AGRICULTURAL OUTPUT AND ECONOMIC GROWTH IN KENYA: A CAUSALITY TEST

BY

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DECLARATION

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

OIPK 29.11.2021

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This research project has been submitted for examination with my approval as the university supervisor.

29.11.2021

Signature Date

Dr. John Kamau Gathiaka

DEDICATION

To my mother Teresa, and my siblings Benja, Tichi, and Heather,
I will always be grateful for how you encourage me to face the practical realities of life – its responsibilities, its opportunities, its successes, and its defeats.

ACKNOWLEDGEMENT

I thank God Almighty from whom all things come; for His blessings and sustenance without which I would not have completed my research project.
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God bless you.

ABSTRACT

The link between economic growth and agricultural output is extensively documented, but the causal relationship has not been well investigated. Understanding the relationship between the two factors can aid policy development in both domains. This study looks into the causality regarding economic growth and agricultural output in Kenya from 1971 to 2019. The study adopted the ARDL model to estimate the short-run and long-run relationship between agricultural output and real GDP. According to the study, agricultural output has no causal and non-significant influence on economic growth. Based on that, the government should reconsider improving real interest rate, gross domestic saving, gross capital formation, inflation rate, and foreign direct investments to enhance the economy.

Keywords: Economic Growth, Agricultural Output, Granger causality test

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LIST OF ABBREVIATIONS AND ACRONYMS

ADF	Augmented Dickey-Fuller
ARDL	Auto-Regressive Lag Distributed Model
ALDEV	African Land Development
ARMA	Auto Regressive-Moving Average
ASALs	Arid and Semi-Arid Lands
ASDC	Agricultural Sector Development Strategy
CDF	Constituencies Development Fund
FAOSTAT	Food and Agricultural Organization of the United Nations Corporate Statistical Database
GDP	Gross Domestic Product
GoK	Government of Kenya
ITCZ	Inter-Tropical Convergence Zone
KNBS	Kenya National Bureau of Statistics
MTP	Medium Term Plan
MT	Metric Tones
NIB	National Irrigation Board
PP	Philips-Perron
SRA	Strategy for Revitalizing Agriculture
VAR	Vector Autoregression
VEC	Vector Error Correction
WDI	World Development Indicators

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the study

In the economy of Kenya, agriculture forms a significantly large sector as it is a source of employment and a primary determinant of GDP (PAM, 1995). Approximately 75% of Kenyans reside in rural areas and are mainly involved in crop, animal, and forest product production, processing, and marketing. The agricultural sector sustains roughly 75% of the unemployed in the countryside and is a primary source of living. It also accounts for about 65% of commodities export and approximately 60% of external trade revenues (World Bank, 2013). In addition, Kenya's agriculture industry accounts for 51% of the country's GDP, with 26% coming from direct sources and 27% coming from indirect sources such as industrialization, undernourishment reduction, etc. (World Bank, 2015). Hence, Kenya's GDP growth is expectedly associated with the expansion of the agriculture industry (World Bank, 2015).

Agriculture's impact on employment of those residing in the countryside, foreign trade profits, and income from the countryside residents is so significant that any significant increase in agricultural output will indeed result in significant improvements in rural living standards and economic growth. Agriculture can be a driver of private-sector investment, a source of national economic growth, and the number one base for agriculture-oriented companies and the non-farm economy for the countryside dwellers (Titus O. Awokuse & Ruizhi Xie, 2015). Despite the formalization of government policies and commitment to sustainable agriculture, Kenya's rural areas are still undeveloped due to numerous complicated challenges in terms of planning, executing, and monitoring, and evaluation which remain unresolved.

Nevertheless, the apparent association between productivity in agriculture and the growth of the economy is a contentious issue. The precise direction and causal association between the development of the economy and agricultural output has been investigated by Gollin (2010), Tiffin, R. & Irz, X(2006) among others. Poor output levels and slow agriculture sector growth are frequently cited as the primary drivers of low incomes in emerging countries (Alston, J.M & Pardey, P.G, 2014). Expectedly, there is evidence of a connection between an increment in agricultural output and economic development.

Gollin (2010) conducted a selective review of the literature on agriculture's function and contributions to economic growth. He stated that in many developing nations (such as Kenya), development in agricultural output is essential but not an adequate cause for economic growth if other growth fundamentals such as food supply, income distribution, housing, health care,

and employment are not effectively addressed. Increased production in agriculture, nevertheless, is the most vital and primary source of economic growth.

Mundlak (2005) contends that "economic progress in history would have adopted a radically unique path if agricultural output had not increased over the years." For example, a historical study highlights the necessity of an agricultural sector that is well-developed as a condition for the Industrial Revolution to start. If agriculture is allowed to flourish, it can boost economic growth, decrease poverty, and protect the environment. Furthermore, agriculture and its facets are frequently promoted as critical drivers for kick-starting the growth of the economy and decreasing paucity in numerous growth studies (World Bank, 1981)(World Bank, 2008).

On the other hand, it's also possible that (non-agricultural) economic expansion will have a favorable impact on agricultural production. As a result, agriculture may profit from broader economic growth processes. Changes affecting the agricultural industry have a huge overall influence due to its considerable size. However, these repercussions might be complex.

The fact that the agriculture sector employs a significant number of people does not imply that it is a crucial driver of the growth in the economy. In truth, most emerging countries' agricultural sectors are inefficient in comparison to other facets of the economy. Growing a low-output industry is seldomly a positive idea for development. Furthermore, some scientists, such as Matsuyama (1992), observed that increases in agricultural output may be negatively connected to economic growth.

As a result of these arguments, the actual causal relationship between agricultural output and economic expansion remains unclear. However, one may claim that gains in agricultural output are required to come before any additional economic expansion, but still, that growth of the economy can similarly have a beneficial impact on agricultural output, posing the dilemma: Is growth in agricultural output a pre-requisite for economic growth or should growth in agricultural output fairly be considered as a side-effect of common economic growth?

However, in a more globalized setting, recent literature appears to call into question the rigid relationship between economic expansion and agricultural development (Matsuyama, K, 1992). Tsakok, I. & Gardner, B (2007) for example, state that in certain situations, economies can skip the agricultural development process. Instead of developing their agriculture sector, these countries could invest in their industrial sector to stimulate economic growth and import food.

1.1.1 Agricultural output and economic growth in Kenya

Agriculture is among the various six significant divisions identified in Kenya's Visiom 2030 strategy for achieving the Government of Kenya's (GoK) economic growth target of 10% per

year. Vision 2030's third Medium Term Plan (MTP-III) spans the years 2018–2022 and aims to build on the accomplishments of MTP-II (2013–17). The half-decade agenda aims for a regular annual real growth of the GDP by 8.2% between 2018 and 2022, with a growth of two figures by 2022 (World Bank, 2015).

Achieving these objectives will require considerable agricultural growth, which averaged 3.5% (as illustrated in figure 1.2) during 1997–2012(International Monetary Fund, 2014). This will be critical in producing additional resources to accomplish long-term development. In 2004, the GoK established the Strategy for Revitalizing Agriculture (SRA) which served as guidance for both the commercial and governmental sectors in overcoming agricultural difficulties. As a result of this policy, the agriculture industry grew at a faster rate of 6.1% in 2007 (GoK, 2010a).

SRA was replaced by the Agricultural Sector Development Strategy (ASDS). It seeks to achieve a 10% annual growth rate in the agriculture sector in line with Vision 2030. To modernize agriculture and increase production, the ASDS strives to use modern methods and technology in the agricultural sector. The government also works to ensure farmers are provided with effective and efficient services by farming-related institutions.

In the agriculture sector, according to Vision 2030, production remains a major problem. Over the previous five years, most agricultural output levels have remained nearly constant or have decreased (GoK, 2007) (Muraya, B. W., & Ruigu, G, 2017).

Table 1: Trends in Crop Production, 1900 - 2012 based on a five-year average, 1986 - 1990 versus 2008 - 2012

Food Crops	Area Change (%)	Production Change (%)	Yield Change (%)
Bananas	1.4	11.7	88.7
Beans, dry	55.6	22.2	−23.0
Coffee	2.8	−61.2	−62.3
Cowpea	273.8	236.8	123.2
Maize	39.6	17.3	−16.4
Potato[b]	39.3	23.6	−11.7
Rice, paddy	58.9	60.8	−3.6
Sorghum	51.5	9.6	−29.6
Sugarcane	49.4	23.6	−17.5
Tea	96.4	114.8	9.9
Tomatoes	110.3	399.5	142.6
Wheat	−6.4	44.6	51.6

Source: **(Food and Agricultural Organization of the United Nations Corporate Statistical Database (FAOSTAT), 2014)**

Table 2: Livestock Populations in Kenya

	Year				Annual Growth Rate (%)		
	1980	1990	2000	2010	1980–1990	1990–2000	2000–2010
Livestock Group	('000s)						
Cattle	10,000	1,3793	11,444	17,862	3.79	−1.70	5.61
Sheep	5,000	9,050	7,939	17,562	8.10	−1.23	12.12
Goats	8,000	10,186	10,004	28,174	2.73	−0.18	18.16
Pigs	74	128	311	347	7.32	14.23	1.19
Camels	608	850	718	3,031	3.98	−1.56	32.24
Poultry	16,400	25,228	26,291	30,398	5.38	0.42	1.56

Source: **(FAOSTAT, 2014)**

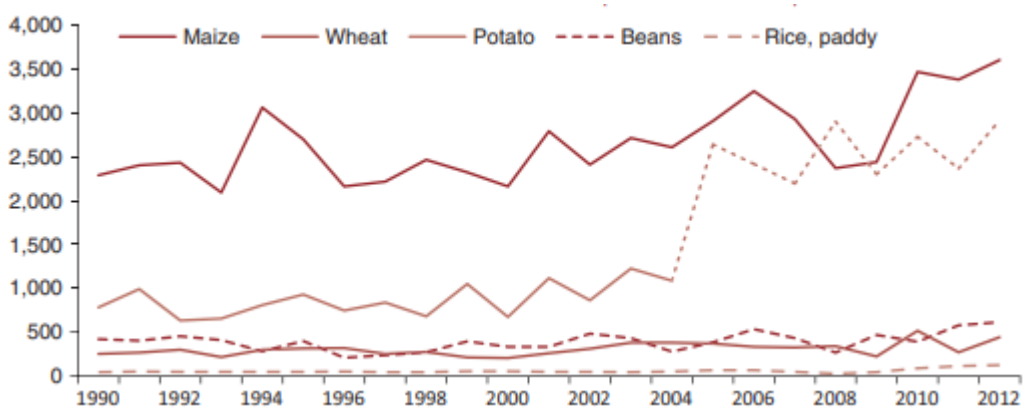

Figure 1: Food Crop Production (thousand MT), 1990 - 2012

Source: **(FAOSTAT, 2014)**

The expansion of the national economy and the growth in agriculture are highly correlated, as seen in Figure 2. This study will focus on Real Gross Domestic Product (RGDP) per capita which is considered Kenya's economic growth measure.

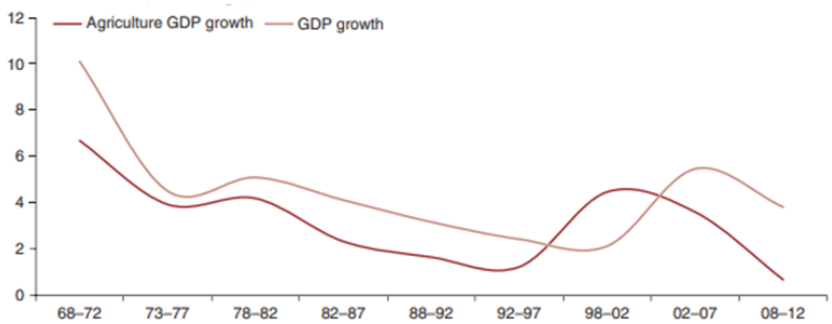

Figure 2: Average Agricultural GDP versus National GDP Growth in Kenya (% change), 1968 - 2012

Source: **(World Development Indicators, 2014)**

The agricultural sector recorded impressive growth over the 1995 – 2005 period. Some of the cross-cutting factors that drove this growth included the following:

i. Improved market access through reduction of distance to motorable roads.

Even though accessibility to markets is an important element in output, road value is essential for establishing access to markets for both inputs and products. The average distance to roads usable by motor vehicles decreased from one kilometer in 1995 to half a kilometer in 2005. The Constituency Development Fund (CDF) is used to construct feeder roads in rural regions. This is a decentralized fund established in 2003 that distributes 2.5% of total state proceeds to 210 constituencies (Betty Kibaara et al., 2009).

ii. Enhanced uptake of extension and monetary amenities.

Extension amenities, when properly designed and executed, have been shown to increase agricultural production (Evenson R.E, and Mwabu G, 1998). Vital information, such as plant products and animal pricing patterns, current and new technology, farm products, and animal management, and promotion is given to farmers by agricultural extension services. Farmers' capacity to maximize the use of scarce resources improves when they are exposed to such knowledge.

By sending a crucial signal to input distribution networks, awareness of current technology drives effective demand. As a result, the contributions of extension and input distribution networks to agricultural productivity are mutually reinforcing (Betty Kibaara et al., 2009). The distance between households and agricultural extension service providers decreased from 5.4 kilometers in 1995 to 4.8 kilometers in 2005, while the distance between households and veterinary aid service providers decreased from 4.8 kilometers in 1995 to 4 kilometers in 2005. On the contrary, the percentage of families requesting agricultural loans increased from 29% in 1995 to 37% in 2005. Rural monetary amenities, hence, are an imperative element in the group of amenities required for the growth in production in agriculture.

1.2 Statement of the problem

Despite having vast resources, Kenya's agricultural industry has a poor productivity rate, owing to the failure of many agricultural programs in the past. The causal connection relating to agricultural output and economic growth has elicited a variety of opposing viewpoints among experts (Gollin, 2010), and the position is still unclear. There are three competing hypotheses in the economic literature about the link relating to productivity in agriculture and the advancement of the economy. Productivity in agriculture implies the presence of a fundamental connection between agricultural production and advancement of the economy (e.g., (Rostow WW, 1960), (Schultz, 1953), (Johnston et al., 1961)). Agriculture, according to this idea, is a

requirement for economic growth. The second hypothesis implies a direct link between economic growth and agricultural output (e.g. (Titus O. Awokuse & Ruizhi Xie, 2015)(Olatunji, 2012)(Fatai, 2016)(Oyinbo, 2012)). Agriculture, according to this concept, benefits from broader economic growth processes. The third hypothesis contends that growth strategy has been hindered by a concentration on food production, which stems from the assumption that agriculture is a driver of economic growth (e.g. (Mutuku, 1993)(Benin, 2009)(Selvaraj, 1993)). According to this agro-pessimism viewpoint, economies should place a greater emphasis on industrialization as a driver of economic growth.

An empirical exposition is necessary to obtain insights into the causal changing aspects of the link connecting agricultural output and the growth of the economy in Kenya. Several experimental researches need to be undertaken to exhibit the relationship between levels of productivity in agricultural output or the rate of growth and the larger African economy using cross-country research (e.g. (Fatai, 2016) (Mundlak, Y, 2005) (Matsuyama, K, 1992) (Tsakok, I. & Gardner, B, 2007)). The studies utilize a variety of methodological techniques and data sources, and the findings demonstrate that agricultural output has increased, resulting in economic expansion. Mundlak (2005), on the other hand, underlined that economic expansion may have a favorable impact on agricultural productivity and alleviate poverty.

However, the Kenyan context is understudied. From Fig.2, average agricultural GDP and national GDP growth in Kenya exhibit the same trend over the period 1968 – 2012 except for a short structural break between 1995 and 2005. From the trend, there is a clear graphical illustration of the association between productivity in agriculture and the growth of the economy, but the causal connection is not clear.

1.3 Research questions

Given the scanty empirical evidence relating to the causal association between productivity in agriculture and growth of the economy in Kenya, the drive of this study is to attempt to answer these research questions:

i. What is the direction of causation between agricultural output and the growth of the economy in Kenya?
ii. Is there a short-run or long-run equilibrium association between agricultural output and the growth of the economy?
iii. What policy suggestions could be drawn from the study findings?

1.4 Objectives

The key objective of this study is to find the causal association between economic growth and agricultural output for the period from 1971 to 2019 in Kenya.

The following are the specific objectives:

i. To study the course of causation between agricultural output and economic growth in Kenya.
ii. To establish the short-run and long-run behavior of productivity in agriculture and its impact on Kenya's economic growth.
iii. To extract policy inferences from the findings.

1.5 Research hypotheses

Using the Granger Pairwise Causality test, the following hypotheses will be tested:

Null hypothesis (H_0): Agricultural productivity does not granger cause economic growth.

Economic growth does not granger cause agricultural output.

Alternative hypothesis (H_a): Agricultural productivity granger causes growth of the economy.

The growth of the economy granger causes agricultural output.

1.6 Purpose and contribution of the study

Research efforts to date have focused on the correlation rather than the causal association between the productivity in agriculture and the growth of the economy in Kenya over time. As a result, this research is undertaken to cover the identified gap by presenting experimental data on the course of causation between the outputs in agriculture and the growth of the economy in Kenya and developing relevant policy recommendations. The purpose here is to assess the fundamental association of productivity in agriculture and advancement of the economy in Kenya between 1971 and 2019 through experiments and to provide comparisons between Kenya's economic growth and the performance of the agricultural sector.

1.7 Scope of the study

This study will critically observe the causal association between Kenya's agricultural output and the economic growth, spanning the period from 1971 to 2019.

1.8 Organization of the study

The organization of the study is in form of chapters where chapter two includes theoretical as well as empirical studies and an overview of the literature. Chapter three covers the methodology which has an introduction with a theoretical framework, model specification, the type of data, and the analytical procedure. The study's results and findings are presented in Chapter four, and the summary, conclusion, and policy suggestions are presented in Chapter five.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

This section delivers a detailed description regarding the causal association between agricultural output and economic growth by considering previous studies; though no consensus on the exact relationship has been established. It starts with a viewpoint on the effort brought about by agriculture as a pre-requisite for economic growth. Afterward, part 2.3 reviews the contrasting literature focusing on reverse causality, where economic growth leads to an increase in agricultural output. Section 2.4 discusses the agro-pessimistic view, analyzing in-depth the reasons why a robust agriculture industry should not be perceived as the only necessary and beneficial pre-condition for further economic growth, and lastly, part 2.5 describes the literature review in summary.

2.2 Theories on agriculture as a pre-requisite for economic growth

2.2.1 Rostow's theory of economic growth development

According to Rostow's theory of development, an undeveloped economy is driven by two sectors; the old-style agricultural sector and the current industrial sector. The two segments form the basis of Rostow's analysis of the five phases of the process in the growth of an economy. According to Rostow, the stages of economic growth are:

i. Traditional society

This is where most societies begin before moving on to the next stage of development. It is characterized by subsistence agriculture (hunting and gathering) and insubstantial technology.

ii. Pre-condition for take-off

Individual social mobility and the formation of national identity begins at this stage through external demand for raw materials triggers economic transformation, resulting in the development of more productive commercial agriculture and cash crop production at this stage.

iii. Take-off

As urbanization grows, so does industrialization, and technical advances. The ancillary (goods-producing) segment expands, and the proportion of ancillary to primary segments in the economy rapidly changes to secondary.

iv. Drive to maturity

There is a shift in manufacturing from being venture-motivated (capital goods) to local intake-driven as more industries emerge rapidly. The fast growth of transportation infrastructure is also an aspect of this stage.

v. Stage of high mass consumption

In the final stage, the economy is dominated by widespread purchases of consumer items that are expensive such as automobiles because buyers have income that is not reusable past their fundamental requirements. In addition, there is a shift in population from rural to urban areas.

The first three stages of Rostow's theory of economic growth break down the key role played by agriculture. The other two stages leverage the performance of agriculture as a springboard for industrial take-off. Rostow (1960) made the following assumptions:

i. All states have similar opportunities in development, disregarding the size of the population, natural wealth, or whereabouts.
ii. The agricultural sector has high growth potential, and industries (and, to a short breadth, amenities) progressively engross personnel from agriculture. In essence, Rostow viewed economic growth as identifiable with agriculture and industrialization.

2.2.2 Schultz' food problem

Another viewpoint, also prevalent in early economic writing, was that many impoverished countries were plagued by what Schultz (1953) labeled the "Food Problem." essentially, Schultz claimed a majority of impoverished nations are experiencing a great outflow of food, where there is an extremely low revenue level and must spend a substantial percentage of it on food. Schultz assumed that nations in this condition ought to bring out the majority of their food to meet necessities, probably since imports cost high and there are few items or capital to trade for food. These economies will not be able to kickstart the journey towards the growth of the economy until they can satisfy their basic needs.

The challenge Schultz seeks to answer is how the agricultural segment can make influence the contemporary process in the growth of the economy, as this sector provides society's sustenance, which is a pre-requisite for any further progress. The solution to the food crisis is not only to infuse cash into the agricultural sector; it is also necessary to identify what shapes agricultural investments should take. (i.e., irrigation, canals, ports).

2.2.3 Mellor hypothesis

A rise in agricultural output not only helps individuals meet their nutritional demands but also helps release labor to other areas of the economy. Agriculture's contribution to economic growth was discussed by Tiffin et al. (2006) in the context of five inter-sectoral linkages. The supply of surplus labor to industrial firms, food for household consumption, a market for products from industries, internal reserves for industrial ventures, and foreign funds inflow from profits of agronomic export to fund the importation of transitional and capital products are all interrelated.

Also highlighted by Federico (2005) the transfer of any form of workforce from agriculture-related field to other areas of the economy, for example, the industrial or amenity provision sector, is viewed as a pre-requisite for an increase in agricultural production. Schultz's food dilemma was a major argument for the Mellor hypothesis, reflecting the fact that a country's agricultural surplus is an essential pre-requisite for it to begin the development process.

Various scholars, including those described in the next section, have offered empirical evidence for certain aspects of the Mellor hypothesis, but little effort has been made to test it as a theory.

2.2.4 Empirical literature review on agriculture as a pre-requisite for the growth of the economy.

Experimental texts on the pivotal association between economic growth and agricultural advancement are scarce in Kenya. This section reviews studies arguing that an advanced agricultural division is a vital foundation for future success in the economy.

Awokuse et al. (2015) explored the link between agriculture and the economic expansion using a time series examination of 15 developing economies. The economic variables considered were as indicated; physical export, agriculture rate added per employee, real GDP per capita, and populace as a representation for employment, and unrefined capital creation per employee as a representation for resources. Data was gathered for the years 1971 to 2006 from WDI and the International Monetary Fund website. The empirical link between variables was discovered using an autoregressive distributed lag model and co-integration. Agriculture, as a driver of economic development, was found to be a significant factor. This experimental confirmation backs the role of private and public reserve distribution to agriculture and frame development.

Olatunji (2012) used the Granger connection approach and expressive indicators in the study of productivity in agriculture and price increases in Nigeria. The productivity in agriculture and the rate of inflation are unswervingly linked. The rate of inflation in an economy is another indicator monitored by monetary authorities responsible for setting policies. Rising inflation rates are an indication of macroeconomic imbalances, which frequently stifle economic growth and growth potential. Furthermore, the rate of inflation increased due to a rise in agricultural output from the previous year. Trends in productivity of agriculture and inflation rate display a different output according to the study. Moreover, measures should be flaunted to guarantee the absorption of productivity in agriculture, ensuring food price and inflation rate stability.

Fatai (2016) studied the instrumental association between agricultural output and the growth of the economy in Nigeria by use of time series data and the Granger causality test from 1970 to 2015. Findings from the study showed a two-way connection between the two variables.

Along with the result of co-integration, it was observed that where the series is subjected to a shake-up, it will congregate to the long-run balance for economic growth and agricultural output at a fast rate. The result showed that agriculture has great potential in the process of economic transformation and revenue mobilization following the dwindling performance of oil revenue in Nigeria. Sustaining agricultural production would open the window for employment opportunities; provide food security for the teeming population and mobilization of foreign exchange rate through exports of agricultural products.

In his examination of price rises, productivity in agriculture, and growth of the economy, Oyinbo (2012) used expressive and inferential statistics. The study relied on time-series data. A unidirectional link existed between the currency hike tendency and agricultural production. i.e., a decline in agricultural productivity is caused by a rise in the inflationary rate. According to the research, the central bank of Nigeria should keep inflation at single digits.

2.3 Empirical literature review on reverse causality between agriculture and the growth of the economy.

Changes affecting the agriculture-related industry have substantial overall implications because of its considerable size. However, these implications might be complex. The fact that the agriculture sector employs a significant number of people does not imply that it is a vital cause of the growth in the economy. In truth, most emerging countries' agricultural sectors are inefficient in comparison to other economic facets. Growing a low-output industry is not always a positive for development. The agricultural sector, according to the skeptic school of thought in development economics, is at best a limited source of development. Furthermore, some scholars, such as (Matsuyama, K, 1992), observed that increases in agricultural output may be negatively connected to economic growth.

The causal relationship is instituted by interdependence and complementarity in agriculture and other economic areas. (Hwa, 1988). Furthermore, there is a claim that the association has an added arbitrary nature: in such a scenario, the supposed progressive association between productivity in agriculture and the growth of the economy is owing to an external factor that impacts both factors, rather than one factor directly related to the other.

Mutuku (1993) investigated the agriculture sector's influence on government expenditures and structural adjustment initiatives. In the study, he stated that the intensification of the use of land, which involves the usage of crops that are improved in breed, farm inputs, and composts to boost the fertility of the soil, may increase agricultural production. Minimal agronomists make for a substantial portion of the entire productivity in agriculture. The frame required to increase productivity in agriculture is a benefit of the community that the state provides through

its spending. Agricultural development would be accelerated if the government allocated sufficient funds to the sector. The study discovered that state spending volatility harms the agricultural sector's performance.

Benin (2009) researched in Ghana on agricultural output and government expenditure. The results from the various zones varied slightly. Data on household output and government spending were utilized in the study. A 0.15 percent rise in agriculture-related workforce yield occurred from a unit upsurge in agriculture-oriented government spending. The profit-to-cost proportion of government expenditure in agriculture stood at 16.8. Following that, directing of resources on feeder roads in the countryside had a benefit-to-cost ratio of 5. Health came in third place, a long way behind. Formal education, on the other hand, has a detrimental impact on agricultural production. This is linked to the allocation of higher-skilled labor, which is related to individuals that are better-educated, far from the countryside.

Selvaraj (1993) researched how changes in government spending influenced India's agricultural field’s growth. For a long period, agricultural development was heavily reliant on government funding. The proportion of agricultural spending funded by public funds had been decreasing over time. This was credited to economic changes, as well as agricultural breakthroughs and industrialization. However, this tendency presents a detrimental influence on the agricultural division's performance. Time-series data was the foundation of the research and the study's findings highlighted the significance of government spending on agriculture. Reducing the funds allocated to agriculture harms the sector's performance. According to the findings, there is an opposite association between changes in how the government spends in agriculture and related fields and the growth of that sector.

2.4 Empirical literature review on agro-pessimism

According to "agro-pessimists," development policy has been harmed by an overemphasis on agriculture, which stems from a misunderstanding of the causal connection between agriculture and development (Gollin, 2010). Although the agricultural sector provides for a substantial portion of employment and economic activity in underdeveloped nations, agro-pessimists claim that in some countries, the agricultural sector has low growth potential. Some see the East Asian miracle as proof that economic progress does not always have to be dependent on agriculture and this is backed up by the fact that the development of many Asian countries is attributed to manufacturing that is dependent and meant for exports. Amsden (1989) stated that Korea developed devoid of an agricultural revolution, and various analysts have claimed that China's recent development miracle was fueled solely by agricultural policy reforms in its initial phases (Gollin, 2010).

2.5 Overview of literature review and the knowledge gap

Theoretical and empirical research on agricultural output and its influences on the expansion of the economy is reviewed in this chapter. In many developing nations, agricultural production growth is a necessary but insufficient pre-requisite for economic growth. For most emerging nations, an increase in agricultural production is the primary and most significant source of economic growth. Some studies claimed that agriculture drives economic growth, while others claimed that reverse causality exists and that economies can avoid the process of agricultural development by focusing on their industrial division as a means of promoting the growth of the economy and, as a result, bringing in food from outside instead of developing their national agriculture. Nonetheless, it has been shown that the increase in agricultural output stimulates growth in other areas of the economy.

To have better knowledge regarding the impact of distinct components short of their combination in a study, further research on the individual drivers of agricultural production should be conducted.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Introduction

Chapter three aims to illustrate the theoretical foundation that this research is built on, the analytical model specification, the diagnostic tests, the data type used and its sources, and the tools of analysis.

3.2 Theoretical framework

Agricultural output advancement is the primary and vital driver in the growth of the economy for most developing countries (Gollin, 2010). To look at the association between growth of the economy and agricultural output in Kenya, Rostow's economic growth model was considered.

GDP = f (AGPO, INTR, FDI, GDS, GCF, INF) ……... *(1)*

Expressed explicitly in linear form, equation 1 is rewritten as

$GDP_t = \beta_0+\beta_1 AGPO_t+\beta_2 INTR_t + \beta_3 FDI_t + \beta_4 GDS_t +\beta_5 GCF_t + \beta_6 INF_{t+} U_t$…… (2)

Where:

GDP denotes economic expansion given by real GDP (Ksh.)

AGPO denotes agriculture, forestry, and fishing value added (percentage of GDP)

INTR denotes the lending interest rate adjusted for inflation as determined by the GDP deflator

FDI denotes foreign direct investments

GDS denotes gross domestic savings

GCF denotes outlays on additions to the economy's fixed assets plus net changes in the level of inventories make up gross capital formation

INF denotes inflation which is defined as the change in the Consumer Price Index (CPI) from one year to the next.

β0 is constant while β1. . . β 4 are the equation's coefficients.

3.3 Analytical model specification

To investigate the connection between productivity in agriculture and the growth of the economy in Kenya, the pairwise granger causality test is modeled as a bivariate vector autoregressive (VAR) model as follows:

$$EG_t = \beta_0 + \sum_{i=1}^{p} \beta_i EG_{t-i} + \sum_{j=1}^{p} \varphi_j AGPO_{t-j} + \epsilon_{1t} \dots\dots\dots\dots (3)$$

$$AGPO_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i AGPO_{t-i} + \sum_{j=1}^{p} \omega_j EG_{t-j} + \epsilon_{2t} \dots\dots\dots\dots (4)$$

Where:

EG is real gross domestic product (GDP) which measures economic growth in ksh.

AGPO is agricultural output given by gross agriculture output which evaluates the total cost of the development of different crop and livestock products in ksh.

ϵ_{1t} and ϵ_{2t} are error terms for Gaussian white noise

P is the optimal lag length

β_0 and α_0 are constants while $\alpha_i, \beta_i, \varphi_j$ and ω_j are parameter coefficients to be estimated where i = 1, 2,…, p and j =1,2,…, p

To check on the association between output in agriculture and the growth of the economy, descriptive and inferential statistics were utilized. Descriptive statistics condenses the characteristics of the variables on check while inferential statistics tests determine the time-series characteristics of all variables and avoid spurious regression which occurs when there is the regression of some non-stationary time series data.

3.4 Diagnostic tests

3.4.1 Normality test

The Jarque-Bera test is used when running the regression before estimation. The test matches the data's kurtosis and skewness while checking for it to match as a normal distribution.

$$\text{JB} = \text{n}\left[\left({s^2}/{6}\right) + \left({(\text{k}-3)^2}/{24}\right)\right] \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (5)$$

Where:

JB is Jarque-Bera test statistic

n denotes the sample size

s is the sample Skewness co-efficient

k is the kurtosis co-efficient

The H_0 for the test means the data is normally distributed; H_a means that the data does not emanate from a normal distribution. The H_0 is rejected at a 5% significance level.

3.4.2 Unit root tests

Because non-stationarity undermines numerous common experimental findings, the first step in creating a suitable illustration is to decide the series' stationary features, calculated using the following regression:

$$\Delta Y_t = a_1 + a_2 t + \beta Y_{t-1} \sum_{i=1}^{n} \gamma_i \Delta Y_{t-1} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(6)$$

Where:

Δ is the first difference operator

$Y_t$is the relevant Series (agricultural output, real GDP)

t is the index of time (t= 1, …, T)

If all of the variables are confirmed to be stationary after analyzing their stationary characteristics i.e. integrated of order 0, Ordinary Lest Squares (OLS) method is used to detect the association of agriculture-related productivity and growth of the economy, if it is determined that the variables are combined of different orders, that is, order 1 and 0 integration Auto-Regressive Lag Distribute (ARDL) model is used to association relating to agricultural output and growth of the economy and if all variables turn out to be non-stationary, that is integrated of order 1, the Johansen multivariate co-integration approach, introduced by Johansen (1988) and Juselius (1989), is used to investigate a possible co-integrating connection between these variables (1990).

The co-integration test is critical in determining the model that will be used to identify the link between agricultural output and economic growth. Co-integration simply means that the consequences of a shock to one variable spreads to the others with a time lag.

3.4.3 Granger causality test

One proxy for agricultural production and one proxy for economic growth is used to construct a bi-variate Vector Auto-Regressive (VAR) model. Gross agricultural output and real GDP are the respective proxies utilized.

The VAR model for application in the examination is:

$$\begin{bmatrix} EG_t \\ AGPO_t \end{bmatrix} = \begin{bmatrix} P_1 \\ P_2 \end{bmatrix} + \begin{bmatrix} a_{11}^1 & a_{12}^1 \\ a_{21}^1 & a_{22}^1 \end{bmatrix} \begin{matrix} EG_t \\ AGPO_t \end{matrix} + \dots + \begin{bmatrix} a_{11}^q & a_{12}^q \\ a_{21}^q & a_{22}^q \end{bmatrix} \begin{bmatrix} EG_{t-q} \\ AGPO_{t-q} \end{bmatrix} + \begin{bmatrix} \varepsilon 1t \\ \varepsilon 2t \end{bmatrix} \quad \dots\dots\dots (7)$$

Where:

EG denotes economic growth

AGPO denotes agricultural output.

P is the constant term

q is the order of the Vector Auto-Regressive model

The Granger causality test is applied after obtaining co-integration test results. According to Granger (1988), there is at least one-directional Granger causality if two time-series variables are co-integrated.

If no co-integrating connection exists, the variables are stabilized by picking the difference and checking for connection in a VAR context. A vector error correction (VEC) model is a constrained VAR for application to co-integrated non-stationary series.

3.4.4 Auto-correlation

Auto-correlation is a coefficient of correlation, often between two values of the same variable. Breusch-Godfrey test was used to test whether the disturbance terms of random subsequent periods are correlated within a given data set. Lagged figures in the dependent variable are added to the presence of auto-correlation.

3.5 Definition and Measurements of Variables

This section entails definition, description, and source of data. Column one of Table 2.2 captures variable names and the second column gives data description. The data was sourced from WDI (2021).

Table 3: Definition and Measurements of Variables

Variable	Data Description	Data Source
GDP growth rate	"The change in GDP at constant prices as a proportion of GDP is used to calculate the average annual growth rate of real GDP." WDI	World Bank Data Indicators
Agricultural output	Crop, animal, and forest product production, processing, and marketing	World Bank Data Indicators
Gross capital formation	Net changes in the level of inventories	World Bank Data Indicators
Real interest rate	Inflation-adjusted interest rate	World Bank Data Indicators
Foreign direct investment	Controlled ownership of a firm in one nation by an organization headquartered in another country	World Bank Data Indicators
Inflation	"On a year-over-year basis, the percentage change in the Consumer Price Index (CPI)." WDI	World Bank Data Indicators
Gross domestic saving	"As a proportion of GDP, gross savings equals gross national income minus total consumption plus net transfers." WDI	World Bank Data Indicators

CHAPTER FOUR

4.0 EMPIRICAL FINDINGS

4.1 Introduction

The empirical data on the causal relationship between economic growth and agricultural output in Kenya from 1971 to 2019 are presented in this chapter. The outcomes of the data analysis and interpretation summary statistics, correlation analysis, pre- and post-estimation tests, and regression findings are all discussed.

4.2 Summary statistics

Kenya's average GDP growth rate was 4.797 percent for the period 1971 to 2019 with maximum economic growth being realized at 22.17 percent. Kenya recorded the lowest economic growth of negative 0.799 percent between 1971 and 2019. The average agricultural output as a percentage of GDP stood at 28.03 percent during the period of study with a maximum of 37.01 percent and a minimum of 20.52%. Real interest rate averaged 6.444 percent with a standard deviation of 7.163 percent. The average inflation for Kenya was 11.82 percent with a maximum inflation rate of 45.98 percent. Foreign direct investment, on average, stood at 0.807 percent with a standard deviation of 0.770 percent. The average gross domestic saving as a percentage of GDP was 13.30 percent with a standard deviation of 6.922 percent while gross capital formation had a mean of 20.49% with a standard deviation of 3.343 percent.

Table 4: Descriptive statistics

	(1)	(2)	(3)	(4)	(5)
VARIABLES	N	mean	sd	min	max
GDP growth annual (%)	49	4.797	3.931	-0.799	22.17
Agricultural output(%GDP)	49	28.03	3.502	20.52	37.01
Real interest rate	49	6.444	7.163	-8.010	21.10
Inflation	49	11.82	8.012	1.554	45.98
Foreign direct investment(%GDP)	49	0.807	0.770	0.00472	3.457
Gross domestic savings(%GDP)	49	13.30	6.922	4.308	27.15
Gross capital formation(%GDP)	49	20.49	3.343	15.00	29.79

Source: **Compiled from STATA**

4.3 Correlation matrix

Correlation analysis helps to point out potential multicollinearity problems among the explanatory variables. Table 4 presents the pair-wise correlation matrix. There is enough evidence to conclude there exists a weak association between the variables considered in the study. In particular, agricultural output, real interest rate, foreign direct investment, domestic saving, and gross capital formation, all have a positive but weak association with economic growth. However, inflation has a negative but weak association with economic growth.

Table 5: Pairwise correlation matrix

	GDP growth	Agricultural output	Real interest rate	Inflation	Foreign direct investment	Gross domestic saving	Gross capital formation
GDP growth	1.000						
Agricultural output	0.190	1.000					
Real interest rate	0.121	-0.110	1.000				
Inflation	-0.411	-0.173	-0.350	1.000			
Foreign direct investment	0.074	0.150	-0.143	0.068	1.000		
Gross domestic saving	0.142	0.239	-0.377	0.411	-0.190	1.000	
Gross capital formation	0.389	0.167	-0.228	0.045	0.013	0.619	1.000

Source: **Compiled from STATA**

4.4 Structural breaks

Structural break was tested for the period 1971-2019.

Table 6: Test for a structural break

```
Test for a structural break: Unknown break date

                            Number of obs =         49

Full sample:                        1971 -       2019
Trimmed sample:                     1979 -       2012
Estimated break date:               1980
Ho: No structural break

     Test            Statistic          p-value
─────────────────────────────────────────────────
     swald           333.2393           0.0000
─────────────────────────────────────────────────

Exogenous variables:           Agricoutput Realinterestrate Inflationconsumerpricesannu FDI GDS
                                    GCF
Coefficients included in test: Agricoutput Realinterestrate Inflationconsumerpricesannu FDI GDS
                                    GCF _cons
```

The test rejects the null hypothesis of no structural break and detects a break in the year 1980

4.5 Unit root test

Before performing an econometric analysis of time series, the study conducted a unit root test to determine the integration order of the variables included in the study. The Phillips-Perron test was used to determine if the variables were stationary in this study. The stationarity test findings for the variables used in this investigation are shown in Table 5. The unit root test result demonstrates that some variables (GDP growth rate, real interest rate, inflation, foreign direct investment, and gross capital formation) are integrated of order zero while agricultural output and gross domestic savings are integrated of order one. Since we have a mixture of integration order of the variables used in the study i.e. some variables are integrated of one while others are integrated of zero, the appropriate model to estimate is ARDL.

Table 7: Unit root test results

Variable	**Calculated test statistic**	**Critical values**			**Stationarity status**
		1%	5%	10%	
GDP growth rate	-5.929	-3.5594	-2.936	-2.602	I (0)
Agricultural output	-1.566	-3.5594	-2.936	-2.602	I (1)
Real interest rate	-4.635	-3.5594	-2.936	-2.602	I (0)
Inflation	-3.969	-3.5594	-2.936	-2.602	I (0)
Foreign direct investment	-4.722	-3.5594	-2.936	-2.602	I (0)
Gross domestic savings	-1.279	-3.5594	-2.936	-2.602	I (1)
Gross capital formation	-3.686	-3.5594	-2.936	-2.602	I (0)

Source: **Compiled from STATA**

4.6 Diagnostic tests

Pre-estimation tests were conducted to ensure that the assumptions of classical linear regression hold.

Multicollinearity

The VIF values of the explanatory variables used in this investigation are shown in Table 6. Multicollinearity was not an issue because the mean VIF of all explanatory variables was less than 10.

Table 8: VIF multicollinearity test

Variable	VIF	1/VIF
Gross domestic savings	2.91	0.343056
Gross capital formation	1.91	0.523015
Inflation	1.68	0.594541
Agricultural output	1.29	0.773934
Real interest rate	1.29	0.775603
Foreign direct investment	1.27	0.785759
Mean VIF	1.73	

Source: **Compiled from STATA**

Autocorrelation test

Table 4.5 shows the autocorrelation test results.

Table 9: Breusch-Godfrey LM test for autocorrelation

lags(p)		chi2 df	Prob > chi2
1		0.020 1	0.8862
	H0: no serial correlation		

Source: **Compiled from STATA**

Model stability test

To see if the fitted ARDL model was stable, the CUSUM squared test was used. A model is considered stable if it falls under the 0.05 threshold of significance in this test. Figure 3 depicts the findings.

Figure 3: Test for model stability

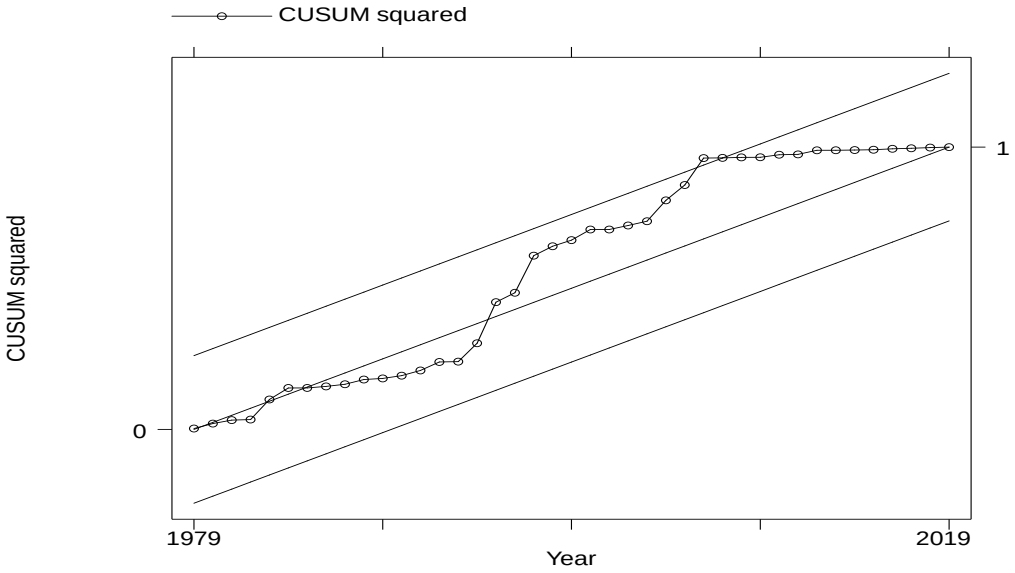

Figure 3 indicates that the model is within the 5% significance level and was thus stable.

4.7 Regression output

The study's primary objective was to test the null hypothesis. Table 9 shows the results.

4.7.1 Granger-causality test

Table 10: Granger causality Wald tests

Equation	Excluded	F	df	df_r	Prob > F
GDP growth annual	Agricultural output	.63129	2	42	0.5369
GDP growth annual	ALL	.63129	2	42	0.5369
Agricultural output	GDP growth annual	2.3712	2	42	0.1058
Agricultural output	ALL	2.3712	2	42	0.1058

Source: **Compiled from STATA**

In the first row, p-value for agricultural output is greater than 5 percent (0.5369 > 0.05). Therefore, the null hypothesis stating that that “lagged values of agricultural output do not granger cause GDP growth rate” is not rejected at a 5% level of significance. Similarly, because the corresponding p-value (0.1058) is larger than 0.05, the null hypothesis that "lagged values of GDP growth rate do not granger cause agricultural output" cannot be rejected. This means that the GDP growth rate does not Granger-cause agricultural production, and the causation does not flow from agricultural output to GDP growth rate. In conclusion, in Kenya, there is no causal relationship between economic growth and agricultural output. As a result, economic

growth is not a need for agricultural production performance, but agricultural output does contribute to economic growth.

4.7.2 ARDL result

Since the variables were integrated of a combination of order 1 and 0, the ARDL model was fitted. It is also possible to test for cointegration within the ARDL framework. The bounds' testing approach was used to assess for the existence or lack of cointegration. If the estimated F is greater than the I (0) lower bound critical values, the null hypothesis of No Cointegration is rejected (Pesaran et al. 2001). The null hypothesis of No Cointegration is also rejected if the estimated test statistic for I (1) regressors is less than the t critical values. The Error Correction model is fitted inside the ARDL framework to capture both the short-run and long-run connections. Failure to reject the null hypothesis, on the other hand, implies that there is no cointegration, leaving us with just the short-run linkage, which is the ARDL model.

ARDL test

The test looked to see if the ARDL framework was cointegrated. The findings are summarized in Table 10. Because the F statistic is greater than the lower bound crucial values, the null hypothesis is rejected. Because the test statistic was found to be lower than the upper bound crucial values, the null hypothesis was likewise rejected.

Table 11: The ARDL bounds test statistics

Statistical test	**Critical values**					**Cointegration**	**Decision**
F=7.234	I (0) values	2.12	3.23	3.61	4.43	**YES**	Estimate ECM
t = -4.783	I (1) values	-2.57	-2.86	-3.13	-3.43	**YES**	Estimate ECM

Source: **Compiled from STATA**

The Error Correction Model (ECM) regression results

The ECM estimates are presented in Table 11.

Table 12:The ECM regression results

	(1)	(2)	(3)
VARIABLES	ADJ	LR	SR
Agricultural output		0.00318	
		(0.109)	
Real interest rate		-0.0879	
		(0.0585)	
Inflation		-0.203***	
		(0.0701)	
Foreign direct investment		1.084**	
		(0.503)	
Gross domestic savings		0.106	
		(0.113)	
Gross capital formation		-0.0189	
		(0.237)	
L. (GDP growth annual)	-0.754***		
	(0.158)		
D. (Gross domestic savings)			0.263**
			(0.122)
LD. (Gross capital formation)			0.267***
			(0.0957)
Constant			4.022
			(3.676)
Observations	45	45	45
R-squared	0.636	0.636	0.636

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

From the regression results, the coefficient of the speed of adjustment parameter was found to be -0.754 and statistically significant at a 5 percent level. This implied that 75.4% of the disequilibrium was corrected within a year. As demonstrated in the granger causality test result,

agricultural output is not statistically significant in explaining the variation in economic growth for Kenya. The long-run coefficient for agricultural output is positive though non-significant. Inflation has a considerable yet negative impact on Kenya's economic growth in the long run. As a result, a one-unit increase in inflation will result in a 0.0879 unit decline in Kenya's economic growth.

Foreign direct investment significantly enhances economic growth for Kenya at a 5 percent level of significance. An increase in foreign direct investment of one unit, for example, will result in an increase in economic growth of 1.084 units. In the long run, Kenya's gross domestic savings have little influence on its economic development. Gross domestic savings, on the other hand, have a positive and large influence on economic growth in the near run. Economic growth will improve by 0.263 units for every unit increase in gross domestic saving. In a nutshell, gross capital formation has a large and favorable impact on economic growth. In the short term, a one-unit increase in gross capital formation will result in a 0.267-unit rise in economic growth for Kenya.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Introduction

This chapter provides a summary, conclusion, and policy recommendation drawn from econometric analysis in chapter four.

5.2 Summary of empirical findings

The study's main goal was two-fold. The study's first goal was to study the granger causality between agricultural productivity and economic growth in Kenya. The second goal was to investigate the impact of agricultural output on Kenya's economic growth. The econometric studies presented in this chapter demonstrated that there is no causal association between agricultural production and Kenyan economic development. In addition, the study finds little evidence of a link between agricultural production and Kenyan economic development. When other factors are controlled for, the study found that inflation, gross domestic savings, gross capital formation, and foreign direct investment have a significant influence on Kenya's economic development.

5.3 Conclusions

The study concludes that agricultural output does not significantly contribute to economic growth for Kenya. However, inflation, gross domestic savings, gross capital formation, and foreign direct investment significantly impact the economic growth of Kenya.

5.4 Policy recommendations

The government of Kenya should encourage household savings by implementing tax reforms that are favorable to businesses and lower-income groups. This will in turn enhance gross domestic savings and overall economic growth. The government should also improve public finance management, with an emphasis on fiscal planning reforms, execution, and oversight to control inflation and money supply.

In regards to gross capital formation and foreign direct investment, the government should create an environment that promotes private sector development by giving new firms tax breaks to enhance the ease of doing business consequently attracting both local and foreign investors.

5.5 Areas for further research

To have a better grasp of the influence of these elements without aggregating them in a study, more research on the causation between economic growth and the specific drivers of agricultural production should be conducted.

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