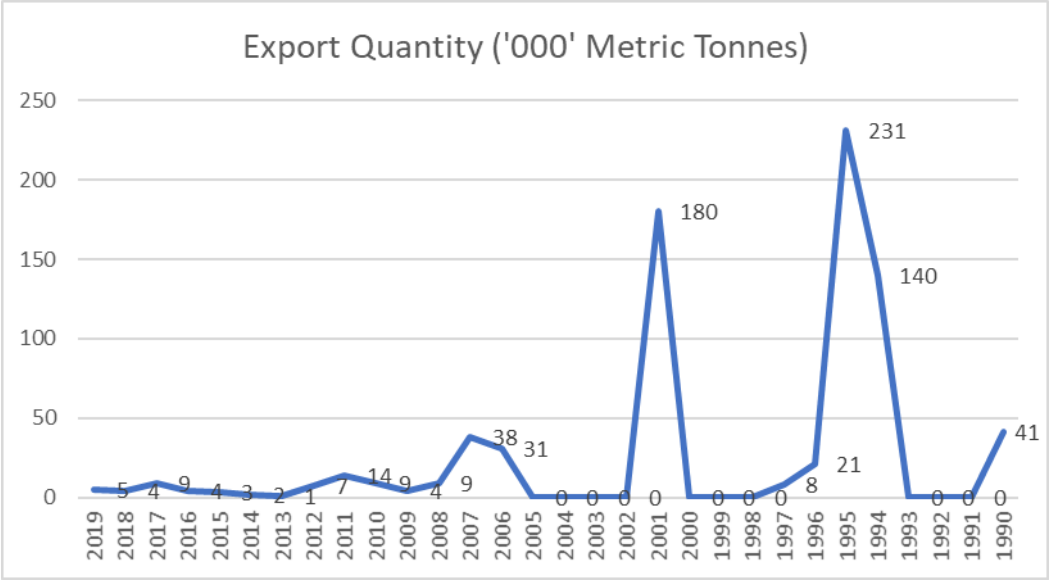

Figure 4.5 Maize Export Quantity in Tonnes
Source: Research Data (2020)

4.7.1 Correlation between Maize Export Quantity and Domestic Maize Prices

The study applied correlation analysis to establish the effect of maize export quantity and domestic maize prices and results are shown below.

Table 4.9 Correlation Results for Maize Export Quantity and Domestic Maize Prices

	Export quantity
Export quantity	1.0000
	0.0236
Maize price	0.9015

Source: Research Data (2020)

The research also focussed on determining the effect of maize export quantity on the domestic maize prices in Kenya and the results indicated that maize export quantity had a positive and insignificant effect on domestic maize prices (P = 0.0236, Sig = .9015>.05).

4.8 Effect of Land Acreage under Cultivation and Domestic Maize Prices

The study further indicated that on average 1,826,230 hectares of land were under maize cultivation within the country during the research period.

Table 4.10 Summary of Land Acreage under Cultivation

Variable	LA
Mean	1826.23
Median	1760.50
Standard Deviation	238.27
Maximum	2338.00
Minimum	1351.00
Kurtosis	-0.77
Skewness	0.26

Source: Research Data (2020)

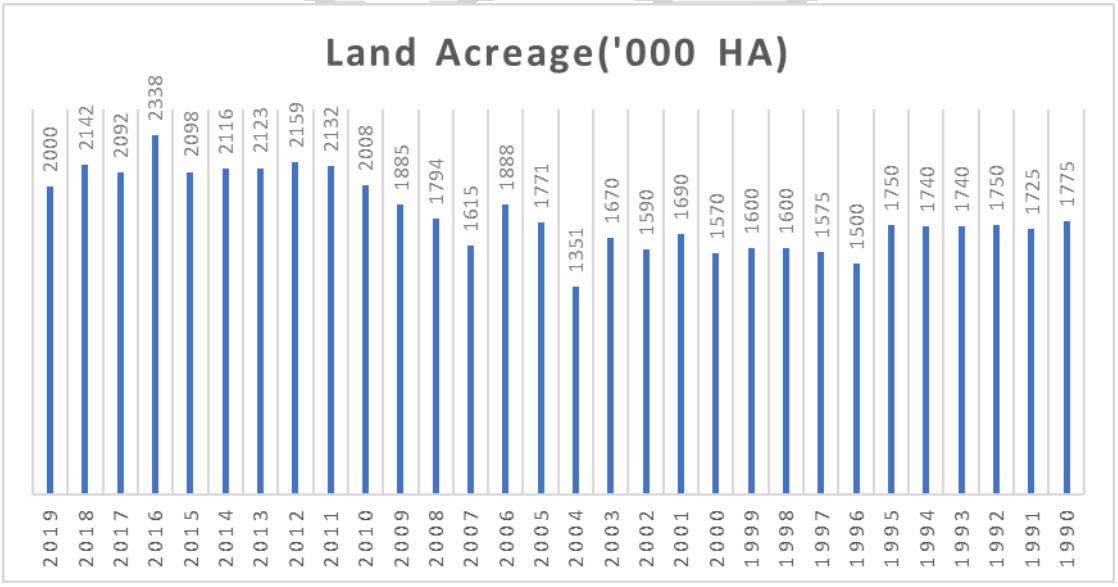

Figure 4.6 Land Acreage under Cultivation in Hectares
Source: Research Data (2020)

4.8.1 Correlation between Land Acreage and Domestic Maize Prices

The study employed correlation analysis to determine the effect of land acreage under maize cultivation on domestic maize prices in Kenya.

Table 4.11 Correlation Results for Land Acreage and Domestic Maize Prices

	Land acreage
Land acreage	1.0000
	0.6253*
Maize price	0.0002

Source: Research Data (2020)

The study sought to establish the effect of land acreage under maize cultivation on domestic maize prices and the findings showed that land acreage under cultivation had a positive and significant effect on domestic maize prices (P = 0.6253, Sig = .0002<.05).

4.9 Effect of Maize Produced on Domestic Maize Prices

The last study objective sought to establish the effect of maize production on the domestic maize prices in Kenya. The summary of the maize production quantities in Kenya is presented below.

Table 4.12 Summary of Maize Quantity Produced

Variable	MP
Mean	2886.60
Median	2751.00
Standard Deviation	610.29
Maximum	4014.00
Minimum	1755.00
Kurtosis	-1.14
Skewness	0.25

Source: Research Data (2020)

The summary statistics indicated that between 1990-2019 on average Kenya produced 2,886,600 metric tonnes of maize. The results showed that the maximum production achieved within the period was 4,014,000 metric tonnes.

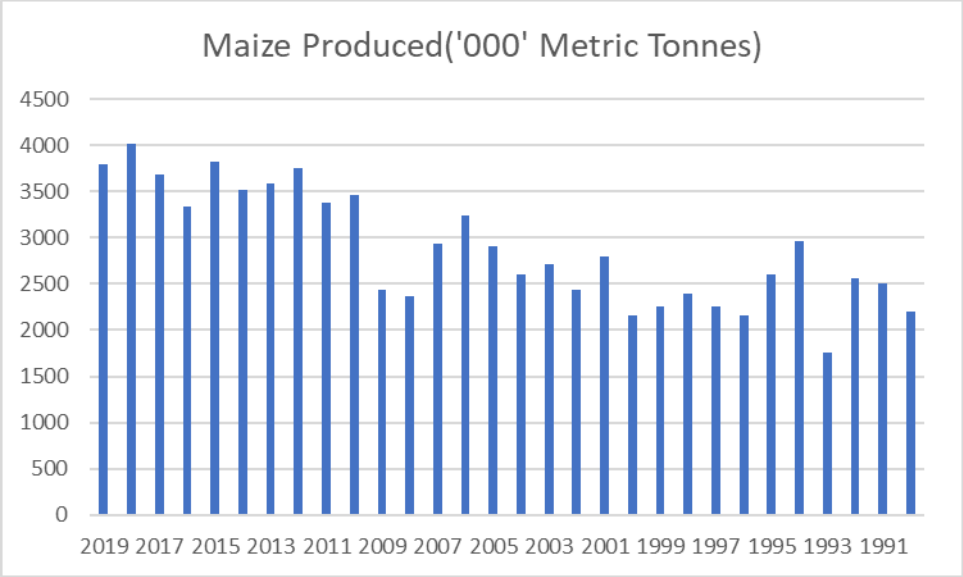

Figure 4.7 Land Acreage under Cultivation in Hectares
Source: Research Data (2020)

4.9.1 Correlation between Maize Quantity Produced and Domestic Maize Prices

The study employed correlation analysis to determine the effect of maize quantity produced on domestic maize prices in Kenya.

Table 4.13 Correlation Results for Maize Quantity Produced and Domestic Maize Prices

	Maize quantity produced
Maize production	1.0000
	0.6707*
Maize price	0.0001

Source: Research Data (2020)

The study objective sought to establish the effect of maize quantity produced on the domestic maize prices in Kenya and the findings indicated there is a positive and significant effect on domestic maize prices (P = 0.6707, Sig = .0001<.05).

4.10 Diagnostic Tests

4.10.1 Heteroscedasticity Tests

The study conducted heteroscedasticity tests which helps in indicates whether the random error term from a multiple linear regression must have constant variances. The study applied the Breusch-Pagan test.

Table 4.14 Heteroscedasticity Results

Ho: Constant variance	
Variables: fitted values of Prices	
chi2(1)	= 4.95
Prob > chi2	= 0.261

The findings in Table 4.3 presented above show that the null hypothesis of the constant variance of residuals was accepted since the probability value of 0.261 was greater than the critical value of 0.05. This shows that there was a constant variance and no problem of heteroscedasticity.

4.10.2 Collinearity Analysis

The study applied collinearity tests to examine the linear independence of the predictor variables. The research adopted the variance inflation factor to examine the multicollinearity.

Table 4.15 Collinearity Results

Variable	VIF	1/VIF
Maize Production quantity	**5.52**	**0.181087**
Land acreage under maize	**3.13**	**0.319486**
Exchange Rate variation	**2.29**	**0.435977**
GDP Growth Rate	**2.14**	**0.466840**
Maize Import Quantity	**1.52**	**0.656693**
Maize Export Quantity	**1.16**	**0.859213**
Mean VIF	**2.63**	

The results shown above indicated that all the variables had VIF values of less than 10 which indicates that there was no collinearity problem between the independent variables. The study tolerance values (1/VIF) were also above 0.1 which indicated further there was no collinearity violation within the research data.

4.10.3 Normality Tests

The study conducted normality test to determine if the data utilized in the analysis was from a normal distribution. The research adopted the Shapiro-Wilk test and the findings are as presented.

Table 4.16 Normality Results

Variable	Obs.	Prob>z
GDP Growth Rate	**30**	**0.18433**
Exchange Rate	**30**	**0.07701**
Maize Import Quantity	**30**	**0.06049**
Maize Export Quantity	**30**	**0.05679**
Land acreage under maize	**30**	**0.18390**
Maize Production	**30**	**0.10360**
Domestic Maize Price	**30**	**0.07910**

4.10.4 Stationarity Tests

Unit root test were conducted to ensure that the series were stationary and check the problem of having a spurious regression. The study conducted stationarity tests on the observations of the research data using the Levin-Lin Chu statistical tests.

Table 4.17 Stationarity Results

Variable	Method	Statistic	Prob.**	Obs
Null: Unit root (assumes common unit root process)				
GDP growth	Levin, Lin & Chu t*	-1.65525	0.0489	30
Exchange rate	Levin, Lin & Chu t*	0.08531	0.0340	30
Maize import	Levin, Lin & Chu t*	-2.65454	0.0040	30
Maize export	Levin, Lin & Chu t*	-1.77107	0.0383	30
Land acreage	Levin, Lin & Chu t*	-1.78828	0.0369	30
Maize produced	Levin, Lin & Chu t*	-6.04556	0.0000	30

The study variables were found to be stationary at first difference I (1) because the Levin, Lin & Chu t* statistic had a probability value which was less than .05 which is significant at 5% level of significance as indicated in the table above.

4.10.5 Autocorrelation Tests

The study also conducted serial correlation tests which examines the degree of correlation between the values of the same variables across different observations in the data. The research employed the Durbin-Watson statistic in the analysis.

Table 4.18 Autocorrelation Results

Durbin-Watson Statistic	
D-W =	2.126
Prob > chi2 =	0.000

The Durbin-Watson tests produces a test statistic that ranges from 0 to 4. Values closer to 2 imply no correlation while values closer to 4 and 0 imply extreme autocorrelation. The findings indicate a d-w statistic of 2.126 which implied there was no autocorrelation problem within the fitted model. From the above diagnostics tests the study data met the assumption of ordinary least square regression and this was adopted in analyzing the determinants of domestic maize prices.

4.11 Regression Analysis

The main objective of the research was to analyse the determinants of domestic maize prices in Kenya. The research applied diagnostics tests presented in previous section prior to conducting the ordinary least square regression of the time series data. the findings are presented in this section.

Table 4.19 Regression Model

Mean dependent var	17.38828	S.D. dependent var	11.94607
Sum squared residual	1012.769	S.E. of regression	5.810246
R-squared	0.802868	Adjusted R-squared	0.763441
F (6, 30)	20.36368		

The regression output yielded a $R^2 = .8029$, *F-Calc = 20.363, Prob> chi2 = .0000<.05* which implied that 80.29% of the changes in the domestic maize prices in Kenya are determined by the GDP growth, exchange rate, maize import quantity, maize export quantity, land acreage under maize cultivation and maize produced in Kenya.

Table 4.20 Regression Results

	Coefficient	*Std. Error*	*t-ratio*	*p-value*
constant	−4.37409	3.21495	−1.361	0.1838
GDP Growth Rate	0.359833	0.622976	0.5776	0.5678
Exchange Rate Variation	0.204877	0.0757168	2.706	0.0111
Maize Import Quantity	0.0104035	0.00305763	3.402	0.0019
Maize Export Quantity	−0.0118188	0.0168531	−0.7013	0.4885
Land acreage under Maize	−0.0121673	0.00542362	−2.243	0.0324
Maize Quantity Produced	0.00892650	0.00397101	2.248	0.0321

Model 1: OLS, using observations 1990-2019 (T = 30)

Dependent variable: Maize Prices shs/kg

The study findings indicated that GDP growth rate did not have a significant influence on the domestic maize prices in Kenya *(β=.3598, p= 0.5678>.05).* The results indicated that exchange rate had a positive and significant influence on the domestic maize prices in Kenya *(β=.2049, p=0.0111<.05)* which indicates that a change in exchange rate by one unit will lead to a 0.2049 change in maize prices. The study further showed that maize import quantity had a positive influence on the domestic maize prices *(β=.0104, p=0.0019<.05)* which implied that a change in the maize import quantity will lead to 0.0104 change in the domestic maize prices. The study further noted that there was insignificant influence of maize export quantity *(β= −0. 0118, p=-0.4885>.05).* The findings also showed a statistically significant influence of land acreage under maize cultivation *(β=−0.0121, p=0.0324<.05)* and maize quantity produced *(β=0.0089, p=0.0321<.05)* on the domestic maize prices in Kenya. This indicated that change in land acreage under maize production will lead to a -0.0121 change in domestic maize prices while maize quantity produced will lead to a 0.0089 change in the domestic maize prices in Kenya.

4.12 Chapter Summary

The study findings showed that the maize prices in the country have been fluctuating between 1990-2019 with a minimum of 18.56Kshs/kg to a maximum of 40.73Kshs/kg. The regression of the determinants of domestic maize prices changes indicated that 80.28% of the changes are statistically predicted by GDP growth, exchange rate, maize import quantity, maize export quantity, land acreage under maize cultivation and maize produced in Kenya. As such, the results in line with the theory of demand and supply which showed that various market forces are critical in determining maize prices in Kenya.

CHAPTER FIVE

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The fifth chapter of the study presented the discussion of the study results in line with the objectives of research. The chapter further presented the conclusions and recommendations of the study.

5.2 Discussion

5.2.1 Effect of GDP Growth on Domestic Maize Prices

The study findings indicated that GDP growth rate has an insignificant influence on the domestic maize prices in Kenya. This is not supported by studies by Idisardi (2010) who found that the country's GDP had a positive and significant impact on the prices of agricultural products in South Africa and Abdulai, Nkegbe, and Donkor, (2017) who determined that Real per capita GDP has a significant effect on maize prices in Ethiopia. These study results were however consistent with Helga (2005) who found that the GDP of the country does not affect its agricultural prices in Iceland. This was also supported by Leite (2008) who also found no evidence that the GDP of Colombia affects it prices of products.

5.2.2 Effect of Exchange Rate Variation on Domestic Maize Prices

The study results indicated that exchange rate had a positive and significant influence on the domestic maize prices in Kenya. This was supported by Gautam et al (2013) who analysed the effect of real exchange rate volatility of Indian rupee with Euro, US Dollar, UK pound and Japanese Yen on India's agricultural products and found out that real exchange rate significantly influenced the prices of all agricultural products. This was also supported by Kiptui (2008) who found out that the real exchange rate has a positive effect on prices on agricultural products but was statistically insignificant. Barret (2007) also found that the change in the expected exchange rate and change in industrial production of a country jointly influence agricultural volumes and prices. This was however disputed by Yuksel, Kuzey & Sevinc (2012) who found out that there was a negative and insignificant relationship between exchange rate variations and prices.

5.2.3 Effect Maize Import Quantity and Domestic Maize Prices

The study findings show that maize import quantity had a positive and significant influence on the domestic maize prices. This was in line with a study by Mwangi et al. (2014) who found out that import levels have a positive impact on domestic maize prices. This was also supported by De Silva & Ratnadiwakara, (2010) who found that import has a significant effect on the prices of agricultural products. Pearson (2013) however disputed this and found out that import

levels had a negative effect on price levels. He however found out the inverse was true that price levels had a positive effect on the import levels. Chowdhury et. al (2014) also found that imports and exports overall were insignificant determinants of rice prices.

5.2.4 Effect of Maize Export Quantity and Domestic Maize Prices

The study findings indicated that there was insignificant influence of maize export quantity on the domestic maize prices. This was not in line with Folawewo and Olakojo (2010) who also found that agricultural exports were significantly affected by the world price and the real income of the trading partners. Yusuf (2007) also found that export growth significantly affected supply side factors such as previous domestic price, GDP, and relative prices. Suresh and Neeraj (2014) also found that GDP, difference in per capita income and prices similarity were significant and positively affected India's exports for both sets of countries.

5.2.5 Effect of Land Acreage and Domestic Maize Prices

The study findings noted that there was significant influence of land acreage under maize cultivation on the domestic maize prices in Kenya. This was in line with Subarian (2006) however found out that land under cultivation had a significant effect on maize prices.

5.2.6 Effect of Maize Quantity Produced on Domestic Maize Prices

The study findings noted that there was significant influence of maize produced on the domestic maize prices in Kenya. Li, Takahashi, Suzuki, and Kaiser (2011) found out that Maize production significantly affects the prices of maize. This was also supported by Hassan, Abdullah, Ismail, and Mohamed (2014) examined the factors influencing the total factor productivity growth of maize production in Nigeria and found out that maize production significantly affects maize prices.Nyamohanga (2017) also found out that maize crop production among small-scale farmers had a significant effect on maize prices in Kuria East Sub-County. Mwangi and Kariuki (2015) noted that the size of the firm, the cost of production, and the revenue generated from the agricultural activities enhanced agricultural technology adoption and therefore affected prices.

5.3 Conclusions

Based on the results, the study concluded there is a statistically significant relationship between the GDP growth, exchange rate variations, maize import quantity, maize export quantity, annual land acreage and annual quantity produced and the domestic maize prices. The first objective examined the effect of GDP growth and the study concludes there is an insignificant influence of the country's GDP rate and the domestic maize prices. The study also analysed

the effect of exchange rate and the research concluded that exchange rate variations have a positive and significant relationship with domestic maize prices.

The study reviewed the effect of maize import quantity on the domestic prices and the research found out there is a positive and significant relationship between maize import quantity and the domestic maize prices. The research examined the effect of maize export quantity on domestic maize prices and the study concludes there is no significant influence of maize export quantity on the domestic maize prices. The study also reviewed the effect of land acreage under maize cultivation on domestic maize prices and the research concludes there a significant and negative effect of land acreage under cultivation and the domestic maize prices. The study further concludes that maize quantity produced had a significant and positive influence on the domestic maize prices in Kenya.

5.4 Recommendations

5.4.1 Policy Recommendation

The study recommends that the Ministry of Agriculture in liaison with other government agencies should improve the incentives offered to maize farmers to improve their production quantity and reduce reliance on maize importation. The study results can also inform policy changes within the Treasury and Central Bank of Kenya in designing monetary policies that will ensure the local maize prices are not exposed to the volatility in of the domestic currency. Further through adopting effective trade policies government agencies can help in fostering the competitiveness of the domestic maize production as well as negotiate for optimal pricing of maize imported to the country to ensure there is minimal disruption of the local maize prices.

5.4.2 Practical Recommendations

The study recommends that farmers across the country should regularly review the macroeconomic factors (GDP growth and Exchange rates) as they have a significant influence on the maize pricing. This can be achieved through forming cooperatives and other farmer groups that can undertake linkages with government institutions and other stakeholders who can play an advisory role to farmers. The research further recommends that maize farmers should increase their investment in modern technologies which can help in improving their maize production which can narrow the quantity of maize imported to the country.

The study suggests that maize farmers could also increase the land under cultivation as this can translate to more large-scale farming which leads to higher maize production to meet the local supply shortfalls. To foster the competitiveness of their crop locally, the study recommends

that maize farmers should join in groups and seek extension services on the best crops to cultivate which can result in higher production levels which can offer farmers a bargaining power for better prices. The study also recommends that farmers should leverage on the available agricultural technologies which can offer real-time data on among other things weather patterns, right crop and planting conditions, market linkages and market information which can help strengthen the farmers' maize production levels, improve the local supply of maize for export and participation in global maize markets.

5.5 Suggestions for Further Research

The study mainly focussed on secondary data in determining how these aspects influence domestic maize prices in Kenya. Further study should be considered taking into account the effect of other substitute products on the domestic maize prices in Kenya. Further research work can be conducted taking into account more East African to get a comparison of the selected determinants impact maize prices across the regional countries.

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APPENDICES

Appendix I: Data Extraction Form

Variable	**Annual Value 1990-2019**
GDP growth	
Exchange rate	
Maize import quantity	
Maize export quantity	
Land acreage under maize cultivation	
Maize quantity produced	

Appendix II: Ethics Review Letter

Strathmore UNIVERSITY

24th March 2020

Ms Kilwake, Pamela
pkilwake@gmail.com

Dear Ms Kilwake,

RE: Effect of Market Factors, Maize Production on The Maize Price Fluctuations in Trans Nzoia County, Kenya

This is to inform you that SU-IERC has reviewed and **approved** your above research proposal. Your application approval number is **SU-IERC0700/20.** The approval period is **24th March 2020 to 23rd March 2021.**

This approval is subject to compliance with the following requirements:

i. Only approved documents including (informed consents, study instruments, MTA) will be used
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by SU-IERC.
iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to SU-IERC within 72 hours of notification
iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to SU-IERC within 72 hours
v. Clearance for export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days upon completion of the study to SU-IERC.

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://oris.nacosti.go.ke and also obtain other clearances needed.

Yours sincerely,

for;
Dr Virginia Gichuru,
Secretary; SU-IERC

STRATHMORE UNIVERSITY INSTITUTIONAL ETHICS REVIEW COMMITTEE (SU-IERC)
24 MAR 2020
TEL: +254 (0)703 034 000
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NAIROBI - KENYA

Cc: Prof Fred Were,
Chairperson; SU-IERC

Appendix III: Nacosti Approval

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **282381**

Date of Issue: **15/May/2020**

RESEARCH LICENSE

This is to Certify that Ms.. Pamela Kilwake of Strathmore University, has been licensed to conduct research in Transnzoia on the topic: EFFECT OF MARKET FACTORS, MAIZE PRODUCTION ON THE MAIZE PRICE FLUCTUATIONS IN TRANS NZOIA COUNTY, KENYA for the period ending : 15/May/2021.

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282381

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