BINDURA UNIVERSITY OF SCIENCE EDUCATION

IMPACT OF AGRICULTURAL PRODUCTION ON ECONOMIC GROWTH IN ZIMBABWE FROM 1990 TO 2020

SUBMITTED BY **CLAUDIN MACKLEENS CHIUKAKA**

SUPERVISOR **DR DAMIYANO**

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NAME OF AUTHOR	**: CLAUDIN MACKLEENS CHIUKAKA**
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(Signature of Student) Date

..... …/……/……/

(Signature of Supervisor) Date

…… …/……/……/

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DECLARATION

I, CLAUDIN MACKLEENS CHIUAKA, declare this research project herein is my own work and has not been copied or lifted from any source without the acknowledgement of the source.

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DEDICATIONS

I would like to dedicate this dissertation to my parents, Cleopas and Rosiliny Chiukaka for their outstanding devotion to my education from the very beginning up to this level, understanding the difficulties in making ends meet yet still managing to do so. Thank you Dad, thank you Mom! May your sacrifices be rewarded countless folds.

To my siblings and closest friends, thank you for the support and belief. I dedicate this to you because you've always been there during the good times and during the bad. I appreciate you, greatly.

ABSTRACT

This study was an investigation in the impact of agricultural production on the economic growth of Zimbabwe from 1990 to 2020. The study hypothesized that agricultural production has an impact on economic growth and several variables were included in the model to explain the variations in the economic growth variables and ascertain whether in Zimbabwe, for the 31 years under review, agricultural production was significant to the economy's growth. The study employed the Ordinary Least Squared (OLS) method to estimate the regression model. The study used agriculture, forestry and fishery (annual % growth), employment in agriculture (% of total labor force), gross capital formation (% of GDP), and inflation, GDP deflator (annual %) as the independent variables and GDP growth (annual %) as the dependent variable. The results showed that for the period under investigation, agriculture has a positive impact on economic growth. The study also revealed that there exists a positive relationship between employment in agriculture and economic growth. These outcomes suggest that agricultural sector production has a contribution to GDP that facilitates economic growth and this was also supported by the theoretical and empirical evidence provided. The study thus provided enough statistical evidence to reject the null hypothesis of agriculture having no impact on economic growth in Zimbabwe, and concluded to accept the alternative hypothesis that agriculture has an impact on economic growth. Based on the outcomes of the study, recommendations were made to ensure that the agricultural sector and its production develops as this is necessary in the early stages of development and is an engine of economic growth.

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Most importantly, to the Almighty God, I give my utmost thanks, for if not for His grace, all this would not have been possible

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ABBREVIATIONS

AGRIBANK	Agriculture Bank of Zimbabwe
ARDL	Autoregressive Distributed Lag
CGE	Computable General Equilibrium
FAO	Food and Agriculture Organization
FDI	Foreign Direct Investment
FTLRP	Fast Track Land Reform Program
GDP	Gross Domestic Product
IMF	International Monetary Fund
MAMID	Ministry of Agriculture, Mechanization and Irrigation Development
OLS	Ordinary Least Squares
UNDP	United Nations Development Program
VAR	Vector Auto-regression
VECM	Vector Error Correction Model

CHAPTER ONE: INTRODUCTION

1.0. Introduction

This research analyzes the impact of agricultural production on the growth of the Zimbabwean economy from the period 1990 to 2020. This chapter starts by giving a description of the background of study, problem statement and the research objectives and questions. It goes further to take a look at the significance of study, study hypothesis, assumptions, limitations and delimitations and, defines some important terms within the chapter. Conclusively, the chapter gives a concluding summary.

1.1. Background of Study

Countries in the Sub-Sahara seemingly have an advantage in the production of agricultural products. This is based on the fact that; it is one of the most undertaken economic activity within these countries. Developing countries engage in agricultural activities as these provide a source of food as well as providing raw materials used in trade with developed countries for manufactured goods. As a developing nation, Zimbabwe lacks the institutions that encompass manufacturing stages of production hence the vitality of existence of a more natural resource based source of production cannot be understated

Zimbabwe is classified as an agro based economy which is landlocked with land coverage of over 39 million hectares. 33.3 million hectares are set aside for agricultural purposes according to World Bank (2020). Agriculture in the country is regarded as the backbone as its essentiality cannot be undermined or understated (Sithole, 2006). The country has land that is vast and fertile which makes it suitable for agriculture and it possesses a good climate and good rainfall patterns, which are all necessary for agricultural production. In most developing countries, agriculture form the bedrock of economic growth, development and eradication of poverty. In Zimbabwe, 70% of the population rely on agriculture as a livelihood (GoZ, 2015). The Ministry of Agriculture, Mechanization and Irrigation Development (MAMID) (2013), claimed that agriculture provided employment to almost 70% of the country's population. According to World Bank (2020), in 2019, agricultural sector employment stood at 66.19%. According to Bafana (2011), 60-70 percent of the population secured employment as a result of agricultural activities, with agricultural activities responsible for supplying 60% of the raw materials that industries require as well as contributing 40% to total export earnings

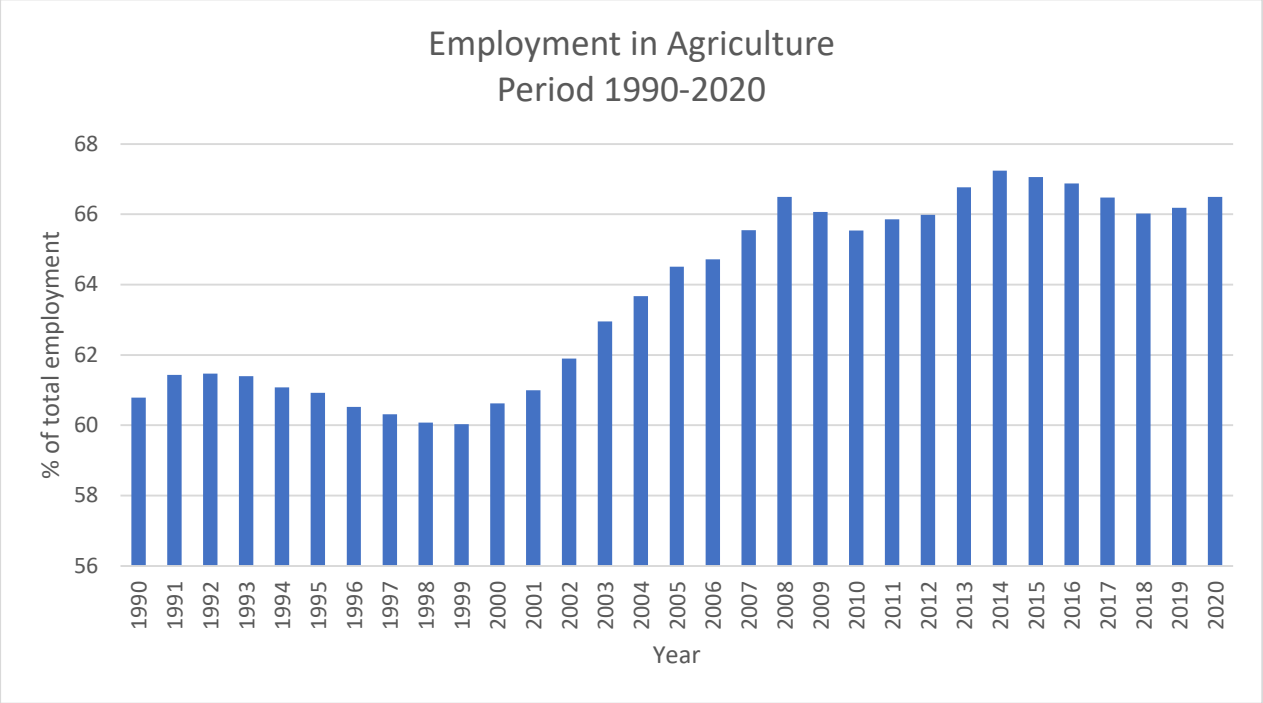


Figure 1.1: Agricultural employment in the agricultural sector in Zimbabwe from the period 1990-2020

Source: Created by Author using Microsoft excel and data from World Bank

The above chart was created using data obtained from World bank, showing employment in agriculture as a percentage of the total labor force. The early 2000s saw an increase in agricultural sector employment in Zimbabwe due to the Fast Track Land Reform Program which saw more than 10 million hectares of land distributed to 170 000 – 220 000 households. The economic crisis that started in the early 2000s forced the majority of the Zimbabwean population to get into the agricultural sector as the service sector and manufacturing sectors were underperforming as a result of hyperinflation. Agriculture became a safe haven for the Zimbabwean population as it provided a seemingly affordable source of livelihood.

United Nations Development Program (UNDP) (2012) argues that about 75% of the world's poor relies on farming and fishing as they also live in rural areas Using resources efficiently, that is, human and natural resources, whilst considering their abundance in Zimbabwe, can give the country an edge over its African counterparts. Zimbabwe used to be a net exporter of maize during the 1990s, before the Fast Track Land Reform Program was implemented, which saw 4000 white farmers being resettled. During the period from 2000 up to 2008, Zimbabwe experienced a decline in its GDP by more than 71% as a result of factors like capital constraints, hyperinflation, the Fast Track Land Reform Program as well as the government control exerted

over markets (Robertson, 2011). According to Sukume and Guveya, (2009) agricultural production during the same period fell by 30%. Moyo (2011) argues that Zimbabwe has failed to meet the country's food requirements since then. The country has up to recent years, implemented several agricultural policies to improve agricultural production. Todaro and Smith (2009) observed that agriculture has become a pivotal part of a nation's development. The sectoral contribution of agriculture is in four major ways, which are factor contribution, market contribution, product contribution and foreign exchange contribution. The agricultural sector has been subsidized by the government to promote as well as assist the large and small scale farmers. According to Mushamba (2002), the Agricultural Bank of Zimbabwe (Agri Bank) emerged as a major purveyor of agricultural finance as it promoted agricultural production by offering credit to farmers for the purchase of agricultural inputs as well as engaged in agricultural marketing. The adoption of smart agriculture and irrigation also vastly improved agriculture as it now provides income for many Zimbabwean families, through employment creation.

Newitt (2007) argued that in the year 2005, agricultural production, including fishing and forestry, accounted for about 18% of Zimbabwe's GDP. This dropped during the 2012 to 2016 period as agriculture accounted for an average of about 8.0% of total GDP and about 16% of the country's export earnings (UNDP, 2017). Zimbabwe for years now, has been swarmed by a number of severe economic crisis and the covid-19 pandemic worsened the effects. Zimbabwe's agricultural production contribution to GDP is very high. There is highly productive and unutilized land and a lot of potential to stimulate further growth through agricultural production. In 2019, Zimbabwe experienced an estimated 1.8% contraction in GDP as a result of covid-19 and climate change and this was expected to carry on for the proceeding two to three years (World Bank, 2020). On top of that, Word Bank (2020), mentioned that there was a substantial decline in agricultural production which led to high prices and food insecurity, stating that almost 50% of the country's population in 2019 was food insecure. In 2020 value added in the agricultural sector as percentage of GDP was 8.77% compared to the previous 9.82% in 2019 according to World Bank (2020). As mentioned prior, above, the introduction of smart agriculture was necessitated by the persisting effects of climate change, in order to stimulate agriculture.

The relevance of agriculture to the Zimbabwean economy was stressed by Food and Agriculture Organization (FAO) (2020), which mentioned that agriculture remains the backbone of the Zimbabwean economy as Zimbabwean remain a rural people, whose

livelihood is dependent on agriculture and related rural economic activities. The contribution to Zimbabwe's total GDP from agriculture was estimated to be around 17% (Maiyiki,2010).

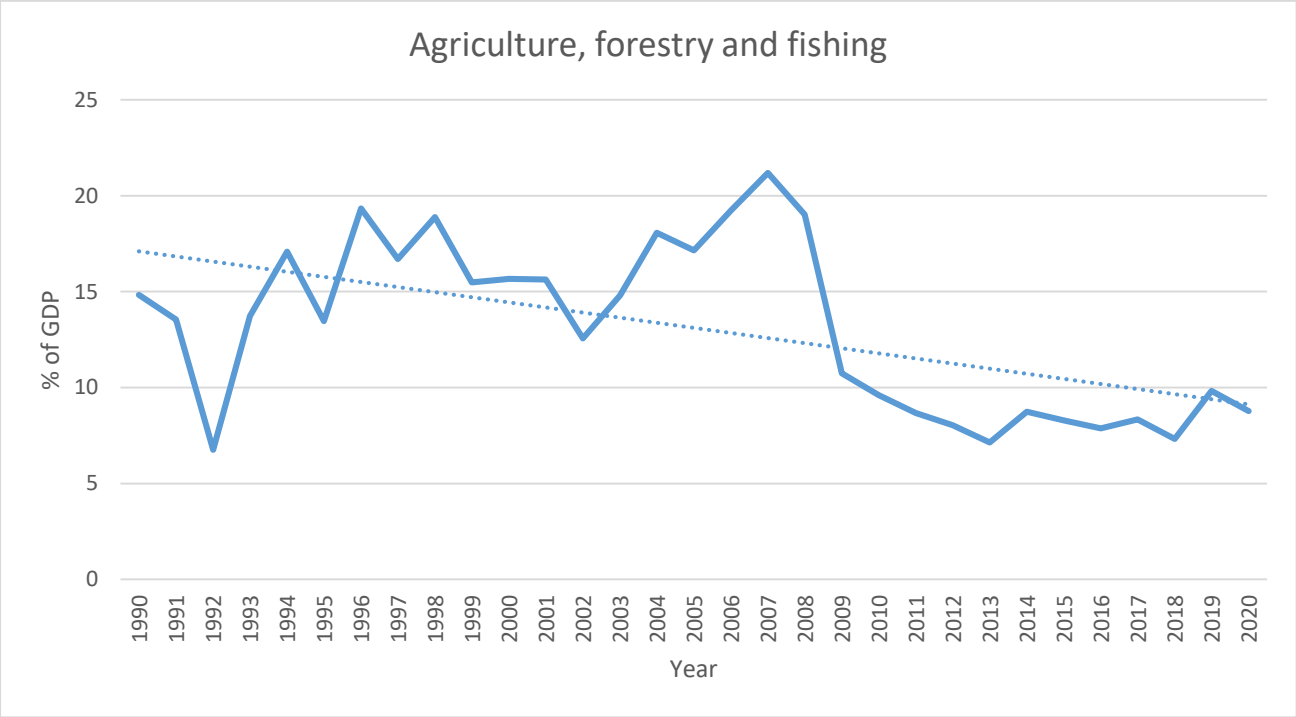


Figure 1.2: Contribution of Agricultural Production to Zimbabwe's GDP during the period of 1990-2020

Source: Created by Author using Excel and data from World Bank

The graph above depicts agricultural production which encompasses forestry and fishing as a percentage of total GDP for Zimbabwe. During the period of 1990 to 2020, the agricultural production contribution to GDP was highest in 2007 with a figure of 21.2% and lowest in 1992 with a value of 6.8%. In 1991 the contribution of agriculture to GDP stood at 13.5 but a sharp decline of about -6.8% saw the figure landing at 6.85 in 1992. The decline was attributed to the drought that occurred in 1992. During the depicted time frame, agricultural production contribution to GDP fluctuated but the overall trend was a downward trend as depicted in the figure above showing a decline in the contribution made by the agricultural sector to GDP. However, this does not necessarily prove that there is no impact made by agricultural production hence the need to carry out the study in order to test that hypothesis.

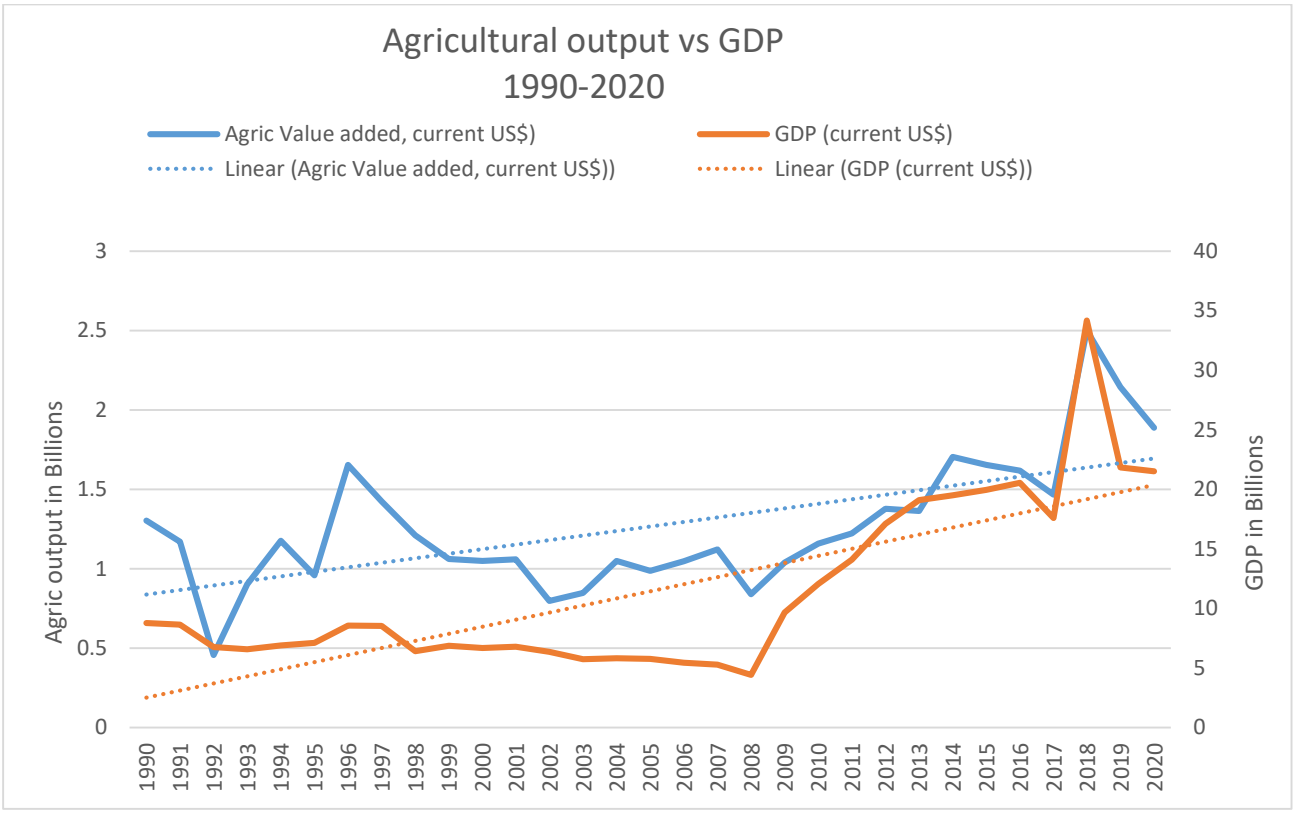


Figure 1.3: Zimbabwe's GDP and agricultural output from period 1990 – 2020 measured in billion US$

Source: Created by author utilizing Microsoft excel and World Bank data

Figure 1.3 shows agricultural sector output measured in billion US$ (left vertical axis) and GDP proxy for national output measured in billion US$ (right vertical axis). The two graphs show an upward trend from 1990 – 2020 meaning both national output and agricultural output have increased over the years. From 1990 to 1991, both national output and agricultural output declined but started increasing from 1992 up to 1995. Throughout the entire period, the trend has been uniform, that is a fall in national output corresponded to a fall in agricultural output. On overall, the trend shows that agricultural output and national output during the 30 years under study, have had a positive relationship as observed though inspection. The study however, seeks to ascertain the significance of this relationship thus an analysis of the impact of agricultural production to growth on the economy is necessitated.

The performance of the agricultural sector is essential and a key determinant of the improvement of the majority of the population's livelihood. Myrdal (1984) posits that achieving long-term economic growth is possible through establishment of a firm agricultural sector. The population of Zimbabwe, according to World Bank (2020) was estimated to be 15 million and this showed that land and labour in the country are abundant and these are notably

key farming resources. The availability of these key resources thus raise concerns on whether agricultural production should be an instrument that facilitates growth. The research thus is propounded on the notion that previous studies have regarded agricultural production as a prerequisite for economic growth and industrialization.

1.2. Problem Statement

Agriculture plays are crucial role in the Zimbabwean economy's development. Zimbabwe's agricultural production suffered a decrease as a result of the covid-19 pandemic in 2019. Prior to that, the agricultural performance had suffered a decline over the years, as national requirements were not being met, specifically in the maize and wheat production. The decline in production from the 2000 was attributed to the fast track land reform program, together with the impacts of macroeconomic mismanagement and the disruption of research and extension services, input supplies and marketing systems (Ndlela and Robinson, 2007). There is therefore, need to know the relationship between agricultural production and economic growth, since policies for development in Zimbabwe are somewhat based on the assumption that the key driver of economic growth in Zimbabwe is agriculture. The research was undertaken to analyse the impacts of agricultural production on economic growth in Zimbabwe.

1.3. Objectives of the Study

The main objective of the study was to analyse the impact of agricultural production on economic growth in Zimbabwe.

The specific objectives are:

1. To examine the effect of agricultural production on economic growth in Zimbabwe
2. To investigate the relationship between agriculture production and economic growth
3. To examine the effect of employment in agriculture on agricultural production in Zimbabwe
4. To evaluate the relationship between agricultural sector production, employment in agriculture and economic growth in Zimbabwe.

1.4. Aim of the Study

The research study aimed to establish the impacts of agricultural production on economic growth and identify at the same time other economic variables that may affect economic growth in Zimbabwe apart from agriculture alone. More attention will however, be paid to the agriculture variable as the study is based on assessing its impact to economic growth.

1.5. Research Questions

The research questions that this study seeks to investigate are given below:

1. What are the effects of agriculture production on economic growth in Zimbabwe?
2. What is the relationship between agriculture production and economic growth?
3. What is the effect of employment in the agricultural sector on agricultural sector production in Zimbabwe?
4. What is the relationship between agricultural sector production, agricultural employment and economic growth in Zimbabwe?

1.6. Statement of Hypothesis

The study hypothesis is stated as follows:

H_0: Agricultural production has no impact on economic growth

H_1: Agricultural production has an impact on economic growth

1.7. Scope of the Study

The study examined the contribution of agricultural production to the growth of the Zimbabwean economy between the period 1990 to 2020.

1.8. Significance of the Study

1.8.1. To the Government

The research can assist the government in the allocation of funds to the agriculture sector from the national budget, in order to realize economic growth, through the meeting of

macroeconomic objectives by expanding that sector. The formulation and implementation of policies that promote agricultural activities which favors economic growth can also be made possible, provided that the assessment of agricultural production impacts on economic growth are significant enough. Availing sufficient funds to cater for the drawbacks in the agriculture sector, through increasing government expenditure, channeling the funds to the agriculture sectors as well as offering relevant and much needed support to the sector would be greatly considered provided agriculture is significant to the growth of the economy of Zimbabwe.

1.8.2. To the Researcher

The research will build up knowledge of agriculture sector and its relevance to the overall economy's growth. It will highlight the impacts of agriculture on the economy and whether these impacts are positive or negative. Through conducting this research, the research is tested to see how the theoretical researching knowledge possessed fared in practice. Undertaking of the research thoroughly, guarantees the completion of the degree as this research is a prerequisite for the awarding of a Bachelor's degree Honors in Economic

1.8.3. To the University

The University will provide literature review for other student and staff members, who may in future carry out research on the same topic of the impacts of agriculture on the nation's economic growth. The availing of this research to other students provides material from which future researchers can extract information and references for their studies.

1.8.4. To the Households

Households will benefit from improved efforts towards achieving a higher economic growth which they benefit from though high standards of living.

1.8.5. To the Policy Makers

The research could benefit policy makers, for example, those in the Ministry of Agriculture through the incorporation of the findings and the recommendations made from this study when they formulate national policies which are crucial for stimulating growth within the economy

1.9. Assumptions

- All economic variables and activities other than agriculture that effect economic growth are held constant
- Agriculture is affected by external factors
- Data is readily available and accessible from the period 1990-2020
- The researcher also assumes that the information to be collected will be accurate and that it can be relied upon

1.10. Limitation of the Study

Limitations are constraints outside the control of the researcher and are inherent to the study that could affect the generalizability of the study results (Terrell, 2016). The deficiency of research material was an issues, as the researcher found it difficult to gather the much needed information. As a remedial measure, the researcher engaged in the extensive use of the internet which required the purchase of data. The gathering of data was not easy as some sites required subscription for information to be availed. The research had to look for alternative sites which provided necessary but not sufficient information for undertaking the research.

1.11. Delimitation of the Study

Miles and Scott (2017) states that delimitations are restrictions that are self-imposed on the study. This study aimed to investigate the impacts of agricultural production on Zimbabwe's growth prospects and how economic growth, which is an increase in Zimbabwe's Gross Domestic Product or total output is affected by the activities in the agriculture sector. The scope of the research was limited to the period 1990 to 2020. Data and information was gathered from the World Bank, Ministry of Agriculture and the Food and Agriculture Organization.

1.12. Definition of Terms

Economic growth – The percentage change in the national income of a country (Lipsey and Crystal, 1999)

Agriculture – The Oxford English Dictionary (1971) defines it as the science and art of soil cultivation, as well as the pursuit of gathering of crops and rearing of livestock. It indicates the ploughing of a field, planting of seeds, crop harvesting, milking of cows and/or rearing of livestock (David, 2014).

Agricultural sector – Todaro (2008) defines it as the proportion of the economy that engages in agriculture, forestry and fishing activities

Gross Domestic Product - is the summed up value of all public and private consumption, government outlays, investment spending, and net exports that are occur within the confinements of a defined territory (Investopedia, 2014)

1.13. Summary

This chapter performs an introductory purpose as it introduced the study problem and gave a general outline of the major aspects of the research. The main objective of this chapter was to act as a guide to readers on what the research is about. Context concerning the study was given within the background of study and description of the problem outline in the problem statement. This chapter preceded the literature review which builds up from where this chapter ended, to proceed to look at relevant literature from past studies in order to justify the need for this particular research.

CHAPTER TWO: LITERATURE REVIEW

2.0. Introduction

The presentation of a theoretical framework is necessary in order to allow for the provision of a conceptual framework and appropriate policy recommendation that underpin the study. Adding on to the theories discussed in this chapter, a presentation of empirical literature shall be done. Empirical literature explores the studies done by others and the various research methods applied in a bid to identify any gaps in literature. This chapter is divided into two sections. The first section deals with theories that explain the relationship between agricultural production and economic growth and the second section deals with the empirical literature. The literature is then assessed e and concluding remarks are provided towards the end of the chapter.

2.1. Literature Review

Literature review refers to the revelation of the state of knowledge with regards to a subject under study, according to Lotsmark (2007). Theoretical literature comprises of theories developed in a bid to explain agricultural production and its contribution to the growth of an economy. Empirical literature, on the other hand refers to literature availed through related studies by accredited researchers. The reviewing of literature helps therefore in unveiling the possible approaches and solutions to the problem.

The assumption that agriculture is crucial in the development of an economy emanates from the fact that it is the initial stage of production for manufactured edible and inedible products. Apart from the reason that it tends to feed the nation's population, it correlates with all of the industries of the nation. A nation that is socially and politically stable is created by the establishment of a stable agricultural base. As economic growth is among the macroeconomic objectives, nations like Zimbabwe, through their governments invest money into the agriculture sector to stabilize the economy such that there is less dependence from other nations for food. The agricultural sector in Zimbabwe is important as it determines the growth and capacity of other sectors as well as the imports and exports based on shortages and surpluses of products.

2.2. The Zimbabwean Agricultural Sector

Most of the poor people in Zimbabwe are living in rural areas where agriculture is the main source of livelihood for them. Although men are dominating the agriculture sector, females are

actively taking part. Some families have devoted to having bigger family sizes to assist with farming.

The Zimbabwean agricultural sector can be broken down into two; large-scale commercial farming as well as small-scale subsistence farming, with the latter occupying relatively more land but located in regions which have infertile soil and rainfall patterns that are unreliable. As defined by Akinboyo (2008) define agriculture as the science that involves crop production, rearing of livestock, forestry and fishing, thus basically it is the utilization of land for keeping livestock and producing crops. Zimbabwean farmers grow a variety of crops and also produce other farm products which include but are not limited to, maize, cotton, tobacco, sugarcane, cattle, sheep, milk and wool. Farm products are utilized in either of two ways, for family consumption or for trade and/or exporting.

Livestock and livestock products as well contribute significantly to the economy of Zimbabwe, with cattle accounting for 35% to 38% of the GDP contributed by the agricultural sector (FAO, 2020). Every family in the rural areas owns either donkeys, cattle, sheep, goats, or chickens. Maiyiki (2010) estimated that up to 60% of rural households own cattle, 70% - 90% own goats, while over 80% own chickens. The importance of livestock in rural livelihoods and food security lies in the provision of meat, milk, eggs, hides and skins, draught power, and manure. Livestock in Zimbabwe also acts as a strategic household investment. Small ruminants (sheep and goats) and non-ruminants, particularly poultry, are an important safety net in the event of drought – they are easily disposable for cash when the need arises or during drought. Zimbabwe's smallholder system has the potential to grow and become the mainstream of the livestock sector's performance indicator. According to World Bank (2020), forests account for 40% of the Zimbabwean total land area, which is about 15 624 000 hectares. Zimbabwe has in the last 20 years had a steady deforestation rate (FAO, 2020). The average hectares lost annually are almost 327 000 since 1990, which totals almost 6 million hectares lost in the last 20 years

The effects of climate change have impacted agricultural production worldwide which has made the returns from agriculture decrease overtime, without the adaptation of smart agriculture. Zimbabwe is a tropical country which has dry savannah climate characteristics. The Zimbabwean climate benefits from the rains brought by the Indian Ocean monsoon, according to Maiyiki (2010). Mapfumo (2013) asserts that since the 1970s, Zimbabwe has experienced irregular rainfall patterns as the occurrence of drought has been somewhat constant, which led to soil erosion which in turn decreased agricultural production in the

affected areas. The country at some point was regarded as the breadbasket of Africa and was self-sufficient, producing crops not only for domestic consumption but also for exports. This has since changed to such an extent that the country can no longer cater sufficiently for its people in terms of feeding and has to depend on foreign aid.

The beginning of the 1980s, saw a number of agricultural policies introduced to increase food security. Both the small-scale and larger-scale farmers were set to benefit from these policies.

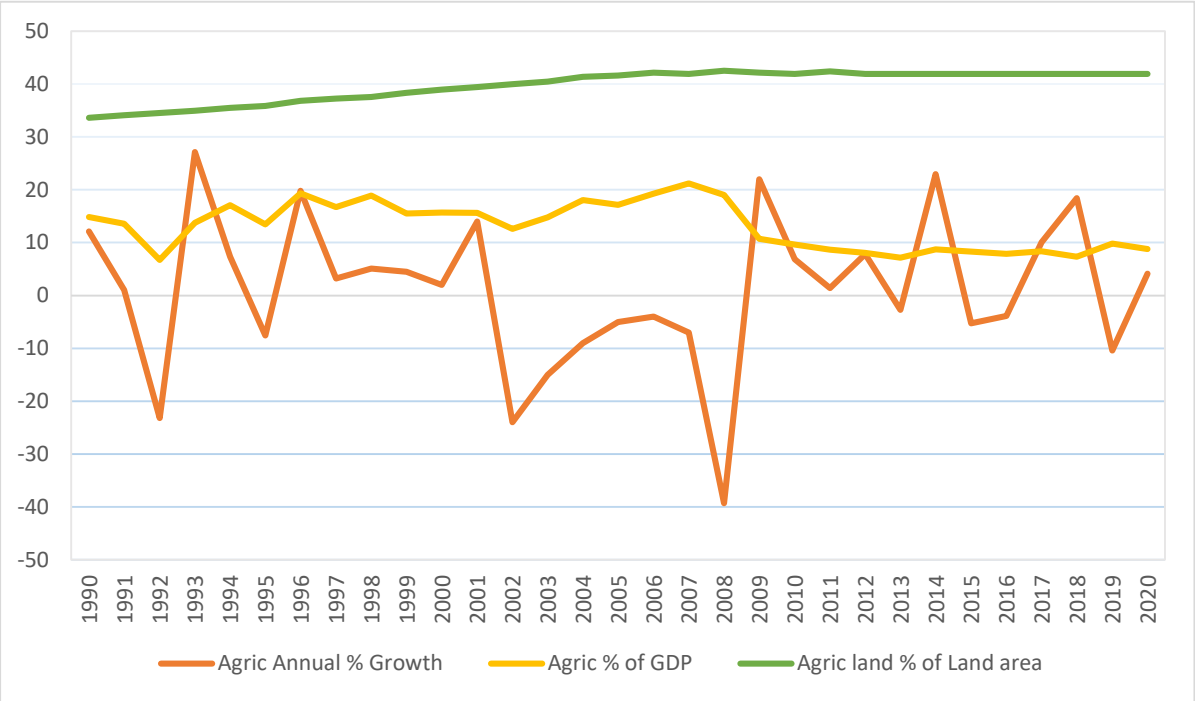


Figure 2.1: Zimbabwe's agricultural contribution to GDP

Source: Created by Author using Microsoft excel and data from World Bank

The figure above shows Zimbabwe's agricultural annual percentage growth, the agricultural contribution to GDP as a percentage as well as the land used for agriculture as a percentage of the total land area between the period 1990 to 2020. As can be seen from the graph, the agricultural land has been increasing throughout the years with the trend showing an upward movement thus more land has been provided, or made available for agricultural activities which is in line with the notion that Zimbabwe is an agro-based economy with its reliance based on agricultural production mostly. The contribution of agriculture to GDP has fluctuated in the stipulated time period which is attributed to various reforms and policies as well as climatic conditions that has plagued the country. It has been highest in 2007 with a figure of almost 21% and lowest in 1992 with a figure of 6%, the result of the droughts in the late 1980s to early

1990s. The annual agricultural percentage growth has fluctuated as well, swinging between -39% in 2008 and 27% in 1992.

2.3. Empirical Literature

2.3.1. Roles of agriculture in development

Agriculture plays a role in the early stages of development as production in the sector is necessary for food provision and enables the nation's population to engage in activities in different sectors, well fed (Laston,2003). The growth of agriculture, independent of other economic activities has since been revoked meaning the growth of agriculture cannot be sustained in the short run as factors of production will be fixed, for example technology thus agriculture in short run faces diminishing marginal returns. The importance of the agricultural sector in the provision of food for the economy was also highlighted by Schultz (1964). Agriculture in Schultz's view is crucial for the growth of the economy as it enables the working workforce to possess the necessary energy to conquer the days.

Dialo et al. (2007), states that agriculture plays a key role in economic growth in Melanesian countries like Fiji, Vanuatu, Solomon Islands and Papua New Guinea. The study showed that in these countries, agriculture plays a very crucial role in providing employment and availing food as well as generating export revenue. Foreign exchange generation was through the export of coconuts, cocoa, palm kernel oil and other coconut products.

The Lewis model, supported by Johnston and Mellor (1961) suggests that agriculture does not only provide or create employment opportunities but also plays a role in economic growth through the linkages in production and consumption. Agriculture provides the role materials that are necessary for the productions of the industrial sector thus production by the agricultural sector becomes consumption by the industrial sector. The suggested linkages between the sectors of the economy increase employment in the agricultural sector, if we take into account increased demand for raw materials by the industrial sector. Agricultural growth, is instrumental in poverty reduction via the aforementioned linkages between the agricultural sector and the industrial sector of the economy. A direct contribution of agricultural sector production to poverty reduction is through the effects of growth of agriculture on profitability and farm employment, and indirectly, a result of an increase in the domestic demand for agricultural products by the non-farming sectors of the economy.

Adelman's general equilibrium idea which states of industrialization as a result of agricultural demand was supported by Singer (1979). According to Singer, a country's development policies should be such that a nation is agriculture driven than export driven as this agriculture demand is what should ultimately lead to industrialization. Agricultural demand led industrialization is when the agricultural sector expansion due to the linkages between the agricultural sector and the industrial sector would also lead to the expansion of the industrial sector. Adelman (1984) suggested that small and medium farmers should have more emphasis placed on them as they are more likely to utilize the domestic linkages with the industrial sector as compared to large scale farmers who can afford to import inputs which then poses threats to the linkages that are supposed to drive for industrialization.

Agricultural production contributes to the development of the economy through three contributions which are factor contribution, market contribution as well as product contribution. Product contribution refers to the increase in the supply of agricultural products to the non-agricultural sectors of the economy which enables them to engage in their manufacturing activities. Market contribution simply refers to the domestic market availed by the agricultural sector for goods that are domestically manufactured. Factor contribution references labor supply from the rural agricultural sector to the rest of the economy, as the Lewis model suggested that there is surplus labor in this sector.

2.4. Empirical Evidence

2.4.1. Antony, (2010), Nigeria

This study presented an empirical analysis of the impacts on economic growth caused by agriculture, showing the overall contribution of agriculture to GDP in Nigeria. A functional and operational form was specified, to establish if a causal relationship exists between GDP and agricultural variables. The study revealed that there is a significant impact on economic growth and export growth caused by agricultural variables. This results from the extra production of local agricultural products and these exports are a major source of foreign income which is needed to facilitate growth through increasing output of other sectors.

2.4.2. Awokuse, (2009)

This empirical study showed the bridged gap by examining the linkage between agriculture and economic growth through application of time series analytics to data from different developing countries, with Zimbabwe included. The model was an extension of the

neoclassical growth model, considering the agriculture sector as a major contributor to economic growth as well as being the backbone of every developing nation. The economic variables used in the analysis were agriculture value added per worker, real exports, population as proxy for labor, real GDP per capita and gross capital formation per worker as proxy for capital. Awokuse (2009) used autoregressive distributed lag (ARDL) error correction modelling approach to assess the short run and long run relationship between the variables. The findings indicated that there was strong correlation between the dependent and independent variables as agriculture was ascertained to be an engine that drives economic growth to be realized. Empirical findings of this particular study indicated that public and private sector resource allocation necessitated agriculture and infrastructure development.

2.4.3. Meijerink Gerdien et al, (2007)

This paper studies the contribution of agriculture to the development of an economy and how this relates to poverty. There was an investigation into the relationship between economic or agricultural growth and pro-poor development. They argued that most researchers agree on the contribution by the agricultural sector to economic growth but pointed out that the role of agriculture in terms of GDP is reduced by economic growth. Their study realized the importance and links of the agriculture sector with other sectors but concluded that the direct impact of the agricultural sector is not economic growth but rather aspects like food provision, employment creation as well as foreign exchange through exports and raw materials for the industry.

2.4.4. On Developed Countries

There is less dependence on agricultural production in most developed economies due to the fact that there are fewer resources to use for farming and also the unfavorable weather conditions which do not permit agricultural production. The abundance of capital in developed countries permit them to produce capital-intensive products. Under the constraints of the Heckscher-Ohlin theory, countries with abundant capital should produce capital-intensive goods while those labor abundant should produce labor-intensive goods (Markusen, 2005). The relationship between agriculture production and growth in developed economies is supported by a handful of research. Katircioglu (2006) pointed to the existence of a bidirectional relationship between agricultural production and economic growth using the Granger causality in North Cyprus. Yao (2000) and Xuezhen et al. (2010) examined the agricultural impact on

economic growth of the Chinese economy and concluded that agriculture was important to facilitate the growth of China.

2.4.5. On Developing Countries

The impact of agricultural production on economic growth in developing nations has been a controversial topic among economists. African nation, often are associated with having comparative advantage in agricultural production. Studies on this subject either seek to investigate the impacts of agriculture on economic growth or ascertain whether there exists a causal direction between agricultural production and growth. All these studies ultimately arrive on the same conclusion which is that agricultural production is crucial towards driving a nations growth.

There are several studies investigating the effect of agricultural production on the growth of the Nigerian economy. The works of Izuchukwu (2011), Odetola and Etumnu (2013) and Sertoglu et al. (2017) are all congruent about the significance of agriculture production on the growth of the Nigerian economy. Izuchukwu (2011) through his study showed that there exists a positive relationship between GDP, government expenditure on agriculture, domestic savings and foreign direct investment (FDI) and agricultural production in the Nigerian economy. In retrospect, Odetola and Etumnu (2013) point that although there is a contribution of agriculture to economic growth, it does not necessarily reflect a contribution of economic growth to agricultural growth. This relationship between agricultural production and economic growth in developing nations is often assessed by employing the Autoregressive Distributed Lag (ARDL) and the Granger Causality tests. Other techniques can be employed as well as supported by the works of Moussa (2018) who employed the Johansen test and the Vector Error Correction Model (VECM), Raza et al, employing the Ordinary Least Squares (OLS) AND Izuchukwu (2011) using the SPSS.

2.4.6. General Overview

In a study conducted by Edwige and Lazen (2004), the effect of agriculture on economic growth was analyzed in four different countries. They analyzed the agricultural production impact on economic growth in Burkina Faso, China, Democratic Republic of Congo and Cameroon for the period 1990 to 2001. The study showed that agriculture was a cornerstone in the selected economies. Chidoko (2013) argued that the was a positive impact of agricultural production on economic growth based on the study.

By using 31 observations from 1980 to 2010 in Pakistan, Awan and Vashma (2014) examined the agricultural sector determinants and tried to investigate whether there was a relationship between agriculture and GDP. There were interested in investigating the importance of agriculture in economic growth and development. The economic variables used for the model where Agricultural growth and GDP. They gathered data from the World Bank Meta data of Pakistan. The relationship between the variables was tested using techniques such as the Vector Correction Model and the Co-integration technique. Empirical findings from the study suggested that there existed a statistically significant, positive relationship between GDP growth (proxy for economic growth) and agriculture. The essentiality of the role of agriculture in driving for GDP growth and economic growth could not be understated.

Additionally, a number of issues have been brought up by certain scholars (Gardner, 2005; Chebbi, 2010) questioning the influence of the agriculture sector on economic growth. By examining the causal link between agricultural value added per worker and gross domestic product (GDP) per capita, Lavorel et al. (2013) responded to Gardner's (2005) concern that "is agriculture an engine of growth" for 85 nations. However, their research uncovered a huge allegation. They claim to have discovered a causal link between agricultural value added and growth for poor nations, but not for rich countries. This finding supports the notion that the agricultural sector has served as the foundation of developing economies, which was made previously.

In addition, Matahir (2012) adopted a distinct perspective in his research on the impact of agriculture on economic growth and how it interacts with other economic sectors. The non-causality link between Tunisia's agriculture and other economic sectors was examined using time series Johansen co-integration methods. The conclusion drawn from their research was that policymakers should include agricultural sectors as important resources when examining inter-sectoral growth initiatives. The importance of Tunisia's growing service and commercial sectors to the country's economy cannot be overstated, even if the country's agricultural industries have not profited greatly from them. This is supported by the study that Jatuporn et al. (2011) conducted on the economy of Thailand. In their view, policymakers ought to support agriculture and consider its as Thailand’s economy growth driver.

Katircioglu (2006) further emphasized the significance of the agricultural sector on the growth of the economy of Northern Cyprus in his examination of the influence of the agricultural sector on that economy. His research indicates that the agricultural sector is vital to the growth of any economy, particularly that of the small island of Northern Cyprus. His research showed

that there are long-term, dynamic causal linkages in both directions between the macroeconomic variables. In other words, the economy's growth depends greatly on the reaction from the agriculture sector.

Izuchukwu (2011) discovered a positive causation, or a good association, between the agricultural industry and the Nigerian economy, however Dim and Ezenekwe (2013) discovered the opposite. A number of researchers found positive causality between agriculture and economic growth using a variety of econometric techniques, including cross-sectional and panel approaches (Oluwatoyese, 2013; Ahungwa et al., 2014; Olajide et al., 2012; Ebere, 2014), whereas others found a negative relationship between the two (Dim, 2013; Aggrey, 2009; Oluwatoyese & Applanaidu 2013).

Chukwuma and Ezenekwe (2014) examined whether agriculture matter for economic development in Nigeria. They modelled life expectancy against agricultural output and agricultural expenditure, amongst other variables. They found that found that agricultural output has negative and significant impact on life expectancy in Nigeria. The impact of agricultural expenditure was found to be positive but insignificant. Real gross domestic product and industrial output were also found to influence life expectancy. The study concluded that agriculture matter for economic development but that can be achieved with corresponding and simultaneous development of other crucial sectors such as education, health, and industry will not yield positive fruits for economic development in Nigeria.

Aminu and Abdulrahman (2012) investigated the contribution of agricultural sector and petroleum sector to the economic growth and development (GDP) of the Nigerian economy between 1960 and 2010. The variables in the model were found to be stationary and the results of Chow breakpoint test suggested that there is no structural change or break in the period under review. The results also revealed that agricultural sector is contributing higher than the petroleum sector, though they both possessed a positive impact on economic growth and development of the economy. They concluded that a good performance of an economy in terms of per capita growth may therefore be attributed to a well-developed agricultural sector capital.

Studies have looked at how the agriculture sector affects the expansion of the economy. According to Lipton (2012), a boost in agricultural growth raises the lowest income groups in society's income levels. Findings from cross-country regressions across developing nations also demonstrate that when the growth is in agriculture rather than other sectors, a $1 rise in GDP leads in much higher poverty reduction (Lipton, 2012). Farmers' wages and purchasing

power rise as a result of this sectoral expansion, creating a thriving home market that fuels economic growth in other industries. Oji-Okoro (2011) looked at the impact of the agricultural sector on the growth of Nigeria's economy in research with a local focus on that country. The greatest foreign direct investment, according to his research, is in agriculture (56.43). Consequently, he came to the conclusion that every unit change in FDI for agriculture corresponds to a change of 56.43 units in GDP.

Agricultural and petroleum sector contributions to the expansion and development of the Nigerian economy from 1960 to 2010 were examined by Awe and Ajayi (2009). The research showed a large R^2 for agricultural revenue. The connection was able to account for around 60% of the movement. The income from the expansion of the non-oil sector's economy also has a dynamic link with it. According to Ekpo and Umoh (2012), the agricultural sector's GDP contribution fell from 63 percent in 1960 to 34 percent in 1988 owing to neglect, not because the industrial sector's portion of the economy rose.

The above empirical evidence, though a few is in contrary to the research study, most is in agreement that there is a definite, positive relationship between agricultural production and economic growth. Several researchers utilizing different economic variables have found that the agricultural sector production has an impact on the growth of the economy in the study area. The are several researchers that have conducted similar research in the economy of Zimbabwe. Though a few have done the research, the results of their finding are as follows:

2.4.7. Case of Zimbabwe

A study by Mapfumo and Nhemachena (2019) employed the Vector Auto-regression (VAR) model in the analysis of the causal relationship between agricultural production and economic growth in Zimbabwe. The findings pointed to the existence of a bidirectional causality between agricultural production and economic growth, indicating that there is a significant role played by agricultural production in driving for economic growth.

Another study by Chikodzi and Mushunje (2017) investigated the impact of agricultural productivity on economic growth in Zimbabwe using data from 1980 to 2015. The study found that agricultural productivity had a positive and significant impact on economic growth in Zimbabwe. The authors argued that increasing agricultural productivity could lead to increased food security, reduced poverty, and increased income for farmers, which in turn could stimulate economic growth.

Moyo and Moyo (2016) examined the relationship between agricultural production and economic growth in Zimbabwe using time-series data from 1980 to 2014. The study found that agricultural production had a positive and significant impact on economic growth in Zimbabwe. The authors attributed this to the fact that agriculture is a key sector in the country, providing food, raw materials, and employment opportunities. The study also found that the impact of agricultural production on economic growth was stronger in the short run than in the long run

In addition to the study by Mapfumo and Nhemachena (2019), another study previously done by Mupunga et al. (2017) analyzed the impact of agricultural research and development on the increase in agricultural production as well as the growth of the Zimbabwean economy. According to this research, there is a positive impact of agricultural research and development on agricultural productivity which ultimately drives economic growth.

Another study by Chidoko (2013) analyzing the agricultural production impact on economic growth was performed for Zimbabwe. In this study, Gross Domestic Product was proxy for economic growth as well as the dependent variable whilst Coffee, Cotton, Maize and Tobacco were the independent variable. He utilized the variable in the analysis based on how they are significant in Zimbabwe's agricultural sector as some like Maize and Tobacco are essential to the livelihood for Zimbabwean as they provide food and are pivotal in foreign currency acquisition through trade. The study used the Ordinary Least Squares (OLS) method of estimation. Chinook (2013) justified the variables in the model arguing that they are Zimbabwe's major cash crop therefore their impact in agriculture is transferred to the economy. Findings by Chinook were that agriculture has a positive impact on economic growth. Agricultural production, as it impacts economic growth according to the study, postulations where made that declines in agricultural production are often followed by declines in GDP. Therefore, for a country to achieve a sustainable level of economic growth which leads to economic development, the agricultural sector must be firm and there must be growth from that sector that is transferable to other sectors through the linkages that exist (Chinook, 2013).

A study by Mudzonga and Chigwada (2009) argued that agriculture is at the center of the Zimbabwean economy in terms of food provision. The study showed that agriculture generated 18.5% of GDP through exportation of the products and at most 40% of export earnings through exportation of cotton, tobacco and maize, among others. Chidoko (2013) found that 66% of the industry's raw material are provided by the agricultural sector, and that the fast track land reform program affected agricultural production.

Using a computable general equilibrium (CGE) model, Chitiga and Mabugu (2012) analyzed the contribution of agricultural production on the growth of the Zimbabwean economy. The study findings showed that as agricultural productivity increases, this would lead to an increase in output, employment and exports, ultimately contributing to the growth of the economy.

Although a number of estimation techniques were utilized by previous researchers, they all arrived at the same conclusion which is that agricultural production is necessary for the growth of the Zimbabwean economy. A long run impact on the growth of Zimbabwe was shown to exist through a study done by Matandare (2018).

In conclusion, the few studies conducted in the Zimbabwean economy to assess whether there was an impact on economic growth caused by agricultural production have all agreed that there indeed is an impact and the majority of the research points to a positive impact, with a positive relationship existing between the agricultural production and economic growth variables. The researchers utilized different variables, such that the current research utilized different variables borrowed from the several empirical studies outlined above.

2.5 Theoretical Framework

This section deals with the various theories that deals with agricultural production. Theoretical framework, intends to examine existing theories that can be used to investigate the nexus between agricultural production and economic growth. A number of theories exist and these provide linkages between agriculture and economic growth to form the basis of the theoretical framework.

2.5.1 The Lewis Model

The theory involved rural to urban migration and explained the change from a stagnant economy which is based on a traditional rural sector to a growing economy driven by the development of a modern urban sector. Lewis (1954) posited that economic growth is not only driven by capital accumulation in the modern industrial sector but also from the linkages and interaction between the urban and rural sector. The context in rural economies according to Lewis is that, there exist surplus labor in the agricultural sector and that causes the marginal labor productivity in the agricultural sector to be or close to zero. In the rural agricultural sector, workers share output among themselves so that they get remunerated at their mean product. With these assumptions, the agricultural sector can supply perfectly elastic labor force to the modern industrial sector which in turn grows through capital accumulation and poaching

agricultural sector labor force, and paying wages equal to the ones in the agricultural sector. Through migration from the rural to the urban sector, there is labor force transfer which occurs up until surplus labor or disguised unemployment is absorbed by the urban industrial sector.

Technical progress was introduced in the agricultural sector by Ranis and Fei (1961) and the assumption was that capital investments could be absorbed. The model primarily focuses on the labour transfer process, output growth and employment in the modern industrial sector. This theory, posits that if there is an increase in agricultural production in the economy, the price of food goes down and leaves more income in the capitalist's hands to channel into investment projects within the economy leading to economic growth. Focus is placed on mechanisms by which underdeveloped economies transform the structure of their domestic economies to a more advanced agricultural practice from previously placing emphasis on traditional subsistence agriculture. The extension of this theory adds that unless government support systems are created (that provide incentives, opportunities and access to required inputs enabling small farmers to raise and expand their productivity), full benefits of agricultural development cannot be realised. The Todaro (1969) and Harris-Todaro (1970) models also consider the role of internal migration in a dual sector economy where labour force is drawn from the rural agriculture sector to the urban industrial sector.

Lewis thus, asserted that the linkages between the rural agricultural sector and the modern industrial sector contributed to growth and development of an economy through industrialization. With a continual reinvestment of the industrial sector profits, the excess labour from the agricultural sector could be smoothly integrated into the Zimbabwean industrial sector labour force. The growth of the industrial sector would create more employment and absorb the labour flow from the agricultural sector thus leading to more productivity in the economy which ultimately leads to the growth of the Zimbabwean economy. The agricultural sector according to this theory might not directly lead to the growth of the economy but the supply of labour to the industrial sector is what ultimately leads to the growth of the economy of Zimbabwe through the inter-sectoral linkages.

2.5.2. The Fei – Ranis Model of Economic Growth

The model was developed by John Fei and Gustav Ranis in 1962, is a dualism model of development economics and also an extension of the Lewis model. The model is also known as the surplus labor model. The theory suggests the existence of a dual economy which comprises of a primitive agricultural sector and a modern industrial sector. It takes into account

economic situations of unemployment and underdevelopment as compared to other growth models that assumes homogeneity of all underdeveloped countries. The primitive sector is an established agricultural sector whereas the modern sector is an emerging industrial sector. The crux if development problems emerges as a result of these two sectors co-existing in the economy. According to Fei and Ranis (1962), growth and development is can only be realized through the transformation from dependence on agriculture sector to the industrial sector.

However, the theory still raises the importance of the agricultural sector in the growth and development process as output from agricultural production is necessary for production in the industrial sector. It suffices to say that, since Zimbabwe is an agro-based economy, the agricultural activities are necessary for driving towards economic growth as output of the agricultural sector becomes input for other sectors. Hence, like the Lewis dual sector model, the linkages between the sectors of the economy, are necessary to enable agriculture to play a role in the development in the economic growth of Zimbabwe.

2.5.3. Endogenous Growth Theory

This theory of agricultural growth explains how agricultural production grows over a period of time. According to the theory, the accumulation of knowledge and innovations in technology, which are generated endogenously in the agricultural sector leads to sustained growth in agricultural productivity. The most basic proposition of the theory is that to have a sustainable positive growth rate in the long run, there should be continual developments in technological knowledge within the Zimbabwean economy. The neoclassical growth model by Solow (1956) and Swan (1956) show that the absence of technological advances causes the effects of diminishing returns to cause seizure of the economic growth process. The theory stipulates that growth is endogenously determined and generated by farmers, researchers, and other factors within the agricultural sector and not exogenous factors. Growth in agricultural productivity, according to the theory is excused from being determined by exogenous factors like climate, natural resources and policies by the government but rather attributed to the ability within the agricultural sector to adopt and generate new technology.

Paul Romer was one of the scholars responsible for the development of the endogenous growth theory of agriculture. Romer (1990) focused on the role of knowledge and innovation in an economy's growth prospect, and argued that technological advancement is attributed to purposeful and deliberate investments in research and development. Economic growth is

driven by knowledge acquisition through research and development (R&D). This knowledge is diffused through markets and other social institutions.

Robert Solow also contributed to the development of the theory, suggesting a role of technological progress in the growth of an economy. Solow (1957) argued that technological changes drive productivity growth. He placed emphasis on the importance of knowledge spillover which occurs when the generation of knowledge in one sector of an economy, spills over to other sectors. Thus in the agricultural context, the accumulation of knowledge and technological innovations in the agricultural sector leads to agricultural productivity growth. Growth in agricultural productivity, leads to efficiency improvement within the sector which in turn leads to economic growth according to the endogenous growth theory

Support of the endogenous growth theory of agriculture by Dialo et al. (2012) found that investing in agricultural research and development has a significant impact on growth in Africa. The study finding further confirmed that knowledge spillover from other sectors to the agricultural sector contributed to growth.

This theory highlights the complementarity of different sectors of the economy. The continuous provision of resources to the labor force must be done to increase productivity. Lipton (2012) suggests that the resources provided must include human capital, physical capital as well as technological capital. Based on this theory, economic growth is driven by the accumulation of factors of production, and accumulation results from investment in the agricultural sector. The link between agricultural production and economic growth is in how it affects total factor of production or as an intermediate input in the industrial sector.

2.5.4. Rostow's Stages of Development

According to this approach to the economic growth process, a distinction was made to stages that economies go through in realizing economic growth. Rostow (1960) listed these stages as traditional society, pre-conditions for takeoff, takeoff, drive to maturity and age of high mass consumption. The traditional society stage is the initial stage of development. It is characterized by a subsistence economy that is primarily dependent on agricultural production. The economy at this stage has all economic activities based on traditional methods.

The pre-conditions for takeoff stage is when there are changes within an economy as a result of increased investment in education, infrastructure and technology. This however, does not

mean that the agricultural sector becomes relevant but only that it is now supported by the manufacturing and service sectors.

Rapid economic growth and a shift from agriculture to industrial production is a characteristic of the takeoff stage. There is a further increase in investment at this stage as the economy experiences sustained economic growth. Education and infrastructure as well as technology increases as well.

The drive to maturity stage is when the economy diversifies, and shifts towards a more service based economy, for example industries such as finance, healthcare and education. There is more stability in the economy and more emphasis is placed on research and innovation.

The final stage, according to what Rostow proposed in his book "The Stages of Economic Growth: A Non-Communist Manifesto" in the 1960s, is the age of high mass consumption stage. This stage of development is characterized by high consumption levels and maturity in the economy. There is dominance of the service sector and more focus on maintenance of economic sustainability and economic stability.

Agriculture is a crucial sector in economic development of most countries. It provides raw materials for the manufacturing industry, food for the population as well as foreign exchange through trade. In the early stages of development, that is, the first and second stage outlined by Rostow (1960), agriculture is the primary source of income for the majority of people. This thus, as a result makes it necessary for investment in agriculture as it is essential for growth. Agricultural investment leads to productivity increases as well as efficiency which stimulates economic growth. Use of smart agriculture techniques as well as use of fertilizers and mechanization increases yields, lowering production costs leading to increased profitability. The increased profitability increases incomes for farmers, which they can use to invest in other economic sectors therefore stimulating growth.

For example, a study by Diao et al. (2017) found that modernizing the agricultural sector in Africa could lead to significant economic growth and poverty reduction. The study argues that increasing agricultural productivity through the adoption of new technologies and practices is essential for achieving sustainable economic growth.

Hence, according to the theory by Rostow, Zimbabwe has to build up towards growth by going through these stages outlined above. Zimbabwe, due to its nature of having an agricultural

background have it easy to adopt to the theory as it does not have to adapt to a new livelihood suited for the adoption of the stages by Rostow.

2.5.5. Summary

The chapter gives empirical and theoretical literature in respect to the study. The empirical evidence as well as the theoretical literature showed strong evidence that agricultural production significantly impacts economic growth. This however, need to be validated by the conduction of a similar study that utilizes the variables used in the empirical studies by other accredited researcher. The next chapter provides, the method that the researcher used in order to realize the objectives of the research.

CHAPTER THREE:

METHODOLOGY

3.0. Introduction

This chapter details the methodology used in the study to determine the agricultural production impact on economic growth in Zimbabwe during the period 1990 to 2020. The methodology used in the study is a quantitative methodology. In this chapter, the research design and approach, sample, data collection methods used during data collection and the sources of the data collected are provided.

3.1. Research Design

Has to do with the issues involved in the planning and execution of a research study from problem identification through to the reporting and publication of results. Sekeran (2000), suggests that specifically, a research design details how a researcher tries to rule out alternatives to interpretations of results. It thus provides a framework for data collection and analysis (Bryman, 2003). According to Creswell (2003) the accuracy of results is determined to some degree by the type of research design one adopts for the study. This study utilizes a combination of correlation design as well as descriptive design to ascertain the validity of the study.

3.1.1. Correlation Research Design

A correlation research design investigates the relationship between variables without them being manipulated by the researcher. It shows the strength or rather, the direction of an existing relationship between the variables. Saunders (1999) defines the research design as methods which tries to determine the existence of a relationship or co-variation between quantitative variables. This design is appropriate for this study as the study seeks to determine the nature of the relationship between agricultural production, government expenditure on agriculture and economic growth.

3.1.2. Descriptive Research Design

Williams (2007) defines descriptive research design as a method that determines the situation in current phenomenon. The goal is to draw and classify the phenomenon (Nassaji, 2015). It

takes raw data and summarizes into a form that is usable. It is utilized in this study as it involves manipulation of data into a usable form for predication and estimation purposes.

3.1.3. Data Collection

The data used in the study was collected from World Bank, World Development Indicators and the Food and Agriculture Organization (FAO).

3.1.4. Hypothesis

The study hypothesis is that agricultural production leads to economic growth in Zimbabwe. The research investigates whether there is a significant impact of agricultural production on economic growth.

3.2. Estimation Procedure

The researcher employed the Ordinary Least Squares (OLS) method using E-Views 7. There methodology was used because it is based on the assumption that the independent variables are truly exogenous and there is one-way causation between the explanatory and dependent variables. The regression model has a stochastic error term which accounts for the variations not recorded in the included variables, and has a sum of zero based on the assumption that positive and negative variations cancel each other. There are presumptions connected to the OLS method, and these presumptions must be met.

Firstly, E (μ_1, x_1) = 0, this is implying that there is no covariance between the independent variables and the error term. Secondly, the error term $\mu=\Sigma\mu= 0$, thus following a normal distribution with a variance with 0. The third, presumption is that the parameters should be linear, even if the variables are non-linear and there is variability of X values as these values should not be the same for the same sample. The population regression model is given by $Y_i = \beta_1+\beta_2X_i+u_i$ but since we do not observe it, we estimate for the sample regression function given by $\hat{Y}_i =\beta_1+\beta_2X_i+\mu_i$

3.2.1. Regression Assumptions

- The chosen sample is representative of the population
- There is a linear relationship between the independent variable(s) and dependent variable
- All the variables are normally distributed.
- There are no outliers

- The independent variables are all linearly independent. Gujarati (1995) suggested that there should not be a perfect relationship between independent variables, a situation called multicollinearity.

3.2.2. Linear Assumptions

- The distribution of errors has a mean of 0
- There is constant variance of errors across all the independent variables.
- The distribution of errors is normal
- All the errors are independent

3.2.3. Simple linear regression model

$$Y = \beta_0+\beta_1X_1+u_i \ldots\ldots\ldots\ldots (1)$$

Where **Y** = endogenous variable

β_0 = intercept

β_1 = coefficient of the exogenous variable

X = exogenous variable

u_i = stochastic error term

3.2.4. Multiple linear regression model

$$Y = \beta_0+\beta_1X_1+ \beta_2X_2 \ldots\ldots + u_i$$

Where **Y** = endogenous variable

β_0 = intercept

β_1 = coefficient of the exogenous variable (X_1)

X_1 = exogenous variable

B_2= coefficient of the exogenous variable (X_2)

X_2 = exogenous variable

u_i = stochastic error term

3.3. Model Specification

The research was aimed at analyzing the impact of agricultural production on economic growth in Zimbabwe for the period 1990 to 2020. The model used to estimate the impact of agricultural production on economic growth was expressed as:

$$GDPGRWTH = \beta_0 + \beta_1INFLN + \beta_2AGRWTH + \beta_3GFC+ \beta_4AGEMPL+ u$$

Where:

GDPGRWTH = Gross Domestic Product (annual % growth) (proxy for economic growth)

INFLN= Inflation rate (annual %)

AGRWTH = Agriculture, forestry and fishing value added (annual % growth (proxy for agricultural production)

GFC = Gross Capital Formation (% of GDP

AGEMPL = Employment in agriculture (% of total employment) (modeled ILO estimate)

$\beta_0, \beta_1, \beta_2, \beta_3, \beta_4$ = slope coefficients

u = error term (captures the effects of all other variables that affect economic growth but were not included in the model.

3.4. Justification of variables

3.4.1. GDPGRWTH

Wikipedia (2023) defines GDP as the monetary measure of the market value of all the final goods and services produced and sold in a specific time period by a country. The research's predictable variable, or our Y, is the gross domestic product (GDP). According to Lipsey and Crystal (1999), GDP is the sum of all expenditures on final products and services generated during a given period of time, often a year. Although several factors do affect it, in this study, it has been impacted by the explanatory variables provided. GDP growth is a standardized and global indicator of economic performance used in all nations. Gross Domestic Product growth is measured as a percentage change. This model includes the variable for gross domestic product since it represents the potential for domestic production. Increased output increases consumer demand for the items made in the economy. This increases the profitability of future investments. Healthy investors react by stepping up their investment. As a result, GDP is a reliable indicator of economic growth (Hadjimichael 1995).

3.4.2. INFLN

According to Laidler and Parkin (1975), inflation is the process of continually increasing prices, or alternatively, a continuously decreasing worth of money. It is described as a persistent increase in the overall price level that is typically linked to an increase in the amount of money and credit accessible in comparison to the available products and services by Merriam-Webster

(online). The study used the measure of inflation by utilizing the GDP deflator. The GDP deflator, which measures inflation, illustrates the percentage change in GDP that results from inflation rather than an increase in output. Inflation was used as a reliable indicator of economic growth proxy by GDP deflator because instead of measuring an economy's output, the GDP deflator tracks the changes in gross domestic product caused by changes in the prices of goods and services.

3.4.3. AGRWTH

In this particular study, the researcher used the variable agriculture, forestry and fishing, value added (annual % growth) as proxy for agricultural production. Agriculture, according to Ahmed (1993), is the backbone of many economies and is vital to a nation's socioeconomic growth since it is a key element and component in national development. Since Zimbabwe is an agro-based economy, the impact of agricultural production on economic growth is worth investigating thus the inclusion of the variable agriculture growth in the model.

3.4.4. GFC

Gross capital formation (previously gross domestic investment) is the sum of expenditures on additions to the economy's fixed assets plus net changes in the stock of inventories. According to World Bank (2020), land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment acquisitions; and the construction of roads, trains, and the like, as well as schools, offices, hospitals, private residential residences, and commercial and industrial structures, are examples of fixed assets. Inventories are products stockpiles kept by businesses to cover temporary or unforeseen swings in production or sales, as well as "work in progress." Net acquisitions of assets are also considered capital formation, according to the 1993 SNA. Thus, the addition of these durable assets adds to the development index of an economy hence the variable is included in the model to ascertain its impact to economic growth

3.4.5. AGEMPL

Employment in agriculture (% of total employment) shows the percentage of the total labor force that is employed in the agriculture sector. Production in the agriculture sector is undertaken by the labor employed in that sector. As countries progress, the proportion of the people employed in agriculture decreases. While agriculture employs more than two-thirds of the population in impoverished nations, it employs fewer than 5% of the people in prosperous ones. This workforce decrease is primarily made feasible by a significant gain in productivity.

The impact of agricultural employment of labor to economic growth stems from the fact that the impact of agriculture on economic growth is under reveal.

3.5. Diagnostic Tests

Because time series data is utilized in this study, several considerations must be made in order for the results to be significant. To construct the regression model BLUE (Best Linear Unbiased Estimators), autocorrelation, multicollinearity, stationarity, and heteroscedasticity must be addressed.

3.5.1. Heteroscedasticity

When the variance of the error term is not equal, this occurs. Because the variance of the error component is amplified, heteroscedasticity has an impact on confidence intervals, t-tests, and F-tests. This study used The Breusch-Pagan-Godfrey Test (also known as the Breusch-Pagan test) to test for heteroscedasticity. Heteroscedasticity means "differently scattered" and is the inverse of homoscedasticity, which means "same scatter." Homoscedasticity is a crucial assumption in regression and its violation makes conducting regression analysis difficult. Homoscedasticity will be tested to ensure that the error terms follow a normal distribution and they exhibit a constant variation over time since there is the risk of variations based on the values of the independent variables observed over a period of 30 years given that the study utilized time series data. Khubaib and Mustafa (2019) suggest that a probability value below the significance level of 0.05 is an indication of the presence of heteroscedasticity.

3.5.2. Autocorrelation

Many parametric statistical processes (for example, ANOVA and linear regression) presuppose that the errors of the models employed in the analysis are independent of one another (that is, that the errors are not connected). When this assumption is violated in time-series research designs, the errors are said to be autocorrelated or dependent. Because time-series designs collect data from a single participant at several points in time rather than from numerous participants at a single moment in time, the assumption of independent errors inherent in many parametric statistical studies may not be valid. When this happens, the results of these studies, as well as the conclusions formed from them, are likely to be deceptive until remedial action is done. In a time-series linear model, the error is often defined as an observed value Y t (i.e., a dependent variable score measured in a theoretical process at time t) minus the anticipated value t (based on model parameters). When real sample data are used (rather than theoretical

process data), the anticipated values are based on the model's parameter estimations, and the difference $Y\ t - \hat{Y}\ t$ is referred to as a residual. As a result, a residual is an estimate of a mistake.

The study utilized the Durbin Watson Statistic to test for autocorrelation. The Durbin-Watson test yields a score ranging from 0 to 4. A result close to 2 indicates a very low amount of autocorrelation. A result closer to 0 indicates a stronger positive autocorrelation, whereas a result closer to 4 indicates a higher negative autocorrelation. Thus, a value which does not fall in the range of 1.5 to 2.5 is an indication of the presence of the presence of negative or positive autocorrelation (Enders, 2014). However, the Durbin-Watson statistic only tests for first order correlation thus for higher order correlation we use the Breusch-Godfrey Serial Correlation LM Test to determine whether the observed variations in GDP are a result of the current year effects of agricultural production, agricultural employment and other variables in the model and not from lagging effects from previous year's effects.

3.5.3. Multicollinearity

Gujarati (2003) claims that the original definition of multicollinearity was the existence of a perfect or precise link between some of the explanatory variables in the regression model. The test was performed to determine if there was a relationship between variables such as agricultural production and employment in agriculture since production results from the employment of labor in that sector hence the risk. A correlation of more than 0.8 indicates co-linearity or a significant relationship between the explanatory variables and this was tested using the correlation matrix

3.5.4. Normality

The test was employed to determine if the residuals are normally distributed or not. Fulfilling the normality assumption ensures that the best linear unbiased estimators (BLUE) conditions hold. The study used the Jarque-Bera test for normality. The null hypothesis for normality, H_0: residuals are normally distributed, is rejected if the Jarque-Bera statistic p-value is less than the significance level thus we accept the null hypothesis for H_0: residuals are normally distributed, when the p-value of the Jarque-Bera statistic is greater than the significance level. The normality test was carried to ascertain whether the error terms being normally distributed reduced the uncertainty arising from the usage of the model in real life.

3.5.5. Stationarity

Occurs when the mean and variance do not change consistently over time or do not stay the same over time. The lag or distance between the two time periods determines the covariance between the two time periods, not the actual computation time. The Augmented Dickey-Fuller (ADF) unit root test was used in the unit root/stationarity test to establish the order of integration of the variables. Badawi (2003) argues that employing the unit root test avoids coming up with spurious regression by determining the time series properties and ensuring that non stationary series is not estimated. The stationarity of the variables would later, help determine if the was a relationship in the long run between the variables as a series stabilized over time.

3.6 Model Specification Tests

The researcher carried out test to ensure that the regression model was correctly specified that is ensure goodness of fir as well as the overall validity of the model. These tests show the effects exerted on the dependent variable by the independent variables and how well these independent variables explain the dependent variable.

3.6.1. R-squared and Adjusted R-squared

The R-squared shows the variations in the dependent variable that are explained by the independent variable(s). It measures the proportion of the variations in the dependent variable that are accounted for by the independent variables, according to Gujarati (2008). The R-squared lies between 0 and 1. The r-squared value close to 1 shows a good fit of the model, meaning the independent variables explain the dependent variable in a good way. Complete lack of fit is shown by an r-squared value close to zero. The adjusted r-squared is slightly modified from the r-squared in that it has been adjusted to account for the number of independent variables in the model. The research thus, used both the r-squared and adjusted r-squared to ensure fitness of the model. The variations in GDP would thus be explained by the combined variations in agricultural production, agricultural employment, inflation and gross capital formation.

3.6.2. F-statistic

The test statistic measures the overall significance of the regression model. The null hypothesis is that the true slope coefficients are all equal to zero. The null hypothesis is rejected when the

p-value for the F-stat is close to zero or less than the significance value. The null hypothesis that none of the independent variables explain the variations in GDP is significant if the p-value is less than the significant level.

3.7. Stability Tests

The study also employed stability tests to test whether the model could be used for forecasting purposes. The CUSUM and Ramsey's RESET test were employed.

3.8. Summary

The chapter gave a detailed description of the research methodology and the design of the research that was employed. The statistical analysis package used was also outlined. The various diagnostic tests, specification test and stability tests that were used, were also explained briefly explained. The research made use of the OLS techniques to estimate the regression equation to determine the relationship between GDP and the independent variables. The next two chapters are built on the data analysis, presentation and overall usage of the methodology introduced in this chapter.

CHAPTER FOUR:

DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.0. Introductions

The chapter gives a presentation of the findings and outcomes from the conducted research. The study utilized the use of the E-Views 7 software to determine the impacts of agricultural production and economic growth as well as to determine the relationship between the variables in the regression model. The chapter presents descriptive statistics, diagnostic tests and stability tests. It goes further to give evaluations about the regression results, to determine whether the model is correctly specified and its overall importance.

4.1. Table 1: Descriptive Statistics

	GDPGRWTH	AGEMPL	AGRWTH	GCF	INFLN
Mean	1.020335	63.74338	1.079655	12.89315	36.64033
Median	1.439615	64.51000	2.000000	13.14608	2.171761
Maximum	21.45206	67.24000	27.12208	23.72906	604.9459
Minimum	-17.66895	60.03000	-39.30000	1.525177	-27.04865
Std. Dev.	8.847251	2.643064	14.60534	6.137469	119.1660
Skewness	0.049815	-0.116273	-0.547714	-0.089751	3.873057
Kurtosis	3.069116	1.298217	3.527085	2.072572	18.17053
Jarque-Bera	0.018992	3.810601	1.908799	1.152611	374.7733
Probability	0.990549	0.148778	0.385043	0.561971	0.000000
Sum	31.63039	1976.045	33.46931	399.6878	1135.850
Sum Sq. Dev.	2348.216	209.5735	6399.482	1130.056	426016.1
Observations	31	31	31	31	31

Source: Eviews 7

From the above table, AGEMPL has the highest mean value while GDPGRWTH has the least mean value compared to all the variables. Since the mean for all other variables except INFLN is close to the median, it shows that the data for those four variables follows a normal distribution. The median is the middle value of INFLN is significantly different from the mean meaning the data is skewed. The maximum value of INFLN is 604.9459 and the minimum is -27.04865 and the mean is 36.64033 which signifies the presence of an outlier as the maximum value is too high compared to other values. Standard deviation shows the dispersion of the data from the mean (Crawshaw, 2011). A higher standard deviation shows more variation among

the data whilst a lower standard deviation shows lesser deviation from the mean. INFLN has a higher standard deviation of 119.1660 showing more dispersion from the mean, meaning it does not follow a normal distribution compared to AGEMPL which has a standard deviation of 2.6433064, the least of all the variables thus AGEMPL is normally distributed. GDPGRWTH and INFLN are both positive hence there is skewness to the right while AGEMPL, AGRWTH and GCF are all negative thus the data is skewed to the left. Of all the variables, INFLN with a Jarque-Bera statistic of 374.7733 is not normally distributed as evidence by the p-value of 0.0000 which prompt for the rejection of the null hypothesis of normally distributed data. The rest of the variables are normally distributed as the p-values are higher than the 0.01, 0.05 and 0.1 level of significance thus we fail to reject the null hypothesis; H_0: Data is normally distributed.

4.2. Stationarity Tests

4.2.1. Table 2: Agricultural Employment

Variable	ADF t-stat	Crit-value @ 1%	Crit-value @ 5 %	Crit-value @ 10%	P value	Decision
ADF Unit root test at level						
AGEMPL	-0.692288	-3.679322	-2.967767	-2.622989	0.8334	**Non-stationary**
ADF Unit root test at 1st difference						
AGEMPL	-2.940227	-3.679322	-2.967767	-2.622989	0.053	**Non-stationary**
ADF Unit root test at 2nd difference						
AGEMPL	-6.053993	-3.689194	-2.971853	-2.625121	0.0000	**Stationary**

Source: Eviews 7

The ADF unit root test was not stationary at level hence necessitated a test at 1st difference. The result of the unit root test at 1st difference showed that AGEMPL was still not stationary. However, a unit root test at 2nd difference showed that AGEMPL was stationary as the p-value of 0.0000 was less than the significance levels of 0.001, 0.05 and 0.1. We then failed to reject the null hypothesis of AGEMPL having a unit root at level and 1st difference but rejected the null hypothesis at 2nd difference. Concluding that AGEMPL was stationary at 2nd difference.

4.2.2. Table 3: Agriculture Growth at Level

Null Hypothesis: AGRWTH has a unit root		
Exogenous: Constant		
	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-6.223240	0.0000

Test critical values:	1% level	-3.670170
	5% level	-2.963972
	10% level	-2.621007

Source: Eviews 7

The above results conclude that AGRWTH is stationary at level since the p-value of 0.0000 for the t-stat -6.223240 is lower than the significance values, 0.01, 0.05 and 0.1. Thus we rejected the null hypothesis that AGRWTH has a unit root on all significance levels and accepted the alternative hypothesis that AGRWTH was stationary at level.

4.2.3. Table 4: Gross Capital Formation

Variable	ADF t-stat	Crit-value @ 1%	Crit-value @ 5 %	Crit-value @ 10%	P value	Decision
ADF Unit root test at level						
GCF	-1.64197	-3.67017	-2.963972	-2.621007	0.4495	**Non-stationary**
ADF Unit root test at 1st difference						
GCF	-4.876472	-3.679322	-2.967767	-2.622989	0.0005	**Stationary**

Source: Eviews 7

GCF was tested for stationarity at level and 1st difference. At level the results showed that GCF was not stationary as the p-value of 0.4495 was greater than the significance level of 0.01, 0.05 and 0.1 showing that the t-stat was not significant for the researcher to reject the null hypothesis of having a unit root. The unit root test was conducted at 1st difference where GCF became stationary as shown by the p-value of 0.0005 that was significantly close to zero prompting the researcher to reject the null hypothesis of having a unit root at all significance levels, 1%, 5% and 10%.

4.2.4. Table 5: GDP Growth

Variable	ADF t-stat	Critical value @ 1%	Critical value @ 5 %	Critical value @ 10%	P value	Decision
ADF Unit root test at level						
GDPGRWTH	-3.168193	-3.67017	-2.963972	-2.621007	0.0321	**Non-stationary**
ADF Unit root test at 1st difference						
GDPGRWTH	-6.496831	-3.679322	-2.967767	-2.622989	0.0000	**stationary**

Source: Eviews 7

The unit root test was done on GDPGRWTH to test for stationarity at level. The results showed that GDPGRWTH was not stationary at level at the 1% level of significance as the p-value was greater than the significance level. However, the variable was stationary at the 5% and 10% significance level. The unit root test was done at 1st difference and the variable became stationary at all significance levels. The researcher rejected the null hypothesis; GDPGRWTH has a unit root at all significance levels at 1st difference accepting the alternative hypothesis of no unit root.

4.2.5. Table 6: Inflation

Variable	ADF t-stat	Crit-value @ 1%	Crit-value @ 5 %	Crit-value @ 10%	P value	Decision
ADF Unit root test at level						
INFLN	-5.582795	-3.679322	-2.967767	-2.622989	1.0000	**Non-stationary**
ADF Unit root test at 1st difference						
INFLN	0.901679	-3.689194	-2.971853	-2.625121	0.9940	**Non-stationary**
ADF Unit root test at 2nd difference						
INFLN	-11.46144	-3.689194	-2.971853	-2.625121	0.0000	**Stationary**

Source: Eviews 7

The variable INFLN was tested for stationarity by employing the unit root test at level, 1st difference and 2nd difference. The results at level showed that INFLN was not stationary thus we accepted the null hypothesis of having a unit root. The p-value was 1.0000 which was greater than the 0.001, 0.005 and 0.1 levels of significance hence we could not accept the alternative hypothesis of no unit root in favor of the null hypothesis. The unit root test was employed at 1st difference and the results prompted the researcher to accept the null hypothesis as the p-value of 0.9940 was greater than the significance levels. Thus the researcher could not reject the null hypothesis. At 2nd difference, the researcher rejected the null hypothesis of having a unit root as the p-value was 0.0000 which was close to zero and lower than the 0.01, 0.005 and 0.1 significance levels. The researcher thus accepted the null hypothesis at level and 1st difference but rejected it at 2nd difference as INFLN was stationary then.

From the ADF Unit test results above, it can be observed that some variables were stationary at level, some at 1st difference and some at 2nd difference. This implies that the non-stationary variables at level need to be transformed to the 1st and 2nd difference before estimation to avaoid spurious regression results that affect the effectiveness of the model for forecasting. However, this is not within the scope of this research hence the researcher proceeded to estimate with the initial untransformed variables.

4.3. Diagnostic Tests

4.3.1. Heteroscedasticity

H_0: There is no heteroscedasticity

H_1: There is heteroscedasticity

Decision rule: Accept H_0 if p-value is greater than the given significance level

: Reject H_0 if p-value is less than the given significance level

Table 7: Heteroscedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.50067	Prob. F(4,26)	0.231
Obs*R-squared	5.81461	Prob. Chi-Square(4)	0.213
Scaled explained SS	6.10592	Prob. Chi-Square(4)	0.191

Source: Eviews 7

The decision rule prompts for the acceptance of the null hypothesis that there is no heteroscedasticity (there is homoscedasticity) according to the results on the table and the research concludes at 1%, 5% and 10% levels of significance that there is no significant evidence to reject the null hypothesis and accept the alternative hypothesis as the p-value for the F-statistic is greater than the significance levels. The acceptance of the null hypothesis is further supported by the p-values of Obs R-squared which is higher than the significance level as well.

4.3.2. Autocorrelation

H0: There is no autocorrelation

H1: There is autocorrelation

Decision rule: Accept H0 if p-value is greater than the given significance level

: Reject H0 if p-value is less than the given significance level

Table 8: Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.928582	Prob. F(2,24)	0.4089
Obs*R-squared	2.226544	Prob. Chi-Square(2)	0.3285

Sources: Eviews 7

From the results above, the null hypothesis of no autocorrelation is accepted since there is no significant statistical evidence to reject it in favor of the alternative hypothesis. The p-value of the F-stat is 0.4089 which is higher than the 0.01, 0.05 and 0.1 significance levels thus we find

no evidence for the presence of autocorrelation within our model. The Obs R-squared gives further evidence of the absence of autocorrelation since the p-value is also greater than the significance levels.

4.3.3. Multicollinearity

Table 9: Correlation Matrix

	AGEMPL	AGRWTH	GCF	INFLN
AGEMPL	1.000000			
AGRWTH	-0.079446	1.000000		
GCF	-0.503562	0.400472	1.000000	
INFLN	0.324354	0.089741	0.000184	1.000000

Source: Eviews 7

H_0: There is no multicollinearity

H_1: There is multicollinearity

Decision rule: Accept H_0 if correlation value is less than or equal to 0.8 or 80%

: Reject H_0 if correlation value is greater than 0.8 or 80%

The correlation matrix shows the correlation between the independent variables. The decision rule states that we accept that there is correlation between variables if the value is greater than or equal to 0.8. From our table, no value exists between any two variables which leads us to accept the null hypothesis that there is no multicollinearity in our model.

4.3.4. Normality

H_0: Residuals are normally distributed

H_1: Residuals are not normally distributed

Decision rule: Accept H_0 if p-value is greater than the given significance level

: Reject H_0 if p-value is less than the given significance level

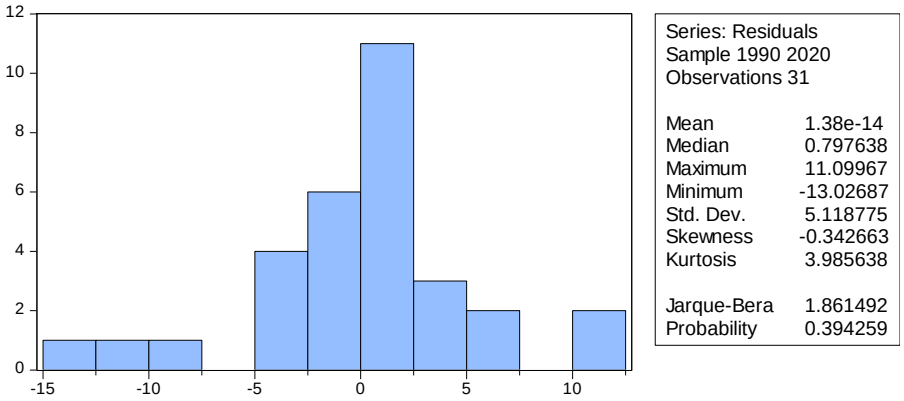


Figure 4.1: Normality Test
Source: Eviews 7

The model has a Jarque-Bera statistic of 1.861492. The p-value is 0.394259 which is not statistically significant to reject the null hypothesis of a normal distribution in our residuals. We thus conclude on all 3 significance levels (1%, 5% and 10%) that our residuals are normally distributed.

4.4. Ordinary Least Squared Method

4.4.1. Table 10: Regression Model

Dependent Variable: GDPGRWTH

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-98.2076	31.9072	-3.077909	0.0049
AGEMPL	1.430841	0.47824	2.991863	0.006
AGRWTH	0.335952	0.07599	4.420805	0.0002
GCF	0.66834	0.21136	3.162123	0.004
INFLN	-0.02616	0.0091	-2.875192	0.008

R-squared	0.665254
Adjusted R-squared	0.613755
F-statistic	12.91771
Prob(F-statistic)	0.000006
Durbin-Watson stat	1.57543

Source: Eviews 7

4.4.2. R^2 and Adjusted R^2

According to Gujarati (2005), the fitness of a model is given by the value of the R^2 which should be at least 0.5. The R^2 shows how much of the variations in the independent variables

explain the variations in the dependent variables. The value of the R^2 the estimated model is 0.665254 meaning about 67% of the changes in economic growth are endogenously determined whilst 33% are exogenously determined. In the same sense, the adjusted R^2 which differs slightly from the R^2 because it takes into account the number of independent variables, has a value of 0.613755 which means 61% of the changes in economic growth are accounted for by factors within the model whereas 39% of the changes are determined outside the model. Since the usefulness and fitness of the model is determined from a value of 0.5, the model is fit. This is because it recorded a positive relationship of 0.665254.

4.4.3. F-statistic

The specification of the model is shown to be correct by the F-statistic p-value of 0.000006. The null hypothesis of not correctly specified is rejected at all significance levels. Thus we accept the alternative hypothesis of correct specification at 0.01, 0.05 and 0.1 levels of significance.

4.5. Stability Tests

4.5.1. Ramsey RESET Test

H_0: The model has no omitted variables

H_1: The model has omitted variables

Decision rule: Accept H_0 if p-value is greater than the given significance level

: Reject H_0 if p-value is less than the given significance level

Table 11:

Ramsey RESET Test			
	Value	df	Probability
t-statistic	1.155145883	25	0.258952531
F-statistic	1.334362012	(1, 25)	0.258952531
Likelihood ratio	1.611962859	1	0.204216104

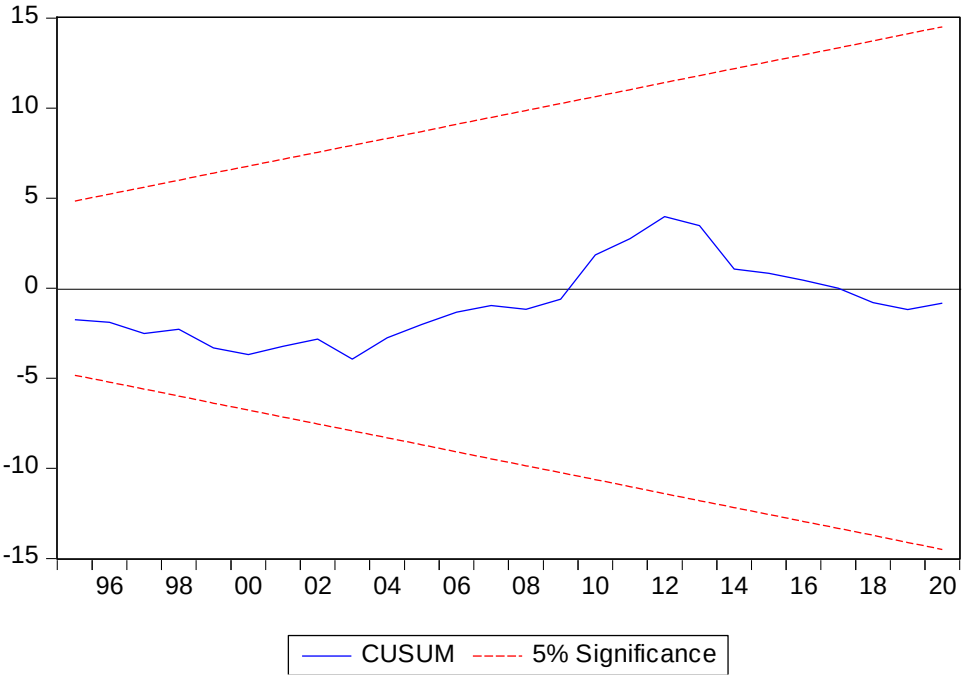
Source: Eviews 7

The tables above show the results from the Ramsey RESET test, which is a test to detect whether there are misspecifications in the general functional form of a regression model (Ramsey, 1969). The RESET stands for Regression Equation Specification Error Test. The test identifies whether non-linear combinations of the fitted values can help in the explanation of the response variable.

The results show p-values for t-statistic, F-statistic and Likelihood ratio to be 0.25895, 0.25895 and 0.20422 respectively. These are not statistically significant as they are greater that our significance levels of 1%, 5% and 10%. Thus given these results, the researcher concluded to accept the null hypothesis of no omitted variables and rejected the alternative hypothesis at the given significance levels. Thus our model was correctly specified.

4.5.2. CUSUM Test

The test assesses the stability of parameters in a multiple linear regression model of the form $\boldsymbol{Y = X\beta + \varepsilon}$. The assumption when fitting a time series regression model is that the coefficients are stable over time. The CUSUM test thus tests for this assumption. It's bases its results on whether there are abrupt changes in the time series, changes that the model may have failed to predict.



Source: Eviews 7

The above graph, shows the results from the regression model's CUSUM test. Since the CUSUM is bound in the 5% significance level boundaries, we can conclude that there are no structural breaks in the time series. The CUSUM is also close to the black line which resembles the long run therefore the model can be used for forecasting purposes.

4.6. Interpretation and Discussion of Results

4.6.1. AGEMPL

The estimated regression model showed that employment in agriculture (AGEMPL) test statistic has a probability value of 0.0060. This means that AGEMPL is statistically significant at 1%, 5% and 10% significance levels, in the model. The positive coefficient with a value of 1.430841 shows that there is a positive relationship between employment in agriculture and GDP growth thus meaning an increase agricultural employment by 1% causes an increase in economic growth by a value of 1.43%.

4.6.2. AGRWTH

Agriculture, forestry and fishing (annual % growth) (AGRWTH) is statistically significant at 0.01, 0.05 and 0.1 levels of significance. This is shown by the probability value of 0.0002. A positive coefficient of 0.335952 shows that there is a positive relationship between agriculture, forestry and fishing (annual % growth) proxy of agricultural production and GDP growth proxy of economic growth. From the results, an increase in agriculture annual growth by 1% causes an increase in economic growth of 0.34%. This stems from the fact that agricultural production plays a crucial role in the early stages of development, by supplying role materials to the industrial sector which further promotes growth. The result was consistent with the objective of the study as this was the variable of interest that necessitated the conduction of the research and also, was consistent with the results of Mapfumo (2011), Matandare (2018), Saungweme and Matandare (2014).

4.6.3. GCF

GCF was estimated to be statistically significant at the 1%, 5% and 10% level of significance with a p-value of 0.0040. There was a positive relationship between GCF and GDPGRWTH showing that an increase in the share of gross capital formation in GDP by 1% results in an increase in economic growth by 0.66834%, ceteris paribus.

4.6.4. INFLN

INFLN has a negative coefficient of -0.026159 which signifies a negative relationship between INFLN and GDPGRWTH. The coefficient is statistically significant at all the 3 significance levels (1%, 5% and 10%) shown by a probability value of 0.0080. Inflation (INFLN) is a

macroeconomic problem that has affected Zimbabwe. The negative coefficient shows that a 1% increase in inflation causes economic growth to fall by -0.03%.

On overall, all the independent variables in the model were statistically significant and explained the model in a good way as evidenced by their respective probability values.

Theoretical model

$$\mathbf{GDPGRWTH = \beta_0 + \beta_1 INFLN + \beta_2 AGRWTH + \beta_3 GFC + \beta_4 AGEMPL + u}$$

Estimated model (with coefficients)

$$\mathbf{GDPGWTH = -98.2076 - 0.02616 INFLN + 0.335952 AGRWTH + 0.6683 GCF + 1.430841 AGEMPL + u}$$

4.7. Summary

The results from the regressed model showed that on overall, all the independent variables in the model were statistically significant and explained the model in a good way as evidenced by their respective probability values. All the variables were significant at 1%, 5% and 10% significance. The results, conclusively show that agriculture production and employment in agriculture has an impact on the economic growth of an economy. They further showed that the two variables both have a positive relationship with economic growth signifying that a unit increase in each of them causes an increase in economic growth. However, the R^2 showed that some of the variations in GDP growth are explained in the error term which then prompts for further study, utilizing more variables in future to account for the remaining variation and to further inflate the R^2.

CHAPTER FIVE

SUMMARIES, CONCLUSIONS AND RECOMMENDATION

5.0. Introduction

The chapter gives a summary of the findings after the conduction of the research and concludes the research altogether. Recommendations are also provided based on the research findings. The chapter seeks to address the research objectives, tying them to the findings of the conducted research.

5.1. Summaries

The study objective was to determine the effect of agricultural production on the growth of the Zimbabwean economy. The study found that agricultural production was statistically significant showing that it has an effect on economic growth in Zimbabwe. The study findings, showed that the variable agricultural production explained the model in a good way. The significance of agricultural production on economic growth stems from the fact that Zimbabwe is an agro-based economy as well as from the fact that it is a developing country thus reliance on agriculture is imperative for growth according to Rostow's stages of development theory as well as according to Lewis (1954). A study by Mapfumo and Nhemachena (2019) concluded the same to say that there existed a bidirectional causal relationship between agricultural production and economic growth, stating that agriculture play a significant role in driving toward the growth of the economy.

The positive coefficient on agricultural production variables signifies a positive relationship between agricultural production and economic growth in Zimbabwe. This means that an increase in agricultural production leads to an increase in economic growth by the value of the agricultural production variable coefficient. This is in line with empirical evidence from previous studies by Chinook (2013) and Mupunga (2017) which concluded that agricultural production has a positive relationship with economic growth, thus an increase (decrease) in agricultural production according to Chinook is associated with an increase (decrease) in GDP. Whilst, Chinook found this relationship, Mupunga et al. (2017) found that agricultural research and development had a positive relationship to economic growth as it increases the relevance of the agricultural sector in the economy.

Agricultural employment, according to this study was found to have a significant impact on economic growth of Zimbabwe. The coefficient on the variables suggested a positive relationship between agricultural employment and economic growth. The importance of agricultural employment in Zimbabwe has been validated by the International Food Policy Research Institute (IFPRI) (2017), stating that increase in agricultural productivity as a result of employment in agriculture is significant to the reduction of poverty and increasing food security in Zimbabwe. The International Labor Organization (ILO) (2017), found that agricultural employment can have spillover effects on other sectors such that it then stimulates growth indirect. Investment in the agricultural sector was found to have an effect in the economy, through increases in agricultural sector employment that leads to increased demand for goods and services by other sectors (ILO, 2017). The significance and positive relationship of the agricultural employment in Zimbabwe results from the fact that agriculture is a much understood activity as the history of the country can attest to. Also the assistance by institutions like AgriBank which avails loans to those individuals with potential in the agricultural business. African Development Bank (AfDB), suggested that developments and investments in the agricultural machinery and inputs can support the productivity of the agricultural sector, leading to increased yields, more food security and increase the incomes of those in the agricultural sector.

5.2. Conclusions

Agricultural production has an effect on the growth prospects of the Zimbabwean economy as supported by the results from the study. They showed that there is a significant impact of the agricultural sector on economic growth even without ascertaining the nature of the impact, whether its negative or positive. As mentioned prior, from the early days, the country's people has always been involved in agriculture and it has always been the cornerstone to the development of society and the economy as a whole. The results imply that agricultural production should be increased in order to increase economic growth sustainably.

The relationship that exists between agricultural production and economic growth in Zimbabwe has been validated by several researchers as well as the data presented in chapter one that shows the upward trend for both agricultural output and national output signifying the positive relationship between the variables. Based on that, and the results from the conducted research, there is definite indisputable evidence of a positive relationship between the variables.

The agricultural sector has played a crucial role in employment as according to FAO (2018) it counted for 60% of the Zimbabwean workforce. The reliance on agricultural production in Zimbabwe has led to the majority of the population, specifically those residing in rural areas to venture into the agricultural sector and it has now become the source of livelihood. The positive linkages between agricultural production and employment in agriculture suggest that economic growth can be realized by increasing agricultural employment which in turn, ceteris paribus, leads to increased agricultural productivity, which empirically, and theoretically leads to economic growth.

5.3. Recommendations

- Based on the contribution of agriculture to the growth of the Zimbabwean economy, it is recommended that the government expenditure on the agricultural sector be increased to purchase advanced farm machinery and tools as well as facilitate the development of agricultural infrastructure. This development process would attract investment which would lead to further economic growth, a contribution made by the investment in the agricultural sector.
- The implementation of agricultural policies should be monitored and transparency and accountability be catered for. Failure in some policy implementation has been attributed to the poor policy enforcements hence the tightening of such pillars of governance can ensure that corruption tendencies are prevented.
- Economic growth can be increased by boosting agricultural production by amending the loopholes in the land legislation so that unutilized agricultural land is distributed among those willing and able to engage in agricultural production. This can be further supported by provision of adequate credit facilities for farmers at rates that are reasonable and with collateral that is in support of those marginalized and small farmers.
- Effects of growing climate change on the weather pattern, can be countered by engaging and utilizing smart agricultural techniques especially in those areas that receive less rainfall or are prone to droughts and the devastating effects of the changing weather patterns.
- Research and Development facilities must be established in order to enable research into plant breeding and hybrid seeds that adapt to the harshest of conditions, weathers, diseases and pests. Also variety of crops can be such that they adapt to the soils types in the different farming regions of the country.

5.4. Conclusion

This chapter looked at the summaries, utilizing the results from the previous chapter. The research concluded that the variable, agriculture production and employment in agriculture are both significant and have positive relationships with economic growth. Thus the conclusion from the research and the recommendation in general is that the government ought to promote the agricultural sector development as according to the theories and empirical evidence, agricultural production is a necessary drive to economic growth.

6.0 References

Ahungwa, G., Haruna, U. and Abdsalam, Y.R., (2012). *"Trend analysis of the contribution of agriculture to gross domestic product (1960-2012)"*. Journal of Agricultural and Veterinary Science, 7(1), 50-55.

Awokuse, O. T. (2009). *"Does Agriculture Really Matters for Economic Growth in Developing Countries?"* Department of Food & Resource Economics University of Delaware Newark, DE 19717, USA.

Bafana, B., (2011). *"The New Agriculturist".* Online. Available http://www.new/ag.info/en/country/profilephp?a=2073

Bryman, A., (2003). *"Research Methods and Organization Studies".* Loughborough University, Loughborough.

Chebbi, H.E., (2010). "*Agriculture and economic growth in Tunisia"*. China Agricultural Economic Review, 2(1), 63-78.

Chitiga, M., and Mabugu, R. (2012). *"The impact of agriculture on the Zimbabwean economy: A GCE modeling approach."* Journal of African Economics, 21 (5), 754-787.

Creswell, J.W., (2003). *"Research Design: Qualitative, Quantitative, and mixed methods approaches (2nd ed).* Thousand Oaks, CA: Sage.

David, R.H., (2014). Agriculture: Definition and Overview, available online from DOI: 10.1007/978-1-4419-0465-2 64

Dim, C. and Ezenekwe, U., (2013). *"Does agriculture matter for economic development? Empirical evidence from Nigeria"*. Journal of Finance and Economics, 1(1), 61-77.

Ebere, C. K., (2014). *"Disaggregated government spending on infrastructure and poverty reduction in Nigeria"*. Global Journal of Human-Social Science Research, 14(5), 1118-1124.

FAO (Food and Agriculture Organization). 2020. Zimbabwe at glance. Online. Available at http://www.fao.org/zimbabwe/fao-in-zimbabwe/zimbabwe-at-a-glance/en

Frisch, H., (1984). *"Inflation: definition and measurement," in Theories of Inflation*. Cambridge: Cambridge University Press (Cambridge Surveys of Economic Literature), pp. 9–19. doi: 10.1017/CBO9780511664588.003.

Gardner, B.L., (2005). *"Causes of rural economic development"*. Agricultural Economics, 32(S1), 21-41.

Gujarati N. D., (2004). *"Basic Econometrics".* New Delhi, Tata McGraw-Hill publishing 4th Edition

Gujarati, D.N., (2003). *"Basic econometrics (Fourth Edition)"*. New York: McGraw-Hill Inc.

Izuchukwu J, (2011). *"The role of Agriculture in Nigeria."*

Izuchukwu, O., (2011). *"Analysis of the contribution of agricultural sector on the Nigerian economic development"*. World Review of Business Research, 1(1), 191-200.

Jatuporn, C., Chien, L.H., Sukprasert, P. and Thaipakdee, S., (2011). *"Does a long-run relationship exist between agriculture and economic growth in Thailand?"* International Journal of Economics and Finance, 3(3), 227-233.

Johnston, B. and Mellor, J., (1961). *"The role of agriculture in economic development"*. American Economic Review, 51(4): 556-593

Katircioglu, S.T., (2006). *"Causality between agriculture and economic growth in a small nation under political isolation6".* International Journal of Social Economics.

Kuznet, S., (1963). *"Quantitative Aspects of the Economic Growth of Nations VII".* Distribution and Income by Size, Economic Development and Cultural Change,11(2):1-80

Kuznets, S., (1966). *"Modern Economic Growth: Findings and Reflections".* America Economic Review 63(3); 230-58

Lavorel, S., Storkey, J., Bardgett, R. D., Bello, F., Berg, M. P., Roux, X. and Harrington, R. (2013). *"A novel framework for linking functional diversity of plants with other trophic levels for the quantification of ecosystem services"*. Journal of Vegetation Science, 24(5), 942-948.

Lewis, W.A., (1954). *"Economic Development with Unlimited Supplies of Labor."* The Manchester School.

Lipsey, R. and Crystal, A. (1999). "*Principles of Economics"*. Oxford University

Lipton, M., (2012). *"Learning from others: increasing agricultural productivity for human development in Sub-Saharan".* United Nations Development Program: Regional Bureau for Africa.

Maiyaki, A.A. (2010). *"Zimbabwe's agricultural industry"*. African Journal of Business Management, 4(19), pp.4159-4166

MAMID. (2013). *"Zimbabwe Agriculture Investment Plan (ZAIP): 2013-2017, a comprehensive framework for the development of Zimbabwe's agriculture sector."* Ministry of Agriculture, Mechanization and Irrigation Development, Harare. Zimbabwe

Mapfumo, P., and Nhemachena, C. (2019). *"The causal relationship between agriculture and economic growth in Zimbabwe: A VAR analysis."* Cogent Economics and Finance, 7 (1), 1601010.

Markusen, J. (2005). *Modelling the offshoring of white collar services: From comparative Advantage to the new theories of trade and FDI*. [Online].

Matahir, H., (2012). *"The empirical investigation of the nexus between agricultural and industrial sectors in Malaysia"*. International Journal of Business and Social Science, 3(8), 225-230.

Matandare, M.A., (2018). *"Agriculture expenditure and economic growth in Zimbabwe during the pre-economic meltdown period: cointegration and error correction models*." Prestige International Journal of Management & IT-Sanchayan, 7(2), pp.83-97.

Merriam-Webster. (n.d.). Inflation. In Merriam-Webster.com dictionary. Retrieved May 12, 2023, from https://www.merriam-webster.com/dictionary/inflation

Miles, D.A. and Scott, L. (2017). *"Workshop: Confessions of a Dissertation Chair Part 1: The Six Mistakes Doctoral Student Make with The Dissertation"*, Presented at the 5th Annual 2017 Black Doctoral Network Conference in Atlanta, GA on October 26-29 2017.

Ministry of Agriculture and Cooperatives. (2002). *"Development in Fertilizer, Government programs and Smallholder farmers".* Agricultural Consultative Forum Food Security Research group.

Moussa, A., (2018). *"Does agricultural sector contribute to the economic growth in case of republic of Benin."* Journal of Social Economics Research, *5*(2), pp.85-93.

Moyo. S., (2011). *"Three decades of agrarian reform in Zimbabwe".* Journal of Peasant Studies, Vol 38: pp 493−531

Mupunga, O., Masuka, R., and Kamuti, M. (2017). *"Agricultural Research and Development, productivity, and economic growth in Zimbabwe"*. Agrekon, 56 (3), 303-315.

Mushamba. S., (2002). *"Case study on prospects for finance, credit and investment for urban and periurban agriculture in Zimbabwe."* FAO.

Myrdal. G., (1984). *"International inequality and foreign aid in retrospect".* Pioneers in development, 151-165.

Ndlela, D. and Robinson, P. (2007). *"Distortions to Agricultural Incentives in Zimbabwe"*, Agricultural Distortions Working Paper 39, December 2007

Newitt. M.D.D., (2007). Zimbabwe. Microsoft Student [DVD]. Redmond WA, Microsoft Corporation

Newitt. M.D.D., (2007). Zimbabwe. Microsoft Student [DVD]. Redmond WA, Microsoft Corporation

Odetola, T. and Etumnu, C., (2013). *"Contribution of agriculture to economic growth in Nigeria."* The 18th.

Oluwatoyese, O.P. and Applanaidu, S.D., (2013). *"Effect of agricultural, manufacturing and service sector performance in Nigeria, 1980-2011"*. Journal of Economics and Sustainable Development, 4, 35-41.

Oluwatoyese, O.P., (2013). *"Effect of agricultural, manufacturing and services sectors performance in Nigeria, 1980-2011"*. Journal of Economics and Sustainable Development, 4(20), 35-41.

Oxford English Dictionary. (1971). "The Oxford English Dictionary, Oxford University Press, Oxford, UK.

Raza, S.A., Ali, Y. and Mehboob, F., (2012). *"Role of agriculture in economic growth of Pakistan."*

Rostow, W., (1960*). "The stages of economic growth: a non-communist manifesto"*. London: Cambridge University Press. Rosenwag

Schultz, T.W., (1964). *"Transforming Traditional Agriculture"*. New Haven: Yale University Press.

Sekeran, U., (2000). *"Research Methods for Business".* John Wiley and Sons, New York.

Sertoglu, K., Ugural, S. and Bekun, F.V., (2017). *"The contribution of agricultural sector on economic growth of Nigeria."* International Journal of Economics and Financial Issues, 7(1).

Sithole. S. Z., (2006). *"Ministry of Lands, Agriculture and Rural Resettlement"*, Harare. Plant Protection Institute, Zimbabwe.

Terrelle, S., (2016). *"Writing a Proposal for your Dissertation: Guidelines and Examples",* New York, NY: The Guiliford Press.

Todaro, M.P. and Smith, S.C. (2015). *"Economic Development".* 12th ed, Pearson Education Limited, Edinburg Gate, Harlow CM20 2JE, United Kingdom.

United Nations Development Programme., (2012). *"Towards a Food Secure Future".* Africa Human Development Report 2012. New York.

Williams, C., (2007). *"Research Methods"*. Journal of Business and Economic Research, 5, 65-72.

World Bank. 2020. The World Bank in Zimbabwe. Online. Available: https://www.worldbank.org/en/country/zimbabwe/overview.

Xuezhen, W., Shilei, W. and Feng, G., (2010). *"The relationship between economic growth and agricultural growth: The case of China".* In 2010 International Conference on E-Business and E-Government (pp. 5315-5318). IEEE.

Yao, S., (2000). *"How important is agriculture in China's economic growth?"* Oxford Development Studies, 28(1), pp.33-49.

Appendix I: Data

Data collected from World Bank

YEAR	GDPGRWTH	INFLN	AGRWTH	GCF	AGEMPL
1990	6.988552933	-0.920431	12.1350644	17.37694276	60.78600044
1991	5.531782374	-6.7773	1.035132961	19.10339983	61.43000031
1992	-9.015570075	-14.129658	-23.19156028	20.2372647	61.47000122
1993	1.051458647	-3.7911222	27.12207679	22.77488758	61.40000153
1994	9.235198825	-3.8956726	7.313199778	23.72905557	61.08000183
1995	0.158025687	3.0385383	-7.585188342	19.66018675	60.91999817
1996	10.36069677	8.9843833	19.8140402	18.54193988	60.52000046
1997	2.680594179	-2.8790481	3.211132089	18.13390253	60.31000137
1998	2.885211796	-27.048649	5.081670729	20.75046077	60.08000183
1999	-0.817821033	8.0068133	4.463269879	14.39628046	60.02999878
2000	-3.059189749	0.6279	2.000000024	13.56942382	60.61999893
2001	1.439615396	-0.1308902	14.00000053	10.26647344	61
2002	-8.894023631	2.7129503	-24.00000099	5.00	61.90000153
2003	-16.99507473	8.8012756	-14.99999808	7.999999232	62.95000076
2004	-5.807538023	7.6115243	-9.000000546	4.509114857	63.66999817
2005	-5.711083707	5.1366011	-5.00000309	1.525176678	64.51000214
2006	-3.461495188	-2.0176787	-3.999999774	1.571161391	64.72000122
2007	-3.653326835	0.8948868	-6.999996052	7.109753359	65.55000305
2008	-17.66894633	1.3492225	-39.29999915	5.127906253	66.5
2009	12.01955997	95.408659	22.00893475	12.7468017	66.06999969
2010	21.45206092	2.5755362	6.875226362	18.76330094	65.54000092
2011	14.62020726	2.1717613	1.386036835	17.39776602	65.86000061
2012	15.74487708	4.8559453	7.815401483	9.856976905	65.98999786
2013	3.196730887	8.0911403	-2.726827796	9.209479121	66.76999664
2014	1.484542622	0.6249747	22.97398709	9.639223964	67.23999786
2015	2.023649996	0.3674195	-5.256534716	10.03564041	67.05999756
2016	0.900955396	2.0140945	-3.895121467	9.86137061	66.87999725
2017	4.080263903	3.0569052	10.03536078	9.700147348	66.48000336
2018	5.009866783	200.76958	18.40694047	14.14830624	66.01999664
2019	-6.332446407	225.39465	-10.40282547	13.79935177	66.19000244
2020	-7.816950647	604.94586	4.14989161	13.14608116	66.4988878

Appendix II: Descriptive Statistics

	GDPGRWTH	AGEMPL	AGRWTH	GCF	INFLN
Mean	1.020335	63.74338	1.079655	12.89315	36.64033
Median	1.439615	64.51000	2.000000	13.14608	2.171761
Maximum	21.45206	67.24000	27.12208	23.72906	604.9459
Minimum	-17.66895	60.03000	-39.30000	1.525177	-27.04865
Std. Dev.	8.847251	2.643064	14.60534	6.137469	119.1660
Skewness	0.049815	-0.116273	-0.547714	-0.089751	3.873057
Kurtosis	3.069116	1.298217	3.527085	2.072572	18.17053
Jarque-Bera	0.018992	3.810601	1.908799	1.152611	374.7733
Probability	0.990549	0.148778	0.385043	0.561971	0.000000
Sum	31.63039	1976.045	33.46931	399.6878	1135.850
Sum Sq. Dev.	2348.216	209.5735	6399.482	1130.056	426016.1
Observations	31	31	31	31	31

Appendix III: Unit Root Tests

Test for AGEMPL at Level

Null Hypothesis: AGEMPL has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.692288	0.8334
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

Test for AGEMPL at 1st Difference

Null Hypothesis: D(AGEMPL) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.940227	0.0530
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

Test for AGEMPL at 2nd Difference

Null Hypothesis: D(AGEMPL,2) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.053993	0.0000
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

Test for AGRWTH at Level

Null Hypothesis: AGRWTH has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.223240	0.0000
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

Test for GCF at Level

Null Hypothesis: GCF has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.641970	0.4495
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

Test for GCF at 1st Difference

Null Hypothesis: D(GCF) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.876472	0.0005
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

Test for GDPGRWTH at Level

Null Hypothesis: GDPGRWTH has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.168193	0.0321
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

Test for INFLN at Level

Null Hypothesis: INFLN has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		5.582795	1.0000
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

Test for INFLN at 1st Difference

Null Hypothesis: D(INFLN) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.901679	0.9940
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

Test for INFLN at 2nd Difference

Null Hypothesis: D(INFLN,2) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.46144	0.0000
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

Appendix IV: Correlation Matrix

	AGEMPL	AGRWTH	GCF	INFLN
AGEMPL	1.000000	-0.079446	-0.503562	0.324354
AGRWTH	-0.079446	1.000000	0.400472	0.089741
GCF	-0.503562	0.400472	1.000000	0.000184
INFLN	0.324354	0.089741	0.000184	1.000000

Appendix V: Heteroscedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey

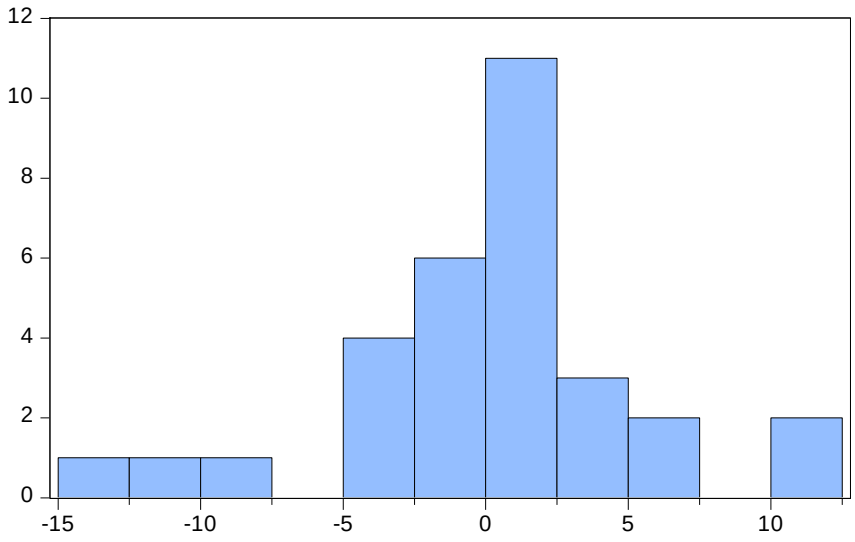
F-statistic	1.500669	Prob. F(4,26)	0.2310
Obs*R-squared	5.814607	Prob. Chi-Square(4)	0.2134
Scaled explained SS	6.105917	Prob. Chi-Square(4)	0.1914

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 05/22/23 Time: 23:36
Sample: 1990 2020
Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-385.4868	250.2345	-1.540502	0.1355
AGEMPL	6.123785	3.750659	1.632722	0.1146
AGRWTH	0.660344	0.595983	1.107991	0.2780
GCF	1.845489	1.657589	1.113358	0.2757
INFLN	-0.109565	0.071352	-1.535550	0.1367

R-squared	0.187568	Mean dependent var	25.35664
Adjusted R-squared	0.062578	S.D. dependent var	44.53798
S.E. of regression	43.12191	Akaike info criterion	10.51263
Sum squared resid	48346.97	Schwarz criterion	10.74392
Log likelihood	-157.9458	Hannan-Quinn criter.	10.58802
F-statistic	1.500669	Durbin-Watson stat	2.205637
Prob(F-statistic)	0.230986		

Appendix VI: Normality Test



Series: Residuals	
Sample 1990 2020	
Observations 31	
Mean	1.54e-14
Median	0.797638
Maximum	11.09967
Minimum	-13.02687
Std. Dev.	5.118775
Skewness	-0.342663
Kurtosis	3.985638
Jarque-Bera	1.861492
Probability	0.394259

Appendix VII: Ramsey RESET Test

Ramsey RESET Test
Equation: UNTITLED
Specification: GDPGRWTH C AGEMPL AGRWTH GCF INFLN
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	1.155146	25	0.2590
F-statistic	1.334362	(1, 25)	0.2590
Likelihood ratio	1.611963	1	0.2042

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	39.82945	1	39.82945
Restricted SSR	786.0558	26	30.23292
Unrestricted SSR	746.2264	25	29.84906
Unrestricted SSR	746.2264	25	29.84906

LR test summary:

	Value	df
Restricted LogL	-94.09922	26
Unrestricted LogL	-93.29324	25

Unrestricted Test Equation:
Dependent Variable: GDPGRWTH
Method: Least Squares
Date: 05/22/23 Time: 23:38
Sample: 1990 2020
Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-101.3521	31.82069	-3.185101	0.0039
AGEMPL	1.497421	0.478681	3.128222	0.0044
AGRWTH	0.336609	0.075512	4.457708	0.0002
GCF	0.662726	0.210068	3.154815	0.0042
INFLN	-0.026182	0.009040	-2.896220	0.0077
FITTED^2	-0.019967	0.017285	-1.155146	0.2590

R-squared	0.682216	Mean dependent var	1.020335
Adjusted R-squared	0.618659	S.D. dependent var	8.847251
S.E. of regression	5.463429	Akaike info criterion	6.406016
Sum squared resid	746.2264	Schwarz criterion	6.683562
Log likelihood	-93.29324	Hannan-Quinn criter.	6.496489
F-statistic	10.73394	Durbin-Watson stat	1.572268
Prob(F-statistic)	0.000014		

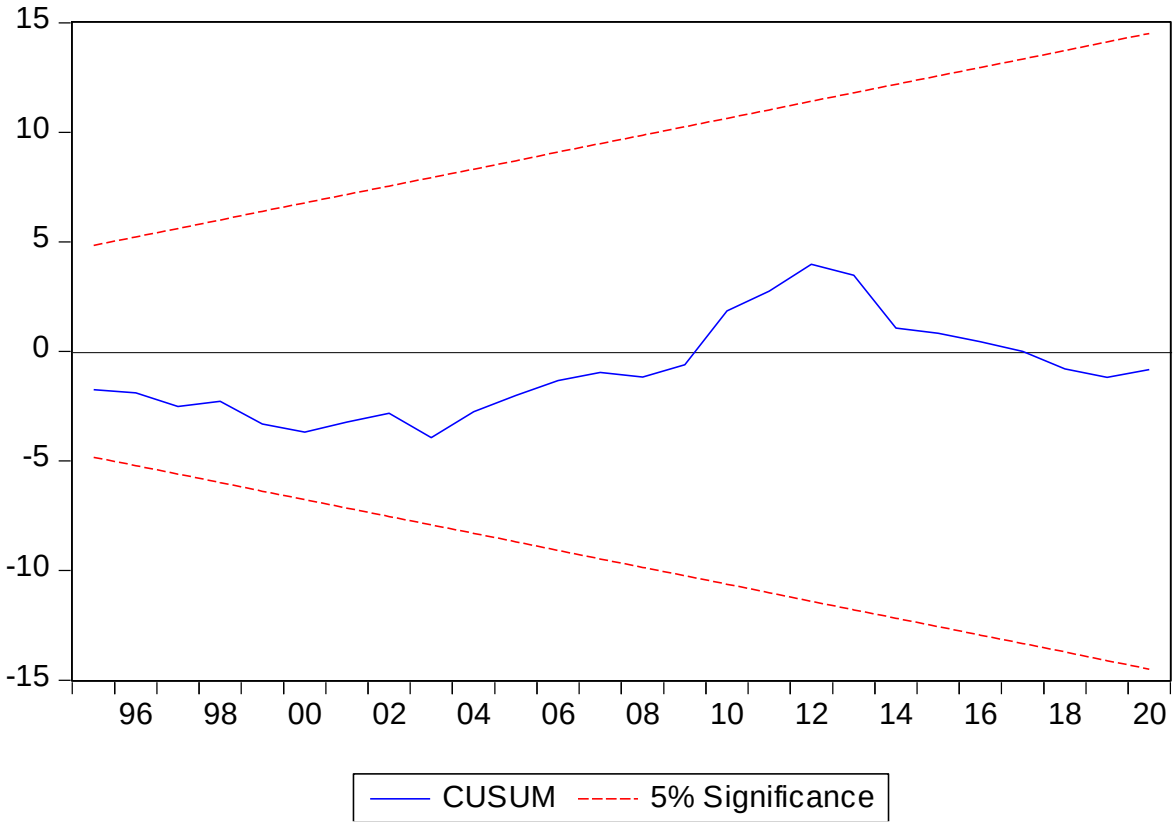
Appendix VIII: Regression Model

Dependent Variable: GDPGRWTH
Method: Least Squares
Date: 05/21/23 Time: 00:48
Sample: 1990 2020
Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-98.20758	31.90724	-3.077909	0.0049
AGEMPL	1.430841	0.478244	2.991863	0.0060
AGRWTH	0.335952	0.075993	4.420805	0.0002
GCF	0.668340	0.211358	3.162123	0.0040
INFLN	-0.026159	0.009098	-2.875192	0.0080

R-squared	0.665254	Mean dependent var	1.020335
Adjusted R-squared	0.613755	S.D. dependent var	8.847251
S.E. of regression	5.498447	Akaike info criterion	6.393498
Sum squared resid	786.0558	Schwarz criterion	6.624787
Log likelihood	-94.09922	Hannan-Quinn criter.	6.468893
F-statistic	12.91771	Durbin-Watson stat	1.575433
Prob(F-statistic)	0.000006		

Appendix IX: CUSUM Test



Appendix X: Autocorrelation Test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.928582	Prob. F(2,24)	0.4089
Obs*R-squared	2.226544	Prob. Chi-Square(2)	0.3285

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 05/22/23 Time: 23:39
Sample: 1990 2020
Included observations: 31
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.064390	32.19094	0.064130	0.9494
AGEMPL	-0.025963	0.483127	-0.053739	0.9576
AGRWTH	0.025497	0.079026	0.322635	0.7498
GCF	-0.034533	0.214388	-0.161079	0.8734
INFLN	0.000699	0.009344	0.074762	0.9410
RESID(-1)	0.255311	0.206597	1.235791	0.2285
RESID(-2)	-0.174750	0.211695	-0.825480	0.4172

R-squared	0.071824	Mean dependent var	1.38E-14
Adjusted R-squared	-0.160220	S.D. dependent var	5.118775
S.E. of regression	5.513613	Akaike info criterion	6.447997
Sum squared resid	729.5982	Schwarz criterion	6.771800
Log likelihood	-92.94395	Hannan-Quinn criter.	6.553549
F-statistic	0.309527	Durbin-Watson stat	2.080226
Prob(F-statistic)	0.925745		