ECONOMIC GROWTH AND FOOD SECURITY IN KENYA: A TIME SERIES

ANALYSIS APPROACH

BY

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LIST OF ABBREVIATIONS

ADF	AUGMENTED DICKEY-FULLER
ASDS	AGRICULTURAL SECTOR DEVELOPMENT STRATEGY
FAO	FOOD AND AGRICULTURE ORGANIZATION
FNSP	FOOD AND NUTRITION SECURITY POLICY
GDP	GROSS DOMESTIC PRODUCT
GOK	GOVERNMENT OF KENYA
KNBS	KENYA NATIONAL BUREAU OF STATISTICS
KARI	KENYA AGRICULTURAL RESEARCH INSTITUTE
KIPPRA	KENYA INSTITUTE OF PUBLIC POLICY RESEACH ANALYSIS
OLS	ORDINARY LEAST SQUARES
VAR	VECOR AUTOREGRESSIVE
WDI	WORLD DEVELOPMENT INDICATORS

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ABSTRACT

Many nations in the developing world continue to be food insecure with many people living the poverty level. This study sought to establish the effect of food security on economic growth in Kenya. Secondly, the study also sought to analyze the effects of other factors on economic growth. In order to achieve the research objectives, VECM was employed after the optimal lag determination. The cointegration test was applied to check whether the variables are cointegrated using time series data, annual observation for the period 1980-2016. This data was obtained from the World Development Indicators (WDI). Additionally, data for food insecurity was obtained from (FAO) and the Kenya National Bureau of Statistics (KNBS) databases. The Johansen cointegration confirmed that food security and economic growth were cointegrated. The first model showed that food availability affects economic growth positively and significantly while that food accessibility as the second dimension of food security affects economic growth negatively and significantly. Secondly, it was established that the two models also showed that food security significantly cause economic growth. The study recommended that since food security causes economic growth and economic growth cause food security, then proper measures should be put in place to facilitate food availability because it is economic growth.

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CHAPTER ONE: INTRODUCTION

1.1 Introduction

FAO defines food security as the situation in which all people at all times have both physical and economic access to adequate, nutritious and safe food to achieve their dietary requirements and preference for food to be able to have an enjoyable and active healthy life(World Food Summit, 1996). The third world nations have not yet been able to achieved this .It can also be defined as the ability to meet the annual calorie food needs annually through local production, international trade as well as storage by nations, regions or even individuals (FAO, 1983). Families are said to be food secure if they can satisfy at least 80 percent of its nutritional requirements without fail (FAO, 1996). According to the World Bank 52.3 percent of the Kenya's population is poor and continues to live below poverty line.

Food security is measured by four main components which include; food accessibility, availability, and utilization as well as stabilization of food which remains to be very weak in Kenya despite the effort by the state to attain food security in terms of the accessibility and availability. This is because food security is only attained when there is production of sufficient staple food for consumption. The efficient production of maize in Kenya can result to food security since it is the staple food in Kenya. Food insecurity in Kenya is caused by among others high poverty levels, land degradation, human conflicts and flooding (Nyariki, 2007).

Poverty caused by food inadequacy is not only a supply problem but an income and purchasing power problem as well. Some of the key challenges to the transportation of food from the areas of availability to the areas of need is the poorly developed infrastructure in many places in the country. In terms of the quality of nutrition, food availability in Kenya is not satisfying. It is estimated that 33% of the mean caloric intake is below 2,100 Kcal/person/daily which is

recommended in Kenya (Republic of Kenya, 2018). At least 30 percent of the food consumption by the households in the rural areas is bought with the 70 percent produced from their farms. The urban consumption consist of 98 percent bought and the 2 percent is by own production (FAO, 2018).

Approximately 79 percent of the Kenyans depend on income generated through agricultural activities and they mostly live in rural areas. At least 50percent of the people in Kenya are poor and they cannot meet their daily nutritional requirement with majority being rural residents. The poor people in the rural areas are mainly the small scale farmers, herders and semi-skilled, where the head of families are disabled, suffer from HIV/AIDS etc. Statistics shows that majority of those who live in rural areas accounting for 75 percent are poor and they practice small-scale farming. Therefore, increase in the GDP growth due to agriculture is two times important in poverty and hunger reduction relatively to other sectors in the economy (World Food Summit, 1996).

Kenyan economy is the biggest in the EAC and in fact among top ten in Africa. Kenya's economic growth and development is anchored on the improvement in the agriculture sector. Approximately, 90 percent of the population in the rural areas depend on their incomes directly and indirectly from agricultural sector. Despite government initiatives to improve agriculture, there are various barriers to economic development which include inflation, corruption, crumbling infrastructure and high inequality levels. Other reasons for poor performance include post-election chaos in 2007/8, financial crisis and oil prices globally, drought and flooding.

1.2 Agricultural Policy Concerns in Kenya

There are various policies adopted by the government with the most recent being the president's one of the big four agendas aimed at attaining 100 percent Nutrition and Food Security in Kenya.

This is meant to be achieved by increasing farmers' incomes by 34 percent, ensure that malnutrition is reduced by 27 percent for the children aged 5 years and below, create 1000 Small and medium enterprises engaged in agro-processing as well as the creation of more than 600,000 new job opportunities. Further, this agenda includes the reduction of food insecurity by 50 percent, reduction in the percentage of the cost of food 47percent as well as increase in the share of agriculture on GDP by 48 percent.

The new (FNSP) specifies the dimensions of nutrition and food security whose main aim is increase value addition and synergy to the already available sectors as other government initiatives and organizations. The emphasis are to have the involvement of both the public and private sector and make the role of eradicating hunger and nutrition improvement as Kenya's universal role for all Kenyans. This, in line with policy aligns with the universal right to food to all individuals in the context of human rights, rights of the children and rights of women.

The Kenyan constitution provides that all Kenyans have a right to food and freedom from any kind of hunger and enough food. Kenyans are guaranteed the right to food of adequate and acceptable quality (Article 43 (1) (c). This right to food is indivisible and different from the other rights because it is meant to ensure that Kenyans live a healthy and dignified life. The provision for adequate food is to ensure that people can access to adequate and the right quantity and quality of food to ensure diet needs are achieved. This food should be culturally correct and free from any poisonous elements. This right is meant to ensure sustainability without undermining the other human rights. This right encompasses having access to seeds, adequate incomes, employment, adequate housing, cooking and storage facility.

In the continuing efforts by the government to ensure the country is food secure, the Agricultural Sector Development Strategy (ASDS) gives a listing of properties, problems, strategies,

interventions, existing opportunities as well as the vision and mission that makes the agricultural sector successful going to the future. It provides the problems that this sector is experiencing and gives the possible solutions. Since the problems cannot be solved once, the strategy provides the implementation in phases. The key objectives are mainly commercialization, increased competitiveness in the sector, management of the key factors of production and increasing productivity.

The first policy towards boosting agriculture by the government of Kenya is the Maize subsidy and Marketing Policy. The idea is the free maize marketing as well as the subsidy scheme for the vulnerable. To ensure that this is inclusive, the scheme is widened to incorporate the vulnerable groups in urban centers and those dispersed in high potential rural settings. Marketing of the crop by the government ensures that there is market for the commodity produced by the farmers. Subsidies make it economical for the production maize since it reduces the production costs of the commodity.

The agricultural sector has been affected by lack of diversification of their produces as many of them plant only maize neglecting the other crops such as Pyrethrum, Nuts, etc. The government of Kenya has engaged on encouraging farmers to plant other types of crops. The main crops grown in Kenya are maize, wheat, tea, maize, coffee etc. with horticulture providing more than 85% of the population. Out of all the mentioned crops , coffee and tea provide for 45 percent employment pay in the agricultural sector. Closely linked to this is the narrow base for agricultural exports (UNDP 2002). The ideal policy that the government is encouraging is broadening the base for crops that are grown for domestic consumption as well as for exports.

Some of the challenges encountered in the agricultural sector include lack of adequate market for agricultural output, poor transport network, high transaction costs and poor accessibility to both

input and output markets. These challenges originate from production to eventual marketing locally or in the international markets. These are caused by lack of constant supply of raw materials as result of the unregulated production characterized by guts and shortages, low competitiveness and transport costs reflected on high prices. Poor transport system makes market integration in the country poor. This has caused the government of Kenya to prioritize the construction of feeder roads in the rural areas so as to enable the transportation of outputs from the interiors to the market place or stores. Despite the agricultural sector being a source of livelihood to at least 75 percent of the Kenyan people, there are limited productivity and investment activities related to the agriculture.

Due to vitality of this sector in the economy, the government has continued to increase financing to this sector. Previously in 2003 the leaders had to what is popularly known as the Maputo Declaration in which they agreed to allocate 10% of annual budgets and Kenya tried to adhere to this to the agricultural sector and this has materialized through public institutions (Government of Kenya, 2010a). The government of Kenya has tried to increase its budgetary allocation towards agriculture in its commitment to the Maputo declaration, for instance allocations to the State Department for Crop Development rose by 44.4% to Ksh 25.3 billion in 2018/2019 budget or 15% of the budget compared with 2017/18. The increase has mainly gone to the Crop Development and Management Programme whose allocation has almost doubled to Ksh 20.9 billion from Ksh 12.2 billion in 2017/18(Government of Kenya, 2019a).

Other measures undertaken by the government include financing research in this area to mainly come up with ways of increasing productivity and high quality produce. This is mainly implemented by the Kenya Agricultural Research Institute (KARI) and other institutions of

higher learning. The government has continued to increase funding towards agricultural related activities.

1.3 Food Security and Economic growth

There exist divergent views on how food security affect economic growth. Torero (2014) established a uni-directional causality from food security to economic growth. He argued that sustained economic growth is as result of achieving food security in the country. He also noted growth only is not the only solution to chronic malnutrition but just one of the factors of food security policy (Torero, 2014). Similarly, the solution to food security from the production ignoring the demand side is not the solution to economic growth as far as the accessibility of adequate food to the poor is concerned (KIPPRA, 2007).

There are few studies carried out in Africa regarding the role of food security on the growth of the economy. Therefore this necessitates the studies to be carried out in this area since food security is crucial to the citizens of any country. In the Sub-Saharan Africa it has only been done in Ethiopia and this study addressed that by finding out how food security affect economic growth particularly in Kenya.

It is estimated that over 80 percent of Kenyan citizens live in rural areas depend on agricultural activities. Consequently, the Kenyan government continues to prioritize agriculture as one of the ways of promoting economic growth and development.

1.4 Problem Statement

Close to 815 million people out the 7.6 billion people in the world who account for 10.7 percent of the global population are estimated to be suffering from chronic malnutrition (FAO, 2016; UN, 2016) In addition to this, 10 million people in the world are considered food insecure and their livelihood is dependent on relief food and they incur high expenses on food due to high prices (Kenya Agricultural Research Institute, 2018).

Food security is a key factor in economy of a given country. The idea is that food security is important in increasing productivity of labour though it remains to be a serious problem in third world nations. Many people in the third world nations are food insecure and unable to meet three meals in a day. Food security leads to increased levels of poverty in a country. Majority of the global hungry population live in the developing nations and they account for 12.9 per cent of the population is undernourished (FAO, 2017; World Hunger Statistics, 2018).

The issue of link between food security and growth in the economy remains a topic of discussion especially in the SSA. This region consists of the highest proportion of those who suffer from hunger. Few studies, if any, have been carried out in the developing nations like Ethiopia in which food insecurity was found to negatively affect economic performance (Timer, 2004; Gay et al., 2014). Despite the studies done in the Sub-Saharan Africa and specifically in the East African region, there is no empirical study carried out in Kenya focusing on the impact of food security on growth. This study addressed this gap by investigating the effect of food security on economic growth.

To fill this gap study on the role of food security particularly in Kenya, this paper investigated the impact of food security in Kenya using time series data .Further, this paper established the existence of causality between economic growth and food security .

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1.5 Research Objectives

The general objective of this study is to investigate the effect of food security on economic growth in Kenya. Specifically, this study seeks to:

i.   Investigate the impact of food security on economic growth in Kenya in the short-run and in the long-run.

ii.   To analyze the effect of other factors on economic growth.

iii.   Recommend food security policy towards economic growth.

1.6 Research Questions

i.   What is the impact of food security on economic growth in Kenya?

ii.   What is the effect of other factors on economic growth in Kenya?

1.7 Significance of the study

There exist no empirical investigations in Kenya on the role effect of food security on economic growth in Kenya. Therefore, this paper shed light on whether or not there exist a causality from food security to growth and vice versa. The study is expected to add into the already existing body of literature on this area. Finally, the study results recommended appropriate policies regarding the role of food security on economic growth.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This section reviews both the theoretical and empirical review on the past studies carried out in this area .Theoretical section consists of the related theories while the empirical review consist of the previous studies carried out in this area.

2.2 Theoretical Review

There exist little on theory on the nexus between food security and economic growth, however there are a couple of authors who have talked about it. On his theory of wealth Pigou postulates that increase in the price levels reduces wealth in real terms hence reduced spending on consumption. This implies that reduced consumption derail economic growth (Mankiw & Scarth, 2011).

2.2.1 Malthusian theory

High level of population growth were noted by Thomas Malthus as one of the factors that lead to food insecurity.He focused on the equilibrium between the food available and economic growth. According to him, to ensure stability in economic growth, the rate of food accessibility should be higher than the proportion of the population growth (Burchi and DeMuro ,2012). Countries that experience low economic growth are characterized by high fertility rate which translate to high economic growth. The implication here was that high fertility rate are associated with high food insecurity and this affects economic growth negatively. In fact, the findings by Devereux (2000) were that population growth leads to decrease in the landholdings and exerts pressure on natural resources.

Growth is affected by several factors including food security and thus economic growth is associated with improvement in entitlement to food by individuals. According to AmartyaSen (1981), there are four main categories of food entitlement: base of trade, production base, and ownership to labor base as well as inheritance and transfer. Various theories of economic growth have identified capital and labour to be the key determinants of economic growth (Solow, 1956). This is not excluding the effect of other factors on the productivity. This study in addition to these theoretical factors of economic growth, include food security in the growth equation. Savings can only occur if the population that is involved in the production process is well equipped with knowledge and skills. This is through the provision of formal education which is an investment in human capital (Woodhall, 1997).

There exist several theories that explain the factors that affect economic growth. For instance the Domar and Harrod model is an advanced work of Roy F. Harrod in 1939 and EvseyDomar in 1946. Further, proposed by Gustav Cassel in the year 1924. The growth model brings about the relationship between savings, what is invested and the output. According to them, a nation saves at rate equivalent to the capital-output proportion and the labour force effectiveness to maintain the plant and equipment stocks in equilibrium with labour supply in line with the stead state growth. The stress in this model is that economic growth depends on the amount saved and what is invested i.e. savings and investment. This theory did not expound the scope to investigate the other factors role on economic growth such as food security and this point out a possible area in the theory that has not been studied.

2.2.2 Solow growth model

According to Robert Solow (1956) the various steady states of growth are independent of the savings rate despite the fact that the levels of the variables are dependent on the savings

themselves. This model implies that exogenous technological improvement and capital accumulation are the key determinants of economic growth. The implication is that countries should invest more in the technological advancements and growth to enhance this continuous growth of the economy. Capital accumulation eventually comes to an end in the Solow model. Labour which is a key factor of production affects the output by ensured training and skills. A well trained labour is more productive than unskilled labour.

2.2.3 Endogenous growth model

The endogenous theory of growth is credited to Barro (1990) and stipulates that fiscal policy has an effect on the ratio between the per capita output ratios. In this theory, Cobb-Douglas function is used to explain economic growth in which growth is the dependent variable. The theory is based on the assumption that products are provided by the government as a variable of production and as a result direct taxes are adversely affected. This makes it possible for the interaction between the economic policies with capital and labour to ensure sustainable economic growth. This theory is modeled with technology having a role to play. The returns are constant and thus the inclusion of the services financed by government taxation because of its effect on the output or economic growth (Barro (1990). The argument by Romer (1986) was that private investments creates positive externalities in the whole economy and thus capital accumulation cause increasing returns and hence the long run positive growth rate (Masika, 2014).The theory should therefore provide the link between economic growth other factors that are deemed to affected growth .These include aspects such as food security, human capital through training, skills and experience among others.

In relation to food security and growth effects in , the study findings showed that food insecure African countries experience slow rate in rates of growth as compared to countries who are food secure with relatively high growth(Levine and Renelt ,1992;Collier and Gunning ,1999; Levine and Easterly ,1997). Finding the solution to food insecurity from the supply side while ignoring the demand side does not solve the problem of access to sufficient food by vulnerable groups (KIPPRA, 2007).

2.3 Empirical Review

A study by Agboola (2010) using panel data for 128 nations sought to establish how food security affect growth in SSA nations for time period 1970/74-2000/09. The results concluded that the factors that affected economic growth positively include initial investment, life expectancy, food security and rate of school enrolment for the countries considered in the study. Further, GDP, rate of inflation, rate of population growth negatively affect economic growth rate. It was also noted that food insecurity African countries causes a reduction in growth in the long run. The study results were achieved by means of carrying out a normal regression model.

The findings from the study by Plessis (2002) arrived to conclusion that all determinant of the economic growth have the highest convergence impact and this justified the inclusion of food security variable in economic growth model. Increased population affect economic growth negative which is similar to the findings in the Solow growth model prediction that increased population growth reduces food accessibility and hence low level of economic growth. Further, Plessis revealed that increased level of capital has a positive impact on growth performance.

The investigation to establish the effect of food security on growth in the economy by Torero (2014) established that, the United Nations FAO reached to conclusion that high level of food

malnutrition cause the reduction in gross domestic product by a tune of between 4 to 5 percent annually. The study suggested that food security is achievable by increasing agricultural output through research and innovation. According to Torero food stability and long-term security are associated with economic growth. Food insecurity negatively affect human capital .Food insecurity is associated with increased government fiscal costs and this increases government expenditures which is caused by the failure to address the issue of food insecurity. Consequently, this leads to stagnated economic growth in the long-run.

The study by Aseyegn (2016) sought to establish the linkage in Ethiopia between increase in the prices of food and stabilization policies (access to food and food stock). Particularly, the study established causality relations between food availability and economic growth. The results of the study indicated that the situation of severe (chronic) food insecurity in Ethiopia was as result of inflation due to increased money supply in the economy, growth in population, budget deficits, and lack of storage facilities, weak institutions, and fragility in the resource base.

The empirical investigation on the link between food security and economic performance in Asia by Timer (2004) established that the relationship between the two switch from positive to negative. This study was a philosophical study in which it involved the review of the literature without necessarily any data collection. This was found to be a challenge to the policy design and implementation. In fact, Asia being a rice-based economy, the provision of food by the government changes from being an initiative, promoter of economic growth and then to a political act to address structural transformation and hence this interferes with efficiency. The empirical findings in this study indicate that rice was over 50 percent of the food energy intake because it is the main staple food for many people in the region. This implies that access to food is important for survival and farmers grew it in small scale using the new technology.

Using an AGLINK-COSIMO recursive-dynamic, Gay, Fellmann and Kavallari (2014) sought to investigate the effects of food security on economic growth. The study results indicated that food insecurity in less developed world affect growth in the long-term.The results indicated that, modeled fast, economic growth help third world nations to enhance their trade balance, however this does not help in addressing food security domestically by increasing consumption. This study incorporated both downward and upward shocks in economic growth affect the developments on agricultural commodity markets in the period 2012–2021.

This study by Destaand Asayehgn(2016) sought to investigate if there is a relationship between growth in the economy and food security in Ethiopia. The objective was achieved by developing an eclectic framework in the analysis. The gap they sought to address was that of the causality from growth and food security in Ethiopia. The study was a philosophical study in which they sought to review the existing literature and they established that food insecurity in Ethiopia was caused by the government's failure to address financial infrastructure that causes inflation. The study reviewed all the studies that have been carried out on economic growth and food security.

2.4 Summary Review

The review of both theoretical and empirical review indicates that economic growth is affected by various factors. Theoretical review provided evidence that capital, labour, savings rate and investment rates are the key indicators of economic growth. Several empirical studies show that some of the factors investigated that affect economic growth include human capital development, level of capital accumulation and food insecurity was found to affect economic growth negatively.

Few studies carried out in the developing nations such as in Ethiopia in which food insecurity was found to negatively affect economic performance (Timer, 2004; Gay et al., 2014). Despite

the studies done in the Sub-Saharan Africa and specifically in the East African region, there is limited empirical study carried out in Kenya focusing on the effect food security on economic growth. This paper filled this gap by investigating the effect of food security on economic growth.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

This section outlines the methods applied to analyze the association between the growth of the economy in Kenya and Food security. The chapter begins by giving the theoretical approach, followed by the specified model used in empirical testing, definition of variables, pre estimation tests and finally the data, data types and sources.

3.2 Theoretical framework

Good nutrition and accessibility to food improves the physical health of individuals. Previous research has shown that a labour force in good health is capable of improving productivity, and consequently, economic growth. A healthy labour leads to increased output per person i.e. labour productivity and this leads to increase in economic growth (Grossman, 1972).Despite the aspect that educated population learns faster hence increasing productivity more (Lucas, 1988 & Barro, 1991).The implication is that knowledge and good health are key in growing the economy. With resource constraints, good health and knowledge substitute each other but they should ideally complement each other. As a result, the study adopts the endogenous growth model and modifies to explain the role of food insecurity on economic growth using food accessibility and food availability components to measure food security aspect.

To begin with, the following endogenous growth function is stated:

$$Y = AK^{\alpha}L^{1-\alpha} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots..1$$

Where, Y is taken as a representation of the output (GDP), A represents technology progress, K denotes Capital, and L is the labor force. In this model, the assumption is that output(Y) is produced by use of human capital (H) and physical capital (K).

A population that is healthy has a high level of comprehension and as a result there is high human capital accumulation. Since availability of good nutrition and nutrition and food keeps children in school and hence increased accumulation of human capital. A good nutrition also causes a reduction in the rate at which human capital wears out. Previous research studies provided evidence that high life expectancies are associated with food availability and better nutritional status. This leads to increased time of harnessing benefits from accumulation of human capital.

In analyzing the food security aspect, an income based approach gives a more macro-economic perspective. The focus on food segment through production in agriculture and also trade in food has received various critics for mainly concentrating on a single economic sector. This justifies the reason why the study models both food availability and food accessibility components. Spotting that the economy is made up of independent sectors, food insecurity/ security cannot be viewed solely as a problem of food sector, hence the need to shifting to broaden the approaches to national economy as a whole. By this, there is need to bring the analysis to such variables as economic growth and Inflation among other macroeconomic variables.

The approach shows that food security can be affected by other macroeconomic variables such as inflation, and population growth.

In this regard we modify equation 1 above to include the aforementioned variables and also breakdown Capital into Human capital and physical capital which results into the following:

$$Y = AK^{\alpha}H^{\beta}F^{\gamma}I^{\delta}L^{1-\alpha-\beta-\gamma-\delta} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.2$$

Where, K is the Physical capital, H is the Human capital, I is Consumer price index and L is labor force (unemployment rate); and F is the food availability component.

Equation 2 can further be decomposed and transformed by taking natural logarithm on both sides and differentiating, to obtain the following:

$$\Delta \ln(Y^*) = \ln(A) + \alpha\,\Delta\ln(K^*) + \beta\,\Delta\ln(H^*) + \gamma\,\Delta\ln(F^*) + \delta\,\Delta\ln(I^*) \dots\dots\dots\dots\dots\dots\dots 3$$

Where, K^* represents physical capital, H^* represents Human capital, F^* is the food availability/food accessibility, I^* is the rate of inflation, A represents technology and Y^* represents economic growth.

3.3 Model Specification

From the theoretical model, the study adopts the methodologies by Yousefi (2011) and Niebel (2014) in their studies where GDP growth is the dependent variable and having capital, labor and technology in addition to other control variables as the independent variables. The hypothesized relationship is shown in the function as follows:

$$GDP = f(Physical\ Capital, Real\ Effective\ Exchange\ Rate,$$
$$Food\ accessibility, Inflation\ Rate, poulation\ growth,$$
$$life\ excpectancy, human\ capital,\quad Control\ of\ Corruption,$$
$$Trade\ oppeness) \dots\dots\dots\dots\dots\dots..\dots\dots\dots\dots\dots....5$$

The following econometric equations are estimated in the study.

$$GDP_t = \alpha_1 + \alpha_2 FA_t + \alpha_3 IR_t + \alpha_4 PC_t + \alpha_5 PG_t + \alpha_6 LE_t + \alpha_7 RER_t + \alpha_8 TO_t$$
$$+ \alpha_9 COC_t + \alpha_{10} HC_t + e_t \dots..7$$

Where,

α_0 is the intercept, and α_i are the coefficients

GDP_t –Gross Domestic Product Growth Rate estimated at time t

FAt- Food accessibility at time t,

IRt -Inflation rate at time t,

PCt -Physical capital at period t,

PGt -population growth rate at time t,

LEt -life expectancy at time t,

RERt -real effective exchange rate at time t,

TOt -trade openness at time t

COCt -control of corruption at time t

HCt -Human Capital at time t, and

e_t is the error term.

In economic analysis, it is prominent problem to encounter models where by some of the explanatory variables explain the dependent variables but at the same time, they are explained by the dependent variables they are explaining (Hall 2007). For this case, food security, GDP; and inflation rate depict such characteristics. Carrying out OLS regression models with such variable may yield spurious results. To address such an issue, Sims (1980) brought a different view indicating that in the case of simultaneity among variables, all the variables in the model should be treated in the same way, that is, they should all be considered as endogenous variables. The

variables in this study depicts such relationship hence this study employed the VECM as an estimation technique.

3.4 Definition of Variable, Data Types, Sources and Priori Expectations

Table 1: Definition of Variables and measurement

Variable	Notation	Variable Description	Expected Sign	Source
Dependent Variable(s)				**WDI**
GDP growth rate	GDP	GDP growth rate is used as a proxy for market size for Kenya. It is measured and expressed in current US Dollars.	±Ve	
Independent Variables				
Food Accessibility	FA	Food accessibility is when individuals sufficient resources to acquire adequate quantity and quality nutritional diet. The food has to be proper for diet. This study applied GDP per capita which was based on the purchasing power. It is the ratio of the GDP adjusted to international dollars using purchasing power parity rates as a ratio of total population. The value of measurement is US dollars.	+Ve	FAO
Inflation Rate	IR	This is the annual percentage change in consumer price index measured in US dollars	-Ve	WDI
Physical Capital	PC	It is the nominal value of all the capital formed and it is expressed in US dollars.	+Ve	WDI
Population growth rate	PG	This is the increase or decrease in the number of people in a given country. It is measured as a percentage of the total population.	±Ve	WDI

Life expectancy	LE	It is the mean number of years one is expected to be alive.	+Ve	WDI
Real Effective Exchange Rate	RER	This variable is measured as the trade weight average of the exchange rate of the domestic currency adjusted for inflation changes to the country of concern.	±Ve	WDI
Trade Openness	TO	It is measured by the ratio of (Trade exports plus Trade imports) to Gross Domestic Product.	±Ve	WDI
Control of Corruption	COC	Corruption Perception Index by Transparency International. The index estimate ranges from 0 (totally corrupt) up to 10 (not corrupt).	+Ve	Transparency International

3.5 Diagnostic Tests

3.5.1 Normality Test

Normality test was carried out to examine if the time series data set conforms to a normal distribution. The error term should be normally distributed. The study used Shapiro-Wilk test in testing for normality. The H_0 that, there exists a normal distribution in the population. The H0 $_{is}$ rejected on condition that the p-value is higher than the significance level.

3.5.2 Multicollinearity test

According to Hair, Tatha and Anderson (1998) Multicollinearity leads to difficulties in clearly getting the effect of variables because it leads to the biased estimates of the coefficients since the independent variables used to predict dependent variable are related. This study employed the Variance Inflation Factor (VIF) and its tolerance defined as 1/VIF in detecting this problem as

one of the pretest. In making decision on whether there is Multicollinearity or not; the requirement in this test is that the mean VIF value should be less than 10 for absence of Multicollinearity and greater than 10 for the presence of Multicollinearity.

3.5.3 Stationarity test

Analysis involving time series data usually assume that the variables are stationary. This usually implies that the series do not have trend, and has a constant mean over time in addition to constant autocorrelation over time. According to Gujarati (2011), the main importance's of stationary time series are that, if a   time series is nonstationary, its behavior can be studied only for the period under consideration and cannot be generalized to other time periods which is a disadvantage for the purposes of forecasting nor policy implication. Secondly, regressions subjected to two series which are not stationary lead to results which are inconsistent and spurious. For this reason, an Augmented Dickey-fuller test under the Null hypothesis of non-stationarity was carried out on the study variables. The variables that were found to be non-stationary were differenced to make them stationary

3.5.4 Cointegration test

If multiple variables whose linear combination yields a stationarity, and have equilibrium relationships, then they are said to be cointegrated. To test for cointegration, the study carried out a Johansen test for cointegration. The H_0 of no cointegration against the null hypothesis of cointegration. Cointegration is an important test because it determines the model to be used for estimation. Upon carrying out a cointegration test, the order of integration was two, ie I (2) hence estimating a vector error correction model.

CHAPTER FOUR: EMPIRICAL FINDINGS AND DISCUSSION

4.1 Introduction

This chapter presents the empirical results of the study. Various tests are done and their results discussed here. The research commences with the descriptive analysis followed by the pre estimation tests and finally the model estimation.

4.2 Descriptive Statistics

The statistical properties of the study variables include the mean, standard deviation, the minima and maxima which are produced and tabulated below. The mean is the average value of the particular variables over the period under consideration. The standard deviation captures the degree of variability from the mean. The minimum and maximum shows the minimum values and the maximum values of various variables over a given period under which observations under consideration are spread.

Table 2: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
GDP	39	4.0	2.3	-.8	8.4
FA	29	2361.2	288.4	2073.1	3076.8
IR	39	12.1	8.5	1.6	46.0
PC	39	19.9	3.0	15.0	25.4
PG	39	3.1	.4	2.5	3.8
LE	39	57.9	4.4	51.8	67.0
RER	39	56.7	30.8	7.4	100.6
TO	39	57.0	6.2	47.7	72.9
COC	32	2.1	.9	.5	3.5

Source: Author (2019).

The number of years for which the variables of the study were observed was 39 years except two variables (Food accessibility and control of corruption) which had 29 and 32 years respectively due to missing observations. The variable with the largest mean value was food accessibility with 2361.2. The value is average tonnage for each year. Similarly, food accessibility had also the highest standard deviation of 288.4 while the least was that of population growth rate at .4.

Life expectancy which is the number of years that one is expected to live was found to be 58 and the person with high life expectancy can live up to 58 plus 4.4 indicated by the standard deviation which is approximately 62.3 years. On the other hand the life expectancy would also be less from the mean by 4.4. The average rate of economic growth was 4.0 and the changes from the mean economic growth rate could be up to by 2.3 as indicated by the standard deviation. This change was either positive or negative. Control of corruption had the second least mean value of 2.1 and the standard deviation of 0.9 from the economic growth. Trade openness measures the level of country's trade with other nations and the mean was 57.0 captured by the ratio of (Sum of Trade exports and Trade imports) to GDP. This shows the average scores in the years included in this study.

Maximum shows the highest achievable values of the variables while minimum shows the least possible value for each variable in the last two columns. Food accessibility had the highest value of maximum and minimum of 3076.8 and 2073.1 respectively. It is only GDP growth that experienced a negative rate of growth (-.80) and the highest growth rate for the specified period was 8.4, an indicator of increased economic activity in the country.

4.3 Normality Test

Normality test in this study was carried out using the Shapiro-Wilk test. This is used to check for the distribution of the variable observation in relation to the standard normal distribution. The decision in this test is that; any value of p greater than 0.05 indicates normality while the p values less than 0.05 indicate that the variable does not follow a normal distribution.

Table 3: Shapiro-Wilk test Normality Test

Variable	Obs	W	V	Z	Prob>z
GDP	39	0.96482	1.364	0.652	0.25723
FA	29	0.84198	4.898	3.278	0.00052
IR	39	0.81250	7.269	4.168	0.00002
PC	39	0.96389	1.400	0.707	0.23981
PG	39	0.82742	6.690	3.994	0.00003
LE	39	0.93358	2.575	1.987	0.02344
RER	39	0.89220	4.179	3.005	0.00133
TO	39	0.91012	3.484	2.623	0.00436
COC	32	0.92369	2.546	1.940	0.02621

All the study variables were normally distributed apart from the GDP growth rate and physical capital accumulation since their P values were higher than 0.05 of 0.25723 and 0.23981 respectively. The rest of the variables were found to be normally distributed.

4.4 Multicollinearity Test

Multicollinearity is situation in which explanatory variables effect each other and this cause spurious results. This was carried out using the Variance Inflation Factor (VIF) in which the mean VIF less than 10.0 show that there is no multicollinearity while mean VIF values greater than 10.0 indicates the presence of multicollinearity.

Table 4: Multicollinearity Test (VIF Test)

Variable	VIF	1/VIF
PG	38.71	0.025836
LE	34.94	0.028623
FA	30.90	0.032360
RER	29.64	0.033739
IR	3.33	0.299864
PC	3.08	0.324544
COC	2.76	0.362701
TO	2.38	0.419842
Mean VIF	18.22	

The mean VIF had a mean of 18.22 which was an implication of the presence of Multicollinearity and hence some independent variables were related to each other. The possible solution was to drop them variable with the highest VIF from the model. From the results above, population growth had the highest VIF of 38.71 hence dropped from the model. The new results were presented in the table 5 below.

Table 5: Multicollinearity Test (VIF Test) Correction

Variable	VIF	1/VIF
LE	27.77	0.036012
FA	25.99	0.038479
RER	3.96	0.252222
IR	3.29	0.304237
PC	2.87	0.348686
TO	1.95	0.512154
COC	1.94	0.515946
Mean VIF	9.68	

Upon dropping the population growth from the model, the mean VIF was 9.68 which was less than 10.0 and this implied that there was no Multicollinearity. Hence dropping the population growth rate solved the problem of multicollinearity, an implication that it was the one causing Multicollinearity. The implication is that the independent variables are not related to each other and therefore estimation can be carried out.

4.5 Unit Root Test

Use of non-stationary series lead to the meaningless results. A stationary series is important for two main reasons as given by (Gujarati, 2011). First, if a time series is nonstationary, its behavior can be studied only for the period under consideration. This implies that it is impossible to generalize it to other time period which is a disadvantage for the purposes of forecasting or policy implication. Secondly, regressions subjected to two time series which are non-stationary cause results which are inconsistent and spurious. To test for stationarity for all the study variables, an ADF test for Unit Root test under the Null hypothesis of non-stationarity was carried out. The results of the test are tabulated in table 3 below:

Table 6: Test for Stationarity

Variable	Levels			Order of differencing	Difference		
	Statistic	P-Value	Comment		Statistic	P-Value	Comment
FA	3.053	1.0000	Non- Stationary	2	-5.907	0.0000	Stationary
LE	1.744	0.9982	Non- Stationary	4	-3.540	0.0070	Stationary
GDP	-3.676	0.0045	Stationary	0	-3.676	0.0045	Stationary
IR	-3.523	0.0074	Stationary	0	-3.523	0.0074	Stationary
PC	-2.788	0.0600	Stationary	0	-2.788	0.0600	Stationary
RER	-0.597	0.8717	Non- Stationary	1	-5.392	0.0000	Stationary
COC	-1.582	0.4925	Non- Stationary	1	-3.899	0.0020	Stationary
TO	-3.139	0.0238	Non- Stationary	1	-6.045	0.0000	Stationary

Source: Author (2018)

The unit root test indicated that Food Accessibility, Trade openness, control of corruption, Life Expectancy and real effective exchange rate were found to be non-stationary at level. The rest of the variables were stationary at level. The variables that were nonstationary at levels were differenced at the respective order of difference as indicated in table 6. Food accessibility, and life expectancy were differenced at 2nd and 4th order respectively. The other non-stationary variables were differenced once. Upon achieving stationarity in all the variables, the researcher proceeded to carry out cointegration test.

4.6 Cointegration Test

As noted by Guajarati (2004), cointegration is when variables have a long run relationship. Differencing of variables to achieve stationarity leads to loss of long run properties. For this reason, a test for cointegration relationship was important. The study used a Johansen test to establish the long run relationships. Prior to carrying out the test, lag length determination is vital. The study used the Akaike Information Criterion (AIC), the Schwarz Bayesian information criterion (SBIC) in determining the optimal lag Lengths. The result of the lag selection criterion is displayed in table 5 below:

Table 7: Lag-Selection Criterion

```
   Selection-order criteria
   Sample:  1994 - 2018                          Number of obs     =        25

   lag      LL       LR      df     p      FPE       AIC       HQIC       SBIC

    0    -574.75                         2.4e+10     46.62     46.7282     47.01
    1    -404.035   341.43   64   0.000  6.3e+06    38.0828    39.0564    41.5932
    2    -130.608   546.85   64   0.000  2.74964*   21.3287    23.1677    27.9593
    3     4962.56   10186    64   0.000       .    -381.005   -378.301   -371.254
    4     5753.94   1582.7*  64   0.000       .    -444.315*  -441.61*  -434.564*
```

Source: Author (2019)

From the output above, the optimal lag length was determined to be 4, this is selected by both the

AIC and SBIC among others. Before the cointegration test, the optimal lag length was

determined.

Table 8: Johansen Test for Cointegration

```
                          Johansen tests for cointegration
Trend: constant                                         Number of obs =      25
Sample:  1994 - 2018                                            Lags =        2
─────────────────────────────────────────────────────────────────────────────
                                                       5%
maximum                                     trace    critical
  rank     parms        LL      eigenvalue  statistic   value
     0       72     -321.78554        .      305.3878   156.00
     1       87     -273.93708    0.97824    209.6909   124.24
     2      100     -234.60339    0.95701    131.0235    94.15
     3      111     -206.41342    0.89515     74.6436    68.52
     4      120     -189.88057    0.73357     41.5779*   47.21
     5      127     -181.00405    0.50842     23.8248    29.68
     6      132      -172.8886    0.47756      7.5939    15.41
     7      135     -169.73668    0.22288      1.2901     3.76
     8      136     -169.09164    0.05029
─────────────────────────────────────────────────────────────────────────────
```

Source: Author (2019)

The Johansen test is done by comparing the trace statistics with the critical value. If the value of

the trace statistics is greater than the critical value then this implies cointegration at the specific

level. From the results in table 8, the variables were found to be cointegrated at order 4, that is, I

(4). The 41. 5779 trace value was less than 47.21 which was the critical value. Since the

variables were found to be cointegrated at order 4 which implied multiple equilibrium

interactions, the researcher proceeded to estimate the VECM as described in the preceding

chapter. More important is that, due to the fact of the small sample size, not all the equilibrium

interactions were considered in the model.

4.7 VECM Estimation Results

Table 9: Vector Error Correction Model Results for Economic growth and Food Availability

	MODEL ONE	MODEL TWO
	Economic Growth	Food Accessibility
L._ce1	-0.0511**	-49.66***
	(0.0194)	(14.24)
L2D.GDP	0.771***	0.820
	(0.0833)	(24.24)
L2D.D_FA	0.0347***	0.355
	(0.00414)	(0.509)
LD.IR	0.00784	6.236**
	(0.00412)	(2.193)
LD.PC	0.00515	-26.71**
	(0.0170)	(10.36)
LD.D_LE	1.313	-393.2
	(1.619)	(1002.6)
LD.D_RER	0.0172***	1.273
	(0.00467)	(3.293)
LD.D_TO	0.0000808	-7.032**
	(0.00459)	(2.657)
LD.D_COC	-0.0862	72.64*
	(0.0542)	(32.16)
Constant	-0.0308	-0.0378
	(0.0316)	(18.31)
AIC	-.2171305	3.302232
SBIC	4.053315	7.597362
HQIC	.9158198	4.382445
Log likelihood	89.60557	49.02433

Standard errors in parentheses $^{*}p< 0.05,\ ^{**}p< 0.01,\ ^{***}p< 0.001$

Source: Author (2018)

To find out the existence of both the short-run and long-run equilibrium between the independent variables and dependent variables, the VECM results were presented in Table 9. The

coefficients, - 0.0511 and -49.66 shows the rate of adjustments by the variables towards equilibrium in GDP growth and food accessibility respectively. In this case, it can be interpreted that the rate of adjustment towards equilibrium from the independent variables to GDP growth and food accessibility is 5.11 % and 496.6 % respectively. The implication is that explanatory variables and economic growth are related in the long run and it is statistically significant.

In model one presented in Table 9, GDP growth rate which is a proxy for market size for Kenya measured in current US dollars in the second lag was found to positively affect economic growth in the short run, and statistically significant but had but not statistically significant on food accessibility. This was in line with the study by Agboola (2010) using panel data for 128 nations established food security affect economic growth positively. Food availability at first difference affects economic growth significantly at 10 percent level of significance. A unit change in the accessibility of food lead to economic growth of about 3.47 USD.

Inflation rate significantly affects both food accessibility at 5percent and 10 percent significance levels in the second lag. Increase in the rate of inflation by one percent leads to a reduction in food accessibility by 6.236 US dollars. However, rate of inflation was found to have a non-significant impact on growth.

Physical capital affects food accessibility significantly but has no significant impact on economic growth. The results indicate that a one percent increase in physical capital reduces food accessibility by 26.71 US dollars and its statistically significant at 5% and 10% level of significance

Life expectancy was found to affect economic growth positively but food accessibility negatively, although the relationship was not statistically significant. Improvement in the life expectancy in Kenya leads to the and increase in economic growth by 1.3 US dollars but a

reduction food accessibility by 393.2 US dollars.

Real effective exchange rate captured as the trade-weighted average exchange rate of the Kenyan currency against adjusted for inflation relative to the trading country and expressed as an index number relative to a base year, affects economic growth positively and statistically significant. However, it affects food accessibility positively but not statistically significant. A unit change in real effective exchange rate causes a growth in economy by 0.0172 US dollars.

Both trade openness and control of corruption which is an institutional measure was found to have a statistically significant effect on food accessibility but not to economic growth. A one percent increase in trade openness cause a decrease in food accessibility by 7.032 US dollars and significant at 5% and 10% significant level. Similarly, improvement in the control of corruption leads to an increase in food accessibility by 72.64 US Dollars.

CHAPTER FIVE: SUMMARY AND CONCLUSION

5.1 Introduction

This section presents the discussion of the study summary findings, policy recommendation and proposes further areas of research.

5.2 Summary and Conclusion

The primary objective was to investigate the weather food security affect economic performance or not in Kenya using time series data for the period 1980-2016. This was addressed by first checking the long-run relationship using the Johansen cointegration test which led to the conclusion that economic growth was affected by food security in the long-run. Notably, food security is measured in one dimension; food accessibility was measured by per capita GDP (PPP based) is GDP transformed to global dollars and in this case the purchasing power parity rates as a ratio of total population. The objective was achieved through carrying out two VECM models in which one was economic growth and the second was food availability.

The model showed that food accessibility significantly affects economic growth positively with the VECM results showing that an increase in food security leads to the growth of the economy. The second objective was to find out whether other factors apart from food accessibility affect economic growth and the study findings confirmed that real effective exchange rate was found to significantly and positively have an effect on growth. The study indicated that the rest of the factors did not play any significant impact on economic growth.

On running the second model it showed that food availability was negatively and significantly affected by physical capital and trade openness while positively and significantly affected by inflation rate and control of corruption.

5.3 Conclusions

From the findings of this study, it is concluded that:

i. Food insecurity negatively contributes to economic growth in Kenya.

ii. The study results confirmed that real effective exchange rate positively and significantly affect economic growth while the rest of the factors which include Inflation Rate, Physical, Capital, Population growth rate, Life expectancy, Trade Openness and Control of Corruption did not play any significant effect on economic growth.

5.4 Policy Recommendation

The study established that growth and food security have a long-run relationship. From the study findings, this paper recommends that the Kenyan government should come up with policies that are key to make Kenya a food secure nation because food security is a key factor of economic growth through appropriate agricultural policies to ensure food security.

Secondly, the country should put measures to strengthen the real effective exchange rate because it is a key factor on economic growth. The implication is that improvement on the real effective exchange rate lead to economic growth.

5.5 Further Areas of Research

Although previous research studies have been carried out in the different areas in the world, there are few studies that focus on the role of institutions on food security in any country. Further, there is no study that has been carried out in each economic block in Africa focusing on impact of food security on economic growth. This study proposes that future studies should seek to address that gap.

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