EFFECT OF AGRICULTURAL FINANCING ON AGRICULTURAL PRODUCTIVITY IN KENYA

BY

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DECLARATION

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

Signature...................................... Date......................................

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The research project has been submitted with the approval of my supervisor.

Signature................................... Date..

DR. CHRISTINE NANJALA

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This project has been submitted with the approval of the faculty advisor.

Signature................................... Date...

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DEDICATION

This proposal is dedicated to my family and friends who have been the greatest source of my inspirationas well as supporting me with both moral and financial resources to carry out my research, I thank you all for encouragement, support and continuous inspirations throughoutthis endeavor. May Almighty God always bless you.

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LIST OF ABBREVIATION

GDP - Gross Domestic Product

GOK - Government of Kenya

AFC - Agricultural Finance Corporation

SME's - Small and medium enterprises

NGO's - Non Governmental Organization

SSA - Sub Saharan Africa

ODA - Official Development Agency

EAC - East African Community

AR - Autoregressive model

MA - Moving average

ARMA - Auto regressive Moving average

ACF - Auto correlation Function

PACF - Partial Auto Correlation Function

KARLO - Kenya Agricultural Research & Livestock Organization

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ABSTRACT

The study aimed at determining the effect of agricultural financing on the agricultural productivity which is embarked on the following objectives: to find out the effect of water development financing on agricultural productivity, to determine the effect of asset financing on agricultural productivity as well as to determine the effect of livestock financing on agricultural productivity in Kenya. The study was construed around the theories of financial intermediary, trade-off theory of capital structure as well as pecking order theory. It adopted a descriptive design where the data was gathered from World Bank, AFC and KNBS between 1985 and 2015 pertaining the variables being studied. Data was entirely secondary and was analyzed though descriptive statistics methods, the time series model was fitted after thorough process on the suitability. The study found that water development financing was significant and had a positive effect on agricultural productivity, agricultural asset financing had a negative but significant effect on the agricultural productivity whereas livestock financing had a positive but insignificant effect on the agricultural productivity in Kenya. The finding was presented by use of graphs, tables and models. The recommendation for the study was of great significance to the agricultural finance corporation, Kenyan farmers, the ministry of agriculture, future researchers and academicians among others.

Key Words: Agricultural Financing, agricultural Productivity, Credit.

CHAPTER ONE

INTRODUCTION

1.0 Introduction

The role of this chapter is to give an introduction on the impact of agricultural financing on sustainable farming in Kenya. The chapter is classified into various segments. This includes the background to the problem, definition of agricultural financing, statement of the problem, objectives of the study, scope of the study, significance of the study and justification of the study.

1.1 Background of the Study

Agriculture has been regarded as the backbone of the Kenyan economic development. It significantly contributes to capital formation, employment opportunities, production of raw materials, food security, foreign exchange, and economic growth. Generally, agriculture constitute more that 25% Kenyan Gross Domestic Production (GDP). According to GoK(2007) small scale farmers, commonly referred to as small holdings generates over 60% employment opportunities to the Kenyan labor force.

Agricultural productivity has been low in the less developed nations, particularly in Kenya. The low outputs have been attributed to use of outdated farming technology, poor irrigation facilities, traditional farming methods, and small holdings. These low agricultural outputs have resulted in vicious cycle of poverty characterized with low incomes, low savings, and low investments. Therefore, there is a need for intervention of credit agencies to improve and sustain farming practices. As an important instrument, credit helps small scale farmers acquire command over the consumption goods, fixed and working capital. Agricultural credit also plays a significant role in enhancing agricultural productivity. Access to credit enables small scale farmers acquire necessary

machinery and agricultural inputs. Agricultural output is low in developing countries especially in Kenya due to small holdings, traditional methods of farming, poor irrigation facilities, low or misuse of modern farm technology etc. (Zuberi, 2010). This results in small income and no saving or small saving. Credit is an important instrument that enables farmers to acquire commands over the use of working capital, fixed capital and consumption goods (Siddiqi, 2009). Credit plays an important role in increasing agricultural productivity. Timely availability of credit enables farmers to purchase the required inputs and machinery for carrying out farm operations (Munir, 2009).

Greater commercialization of the farming sub-sector and an increase in smallholder incomes will come from improved technologies that will make the existing resources more productive, as well as policies and actions that will deal with the seasonal intra-year variations in production which include creation of a strategic farm reserve, investment in processing of long life farm products and investment in infrastructure such as roads and electricity

1.2 Agricultural Financing

According to Murray (1953), agricultural finance is defined as "an economic science that deals with farmers or an organization borrowing funds from credit agencies with key interest of agricultural investments." Tandon and Dhondyal (1962) defined agriculture financing as "a branch agro economics that concerns financial resources associated with individual farm units." Therefore, agricultural financing borrowing and lending funds to meet agricultural activities, beginning from production stage to marketing. It involves loans (short-term, medium-term, and long-term), lease, and livestock insurance for the overall agricultural value chain. While agricultural financing may engross various forms, the major concern of this research paper is financing through credit facilities.Credit is an important instrument that enables farmers to acquire commands over the use of working capital, fixed capital and consumption goods (Siddiqi, 2009).

Credit plays an important role in increasing agricultural productivity. Timely availability of credit enables farmers to purchase the required inputs and machinery for carrying out farm operations (Munir, 2009).

1.1.2 Productivity

The concept of productivity is a relative term and sometimes it is considered to be an overall efficient productivity is someone's ability to produce more economically and efficiently (Mohammad, 2009). And effectiveness of productive units or as a ratio of output to the corresponding inputs used. In this study, agricultural productivity could be defined as ratio of output to inputs in relation to number of farm input, labor and technology (tractor machines and ox-plough) employed in agriculture. It will also be defined as the increase in output as a result of interventions adopted to remove constraints in accessibility of required inputs.

1.1.3 Agricultural Financing and Productivity of Crop Farming

There are few agricultural credit institutions, the main one being the Agricultural Finance Corporation (AFC), which is not the most popular. Other sources of credit include commercial banks, whose credit is usually unsuitable for farming, and micro-finance institutions, which are more popular with small and medium enterprises (SMEs), including smallholder farmers.

Smallholder farmers', who are the dominant players in crop farming, use of credit is less due to the unavailability of credit than to the conditions and cost of credit, collateral requirements and inadequate grace periods, among other factors. Other relevant institutions are NGO's and church based organizations which have become very active in farm development in East Africa. Development partner institutions are also relevant in dairy development, as sources of innovations

and funds (Muriuki 2005). Unfortunately, smallholder farmers often face serious financial constraints to scaling up production. In Kenya, land ownership is poorly documented, so farmers can't use their land as collateral to secure loans. Banks are reluctant to lend money to rural farmers and small business owners who have limited assets and virtually no financial history. This lack of access to commercial finance prevents many farmers and entrepreneurs from growing their businesses (FAO, 2011).

1.1.4 Crop Farming in Africa

The agriculture sector has a crucial role to play in the long-term development of most African countries. For many African countries, agriculture remains the most important source of employment, income and overall-wellbeing. The sector provides the largest contribution to national income; it is the biggest source of foreign exchange and is a major source of saving and investment. Moreover, with over 80% of the population in sub-Saharan African (SSA) dependent on the sector and 70% of these dependent on food production through farming and livestock rearing, growth in the sector has the best chance for producing poverty reducing effects. It follows, therefore, that any strategy for sustained growth and poverty reduction must center on rapid growth of the agriculture sector. Although the role of agriculture in growth and poverty reduction in Africa is well recognized, there has been gross under-investment in the sector over the years. Since the mid-1990s, donor contribution to the agricultural sector has declined dramatically. Globally, official development assistance (ODA) to agriculture has decreased by nearly two thirds between 1980 and 2002 from US$ 6.2 billion to US$ 2.3 billion. In terms of private sector investments, it is notable that the African continent has generally been unable to attract significant private sector external resources.

The data show that the allocation decreased in Burkina Faso and Mali between 2004 and 2005. The FAO data further show that 13 countries are in the range of between 5 and 10% while the other 16 had expenditures that were less than 5%. In the former category, there were marginal increases in Kenya (0.4%), Sudan (0.4%), Tunisia (0.2%), and Mozambique (0.1%). The allocation declined in Lesotho from 5.0% to 2.9% and from 5.0% to 4.9% in Senegal between 2004 and 2005. In the latter category, only Tanzania recorded a significant increase from 3.0% to 5.5%. There were declines in Gabon, Burundi, Mauritius and Liberia. The overall picture that emerges from this information is that although commitments were made to increase public expenditure to agriculture, many African countries are yet to make significant changes to their allocation to the sector and are unlikely to meet the agreed targets by 2008.

1.2 Statement of the Problem

In most part of developing countries like Kenya, government has enforced policies to compel small scale farmers to diversify the agricultural production to modern export crops. However, the switch from traditional methods of crop production to more sustainable methods requires agricultural activities that would yield higher returns on factors of production, in line with adoption of new farming methods and techniques, farmers would require credit facilitation since it is costly to finance the modern operations (Mohammad, 2009). Arguably, providing credit facilities to smallholding farmers will increase their productivity and hence increase in the overall agricultural outputs. Improving profitability of agricultural credits enhances financial performance as well (Odu 2007). Therefore, increasing agricultural loans and improving risk management is an effort towards expanding agricultural production and earnings.

The uniqueness of the agricultural sector which is characterized by high level of uncertainty resulting from drought, unreliable input, price fluctuations, and lack of storage facilities compels

the ordinary banks to shy away from availing credit and in the most rare circumstance charge high interest rates (Fries 2004). Acquisition of necessary and modern agricultural capital has been challenging especially in the developing countries, according to Belshaw (1979), underdeveloped countries face a greater problem in devising institutional agencies both privately and publicly to promote smooth flow of funds which can be used effectively in the agricultural sector. A study by Carter and Olinto (2003), in Nigeria found that in rural areas of developing countries, lack of credit facilities have significant adverse effects on farm investment, inline with that, a study by Foltz (2004), found that credit increases not only the productivity of farms but also the profit of households. According to Adewuyi (2002), whose study was conducted using linear programming and Tobit model found that high cost and inadequate supply of input negatively affect agricultural productivity.

However a study by Ajibefu (2002) and Ekborm (1998) indicates contradicting findings regarding the one of the determinant of agricultural productivity linked to financing operations where Ajibefu (2002) found a positive relationship between the two while Ekborm (1998), in his study showed inconsistent results where agricultural financing is negatively related to agricultural productivity. The study therefore aims at providing conclusive findings regarding the contradicting results from previous studies in order to bridge the gap through the investigation of the impact of agricultural financing on agricultural productivityin Kenya.

1.3 Objectives of the Study

1.3.1 General Objective

The main objective of this study is to determine the effect of agricultural financing on agricultural productivity in Kenya.

1.3.2 Specific Objectives

i.   To determine the effect of water development financing on agricultural productivity in Kenya.

ii.   To find out the effect of agricultural asset financing on agricultural productivity in Kenya

iii. To assess the effect of livestock financing on agricultural productivity in Kenya.

1.4 Research Questions

I.   What is the effect of water development financing on agricultural productivity in Kenya?

II.   What is the effect of agricultural asset financing on agricultural productivity in Kenya?

III. What is the effect of livestock financing on agricultural productivity in Kenya?

1.5 Justification of the study

Today's Kenyan farming is predominantly defined as Agrarian economy. According to the history of nations, most countries had to start with agriculture as their principal income generating sector. Agriculture has for the longest time been the backbone not only for the Kenyan economy but for majority of developing countries. However, the ever increasing population raises the demand for agricultural products as the need to feed the masses increases, population statistics shows that population has increased from 1 Billion in the 18th century to 7.616 in 2018, the trend is projected to 8 Billion by 2024 and 9 Billion by 2042. This has led to strong attraction towards researching this lucrative sector of the economy.

1.6 Significance of the study

The following groups and individuals will benefit from the study:

1.6.1 Researchers and Academicians

Many scholars have acknowledged the significant relationship that exist between agricultural financing and agricultural sustainability of any economy and thus offer a foundation and a platform for further studies relating to the subject matter.

1.6.2 Agricultural Financing Corporations and other credit financing institutions

This research paper provides decision makers and managers within the credit financing sectors in Kenya, mainly Agricultural financing Society of Kenya (AFSK) and other commercial banks relevant knowledge on credit finance diversification.The study also provide recommendations on necessary adjustment, within other credit financing in Kenya,

1.6.3 Investors and Farmers

Besides, this study is of benefit to all stakeholders and investors who are concerned with identifying challenges which confront agricultural finance. Once such challenges are identified, beneficiaries are able to establish less risky products which are beneficial to farmers.

1.7 Scope of the study

The study entirely focused on the effect of agricultural financing on the productivity in the agricultural sector in Kenya. The data was gathered from the World bank as well as Kenya national bureau of statistics (KNBS). Data from 1985 to 2015 was used in the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This reviews the literature regarding the topic under the study which entirely involves agricultural financing and sustainable farming in Kenya, it also include the theories that help explain the variables studied as well as the conceptual framework, empirical review and Operationalization of the variables.

2.2 Theoretical Framework

According to Mugenda and Mugenda(2003), a theory is a set of statements or principles devised to explain a group of facts or phenomena, especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena.Theoretical framework is a group of related ideas that provides guidance to a research project or business endeavor (Mugenda, 2003).

2.2.1 Trade off Theory of capital structure

Trade-off theory of capital structure is the oldest proposition and is linked with the Modigliani and Millers theory which aimed at establishing an optimal capital structure (Chen 2011). The theory was developed by Myers in 1984 which majorly emphasized on the balance between the tax savings arising from debt as a result of tax shield as well as agency cost and bankruptcy costs that could result to financial distress (Oruc, 2009).

Trade off theory assumes that each source of finance is associated with its own cost and return which is linked with the earning capacity of the firm and bankruptcy risk (Awan & Amin, 2014).

The farmers need to put into consideration the trade off theory before acquiring the financing and therefore tenents of the theory such as bankruptcy cost play a key role in agricultural financing(Chen, 2011).

The relevance of Trade of theory cannot be overlooked as it highlights the cost and return being the major determinants of the farmers credit acquisition. The tendency of the ordinary banks to charge high interest rates raises the cost of borrowing to the farmers and thus reducing the expected return from the farming investment. It also highlights need for the development of special institution that is customized to supporting agricultural financing activities such as the Agricultural Financing Corporation (AFC)as well as the agricultural cooperatives e.g dairy cooperative, tea farmers cooperatives, coffee farmers cooperatives among others.

2.2.2 Pecking Order Theory

Pecking order theory present the conflicts between the insiders and outsiders in case of a financial intermediary but fails to put into consideration the concept of optimality, it therefore dwells much on the information asymmetry and signaling effect (Luigi & Sorin 2009). The theory was initiated by Myers and Majluf (1984), where they assumed perfect market, the level of debt in this aspect is determined by the forces of demand and supply which includes the availability of the required funds (Mostafa & Boregowda, 2014).

The greatest significance of pecking order theory is derived from the assertion that it fits naturally on a number of elements on how the firms utilize external financing (Eckbo, 1986). In this context pecking order theory indicates that the firm will utilize the internal sources of funds first and in a case where external financing is available, then the firm will opt for debt as opposed to equity, this

is due to the low cost of borrowing, the interest tax deductibility as well as minimal transaction fees (Myers, 2001).

In relation to our study, the farmers will seek financing for their operations based on availability of the finances as well as the need for the money, this theory is therefore insightful as it explains the farmers behavior towards embracing the credit facilities and the extent of reliance. Myers and Majluf (1984) asserted that firms will exhaust internal sources of funds before seeking for external financing, these internal financing include retained profits among others.

2.2.3 Financial Intermediary Theory

According to Leland and Pyle (1977), financial intermediaries are those institutions that deals with the distribution of information. Financial intermediaries are firms that bridge the financial deficit through borrowing from the source and lending to those who need funds for investment purposes, financial intermediary theory was developed by Gurley and Shaw in (1960). The theory relies on the information asymmetry concept where there is a discrepancy between the lenders and the borrowers both before the disbursement of the credit facility (ex - ante) and after the disbursement of the credit facility (ex- post).

Claus and Grimes (2003), argues that information sharing enhanced by the financial intermediaries eliminates the information asymmetry and thus contribute to the sustainability of the financing institutions such as agricultural financing corporation since the risk is optimally reduced. Financial intermediaries are founded on agency relationship where individuals save money with the institution hoping to get returns resulting from prudent allocation and investment of the resources, the institution therefore distributes the resources to the available demand at an interest. This

explains the trust bestowed upon the financial intermediary by the owners of the resources and therefore acts as agents of the investors (Diamond, 1984).

In the agricultural sector however, financing of the main financial intermediary that is the agricultural finance corporation is by the government and therefore the government is the principle whereas AFC is the agent. They need to allocate the resources based on urgency and priority to the farmers who need the financing most and not necessarily on prejudice and unfair practices. AFC should practice prudence in the allocation of the resources which is barely public funds. The principle (government) through their monitoring and oversight system (Parliament) should formulate policies and regulations that ensure effectiveness and health of the financial intermediary in the agricultural sector and therefore support the agricultural activities aligned towards boosting the country's GDP(Diamond & Rayan 2000). The essence of the said theory is to unveil the impact of agricultural financing on agricultural productivity and thus encourage the existence of the financing model.

2.3 Empirical Review

2.3.1 Water development Financing on agricultural productivity

Water development financing is the credit channeled towards the development of dams and water management services, the water supports agricultural activities through irrigation. Water is a very useful natural resource which requires effective utilization and conservation (Fan 2003). The financing in water development is determined by the total area under irrigation in the country as a proportion of total agricultural land. According to SIWI (2005), there is sufficient evidence that investment in water have spill overs to the economic growth of a nation as evidenced in China where it led to huge improvements in local GDP.

A study conducted between 1950- 1993 by World Bank evaluated 208 World Bank funded irrigation projects where the rate of return was 15 %, however the study found out that the size of the irrigated area was one among the factors that influenced the economic returns in the evaluation(Jones, 1995). According to Bhattarai (2007), investment in water development proves to be slightly profitable in many circumstances though the returns may vary based on underlying circumstances such as the fluctuation in the prices of commodities.

2.3.2 Asset Financing on agricultural productivity

Asset financing availed by the agricultural finance and other lending institutions in the agricultural sector will be determined through the proportion of agricultural machinery per 100 square KM or arable land. The term machinery include the tractors and any other fixed asset that is directly used in land preparation, planting as well as harvesting the farms produce (Boucher, 2008)

According to Carter and Weiber (1990), farmers need ex-ante and ex-post access to funding with regards to the farm assets, in this regard ex-ante access is for the capital to finance the pre - operational/initial cost such as acquisition of tractors, farm machinery, transport lorry, green house which are all capital intensive as well as ex-post access which provides capital necessary to facilitate the realization of the laid investment in the sector.

Access to finance to buy farm assets affects firms productivity directly since farmers facing capital constraints end up using low level of inputs which are in addition ineffectively applied and thus reduce the expected output as compared to farmers not constrained (Petrick,2004).

2.3.3 Livestock Financing on agricultural productivity

Livestock financing will be measured on livestock index and seek relationship to the contribution on the country's GDP. The financial intermediary that is specifically established for this mandate

is Kenya Livestock Finance Trust (K-LIFT). The intermediary was initiated in 2009 to support livestock farming and related activities (KLFT 2012). Livestock financing is interesting as the livestock owners in most cases compares the interest rate and the opportunity cost of holding their stock, in this aspect there is a trade-off between the liquid nature of livestock market and the interest charged by the financial intermediaries(Bosman, 1997).

In most cases livestock financing happens for aspiring farmers as the existing farmers shy away from the cost of borrowing thus deterring from using the credit facilities in expanding their farming or even firms produce (Kibaara, 2006).

According to Waithaka (2002), only 2.5 % of all agricultural households have obtained long term credit to use in their farms with more than half using the credit facility to purchase improved dairy cattle. Kibaara (2006), classified the credit providers into two where the AFC and commercial banks targets large borrowers but end up serving few while cooperatives and SACCOS target small borrowers and serve quite a large number of farmers.

2.4 Conceptual framework

Conceptual Framework is the schematic representation of the variables under the study. It is used in research to outline possible courses of action or to present a preferred approach to an idea or thought. It shows an understanding of the relationship of the variables being reviewed (Bradley 2008)

Independent variable   **Dependent variable**

Water Development Financing

- Area under irrigation

14

```
┌──────────────────────────────┐              ┌────────────────────────────────────────────┐
│  Asset Financing             │              │  Productivity in the agricultural sector   │
│                              │              │                                            │
│  - Level of land mechanization│─────────────│  - Agricultural GDP as a % of total GDP    │
│                              │              │                                            │
└──────────────────────────────┘              └────────────────────────────────────────────┘

┌──────────────────────────────┐
│  Livestock Financing         │
│                              │
│  - Livestock sustainability  │──────────
│                              │
│  - No of livestock           │
└──────────────────────────────┘
```
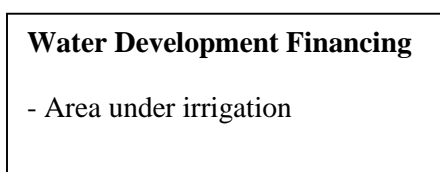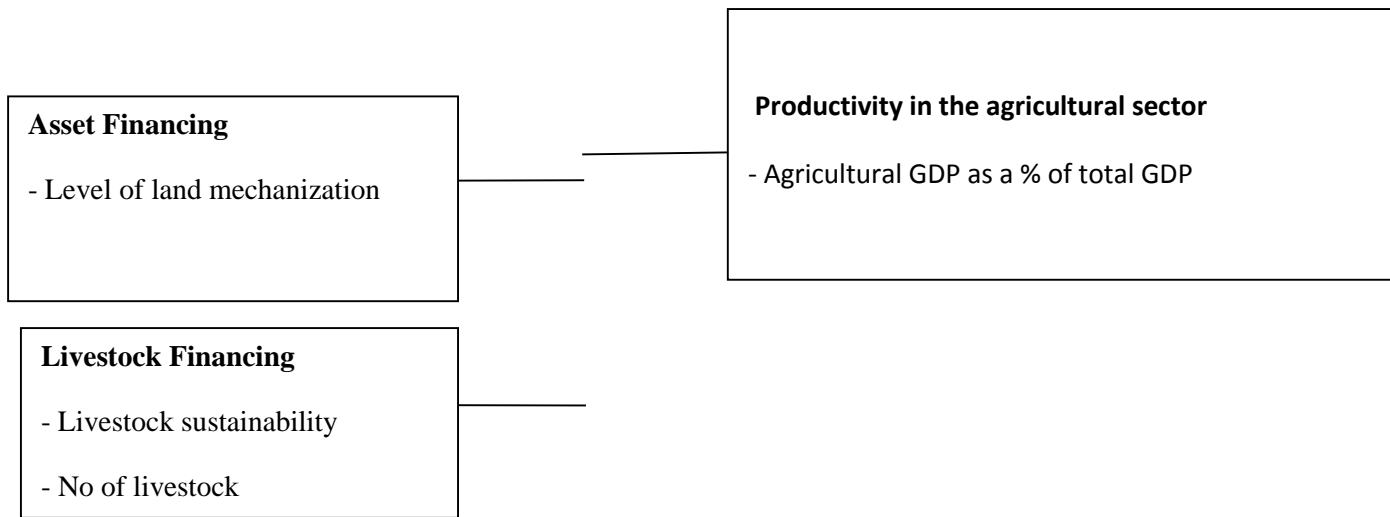
Source: Author (2018)

Figure 1:Conceptual Framework

2.5 Literature Gap

Despite previous studies been scantly conducted especially in the agricultural sector previous studies have not been able to bring forth clear results on the effects of agricultural financing on agricultural productivity across the globe. According to Belshaw (1978), underdeveloped countries face a greater problem in devising institutional agencies both privately and publicly to promote smooth flow of funds which can be used effectively in the agricultural sector. A study by Carter and Olinto (2003), in Nigeria found that in rural areas of developing countries, lack of credit facilities have significant adverse effects on farm investment, inline with that, a study by Foltz (2004), found that credit increases not only the productivity of farms but also the profit of households. The study therefore is conducted to clear the results of the few studies conducted especially the study by Foltz (2004) which is closely related to the current study. The existing gap

will be filled therefore by adding new knowledge pertaining agricultural financing and agricultural productivity.

2.6 Summary of Literature Review

The literature review summarizes the theories related to agricultural financing which includes the financial intermediary theory, trade-off theory as well as the pecking order theory. The theory informs the study especially on the motive and intention of both the farmers and the lenders to extend the financing to the farmers, the financial intermediary theory links the agency theory in explaining the existence of the financial intermediaries that avail resources to those who need it and reward the owners of the resources through dividends. The chapter also outlines the relationship between the independent variables and dependent variables, that is the structure of the study. The empirical studies are scanty as few scholars have dwelt on this area where they link agricultural outcomes with financial variables.

2.7 Operationalization of the Variables

Table 1: Operationalization of the variable

	Variable	Nature	Indicator	Measure
1	Productivity	**Y** (Dependent variable)	Performance	$\dfrac{AgricultureGDP}{TotalGDP}$
2	Water Development financing	**X₁**(Independent variable)	Financing	$\dfrac{TotalIrrigatedland}{Totalagriculturalland}$
3	Asset Financing	**X₂**(Independent	Financing	$\dfrac{NoofagriculturalMachineries}{Totalarableland(100sqKM)}$

		variable)		
4	Livestock Financing	X_3(Independent variable)	Financing	Livestock production index

Source: Author 2018

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the methodologies that the study used, target population, sample size, sampling procedure and instruments of data collecting.

3.2 Research Design

A research design is the plan and structure of investigating so conceived as to obtain answers to research questions. The study adopted a descriptive research design, this is because it enables the use of quantitative methods and techniques in the study (Orodha, 2003). According to Mugenda and Mugenda (2003) a descriptive research design attempt to collect data from members of a population in order to determine the current status of that population with respect to one or more variables.

3.3 Target Population

Population is a well-defined or set of people, services, elements, events, group of things or households being investigated(Mugenda and Mugenda, 2003).The study targeted the agrarian economy in Kenya which hosts financing corporations (AFC) together with the farmers (registered and not registered) in different forms of farming that is food crop farmers and cash crop farmers, livestock farming and fisheries etc.

3.4 Data Collection

The study employed the use of secondary data, this was sourced from government agencies concerned with agricultural developments such as the ministry of agriculture, agricultural finance corporation (AFC) , Kenya National Bureau of statistics together with the World bank database. The data from 1985 - 2015 pertaining to water development financing, asset financing, livestock

financing and agricultural sectors contribution to GDP was gathered to aid in determination of the impact of agricultural financing on the agricultural productivity in Kenya. Other secondary information was sourced from the internet and agricultural journals.

3.5 Data Analysis

Data collected was filtered and screened for errors before the analysis, the study adopted a descriptive statistics approach where use of descriptive methods such as measures of central tendency and measures of dispersion was utilized. They include mean, percentages, ratios, standard deviation and variance. This was effected by use of Microsoft excel tool as well as STATA software. Analyzed data was presented using graphs, charts and tables to aid in user visualization. The study determined the impact of agricultural financing on agricultural productivity over time where the output was presented using time series model in the form shown below:

$$Y_t = a_{ot} + a_1X_{1t} + a_2X_{2t} + a_3X_{3t} + u_t$$

$$AGDP = a_o + a_1WDF_t + a_2AF_t + a_3LF_t \quad \textbf{(Fitted equation)}$$

Where,

Y = Agricultural Gross Domestic Product (AGDP)

X_1 = Water Development Financing (WDF)

X_2 = Asset Financing (AF)

X_3 = Livestock Financing (LF)

u_t = Stochastic variable (Error term)/ white noise error

The selection of the model amongAR, MA or ARMA model was done through a model specification process using Box Jenkings method which indicates characteristics shown below on PACFs and ACFs, the concept of parsimony was used in choosing the parameter and the order of the suitable model.

Table 2: Model identification

	ACFs	PACFs
AR(p)	Dies exponentially	Cuts off to zero after lag p
MA(q)	Cuts off to zero after lag q	Dies exponentially
ARMA (p,q)	Dies exponentially	Dies exponentially

Source: Author 2018

3.6 Diagnostic Tests

Statistical diagnostic test was used to ensure that the model selected suits the data.

3.6.1 Unit Root Test

Unit root indicated that the series is not stationary and therefore de - trending was done to make it stationary. Unit root was tested by use of Dickey-Fuller test where the null hypothesis is that there is unit root. We accept the null hypothesis if the *test-statistic is < than the absolute value of the critical value.* The test-statistic was< than the absolute value of the critical value and therefore we accepted the null hypothesis that there was presence of unit root which needed de -trending.

3.6.2 Residual analysis

The suitability of the residuals was detected through the following tests.

3.6.2.1 Heteroskedasticity test

Heteroskedasticity means that the variance of the lags is not constant, i.e not homoskedastic. It was tested through the use of hettest residual where Ho is that there is constant variance, we accept Ho if $p<0.05$, indicating presence of homoskedasticity.

3.6.2.2 Auto correlation Residual

This was done by use of a correlograms, the output indicatedthe significant of entries in the fitted model and thus signifies more attention.

CHAPTER FOUR

DATA ANALYSIS AND INTERPRETATION OF RESULTS

4.1 Introduction

This chapter presents the analysis of the data that was found on an investigation of the effect of agricultural financing on agricultural productivity in Kenya.The study was conducted on the macro data pertaining to the country at large with close focus to the agricultural finance corporation(AFC) in Kenya. Use of STATA software was enhanced in realization of the research objectives outlined in the prior part of the study.

4.2 Test statistics

4.2.1 Unit root test

Unit root indicates that the series is not stationary and therefore de - trending should be done to make it stationary. The stationarity of the series was first checked using the trend plot and auto-correlation of agricultural productivity as shown below.

4.2.1.1 Plot Graphs and Auto-correlations
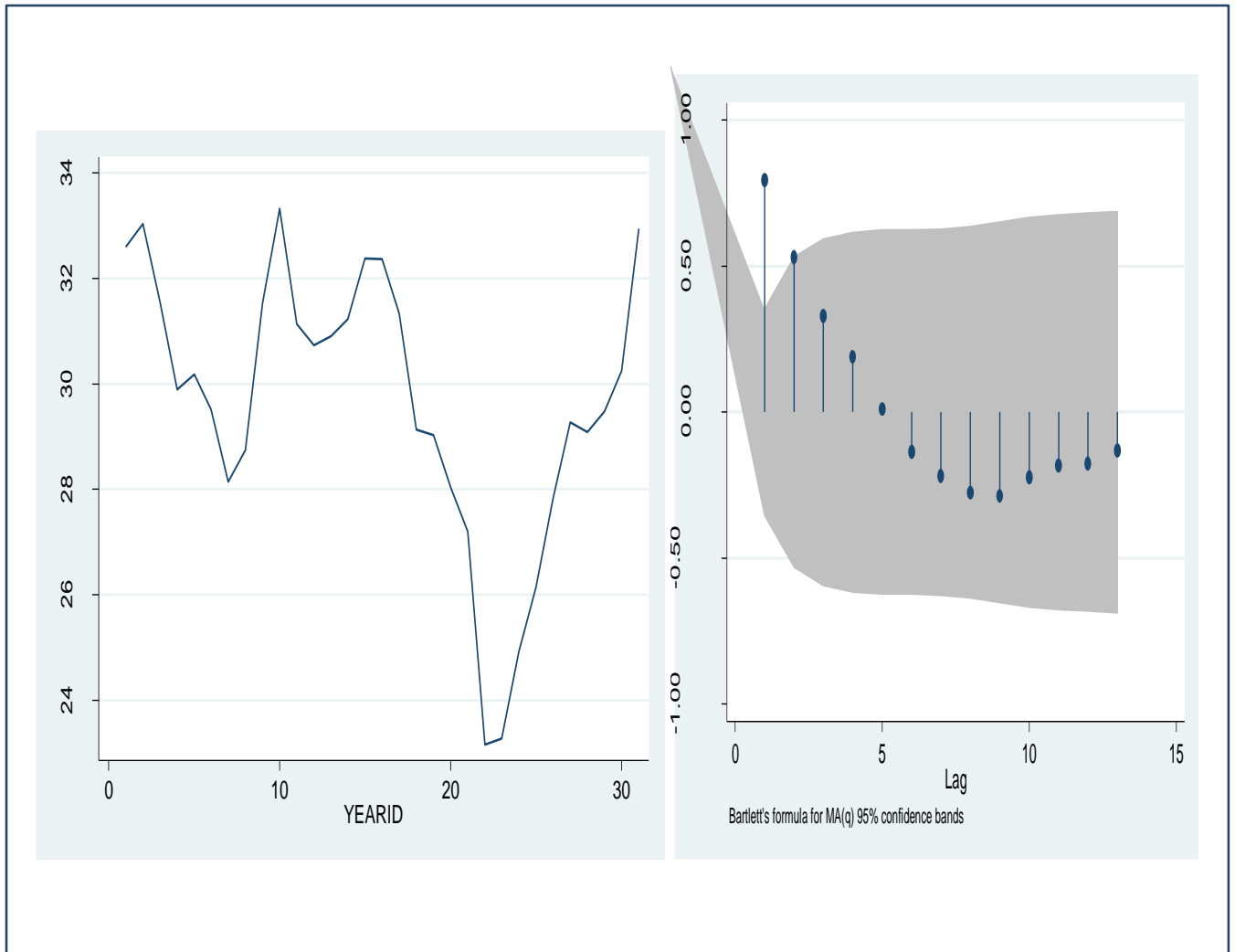
Figure 2: Trend plot and Auto correlation of agricultural productivity

Both the trend plot and auto - correlation Figures above indicated that there is a trend and therefore

the series not stationary, however, this finding was reinforced by use of a more robust statistical

test which is augmented dickey fuller test.

4.2.1.2 Dickey Fuller test

```
Dickey-Fuller test for unit root                Number of obs  =       30

                          ——————— Interpolated Dickey-Fuller ———————
               Test        1% Critical     5% Critical    10% Critical
             Statistic        Value          Value           Value
————————————————————————————————————————————————————————————————————————
 Z(t)         -1.536         -3.716         -2.986          -2.624
————————————————————————————————————————————————————————————————————————
MacKinnon approximate p-value for Z(t) = 0.5157
```

Figure 3: Dickey Fuller Test

The test null hypothesis is that there is unit root, the decision rule is to accept the null hypothesis if the absolute values of *test-statistic is < than the absolute value of the critical value.* Since the absolute value of *test-statistic (1.536)< than the absolute value of the critical value(2.986),* we accept the null hypothesis indicating that there is unit root and therefore de-trending is necessary using the first difference.

4.3 De - trending

This is a process of making a non stationary series stationary, de - trending was done using first difference and therefore resulting to integrated series of d =1. The partial auto - correlations and auto - correlations of the differenced series was as below:

4.3.1 Auto correlations and Partial Auto correlations after first difference
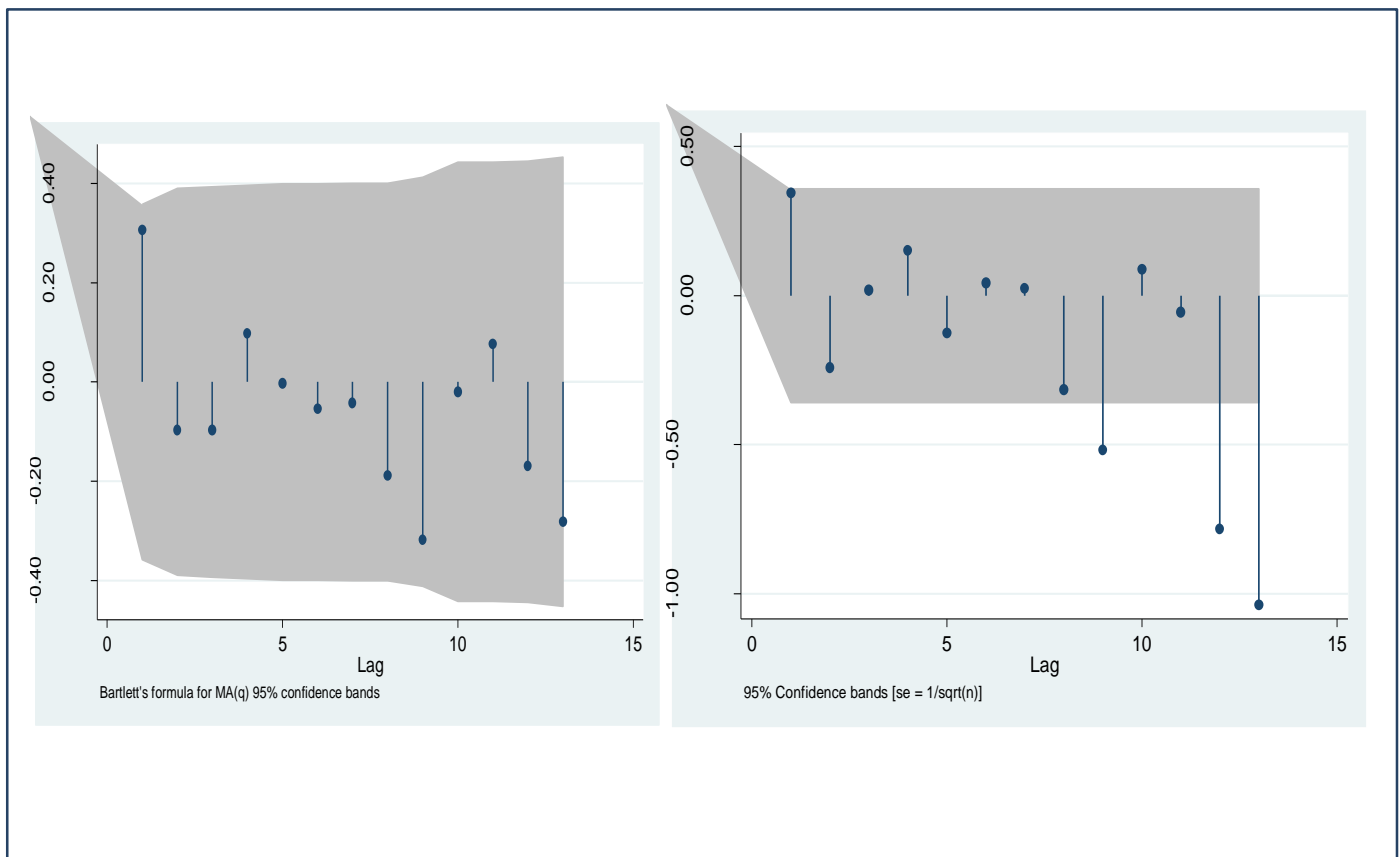
Figure 4: AC & PAC of first difference

The output in figure 4 above shows a visual representation of the results after first difference, which indicates absence of a trend and therefore a prior confirmation of a stationary series, that is there is no unit root, however, the results need confirmation using Dickey Fuller test.

4.3.2 Unit Root test after first difference

Table 3: Unit Root Test

```
Dickey-Fuller test for unit root                    Number of obs   =        29


                              ──────── Interpolated Dickey-Fuller ────────
                 Test         1% Critical      5% Critical       10% Critical
                 Statistic      Value            Value             Value

 ──────────────────────────────────────────────────────────────────────────
  Z(t)          -3.404          -3.723           -2.989            -2.625

 ──────────────────────────────────────────────────────────────────────────
 MacKinnon approximate p-value for Z(t) = 0.0108
```

Figure 5: Unit Root of first difference

The decision rule is to accept the null hypothesis if the absolute values of *test-statistic is < than the absolute value of the critical value.* Since the absolute value of *test-statistic (3.404)> than the absolute value of the critical value(2.989) at 95% level of significance,* we reject the null hypothesis indicating that the series is stationary and thus no unit root.

4.4 MODEL IDENTIFICATION

The model identification was enhanced using Box Jenkins method in determining the time series model to use among auto - regressive model (AR), moving average (MA), auto - regressive moving average (ARMA) and auto - regressive integrated moving average (ARIMA).

Table 4: Box Jenkins

	ACFs	PACFs
AR(p)	Dies exponentially	Cuts off to zero after lag p
MA(q)	Cuts off to zero after lag q	Dies exponentially
ARMA (p,q)	Dies exponentially	Dies exponentially

Using the ACF and PACF of the first difference series, we identify the order (p) of the AR process and order (q) of the MA process since for an AR (p) the sample PACFs cut-off after lag p and for a MA (q) the sample ACFs cut-off after lag q. The PACFs of differenced series cuts off after lags 9,12 and 13. MA process is of order (0) since the ACF does not cut off after any lag. This results to possible ARIMA models as shown: ARIMA (9,1,0), ARIMA (12, 1, 0) and ARIMA (13,1,0).

4.4.1 Model Fitting and Estimation and Selection

4.1.1.1 Model 1- ARIMA (9,1,0)
Table 5: Model 1

```
Sample:  3 - 31                        Number of obs    =        29
                                       Wald chi2(12)    =     27.07
Log likelihood = -48.19361             Prob > chi2      =    0.0075
```

D. DAgriculturalProductivity	Coef.	OPG Std. Err.	z	P>|z|	[95% Conf. Interval]	
DAgriculturalProductivity WaterDevelopment D1.	-9.970913	9.230537	-1.08	0.280	-28.06243	8.120608
AgriculturalAssetFinancing D1.	-.2729551	.2252605	-1.21	0.226	-.7144576	.1685474
LivestockFinancing D1.	.0214133	.0845478	0.25	0.800	-.1442974	.187124
_cons	.0631007	.2572707	0.25	0.806	-.4411407	.5673421
ARMA ar						
L1.	-.4156672	.2912489	-1.43	0.154	-.9865045	.1551702
L2.	-.2443797	.2558943	-0.96	0.340	-.7459233	.257164
L3.	-.5794586	.3471251	-1.67	0.095	-1.259811	.1008941
L4.	-.0390875	.3960767	-0.10	0.921	-.8153835	.7372085
L5.	-.1528093	.4083887	-0.37	0.708	-.9532363	.6476178
L6.	-.3888916	.4453093	-0.87	0.382	-1.261682	.4838986
L7.	.0609451	.4053104	0.15	0.880	-.7334488	.8553389
L8.	-.2522464	.328706	-0.77	0.443	-.8964983	.3920055
L9.	-.4586544	.4022133	-1.14	0.254	-1.246978	.3296692
/sigma	1.193743	.2865916	4.17	0.000	.6320339	1.755452

4.1.1.2 Model 2- ARIMA (12,1,0)
Table 6: Model 2

```
Sample:  3 - 31                      Number of obs      =        29
                                     Wald chi2(15)      =     110.34
Log likelihood = -44.72633           Prob > chi2        =     0.0000
```

D. DAgriculturalProductivity	Coef.	OPG Std. Err.	z	P>|z|	[95% Conf. Interval]	
DAgriculturalProductivity WaterDevelopment						
D1.	10.5281	4.790293	2.20	0.028	1.139301	19.9169
AgriculturalAssetFinancing						
D1.	-.2959529	.1195291	-2.48	0.013	-.5302257	-.06168
LivestockFinancing						
D1.	.0366638	.0926704	0.40	0.692	-.1449669	.2182945
_cons	.018047	.2113246	0.09	0.932	-.3961415	.4322356
ARMA ar						
L1.	.0241283	.2640923	0.09	0.927	-.493483	.5417397
L2.	-.1933456	.355587	-0.54	0.587	-.8902832	.5035921
L3.	-.4705903	.2686061	-1.75	0.080	-.9970485	.055868
L4.	-.0445557	.2823418	-0.16	0.875	-.5979354	.508824
L5.	-.3148513	.3839961	-0.82	0.412	-1.06747	.4377671
L6.	-.0000323	.3301482	-0.00	1.000	-.6471109	.6470463
L7.	-.2686199	.5282542	-0.51	0.611	-1.303979	.7667393
L8.	.1653255	.3266238	0.51	0.613	-.4748454	.8054963
L9.	-.4050701	.4592206	-0.88	0.378	-1.305126	.4949858
L10.	.0784879	.2732349	0.29	0.774	-.4570427	.6140184
L11.	.2649799	.3653606	0.73	0.468	-.4511137	.9810735
L12.	-.5909689	.4097614	-1.44	0.149	-1.394086	.2121486
/sigma	.9357294	.4519648	2.07	0.019	.0498946	1.821564

4.1.1.3 Model 3- ARIMA (13,1,0)
Table 7: Model 3

```
Sample:  3 - 31                        Number of obs    =        29
                                       Wald chi2(16)    =     540.71
Log likelihood = -41.02935             Prob > chi2      =     0.0000
```

D. DAgriculturalProductivity	Coef.	OPG Std. Err.	z	P>|z|	[95% Conf. Interval]	
DAgriculturalProductivity WaterDevelopment						
D1.	3.984603	6.625221	0.60	0.548	-9.000592	16.9698
AgriculturalAssetFinancing						
D1.	-.2800576	.2360968	-1.19	0.236	-.7427989	.1826836
LivestockFinancing						
D1.	.1207056	.1721954	0.70	0.483	-.2167913	.4582024
_cons	-.2533191	.4727456	-0.54	0.592	-1.179884	.6732453
ARMA						
ar						
L1.	-.4635508	.2969115	-1.56	0.118	-1.045487	.1183851
L2.	.038411	.1697772	0.23	0.821	-.2943461	.3711681
L3.	-.5154783	.4822098	-1.07	0.285	-1.460592	.4296356
L4.	-.4338842	.3727784	-1.16	0.244	-1.164516	.2967479
L5.	-.2019861	.3976571	-0.51	0.611	-.9813797	.5774074
L6.	-.4719869	.6582421	-0.72	0.473	-1.762118	.818144
L7.	-.4199425	.6921732	-0.61	0.544	-1.776577	.936692
L8.	-.1299969	.2925482	-0.44	0.657	-.7033808	.443387
L9.	-.6033247	.5969204	-1.01	0.312	-1.773267	.5666178
L10.	-.3227089	.4776436	-0.68	0.499	-1.258873	.6134555
L11.	.0777772	.1507465	0.52	0.606	-.2176805	.3732349
L12.	-.6601944	.3048128	-2.17	0.030	-1.257617	-.0627723
L13.	-.7065055	.3171062	-2.23	0.026	-1.328022	-.0849886
/sigma	.7125138	.2351919	3.03	0.001	.2515462	1.173481

4.1.2 Fitting the Model

Table 8: Fitting the model

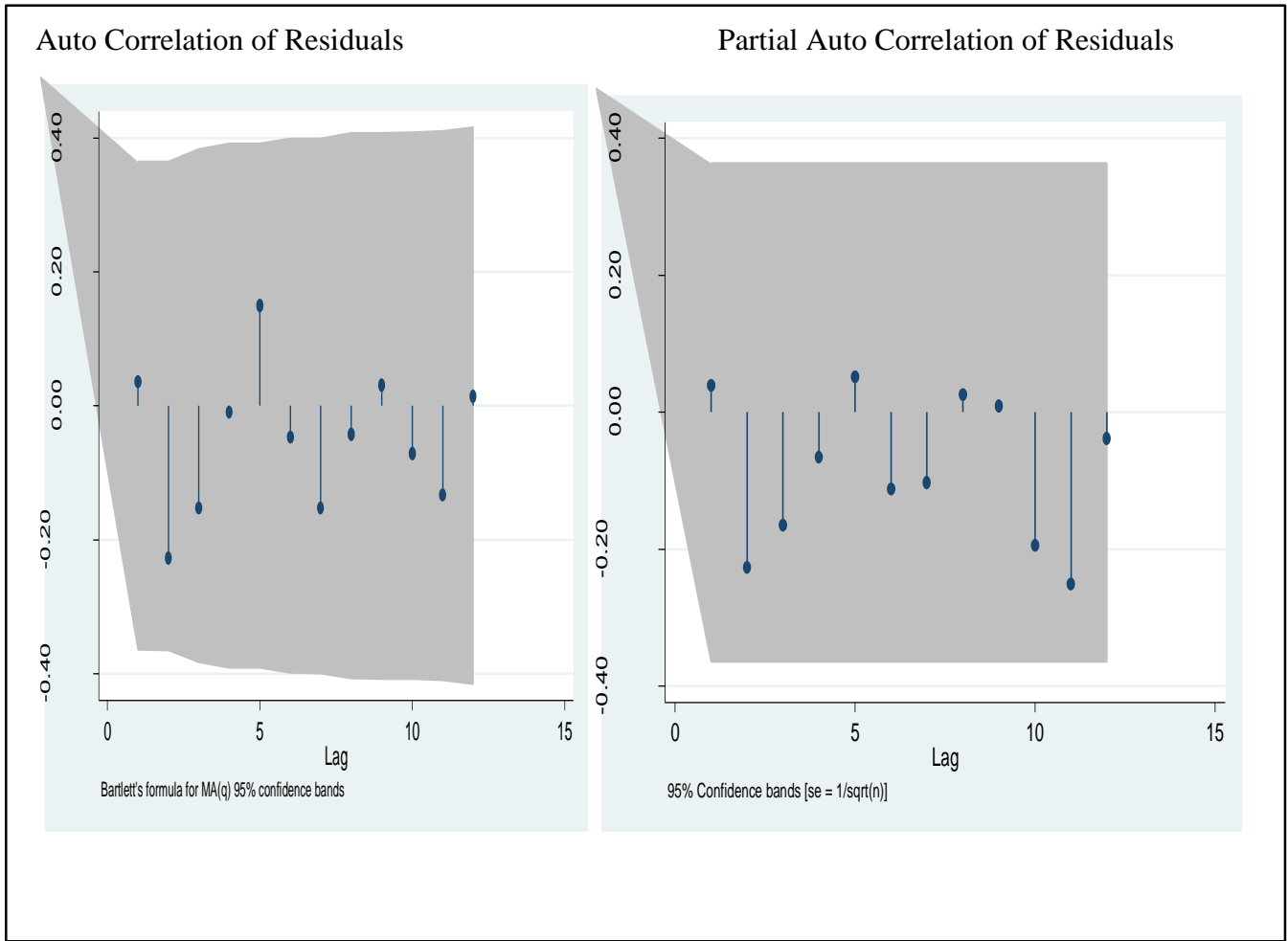| No	Model	Are all coefficients significant	Residual ACFs	No. of Parameters	AIC	BIC
1	ARIMA (9,1,0)	NO	none is significant from zero	4	122.22787	137.26812
2	ARIMA (12,1,0)	2 significant	none significant from zero	5	125.29895	144.44109
3	ARIMA (13,1,0)	Not significant	none significant from zero	8	121.00285	141.51229

Since the three models do not have any significant ACFs of residuals from zero, we check on the significant coefficient where model 2 fits the criteria since the coefficients are significant as well as two of the variables being described in the model. The prob>chi2 = 0.000 which is < significance level (0.05) and therefore the model is adequate for explaining the effect of agricultural financing on the agricultural productivity in Kenya. The study therefore adopted ARIMA (12,1,0) model in explaining the findings of the study.

4.5 DIAGNOSTIC ANALYSIS

Diagnostic analysis enforced the decision for ARIMA (12,1,0) model, this was enhanced by use of white noise test, use of correllogram as well as ACF of residuals and indicated below:

4.5.1 Auto Correlation Functions of Residuals for ARIMA(12,1,0)

Table 9: Auto Correlation of residuals

Auto Correlation of Residuals

Partial Auto Correlation of Residuals

Bartlett's formula for MA(q) 95% confidence bands

95% Confidence bands [se = 1/sqrt(n)]

4.5.2 White noise test

```
LAG      AC       PAC       Q      Prob>Q  [Autocorrelation]  [Partial Autocor]
_____

1      0.0356   0.0386    .0406   0.8403
2     -0.2276  -0.2273   1.7648   0.4138
3     -0.1531  -0.1649   2.5753   0.4618
4     -0.0100  -0.0663   2.5789   0.6306
5      0.1497   0.0512   3.4186   0.6357
6     -0.0471  -0.1126   3.5052   0.7433
7     -0.1530  -0.1031   4.4615   0.7253
8     -0.0427   0.0257   4.5396   0.8055
9      0.0310   0.0094   4.5829   0.8691
10    -0.0710  -0.1948   4.8212   0.9028
11    -0.1332  -0.2511   5.7071   0.8922
12     0.0144  -0.0381   5.7181   0.9296
```
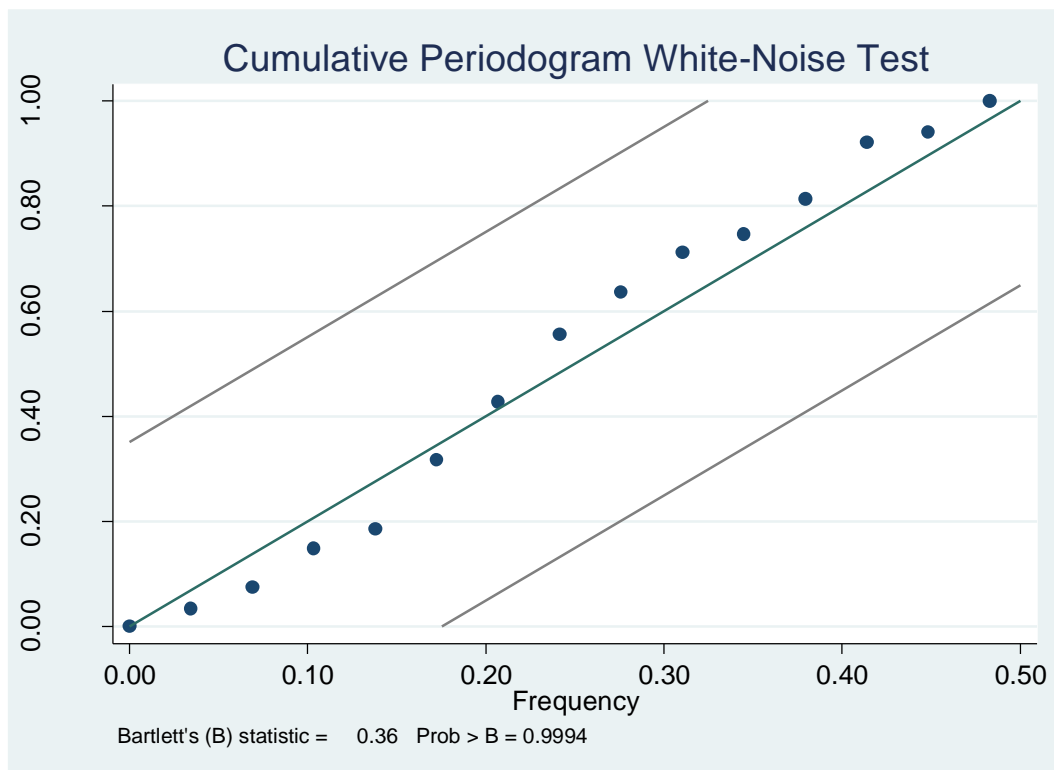

Figure 6: White noise test

The white noise test above indicates that the white noise error (u_t) is normally distributed around in the residual of ARIMA (12,1,0) and therefore parsimoniously represent the desired output pertaining to the effect of agricultural financing on agricultural productivity in Kenya. The mean of white noise should be zero and the graph of white noise test clearly shows that the model is parsimonious.

4.6 Study Variables

4.6.1 Water Development Financing

According to the study, water development financing has a positive impact on the growth domestic product (GDP) of the country. The results show that agricultural productivity increases by 10.5 times when agricultural land is put under irrigation by 1 unit over time. This therefore indicates that the agricultural financing corporation should embark on sponsoring the farmers to be able to use the modern farming practice which include irrigation in this matter. The significant of water development financing cannot be disputed as highlighted by SIWI (2005), who argued that there is sufficient evidence that investment in water have spill overs to the economic growth of a nation. The finding is consistent with the study by SIWI (2005) and Bhattarai (2007) whose studies indicated positive relationship between water development financing and returns and GDP.

Water development financing is statistically significant at 5% where the P value $<0.05 = 0.028$. This means that the findings is highly relevant in explaining the existing relationship and effect of water development financing on agricultural productivity.

4.6.2 Agricultural Asset Financing

Agricultural asset financing is negatively but statistically significant on the agricultural productivity over time. Agricultural productivity declines by 29.59% when agricultural asset

financing is enhanced by 1 unit across time, this is most likely because of the high cost of agricultural assets that probably requires high amount of money to service the debt by the farmers. A study by Petrick (2004), is consistent with the results as it highlights the high cost of agricultural inputs that are highly efficient.

Agricultural asset financing is statistically significant at 5% where the P value $<0.05 = 0.028$. This means that the findings is highly relevant in explaining the effect of agricultural asset financing water development financing on agricultural productivity.

4.6.3 Livestock Financing

Livestock financing has a low positive effect on the agricultural productivity where livestock financing by one index increases agricultural productivity by 3.67 % over time. The variable is statistically insignificant and therefore we can't put much reliance with the results in explaining the effect of livestock financing on the agricultural productivity in Kenya.

The finding can be explained through a study by Bosman ,(1997) which found that there is a trade-off between the liquid nature of livestock market and the interest charged by the financial intermediaries(Bosman, 1997). This therefore makes it difficult for the farmers to embrace the credit from the agricultural financing corporation (AFC) since they choose to sell out the available livestock where they will not pay interest on.

4.7 Chapter Summary

The findings of the study as outlined in this chapter have found that water development financing and agricultural asset financing is statistically significant, however, livestock financing expressed

insignificant results which is explainable from the point of practice where trade off is real between auctioning the livestock and borrowing funds for expansion and change of the breed. Several studies found consistent results to the finding of the study and thus position the study in literature.

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents a summary, discussion and conclusions drawn from the finding of the study. The purpose of these conclusions was to answer the research questions and recommend ways in

which the agricultural financing can be improved in order to increase agricultural productivity. Recommendations for further research as well as limitations of the study were also presented.

5.2 Summary

5.2.1 Findings on Water Development Financing on agricultural productivity

The results show that agricultural productivity increases by 10.5 times when agricultural land is put under irrigation by 1 unit over time. In addition, water development financing is statistically significant at 5% where the P value <0.05 = 0.028. There is a positive relationship between water development financing and agricultural productivity, the correlation informs the researcher in proposing suitable remedies that will improve the trend in the agricultural productivity since late 80's.

5.2.2 Findings on Agricultural Asset Financing on agricultural productivity

Agricultural productivity declines by 29.59% when agricultural asset financing is enhanced by 1 unit over time. Agricultural asset financing is statistically significant at 5% where the P value <0.05 = 0.028. This means that the finding is highly relevant in explaining the effect of agricultural asset financing water development financing on agricultural productivity, however, agricultural asset financing indicated a negative effect on the agricultural productivity in Kenya which implies an inverse relationship.

5.2.3 Findings on Livestock Financing on agricultural productivity

With regards to livestock financing the study found out that, livestock financing by one index increases agricultural productivity by 3.67 % over time. The variable is statistically insignificant and therefore we can't put much reliance with the results in explaining the effect of livestock

financing on the agricultural productivity in Kenya. The relationship is positive despite the weak association between livestock financing and agricultural productivity in Kenya.

5.3 Conclusion

Water development financing has a great influence on the agricultural productivity in Kenya, the government authorities in-charge of disbursing the credit facilities to the farmers should ensure that the core function of AFC is achieved especially in supporting farming activities through irrigation.

This critical importance cannot be disputed as highlighted by SIWI (2005), who argued that there is sufficient evidence that investment in water have spill overs to the economic growth of a nation. The finding was consistent with the study by SIWI (2005) and Bhattarai (2007) whose studies indicated positive relationship between water development financing and returns and GDP.

Agricultural asset financing affect the agricultural productivity negatively but with statistical significant metrics. A study by Petrick (2004), is consistent with the results as it highlights the high cost of agricultural inputs that are highly efficient. Agricultural asset financing requires a thorough analysis on the cost and return trade-off. This is because the cost of agricultural asset is quite high with no direct indicator of efficiency before hand.

Pertaining livestock financing, there was a positive relationship between the level of livestock financing and GDP from agricultural productivity though the significance of the said variable has not been statistically authenticated. The weak model for financing livestock in Kenya has contributed to the effects, therefore the government should restructure the way livestock farmers

access credit and for what purpose since majority can sell existing livestock if in urgent need of money (Bosman, 1997).

5.4 Recommendation

It is evident that water development financing is not only statistically significant but also highly critical in the total GDP from the agricultural sector. The government through the AFC should establish a friendly and interactive model between them and the farmers who are willing to facilitate their farm operations through the use of water. The funds should be highly economical and beneficial to the farmers as compared to the normal lenders. This will go along in increasing the contribution of agricultural activities to the country's GDP.

The ministry of agricultural through its budgetary allocations should launch agricultural trade fairs and campaigns to create awareness of the most efficient agricultural assets that are available to the farmers and educate them on the expected returns since its suspicious that the negative effect is as a result of lack of information on the cost benefit analysis of the available agricultural assets which when wisely chosen can transform the farming system and thus increase the % of GDP from the sector.

The government through the Kenya Agricultural Research and Livestock organization (KARLO) should conduct thorough research on the most disease, drought & pest resistance breeds to be suitable in different geographical locations in the country. In connection to this, the farmers should be educated on the benefits of changing from the normal breed to the grade breeds of livestock through the use of the availed financing by AFC this will have a great effect the GDP since the livestock will be highly productive in terms of meat, milk and even hides through which employment opportunities will be spillovers in the production chain.

5.5 Limitations of the research study

The study was hampered by various constraints among which was time limitation especially in gathering and analyzing the data, the researcher overcame this barrier by proper time planning in order to avoid affecting the quality of the data gathered and finding of the study. Secondly, the

Secondly, only few studies have been conducted in the area of agricultural financing especially in courtesy of NGO's and agricultural based organizations and therefore both qualitative and quantitative information was not adequately available.

5.6 Suggestions for further research

Having explored the effect of agricultural financing on agricultural productivity in Kenya, scholars, future researchers and academicians should aim at situating their studies within the scope of agricultural financing on different aspects. Below are some of the research areas viable:

To determine the relationship between agricultural financing and loan repayment in the sector. Secondly, further research should be conducted on the effect of conflict of interest by Agricultural finance corporation (AFC) on the success of the agricultural based fund.

Last but not least, more effort should be vested on the effect of government interference in the cost of borrowing for the case of ordinary banks through interest capping which was legislated in the year 2016. This study should unveil the spill over effects to the AFC as a result of the controlled cost of borrowing.

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APPENDIX I: BUDGET

Item	Cost
Stationary	1800
Research cost	10,000
Typing and printing and photocopies	3200
Contingencies	2450
Total	**17,450**

Source: Author 2018

APPENDIX II: TIME PLAN

Activity	Feb	Feb	March	April-June	July	August	September
Formulation of statement of problem	✓						
Literature review		✓	✓				

Research design &methodology				✓			
Presentation of proposal					✓		
Data collection					✓		
Data classification						✓	
Data analysis						✓	
Review and revise							✓
Typing of final draft of research project							
Presentation of research to KCA university panel.							✓

Source: Author 2018