# THE IMPACT OF AGRICULTURAL OUTPUT ON ECONOMIC GROWTH IN SOMALIA

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**A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF ECONOMICS AND DEVELOPMENT STUDIES IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF ARTS IN ECONOMICS OF THE UNIVERSITY OF NAIROBI**

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## DECLARATION

This project is my original work and has not been presented for a degree in any other University.

-------------------------------------------- 07/11/2022

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Signature Date

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This project was submitted for examination with my approval as University Supervisor.

-------------------------------------------- 07/11/2022

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Signature Date

**Dr. Fredrick Odhiambo Sule**

## DEDICATION

I dedicate this research project to my lovely parents for their constant encouragement and relentless prayers during the entire period of my education journey.

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**TABLE OF CONTENTS**

## LIST OF TABLES

# LIST OF FIGURES

## LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ADF | Augmented Dickey-Fuller Test |
| ARDL | Autoregressive Distributed Lag |
| CBN | Central Bank of Nigeria Countries |
| ECM | Error Correction Model |
| ECT | Error Correction Term |
| GDP | Gross Domestic Product |
| GDP | Growth Domestic Product |
| IFAD | International Fund for Agricultural Development |
| ILO | International Labor Organization |
| IMF | International Monetary Fund |
| LDCs | Least Developed Countries |
| OCHA | Office for the Coordination of Humanitarian Affairs\ |
| OLS | Ordinary Least Squares |
| RESET | Ramsey's regression equation specification error test |
| S-W | Shapiro-Wilk |
| SESRIC | Statistical, Economic and Social Research and Training Center for Islamic |
| SSA | Sub-Saharan Africa |
| UN FAO | The United Nations Food and Agricultural Organization |
| UN Stats | United Nations Statistics Division |
| UNDP | United Nations Development Programme |
| VEC | Vector Error Correction Model |
| VIF | Variance Inflation Factor |
| WB | The World Bank |
| WDI | Development Data Indicators |

**ABSTRACT**

This research analyzed how growth in Somalia was shaped by agriculture using timeseries data over the years of 1970 to 2020. Agriculture holds Somalia's economy, and it serves as a catalyst for employment and income generation activities. The study established the relationship between GDP and agricultural output employing Autoregressive Distributed Lag (ARDL) estimation techniques, Johansen Cointegration approach, Error Correction Model (ECM), and Augmented Dickey-Fuller (ADF) Unit-root Test. The findings of the empirical analysis offer compelling support for the idea that agricultural output activities might serve as a growth engine for the economy. This research established that growth is shaped positively by gross capital formation, industry value added, service value added, and employment in agriculture. That is, for Somalia to grow, agriculture must expand. Stationary series test suggested stable series for agricultural employment while the other variables achieved a stationary series upon differencing once. Integration of order one was subsequently adopted. The adjustment parameter suggested that short-run deviations were getting smaller and smaller as one moved towards the long-run at a convergence speed of 19.6% per year. The findings suggested that growth significantly rises when production in agriculture rises. In the long-run, growth rises when agricultural output rises. Employment in agriculture too significantly increases growth at 5% significance level. When employment rises, output rises. The gross capital formation, value-added from industry, and value-added from the service sector increased growth. In the short-run, agricultural output and employment in agriculture have positive significant relationships with the GDP while gross capital formation and industry value added have positively contributed to GDP but statistically not significant. The service value added does not significantly impact growth. The adjustment parameter suggested that short-run deviations were getting smaller and smaller as one moved towards the long-run. In particular, the convergence was happening at the rate of 19.6% per year. The adjustment parameter was significant. This suggested that an equilibrium exists in the long-run. This research recommended heavy investment in agriculture and modernization of the sector. This research suggests the inclusion of other variables at the sectoral level in understanding growth drivers in Somalia as an area for future research.

# CHAPTER ONE: INTRODUCTION

## 1.1 Background of the Study

Agricultural production forms the economic bedrock, a powerful tool to end poverty and feed the rising global population in the year 2050 (WB, 2022). The majority of the poor who are actively working in agriculture reside in rural areas. The agricultural output comprises of changes in stocks, the output produced and further processed by agricultural producers, output sold, output for own final consumption, and intra-unit consumption of livestock feed products (OECD, 2021). Agriculture is a very critical sector as it provides daily means of living to the people. In developing countries, the share of agriculture in total employment constitutes 53 %, against an estimated 6 % in the developed countries in 2004 (Schure, Kooten, & Wang, 2007). Since agriculture makes connections between the agriculture sector and other economic sectors easier, its product is essential to the process of economic development. The agriculture sector helps generate income and employment in rural areas, provides food at reasonable and affordable prices in urban areas, and contributes to poverty alleviation in emerging markets. Agriculture as a sector cannot be ignored while its relevance remains evident around the world (Dethier & Effenberger, 2011). It has been widely discussed by scholars that agriculture remains to be a very important tool for realizing strategies for reducing poverty globally as it is the key sector influencing the economy of low-income countries. 60 percent of the economically active population of Sub-Saharan Africa work in the agriculture sector (Gerdien & Pim, 2007). According to Sadoulet & Alain (2010), agriculture remains to be the single crucial economic sector in Somalia interms of its contribution to national income (GDP) through job creation. In Africa, the majority of the food insecure and poor population are living far away from urban centers, and majorly relying on the agricultural production sector as their basic livelihood. The promotion of agricultural productivity and the economy of the rural areas in a technological way increases employment opportunities as well as agricultural production sustainability. This employment opportunity in the rural areas will reduce poverty sources and regional income disparities and, most importantly, decrease the influx of rural-urban migration (Anríquez & Stamoulis, 2007).

Somalia, for the last thirty years, had gone through armed conflict since 1991, when the central government collapsed. Somalia is considered one of the poverty-stricken countries in the world, and it has erratic and hot all-year-round weather, with irregular rainfall and periodic monsoon winds. About 40% of Somalia's population struggle under the claws of abject poverty, with rural poverty standing at 62% (IFAD, 2021). According to FOA (2012), only 1.6 percent of Somalia's total land is cultivated due to rampant insecurity, lack of functional economic infrastructure, and poor access to irrigation systems and agricultural extension services that have lessened the already low crop yields in the country.

Farm and farm-related production account for three-quarters of Somalia's output (WB & FAO, 2018). Livestock has dominated Somalia's economy and provides the greatest proportion of the country's foreign exchange rates. Agriculture-food production is a key income source and the second largest percentage after livestock that contribute to household welfare in Somalia. According to the joint report by the WB & FAO (2018), 46 percent of the employed people in Somalia are working in agriculture (crop cultivation sector employs 25 percent, 9 percent are involving in herding, 4 percent in the fishery sector, while 7 percent are employed in other agricultural related activities). Furthermore, the agriculture sector represents 93 percent of Somalia's total export (95 slightly down before the civil war) (FAO & WB, 2018). According to UN-FAO (1995), Somalia has a total of 637,540 $km^2$, of which 45% is ideal for rangelands for grazing livestock, 14% is covered in forest, while 30% is categorized as desert, which is unsuitable for agricultural development, and the remaining 11% is the nation's arable land. Around 50 percent of Somalia's population food needs are met through domestic production, but the sector continues to suffer a lack of investment, very limited access to agricultural finance, and a lack of in-country agriculture processing that would increase the value of the export (WB & FAO, 2018).

Prolonged periods of conflicts have rendered Somalia a fragile state while exposing the economy to vulnerability, food insecurity, chronic poverty, infrastructural underdevelopment, institutional dysfunction, and internal displacements. On top of that, agricultural production in Somalia faces numerous other challenges including cyclical droughts and floods, invasion of locust from late 2019 and throughout 2020, threatened the sustainability of pastoral resources and crop production in the entire country and the region as it continues agrarian community displacement, and economic instability in the most arable land in the country (FAO, 2021).

### 1.1.1 Trends of Agricultural Sector Performance on GDP

The agricultural sector has dominated Somalia's economy, and according to the employment survey of ILO (2014), the sector continues to be the leading employment sector. According to WB & FAO (2018), the agriculture share of Somalia's GDP rose 13points from 62% to 75% in the pre- and post-war period, respectively.

Agricultural productivity in Somalia progressed in the early years of the 1990s but declined or remained stagnant over the years due to different circumstances; insecurity and instability of the most arable land in the country, especially the riverine areas continues rain-fed reliance which has been affected by the climate change and global warming, and policy implications that have adversely affected the agricultural sector. As you can see in below figure 1, in Somalia, changes in GDP in the past seem to coincide with the fluctuations in agricultural output.

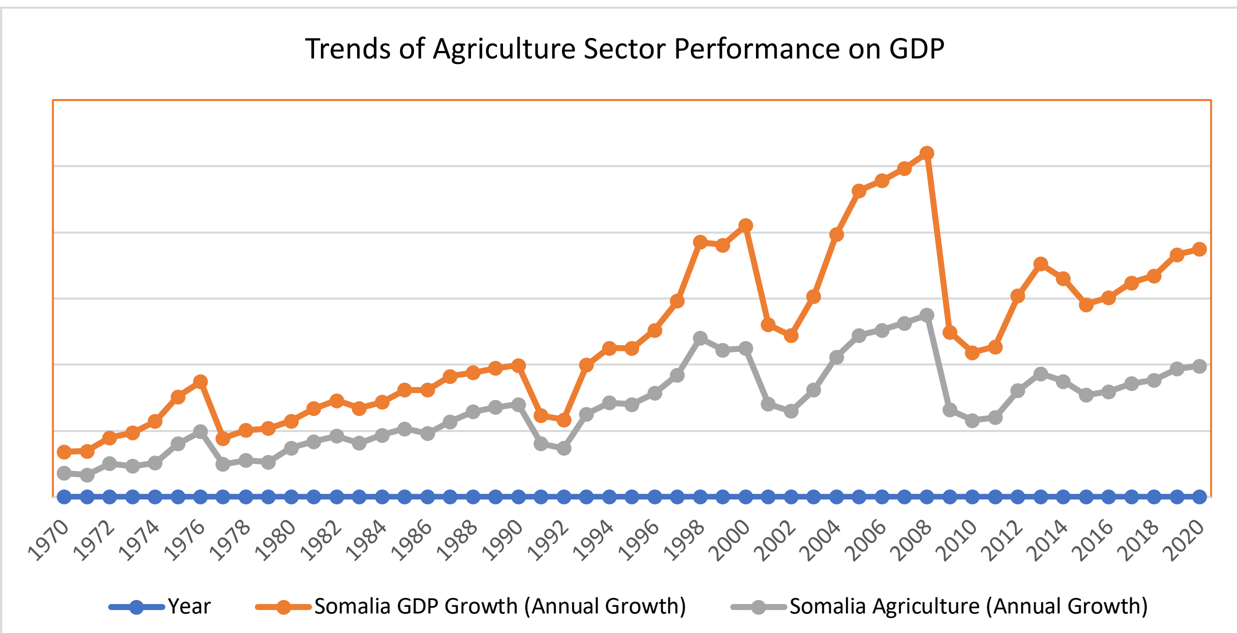


*Figure 1 Data Source: UN Stats*

No doubt that agriculture is the only performing sector that considerably contributes to Somalia's GDP and export (WB & FAO, 2018), but generally, the sector is experiencing both climate and policy-related challenges that need to be addressed effectively.

### 1.2 Statement of the Research Problem

According to (Treakle, 1991), between 1960 to 1969, Somalia was nearly self-sufficient in production food, where 12.5% (20 million acres) is considered suitable for cultivation. Similarly, WB & FAO (2018) observed that in the late 1980s, Somalia was almost self-sufficient in the production of cereals. However, the cereal output declined by 60% from its 1989 peak due to recurrent extreme cycles of drought, floods, and degraded natural environment compounded by the absence of agricultural extension services and research that make Somalia remain a chronic food crop deficit country. Since 2010, Somalia has experienced various failed rainfall seasons, and in 2017 about 3.1 million people became severely food insecure with 50% of the population needing external intervention (OCHA, 2017).

Agricultural production has already been reduced due to political instability, insecurity, lack of proper infrastructure, poor access to irrigations, and frequent climatic disturbances, which are threatening the food self-sufficiency of Somalia. As a result of the above challenges, only 1.6% out of the 20 million acres considered to be suitable for agricultural activities is cultivated (IFA, 2021). According to Warsame, et al. (2022) Political instability caused by armed insurgencies and conflicts sabotages agricultural development.

Production of livestock is commonplace in Somalia with livestock reared including: sheep, goats, cattle, and camels. The majority of the nation's foreign exchange revenues come from this sector. In terms of household food security, the second economic contributor is the agricultural food production sector (EU, 2010). Despite having a current food shortage, Somalia has the capacity to considerably improve food production and lessen its reliance on food imports. However, the sector experiences numerable challenges including security, lack of investment, limited technology, and technical skills, inefficient farming systems and poor water management.

Apart from these challenges faced by the sector, production of food and livestock are at the core of Somalia's economy. Against this backdrop, there is a need to investigate the agricultural productivity determinants in Somalia so that they can be well addressed by the relevant authorities by producing policies and initiatives that are a remedy to the sector problems since agriculture holds Somalia's economy. Therefore, this research analyzed the effects of agriculture on Somalia's growth between 1970 and 2020 in order to more clearly understand the causation effect.

### 1.3 Research Questions

The paper aims to give solutions to the following issues:

a) What is the relationship between agricultural output and economic growth in Somalia?
b) What is the short and long-run impact of agricultural output on economic growth in Somalia?
c) What are the suggested policy recommendations to improve the level of agricultural output and economic growth in Somalia?

### 1.4 Objectives

The main aim was understanding the impact of agricultural output on Somalia's growth in Somalia from 1970 to 2020. Specifically, the following were pursued:

a) To examine the relationship between agricultural output and economic growth in Somalia
b) To examine the short and long-run impact of agricultural output on economic growth in Somalia
c) To suggest some policy recommendations to improve the level of agricultural output and economic growth in Somalia.

### 1.5 Justification of the Research

Sub-Saharan African countries (SSA) have plenty of water resources, ample agricultural land, and a generally favorable climate for agricultural production, but shamefully many SSA's individuals remain hungry and malnourished because the SSA governments do not exploit the abundant agricultural resources and not fulfilling their basic responsibilities for protecting their citizens from hunger (UNDP, 2012). As one of the SSA countries, Somalia is an agricultural-dependent country making agriculture's share of the country's GDP to be 75% with 93% of exports being agricultural (FAO & WB, 2018). In Somalia, agricultural production plays a significant role in the economy since it provides employment opportunities, supplies nearly 50% of the country's food needs, and fosters income generation activities (IGAs) through food sales (Boitt, Langat, & Kipterer, 2018).

Therefore, there are no empirical investigations done regarding the correlation between agricultural output on Somalia's growth. This paper sheds light on whether there is the existence of causality from agricultural performance to economic growth or vice versa. Hence, this work aims to fill the knowledge gap by giving empirical knowledge of the immediate and enduring links between various variables. Furthermore, the paper focuses on adding contributions to the existing body of literature on this area to help other researchers facing comparable challenges in the agricultural output in Somalia and beyond.

Finally, the study results provided appropriate policy recommendations regarding the agricultural output and its share of economic growth in Somalia to the relevant public and private institutions.

### 1.6 Organization of the Research

Chapter one of the research provides a background, states the problem, and goals as well as this research's significance The second chapter dissects relevant literature while identifying the gaps. Approaches are captured in the methodology chapter. Thereafter, findings and discussions are covered in chapter four. Lastly, summary, conclusions, and actionable policies are covered in the fifth chapter.

# CHAPTER TWO: LITERATURE REVIEW

## 2.1 Introduction

This section summarizes relevant theories and previous research. It consists of three subsections; theoretical literature, empirical literature, and overview. The theoretical review digs into existing theories whereas empirical part delves into previous studies. Lastly, the overview summarizes both theoretical and empirical sections.

## 2.2 Theoretical Review

The influence of agricultural output on any country's economy is reflected by its contribution to economic growth. Many similar studies done in Sub-Saharan Africa and Asia have utilized distinct methods to show the correlation between agricultural output and economic growth.

### 2.2.1 Kuznets

Simon Kuznets' inverted U-shape curve theory can be linked to economic growth and income distribution. Disagreement, however, bedevils this model with regard to income inequality in Kuznets's (1955) inverted U-shape hypothesis. According to the theory, a nation will face relatively low but increasing income (wage) at the beginning of its development. This is due to the agricultural sector that is significantly lower productive than the industrial sector. Kuznets (1955) claimed that as an economy shifts focus from agriculture to industry, the distribution of incomes and economic development rise steadily, followed by a plateau phase, below eventually declining (Zhan, 2016). The theory of Kuznets (155) proposed the inverted-U relationship through (i) the declining agriculture's share in total output and (ii) the migration of works from low-income agriculture to high-income industry. In the 1970s, empirical studies on the Kuznets hypothesis were published by Ahluwalia (1976) and Paukert (1973). There was no proof of the Kuznets curve in later studies on the 1980s published by Fields & Jackubson (1994), Bruno, et al. (1996), Ram (1997), and Deininger and Squire (1998). According to Kuznet (1966), the economy of the country serves as a metaphor for the interdependent system in which agriculture and all other sectors play a role. Kuznets argued that the agriculture sector is influenced by what occurs in the other sectors.

Agriculture is a very important sector that contributes to economic development in different ways according to Kuznets's hypothesis. Kuznets concluded that the expansion of products within the sector itself is what causes agriculture's contribution to growth. Since the growth of the economy is elucidated as the overall rise in the net product of various economic sectors, gains in net agricultural output are mostly correlated with the increase in the country's output. Secondly, the agricultural sector helps the economy by enabling industrial expansion, trade expansion, and resource reallocation. Lastly, resource reallocation fosters growth of the economy.

### 2.2.2 The Fei-Ranis Model

Developed by John Fei and Gustav Ranis in 1961, the model recognizes the existence of a dual economy which consists of both the modern and traditional sector and consider the economic situation of resources that are unemployment and underdevelopment in contrast to many other growth models that assume underdeveloped countries to be uniform in nature. Therefore, with respect to the Fei-Ranis theory, the traditional economic sector comprises of the already-existing agricultural sector and the minor industrial sector, which is considered to be the emerging modern economic sector. Furthermore, they contend that moving labor from agriculture to the industry will increase industrial production because labor shortages are nonexistent in emerging markets countries, mandating a complete shift from agriculture to the modern economy. However, the traditional sector's (agriculture) expansion must not be insignificant, and its output must underpin the whole economy by providing raw materials and food. According to this paradigm, the least developed nations' economies are being driven forward by both of their core sectors.

The dual sector model of Fei and Ranis was created in 1954 by Sir Arthur Lewis and is based on the economic expansion of Nurkse's model. The Fei-Ranis incorporates some significant changes from the Lewis model in an effort to improve it and get over some of its drawbacks. According to the Fei-Ranis dualism model, agriculture is connected to industry such that there is overall acceleration of development in an economy. However, the Lewis model at all times underscores the importance of the agricultural sector. Lewis's model describes a growth scenario in which traditional and capitalist sectors do not interact with the exception of the surplus labor force moving from agricultural to the latter. As a result, in this paradigm, one sector lags behind while the other keeps expanding, which means that the capitalist sector could edge out agriculture.

Thus, the Fei-Ranis model validated the Lewis model and clarified the three stages of economic development using dualistic lenses. The dualistic economy model elucidates how improving agriculture productivity would help in promoting the modern sector. Lewis's model disregarded the agricultural sector, but the Fei-Ranis model confesses that agriculture is crucial for the expansion of the modern sector. It actually believes that overall surplus in agriculture and industry shape growth of the economy. Fei and Ranis contend that the optimal shift occurs when investment money from surplus and industrial earnings are significant enough to be used to buy industrial capital goods like machinery and plants. According to the paradigm, the key area of advancement was the shift from the agricultural to industrial sectors. Employment opportunities must be created in order to use these capital assets. Fei and Ranis, therefore, stipulate that for a transformation to be effective, the rates of capital stock expansion and employment prospects must outpace the rates of population growth.

### 2.2.3 Robert Solow Growth Model

**Robert Solow's (1965)** model set out to develop a long-run economic growth model which is more flexible than the Harrod-Domar growth model. According to Solow, the economy consists of just one good, and its yearly rate of production is indicated by the expression $Y_{(t)}$. This good reflects the real income of the economy, with some of the revenue going toward consumption and the balance going toward saving and investments. Solow used the Cobb-Douglas production function ($Q = AK^aL^b$) and pointed out that any increase in Q could come from one of the following three: an increase in K, L, or A. The Solow model suggests that exogenous capital accumulation and exogenous technological improvement are the key economic growth determinants. Solow recognized that increasing inputs, i.e., capital (investment), labor, and technological innovations, can create more output, and that is why the model has provided a basis for measuring the factors contributing to economic growth.

### 2.2.4 Dual Economy Model by Jorgenson

Jorgenson is credited with developing the dual economy theory (1961). The economy was divided into two primary parts under Jorgenson's dual economy theory: the manufacturing (industrial) sector and the traditional one. Laborers remain in agriculture when there is no farm surplus since agricultural output depends only on labor and a set amount of land. Subsequently, if there is an excess of labor in the sector of agriculture, in search for employment opportunities, the labor moves to the industry sector. Additionally, because employees may demand greater wages in the manufacturing sector, labor employment in the modern sector expands at a rate commensurate with the expansion of agricultural surplus. This is because the manufacturing sector is made up entirely of labor and capital. Labor may demand higher wages in the modern sector due to continual labor force migration from the outdated agricultural sector, and there may be some wage disparities. Additionally, this differential can be stable in the long-run and is proportional to the manufacturing wage rate.

Thus, the economic transformation brought on by the migration of excess labor from agriculture might disrupt domestic terms of trade in favor of agriculture, which is a feature shared by both the Fei-Ranis model and the Jorgenson model. The Fei-Ranis model splits economic growth into three phases, with the first stage being the only place where it diverges from Jorgenson's dual economy model. In his analysis, Jorgenson skips the Fei-Ranis first stage as he assumes that the migration of labor from traditional to modern industry will cause a decline in the total agricultural output.

### 2.3 Empirical Literature

Ideba, et al. (2013), using annual data from the Nigerian Central Bank, analyzed growth of agriculture given public expenditures in Nigeria over the period 1961 to 2010. ADF test was commissioned to analyze the importance of agriculture in regard to its economic contribution. Granger Causality test and Johansen's maximum likelihood test were among the instruments used for analysis. The long-term causality was identified through the Johanson cointegration test. The ECM model findings demonstrate that Nigeria's agricultural public expenditure had a positively influenced on the country's economic growth considering the agricultural sector. The Granger Causality was also used to unearth uni-directional causality between capital accumulation and expansion of agriculture. This demonstrates that agricultural public capital spending does not increase as a result of increased agricultural economic growth, but rather the country's agricultural growth is raised by the agricultural public capital expenditure. Therefore, the study recommends to policymakers that agricultural financing should be increased.

Odetola & Etumnu (2013) analyzed agriculture and output in Nigeria over the years 1960 to 2011, and adopted growth accounting approach. It was suggested that agriculture benefuited the economy, and the study further demonstrated the sector's significance for the country's economic development. The positive impact of agricultural output is further authenticated by testing a Granger causality which has shown that the growth of agriculture can cause the growth of GDP; however, no reverse causality was present. Moreover, the resilience of the agricultural sector is evident in its speedy recovery than other sectors that experienced shocks, e.g., Nigeria's civil war between 1967 to 1970 and economic recession periods between 1981 to 1985. Crop production has a significant role in supporting agriculture, which is dependent on the crop production subsector, according to the report. As a result, improving the other subsectors, such as forestry, fisheries, and livestock, will boost Nigeria's agricultural output. This outlines the importance of the crop production subsector.

Syed , et al. (2015) further analyzed the agricultural export and the performance of the economy in Pakistan, commissioning secondary data for 36 years starting from 1972 to 2008. To calculate the association between Pakistan's GDP, agriculture, and other non-agricultural exports, they employed Johansen test. It was established that non-agricultural exports favored growth in Pakistan. Agriculture's exports, however, stifled growth. From the conclusions, the Pakistani government should transform the structure of its agricultural exports by turning them into value-added goods. Since agricultural output accounts for more than 75% of Somalia's GDP, the results that showed negative impacts between the variables are not applicable to Somalia's economy. However, turning agricultural exports into value added is significant to Somalia.

Olabanji, et al. (2017) considered agriculture and the long-term growth of Nigeria over the period 1981 to 2014 were analyzed. The vector error correction (VEC) and Johansen approaches supported the findings of causality in the long-run. This was reinforced by Granger test of causation. Therefore, the paper proposed that the Nigerian government should further strengthen policies related to agriculture, especially storage facilities, agriculture value chain, and market access, to enhance agricultural output and increase sector investment. Moreover, the paper suggests that the government should focus on sector policies that will make agriculture more attractive and profitable. Furthermore, the paper emphasizes the importance of initiating policy strategies and improved technology as this promotes the agriculture sector, encourages youths back to the sector, and, most importantly, allures investors.

Ekine & Onu (2018) investigated how growth performance is affceted by Niogeria's agriculture. Secondary data between 1981-2015 were outsourced by the authors from different statistical sources, including the statistical bulleting of Nigeria's Central Bank (CBN). Ordinary Least Squares (OLS), ADF, Unit Root test, ECM, Casusaity tests, and Co-integration test were the econometric methods used to examine the data. The study found that the growth of the economy was positively impacted by the production of livestock and fish, which was statistically significant at 0.05 percent. Although the study found that there was a connection between the variables as a result of the error correction process, no long-term causal relationship was found. According to the Causality (Walds) test, there is a short-term correlation between GDP, fish production, and animal production. The LM tests were used to demonstrate that serial autocorrelation was eliminated from the model. Finally, since the agricultural output positively impacted economics, the paper suggests that the Nigerian government should promote the agricultural sector to increase agricultural productivity so that economic growth improves.

Runganga & Mhaka (2021) examined the effect of agriculture on GDP in Zimbabwe over the period 1970 to 2018, and employed ARDL.. According to the study's findings, the explanatory variables of agricultural production, inflation, public expending, and GCF had a positively influence on GDP. The study showed that while agricultural production has no long-term effect on growth, it has a favorable short-term impact on GDP. Additionally, the study showed that agriculture becomes less significant once the economy has grown. According to the paper's conclusion, agriculture fosters growth in Zimbabwe and, therefore, policy makers should support the macroeconomic policies that favor economic growth to promote the sector's performance.

Hussin & Ching (2013) examined sectorial contribution to growth in Malysia and China as both countries have recently achieved spectacular GDP growth over the years 1978 to 2007 and analyzed three economic sectors; agriculture, service, and manufacturing sector. Data were stationary at the initial differences. Correlation study findings later revealed that China and Malaysia's economic growth had been positively impacted by the sectors of manufacturing, services, and agriculture. Furthermore, the findings of multiple regression analyses showed that the manufacturing sector contributed most to China's economic growth, whereas the service sector contributed most to Malaysia's economic growth.

Karimou (2018), in Benin, West Africa, researched how the agricultural sector contributes to the performance of economic development. The study considered  time series data between 1961-2014, and employed VECM. The paper indicated that agriculture positively influences the GDP. The variance decomposition showed that the bulk of the GDP's feedback shocks contributed to shocks, and the ECM shows that about 21.6 percent of the GDP's short and long-run discrepancies are resolved within a year. For the first three years and the next ten, agriculture's contribution to GDP shocks is less than 2% and 6% respectively. The contribution of capital to GDP shocks is approximately 3 percent during the first 3 years and above 15 percent for a 10-year period. Thus, the study found that, in addition to capital shocks, agricultural output has a significant impact on GDP. The report states that while capital formation is crucial to Benin's economic success, agriculture output should be the primary economic sector in which capital is substantially invested.

Awan & Alam (2015) looked at how agriculture production affected Pakistan's economic growth. Times-series data spanning the years 1972 to 2012 were employed in the study's ARDL. to test the impact of the different variables, which are real GDP, per capita gross capital formation, inflation rate, employed labor force, agricultural value-added, and trade openness. The inflation rate negatively influenced the economy as a result indicated, while the remaining explanatory variables impacted the economic development positively. The study also discovered that compared to other industries, agriculture contributes more to economic growth. Therefore, the study has recommended that Pakistan should upskill its labour by qualifying the higher education in both industrial and agricultural sector areas.

### 2.4 Overview of the Literature

From the literature, growth is affected by many factors. Some empirical studies cited in this paper indicate that some of the factors investigated that positively impact economic growth include gross capital formulation, agricultural value added, service sector, and manufacturing sector (Hussin & Ching, 2013; Runganga & Mhaka, 2021). Few other studies done in developing countries found that inflation rate and agricultural export negatively impact economic growth (Awan & Alam, 2015; Syed et al., 2015).

There is a gap and paucity in providing explanations for the contribution of agricultural output on economic performance in Somalia with a larger picture, despite the abundance of existing literature regarding the association of agricultural production with economic growth in SSA, especially and generally across the world. The agriculture sector, especially in Somalia, needs vigorous and extensive research so it can provide updated data to enable policymakers to draw up policies that promote the sector. This paper, therefore, filled the gap by probing the effect of agricultural output on GDP in Somalia. The ARDL model will be adopted in the study to analyze how much agricultural output contributes to economic growth. Finally, the study also aims to investigate the model's stability as well as the short and long run links between its variables.

## CHAPTER THREE: METHODOLOGY

### 3.1 Introduction

Timeseries data was utilized in this research, from various sources including; the time-series data used for this paper were outsourced from IMF, UN Stats, World Bank Development Data, and FAO. The time series data spans over 51 years, and the choice of the time lag was because of the data availability. The dependent variable used in the model specification is GDP, which is used to measure economic growth, while agricultural output, industry service output, gross capital formation, service output, and employment in agriculture are the independent variables. The paper checked for stationary series using ADF while cointegration was analyzed using ARDL bounds test. The ARDL bound testing approach has several characteristics that make it superior to traditional cointegration tests giving better outcomes in the sample and it can be evaluated cointegration with small samples rather than Engel-Granger and Johenson validity cointegration techniques that need large sample as they are not reliable for using small samples. A simple linear transformation may also be used to construct an error-correcting mechanism from ARDL (Pesaran et al, 2001).

### 3.2 Theoretical Framework

Solow (1956) and Swan (1956) formed the theoretical basis of this research. In 1956, for the first time, the economists published an economic article introducing the Solow model. Solow's model is essential for understanding the theories of modern growth and for the growth of the economy. The dynamic process between inputs (technology, capital, and labor) and output is known as economic growth. The Cobb Douglas hypothesis (Mankiw, Quah, & Wilson, 2014) states that output (GDP) depends on the sum of physical capital, technological advancements, and the number of people. Solow's neoclassical growth model is an extension of this theory. According to the growth accounting method, we can take into account the increase in output that results from an increase in labor or capital productivity. In respect to the standard of economic growth theory, an economy's level of production is influenced by its degree of capital, employment, and technology (Mahmoudi, 2017).

The Solow model recognizes that investment plays a role in forming capital stock and that investment is made feasible by savings. Although it does not provide information on how technology is utilized to accelerate growth, the model carefully examines labor and the role of technology in growth. The model is only operational under the exogenous variable assumption. The model assumes that returns are constant but increase at a declining rate in factor input. The Solow model also predicts that per capita growth will eventually stop if technology does not advance steadily. Since technology is external technical advancement, it should be determined outside of the model, according to neo-classicalists (Olabode & Ogunrinola, 2018). Based on the aforementioned assumptions, the Solow growth model is chosen for the study as the best fit.

So, the Solow growth model can be written by the following equation:

$$Y_t = A_tF\ (K_t, L_t) \quad (1)$$

Where $Y_t$ shows aggregate output/income level at time *t*, which is normally measured as GDP, $K_t$ and $L_t$ show capital and labor level at time *t*, respectively, while $A_t$ shows the technological development or total factor productivity (TFP).

The model focuses on four variables which are gross domestic product (GDP) or output, technological knowledge or effectiveness of labor (A), capital (K), and labor (L). At time "*t*" the economy is assumed to be comprised of knowledge, capital, and labor. Therefore, the combination of the above variables would yield output. Finally, the model's growth accounting approach makes a number of crucial assumptions. The first is that $A_t$ (TFP or technological development) indicated in equation 1 is separable. The returns to scale are constant. The third assumption holds that producers are price takers and that there is complete competition in the market. The fourth and last supposition is that the producers want to make the most profit possible (Solow R. , 1956).

### 3.3 Empirical Model

Oyakhilomen & Zibah (2014) model was adopted for analytical purposes. The paper made use of the following model to investigate the agricultural output on economic growth in Somalia:

$$GDP = f\ (AGROUT, INDOUT, GCF, SVOUT, EAGR) \quad (2)$$

The explanatory variables are agricultural output, industry service output, gross capital formation, service output, and employment in agriculture which are all based on economic theory. All the variables had a positive relationship with GDP in the long run. These variables determined how agricultural output influenced the rate of economic growth in a given period. According to Pesaran et al.(2001), the model specification of Autoregressive Distribution lag (ADRL) in equation (2) is demonstrated as UECM (unrestricted error correction model) to assess the cointegration between the studying variables.

$$\Delta lnGDP_t = \varphi_0 + \sum_{i=1}^{p} \varphi_1 \, \Delta lnAGROUT_{t-1} + \sum_{i=1}^{p} \varphi_2 \, \Delta lnINDOUT_{t-1} + \sum_{i=1}^{p} \varphi_3 \, \Delta lnGCF_{t-1} + \sum_{i=1}^{p} \varphi_4 \, \Delta lnSVOUT_{t-1} + \sum_{i=1}^{p} \varphi_5 \, \Delta lnEAGR_{t-1} + \beta_0 + \beta_1 \, lnAGROUT_{t-1} + \beta_2 lnINDOUT_{t-1} + \beta_3 lnGCF_{t-1} + \beta_4 \, lnSVOUT_{t-1} + \beta_5 lnEAGR_{t-1} + \mu_t \quad (3)$$

Once cointegration is done, the conditional ARDL model was used to estimate the long run relationship between dependent and independent variables as specified in the below equation (4):

$$lnGDP_t = + \beta_0 + \beta_1 lnAGROUT_{t-1} + \beta_2 lnINDOUT_{t-1} + \beta_3 lnGCF_{t-1} + \beta_4 \, lnSAVOUT_{t-1} + \beta_5 lnEAGR_{t-1} + \mu_t \quad (4)$$

Equation (5) illustrates the short-run dynamics. In this equation, the error correction term lagged ($\delta ecm_{t-1}$) was added to adjust the results.

$$\Delta lnGDP_t = \varphi_0 + \sum_{i=1}^{p} \varphi_1 \, \Delta lnAGROUT_{t-1} + \sum_{i=1}^{p} \varphi_2 \, \Delta lnINDOUT_{t-1} + \sum_{i=1}^{p} \varphi_3 \, \Delta lnGCF_{t-1} + \sum_{i=1}^{p} \varphi_4 \, \Delta lnSVOUT_{t-1} + \sum_{i=1}^{p} \varphi_5 \, \Delta lnEAGR_{t-1} + \delta ecm_{t-1} + \mu_t \quad (5)$$

Where:

GDP = Gross Domestic Product

AGROUT = Agricultural Output

INDOUT = Industry Value Added

GCF = Gross Capital Formation

SVOUT = Service Value Added

EAGR = Employment in Agriculture

$\varphi_0$ = Constant

$\mu_t$ = Error

$\beta_1 - \beta_5$ = Coefficients of the explanatory variables (Long run elasticities)

$\varphi_1 - \varphi_5$ = Short-run elasticities (coefficients of the first-differenciated explanatory variables)

$ecm_{t-1}$ = previous period's error correction

$\delta$ = adjustment parameter

$\Delta$ = First-differentiated operator

$ln$ = Natural logarithm

$p$ = length of lag

Data was analyzed using Stata version 14.2.

### 3.3.1 Variables Definitions, Descriptions, and Expected Behaviors

**Table 3. 1 operationalization**

| Variable | Variable Definition and Measurement | Expected Relationship | Data Source |
|---|---|---|---|
| **Gross Domestic Product (GDP)** – Dependent Variable | GDP measures the total production outputted in the selected period at prices of the same base year. Monetary value of commodities within a country in a year, measured in millions USD. | This is the dependent variable in the model | WDI |
| **Agricultural Output (AGROUT)** - Dependent Variable | AGROUT is the combination of forestry, livestock, and fish production. Its measurement is value. | Positive | FAO |
| **Industry Value Added (INDOUT)** | INDOUT is an aggregation of economic activities: mining and quarrying, water, electricity, and gas. It can be measured by the total disposable outputs less intermediate inputs. | Positive | SESRIC |
| **Gross Capital Formation (GCF)** | GCF comprises of outlays in addition to the economic fixed assets. Fixed assets consist of equipment, machinery purchases, land improvements (ditches, drains, fences, etc.), schools, plants, construction of roads, hospitals, commercial and industrial buildings, etc. | GCF and GDP are anticipated to be positively correlated. | SESRIC |
| **Value-added in services (SVOUT)** | SVOUT is value-added in wholesale, retail trade, restaurants, and hotels. SVOUT entails summing up the total disposable output less intermediate inputs. | It is anticipated to positively impact GDP. | SESRIC |
| **Employment in Agriculture (EAGR)** | EAGR comprises individuals greater than 15 years who provide labor in the agricultural sector for making goods and provision of services. 46 percent of Somalia's total labor is employed by the agricultural sector. | Uncertain | WDI |

### 3.4 Data Sources and Type

The paper employs time-series data of gross domestic product (GDP), agricultural output, industry service output, gross capital formation, service output, and employment in agriculture over the period of 1970 to 2020 in Somalia. The data were sourced from the publication of IMF, UN Stats, World Bank Development Data, and FAO. The sampling period of the study is spread over 51 years, from 1970 to 2020.

### 3.5 Diagnostic Tests to be Conducted

### 3.5.1 ARDL Model

The ARDL model was applied to assess series stationarity. A null hypothesis is accepted for test statistic less than critical value. It was estimated the model's equation given in (3) with co-integration test procedures and standardize the resulting values to examine the impact of the explanatory on the explained variable in the case of Somalia with respect to the short and long run.

$$\Delta lnGDP_t = \varphi_0 + \sum_{i=1}^{p} \varphi_1 \Delta lnAGROUT_{t-1} + \sum_{i=1}^{p} \varphi_2 \Delta lnINDOUT_{t-1} + \sum_{i=1}^{p} \varphi_3 \Delta lnGCF_{t-1} + \sum_{i=1}^{p} \varphi_4 \Delta lnSVOUT_{t-1} + \sum_{i=1}^{p} \varphi_5 \Delta lnEAGR_{t-1} + \beta_0 + \beta_1 lnAGROUT_{t-1} + \beta_2 lnINDOUT_{t-1} + \beta_3 lnGCF_{t-1} + \beta_4 lnSVOUT_{t-1} + \beta_5 lnEAGR_{t-1} + \mu_t \quad (6)$$

The model equation illustrated in equation (4) for the long-run dynamics is intended to look at the long-run correlation between agricultural output and Somalia's GDP growth, while ARDL model equation (5) checked the short run dynamics.

### 3.5.2 Error Correction Term (ECT)

Banerjee, et al. (1998) claim that the error correction term ($ecm_{t-1}$) instruments the model adjustment speed in regaining the equilibrium grasped because a high error correction term is additional evidence of the existence of a stable long-term relationship between the explained and explanatory variables. The ECT's negative sign gives an un-directional effect on variables.

### 3.5.3 Pre – Estimation Tests

To confirm the consistency of the variables used in the study, a time-series of macroeconomic variables was investigated. This was done by conducting several pre-estimation tests, including:

1. **Normality Test**

The normality test is an essential pre-estimation test to determine whether the model used is appropriate. This study utilizes the Shapiro-Wilk (S-W) test to determine whether all variables follow a normal distribution. Kurtosis and Skewness tests will also be considered to test for the normality of the data. According to Mukras (1993), if the p-value is less than 0.05 (the significant level), then the study rejected the null hypothesis.

2. **Unit – Root Test**

Essential in checking that a series is stationary. This then informs the estimation technique. It was tested using ADF. ADF gave several lags to solve the problems of autocorrelation.

3. **Cointegration Test**

To find out the order of co-integration between variables, a cointegration test is performed. The co-integration test is utilized to determine the short and long run relationships between variables. To correct the loss of information problem due to non-stationarity, the cointegration test is performed. Two variables are said to be cointegrated if variable Y and variable X have one order of integration, i.e., I(1), but the ECM in the linear relationship between the two variables is stationary. Performing cointegration is important in the analysis of the association between the variables. Engel and Granger (1987) explained the fundamentals for testing, modeling, and representing non-stationary cointegrated variables.

4. **Multicollinearity Test**

Multicollinearity is often a problem when performing regression analysis (Gujurati, 2004). Multicollinearity occurs when there is a high correlation between two or more independent variables as it creates difficulties in clearly getting the variables' effects, and since the explanatory variables used to predict the dependent variable are highly related, it leads to biased estimates of the coefficients. The Pearson correlation coefficients was adapted to discover the possibility of multicollinearity in the variables. In this case, it will be dropped from the model if any variable has a correlation coefficient of more than 0.7. VIF will be engaged to test the existence of multicollinearity in the variables.

### 3.5.4 Post–Estimation Test

To validate the empirical results of this study, several post-tests was conducted. To ensure if the tested model is stable, the study used the inverse root test and adopted the LM test for residual autocorrelation.

1. **Heteroscedasticity Test**

Linear regression models require that there is no heteroskedasticity of residuals, and the variance of the residuals should not change with the reasonable fitted variable values.

The study uses White Test to ascertain if heteroskedasticity exists. This test determines whether the errors in a regression term are constant or not.

2. **Functional Form**

To ascertain whether there exists significant non-linear relationship in the suggested linear model, the study employed Ramsey’s regression equation specification error test (RESET) test.

# CHAPTER FOUR: DATA ANALYSIS, RESULTS, AND DISCUSSIONS

## 4.1 Introduction

Chapter four presents the empirical results of the impact of agricultural output on economic growth in Somalia. The discussion commences with the descriptive analysis followed by correlation analysis, unit-root test, cointegration tests, and post-estimation tests to investigate the agricultural performance and economic growth of Somalia. The data for this study provided in Annex 1 was obtained from the IMF, UN Stats, World Bank Development Data, and FAO between 1970 to 2020.

## 4.2 Demographics and Correlations

The study uses 51 observations (1970 to 2020) to analyze the impact of agricultural output on economic growth in Somalia as the descriptive statistics data presented in Table 4.2 shows. The main purpose of the descriptive statistics is to discover the statistical properties of the analyzed data. Commonly, descriptive statistics are categorized into measures of variability or spread and measures of central tendency as presented in Table 4.2. The number that all observations are distributed around is referred to as the mean, which is the most popular measure of central tendency. The degree of variability from the mean is captured by the standard deviation. The minimum and maximum displays the minimum values and maximum values of several variables over a specified period, which is the spread of the data under consideration. Therefore, before providing a comprehensive econometric analysis, the paper gives a brief statistical analysis and interpretations.

**Table 4.2 Descriptive Statistics**

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| GDP | 51 | 1202467381.65 | 606325559.50 | 341025549 | 2600027766 |
| AGROUT | 51 | 677281201.31 | 319598091.07 | 167115582 | 1374080244 |
| GFCF | 51 | 224967310.20 | 138427102.02 | 13628098 | 521449396 |
| INDOUT | 51 | 39672306.10 | 13638423.35 | 15999279 | 72122726 |
| SVOUT | 51 | 133556871.47 | 69727463.23 | 11288979 | 283770651 |
| EAGR | 51 | 3442727 | 779172.5 | 2376446 | 4917907 |

### 4.2.1 Correlation Analysis

Ordinarily, the correlation analysis demonstrates the degree to which one variable is dependent against several variables utilized in a model and the values of correlation coefficients can vary from negative 1 to positive 1. A value of negative -1 means there is a strong negative correlation between two tested variables which means if one variable increases the other variable decreases by the same range. In contrast, a value of positive +1 means there is a strong positive correlation between two variables which means if one variable increases the other variable increases by moving in the same direction (if y increases x increase at the same rate). Furthermore, a zero (0) value correlation coefficient demonstrates that there is no correlation between the two variables. Therefore, correlation analysis presents an ideal way of testing for correlation between multiple variables at the same time.

As below Table 4.3 indicates, all tested variables in this study are positively correlated with each other. For example, agricultural output has perfectly correlated with GDP. All the other variables including gross capital formation, industry value added, service value added, and employment in agriculture also indicated that they are positively correlated with GDP. Due to high correlation between all the variables means that variables seem to be reinforcing each other positively.

**Table 4.3 Correlation Analysis**

| | GDP | AGROUT | GCF | INDOUT | SVOUT | EAGR |
|---|---|---|---|---|---|---|
| GDP | 1.0000 | | | | | |
| AGROUT | 0.9842 | 1.0000 | | | | |
| GCF | 0.9778 | 0.9653 | 1.0000 | | | |
| INDOUT | 0.8786 | 0.8559 | 0.8043 | 1.0000 | | |
| SVOUT | 0.9712 | 0.9582 | 0.9596 | 0.8372 | 1.0000 | |
| EAGR | 0.7660 | 0.7169 | 0.7806 | 0.5142 | 0.7381 | 1.0000 |

## 4.3 Inferential Statistics

### 4.3.1 Unit Root Test

It was employed to ascertain that the series were stationary, and adopted the ADF procedure. The ADF unit-root test indicated that agricultural output (AGROUT), GDP, gross capital formation (GCF), service value added (SVOUT), and industry value added (INDOUT) were not stationary while employment in agriculture (EAGR) was stable. Differencing once led to all the other variables being stationary as shown in below Table 4.4.

**Table 4.4 ADF Results**

| Level | | | | First Difference | | | |
|---|---|---|---|---|---|---|---|
| **Variable** | **Computed Statistic** | **5% C. Values** | **Pro Statistic** | **ADF test Statistic** | **5% C. Values** | **Pro Statistic** | **Order of Integration** |
| GDP | -2.840 | -3.500 | 0.1828 | -3.610 | -3.504 | 0.0290 | I(1) |
| AGROUT | -2.901 | -3.500 | 0.1620 | -3.722 | -3.504 | 0.0210 | I(1) |
| GCF | -2.797 | -3.500 | 0.1981 | -1.947 | -1.679 | 0.0289 | I(1) |
| SVOUT | -2.827 | -3.500 | 0.1872 | -2.103 | -1.679 | 0.0205 | I(1) |
| INDOUT | -3.103 | -3.500 | 0.1054 | -3.765 | -3.504 | 0.0184 | I(1) |
| EAGR | -4.382 | -3.500 | 0.0023 | -4.708 | -3.504 | 0.0007 | I(0) and I(1) |

Source: Stata 14.2 output for the result of variables ADF unit root test. Author (2022)

### 4.3.2 Multicollinearity Test

According to Gujarati (2012), multicollinearity is often a problem when performing a regression analysis. If there is multicollinearity in the model it means, there are insufficient results. The Variance Inflation Factor (VIF) and Tolerance (1/VIF) test performed is preceded by regression analysis. Conversely, for VIF exceeding 10, then the variable is perfectly collinear. When the tolerance or the variance inflation factor (1/VIF) is lower than 0.1 there is a multicollinearity problem that needs to be corrected.

Therefore, multicollinearity was absent as shown in **Table 4.4**.

**Table 4.5 perfect Linearity Test**

. **vif**

| **Variable** | **VIF** | **1/VIF** |
|---|---|---|
| lnAGROUT | 6.93 | 0.144380 |
| lnGCF | 4.21 | 0.237629 |
| lnSVOUT | 3.67 | 0.290230 |
| lnEAGR | 3.45 | 0.290230 |
| lnINDOUT | 2.31 | 0.432623 |
| Mean VIF | 4.11 | |

### 4.3.3 Optimal Lag Selection

Before the cointegration test, the optimal lag length was determined. From below Table 4.6, the optimal lag length was determined to be 4. This is selected by the HQIC, SBIC, and among others. Since some of the variables are stationary at the level and others are stationary at the first difference, the study employed a bound test to find out if there is a long-run relationship among the variables.

**Table 4.6 Optimal Lag Selection**

Selection-order criteria

Sample: **1974 – 2020** Number of obs = 47

| Lag | LL | LR | Df | p | FPE | AIC | HQIC | SBIC |
|---|---|---|---|---|---|---|---|---|
| 0 | -5109.8 | | | | 1.4e+87 | 217.694 | 217.783 | 217.93 |
| 1 | -4777.49 | 664.63 | 36 | 0.000 | 4.8e+81 | 205.085 | 205.707 | 206.738 |
| 2 | -4638.78 | 277.43 | 36 | 0.000 | 6.5e+79 | 200.714 | 201.869* | 203.784* |
| 3 | -4595.69 | 86.17 | 36 | 0.000 | 5.9e+79 | 200.412 | 202.101 | 204.9 |
| 4 | -4544.59 | 102.2* | 36 | 0.000 | 4.8e+79* | 199.77* | 201.992 | 205.675 |

Source: Stata 14.2, Author

### 4.3.4 Johansen Procedure for Cointegration

The Johansen cointegration test is done by comparing the trace statistic and the critical value at 5%. If the trace statistic value is greater than the critical value, it shows that there is cointegration at a specific level. As below Table 4.7 indicates, in rank 0, the trace statistic is 139.1217 which is greater than the 5% critical value (94.15). So, according to this study, there is cointegration since the trace statistics is greater than the critical value which means variables are cointegrated among each other and there is a long-run relationship (there is cointegration). As described in the methodology section, an ARDL with an ECM will be tested in case variables are found to be cointegrated. Therefore, the study proceeded to perform ECM to run the long-run relationship among the variables.

**Table 4.7 Johansen Cointegration Test**

Trend: Constant observations = **47**

Sample: **1974-2020** Lags = **4**

| Maximum rank | Parameters | LL | eingevalue | trace statistic | 5% Critical |
|---|---|---|---|---|---|
| 0 | 114 | -4614.1531 | . | 139.1217 | 39.37 |
| 1 | 125 | -4589.9616 | 0.64279 | 90.7388 | 33.46 |
| 2 | 134 | -4570.6669 | 0.56003 | 52.1494 | 27.07 |
| 3 | 141 | -4557.7083 | 0.42388 | 26.2321* | 20.97 |
| 4 | 146 | -4547.9759 | 0.33909 | 6.7674 | 14.07 |
| 5 | 149 | -4544.6525 | 0.13188 | 0.1205 | 3.76 |
| 6 | 150 | -4544.5922 | 0.00256 | | |

| Maximum rank | Parms | LL | eingevalue | trace statistic | 5% Critical |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| 0 | 114 | -4614.1531 | . | 48.3829 | 39.37 |
| 1 | 125 | -4589.9616 | 0.64279 | 38.5894 | 33.46 |
| 2 | 134 | -4570.6669 | 0.56003 | 25.9173 | 27.07 |
| 3 | 141 | -4557.7083 | 0.42388 | 19.4647 | 20.97 |
| 4 | 146 | -4547.9759 | 0.33909 | 6.6469 | 14.07 |
| 5 | 149 | -4544.6525 | 0.13188 | 0.1205 | 3.76 |
| 6 | 150 | -4544.5922 | 0.00256 | | |

### 4.3.5 ARDL Bound Test for Cointegration

The assumption of the ARDL bounds test is based on that the variables are at I(0) or I(1). Most of the variables of this study were found to be stationary at the first difference, in this case, the ARDL bounds test is performed. For the decision criteria of bounds test is, if the computed F-Statistic is less than the critical value of the lower bound I(0) means there is no cointegration. If the F-Statistic is greater than the critical value of the upper bound I(1), then there is cointegration among the variables. Therefore, the observed F-statistic is 4.902 and is greater than the critical value (upper-bound) which means we reject the null hypothesis and accept the alternative. This describes that there is a long run relationship among the study variables. As below Table 8 shows, the F-Statistic is greater than the upper bound I(1) at all critical levels implying that there is a long-run cointegration among the variables. Since there is a long run relationship among the variables, there is a need to perform ECM.

**Table 4.8 Bounds Testing**

H0: no Levels relationship F-statistic = **4.902**
t -statistic= **–3.867**

| | [I(0) 10% | [I(1)] 10% | [I(0)] 5% | [I(1)] 5% | [I(0)] 2.5% | [I(1)] 2.5% | [I())] 1% | [I(1)] 1% |
|---|---|---|---|---|---|---|---|---|
| k_5 | **2.26** | **3.35** | **2.62** | **6.79** | **2.96** | **4.18** | **3.41** | **4.68** |

## 4.4 Model Estimation Results

### 4.4.1 Long-Run Relationship

Long-run dynamics are captured in Table 4.9. The findings suggested that growth significantly rises when production in agriculture rises. The F-probability (0.000) shows the significance of the model since it is below 5 percent of the significance level. Both $R^2$ and adjusted-$R^2$ indicate significant outcomes at 99.8% and 99.6% respectively. The $R^2$ of 0.9982 implies that about 99.8% of the changes in GDP are explained by changes in explanatory variables (agricultural output, gross capital formation, industry value added, service value added, and employment in agriculture). Additionally, T-statistics of the variables are between 2.31 to 13.17 and greater than 2 in the absolute form which means that all the variables are significant.

The estimated coefficient of agricultural output (0.6860) suggested that growth rises by 68% when agricultural output rises by 1%. Employment in agriculture too significantly increases growth at 5% significance level. When employment rises by 1%, output rises by 80%. The gross capital formation, value-added from industry, and value-added from the service sector increased growth estimated coefficients of 0.0576, 0.1631, and 0.0508 respectively.

**Table 4.9 Long Run Estimation**

| | | | | | |
|---|---|---|---|---|---|
| Sample: | 1974 – | 2020 | observations | = | **47** |
| | | | Computed F-statistic | = | **568.99** |
| | | | Probability value | = | **0.0000** |
| | | | R-squared | = | **0.9982** |
| | | | Adj R-squared | = | **0.9965** |
| **Log likelihood =** | **117.47934** | | Root SME | = | **0.0284** |

| lnGDP | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. | Interval |
|---|---|---|---|---|---|---|
| lnAGROUT | .6860948 | .0520951 | 13.17 | 0.000 | .578328 | .7938617 |
| lnGCF | .056621 | .0175934 | 3.22 | 0.004 | .0202263 | .0930158 |
| lnINDOUT | .163124 | .0357241 | 4.57 | 0.000 | .089223 | .2370249 |
| lnSVOUT | .0508878 | .0160765 | 3.17 | 0.004 | .0176311 | .0841446 |
| lnEAGR | .8002529 | 1.566342 | 2.31 | 0.027 | -2.439972 | 4.040478 |
| _cons | -.2124175 | .6573055 | -0.32 | 0.749 | -1.572158 | 1.147322 |

### 4.4.2 Short Run Relationship

The short-run dynamic coefficient results associated with the long-run relationships is obtained from the error correction model (ECM) given in Table 4.10 below. The signs of the dynamics in short-run are consistent with that of the long-run relationship given in Table 4.9 above except gross capital formation, industry value added, and service value added. The agricultural output and employment in agriculture have positive significant relationships with the GDP while gross capital formation and industry value added have positively contributed to GDP but statistically not significant. The service value added does not significantly impacted on economic growth in the short and is not statistically significant. In long run, all the variables have shown positive relationship with the GDP. The error correction coefficient ($\delta ecm_{t-1}$) of -0.1960 is significant, has the correct sign, and indicates a high speed of adjustment to equilibrium after a shock within the current year. The value of ECM shows that approximately 19.6% of disequilibrium from the shock of the previous year converge back to the long-run equilibrium in the current year.

**Table 4.10 Short Run Estimation**

| | | | | | |
|---|---|---|---|---|---|
| Sample: | 1972 – | 2020 | Observations | = | **49** |
| | | | R-squared | = | **0.9885** |
| | | | Adj R-squared | = | **0.9828** |
| **Log likelihood =** | **117.47934** | | Root SME | = | **0.0294** |

| lnGDP | Coefficient | Standard error | t-statistic | Probability value | [confidence interval at 95%] | Interval |
|---|---|---|---|---|---|---|
| lnAGROUT | .4924881 | .0752345 | 6.55 | 0.000 | .3392404 | .6457357 |
| lnGCF | .0172343 | .016593 | 1.04 | 0.307 | -.0165645 | .0510332 |
| lnINDOUT | .0679589 | 0403347 | 1.68 | 0.102 | -.0142001 | .1501179 |
| lnSVOUT | -.0240433 | .0168613 | -1.43 | 0.164 | -.0583886 | .0103019 |
| lnEAGR | 2.971522 | 1.313543 | 2.26 | 0.031 | .2959228 | 5.647122 |
| _ $\delta ecm_{t-1}$ | -.1960007 | .1452085 | -1.35 | 0.187 | -.4917808 | .0997794 |

### 4.5 Post Estimation Test

#### 4.5.1 Normality Test

Normality was examined using a test suggested by Jarque and Bera. The probability value was 57% suggesting that the residuals of the regression of GDP on AGROUT, GCF, INDOUT, SVOUT, and EAGR are normally distributed. Breusch-Godfrey tests shoe that there is no autocorrelation. Therefore, there is no problem with the residuals.

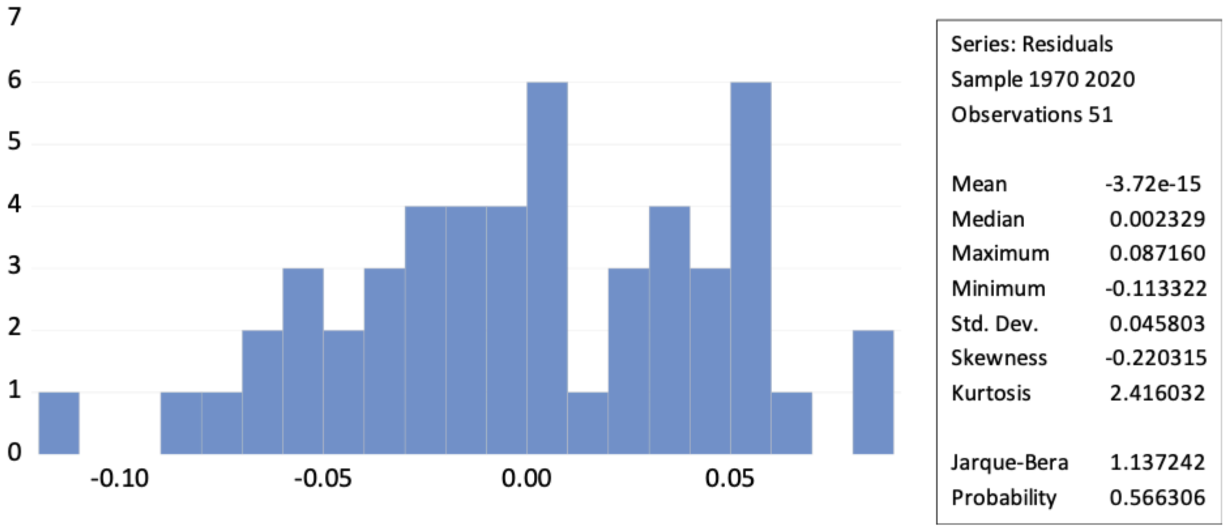


*Figure 2 Normality Test*

### 4.5.2 Autocorrelation

In checking for autocorrelation, the claim under review was that autocorrelation is absent. The probability value from the Breusch-Godfrey procedure was 16.9%, and hence, autocorrelation was absent.

**Table 4.11 autocorrelation test**

| Selected lags | Chi-square statistic | Degrees of freedom | Tail probability |
|---|---|---|---|
| **4** | **6.433** | **4** | **0.1690** |

### 4.5.3 Heteroskedasticity

As the below Table 4.12 shows, there is no heteroskedasticity since the Prob>chi2 of 0.4328 is greater than 0.05 percent of the significance level.

**Table 4.12 Constant variance test**

$H_0$: homoskedasticity

against Ha: unrestricted heteroskedasticity

Chi-square (**48**) = **49.00**

Probability value = **0.4328**

"Cameron & Trivedi's decomposition of IM–test"

| Source | Chi-square statistic | Degrees of freedom | Probability value |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Non-constant variance | 49.00 | 48 | 0.4328 |
| Long tail | 19.11 | 16 | 0.2631 |
| Heavy tail | 0.79 | 1 | 0.3745 |
| Total | **68.90** | **65** | **0.3470** |

### 4.5.3 Stability Diagnostic Test (Model Fit)

Using Autoregressive Distributed Lag (ARDL) method, the study estimated the cumulative sum of recursive residuals (CUSUM) stability test to show the stability of the dataset. As shown in Figure 2 below, the variables are stable as the CUSUM graph is within the limits of 5% significance level and the graph is not crossed the critical boundary. The divergence absence in CUSUM and CUSUMS graphs confirms that the ARDL models both short run and long run estimates are stable. Therefore, the study conclude that the model is stable and there is no major gap.

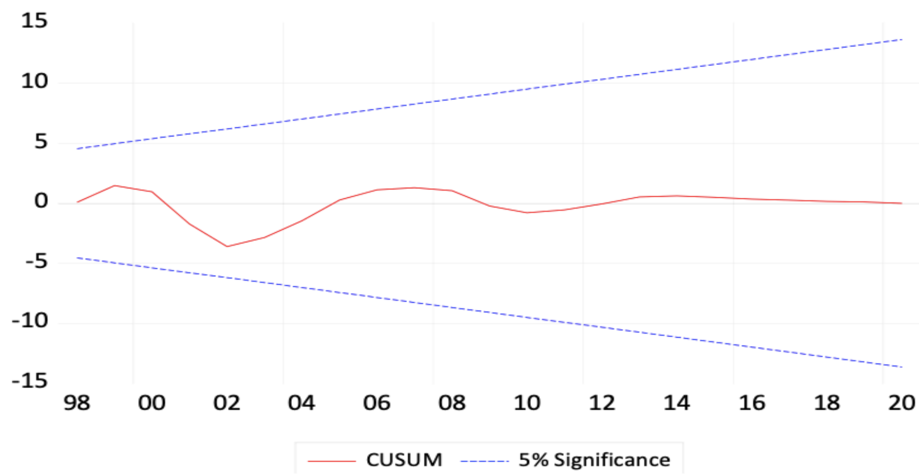


*Figure 2 Stability Test – CUSUM*

### 4.5.4 Ramsey RESET Test

The study specifically tested the estimated model as tabulated in Table 4.13 below. The results suggested absence of omitted variables since probability value was 22.07% which is larger than 5% significance level.

**Table 4.13 Ramsey RESET Test**

$H_0$: relevant variables included

Computed F-statistic = **1.53**

Tail probability = **0.2207**

### 4.6 Result Discussion

The main aim of this research was analyzing how growth in Somalia is affected by agriculture. Growth was measured by GDP and explained by many variables. Timeseries data was utilized, and; hence the series was checked to see whether it was stationary or not. This was realized using the ADF procedure. Thereafter, the variables were tested for co-integration which was followed by the execution of ARDL. Various other tests were undertaken including the bounds test, error correction, and stability test alongside model specification test, autocorrelation, and heteroscedasticity. This research noticed that short-run deviations grew smaller and smaller towards the long-run, and thus there was convergence. In the immediate term, growth was shaped by value addition from services and the industry as well as capital accumulation.

Finally, in pursuant to the studies conducted by Ideba, et al. (2013), Odetola & Etumnu (2013) Runganga & Mhaka (2021) (Olabanji, et al. (2017), Hussin & Ching (2013) Karimou (2018), and Awan & Alam (2015) who have all concluded that agricultural production positively influences the economic growth in Africa and South-East Asia, this research therefore agreed with previous research.

# CHAPTER FIVE: SUMMARY, CONCLUSIONS, AND POLICY RECOMMENDATIONS

## 5.1 Introduction

Summary of the research alongside relevant conclusions and supported suggestions for immediate policy action are captured here, followed by limitations and suggestions for future research considerations.

## 5.2 Summary of the Findings

This research analyzed how growth in Somalia was shaped by agriculture using time-series data over the years 1970 to 2020. Agriculture holds Somalia's economy, and it serves as a catalyst for employment and income generation activities. The findings of the empirical analysis offer compelling support for the idea that agricultural output activities might serve as a growth engine for the economy. This research established that growth is shaped positively by gross capital formation, industry value added, service value added, and employment in agriculture. That is, for Somalia to grow, agriculture must expand.

Descriptive statistics and various model diagnostics were executed. Diagnostics included stationary series test using the ADF, co-integration test using Johansen and ARDL, homoscedasticity test using Breusch, Pagan, & Godfrey procedure, and autocorrelation using Breusch & Godfrey procedure as well as stability based on CUSUM and specification of the model based on Ramsey RESET.

The stationary series test suggested stable series for agricultural employment while the other variables achieved a stationary series upon differencing once. Integration of order one was subsequently adopted. The adjustment parameter suggested that short-run deviations were getting smaller and smaller as one moved towards the long-run at a convergence speed of 19.6% per year.

Long-run dynamics are captured in Table 4.9. The findings suggested that growth significantly rises when production in agriculture rises. The F-probability (0.000) shows the significance of the model since it is below 5 percent of the significance level. Both $R^2$ and adjusted-$R^2$ indicate significant outcomes at 99.8% and 99.6% respectively. The $R^2$ of 0.9982 implies that about 99.8% of the changes in GDP are explained by changes in explanatory variables (agricultural output, gross capital formation, industry value added, service value added, and employment in agriculture). Additionally, T-statistics of the variables are between 2.31 to 13.17 and greater than 2 in the absolute form, which means that all the variables are significant.

A percentage increase in agricultural output in Somalia will boost GDP growth by 0.68 percent. Moreover, a percentage increase in agriculture employment will increase GDP growth by 0.80 percent; employment in agriculture shows statistical significance at a 5% level. Furthermore, a percentage increase in gross capital formation, value-added from industry, and value-added from the service sector will increase the GDP growth rate by 5.8%, 16.3%, and 5.1%, respectively.

In the short-run, Table 4.10 suggested that agricultural output and employment in agriculture have significant positive relationships with the GDP, while gross capital formation and industry value added have positively contributed to GDP but are statistically not significant. The service value added does not significantly impact growth. The adjustment parameter suggested that short-run deviations were getting smaller and smaller as one moved towards the long-run. In particular, the convergence was happening at the rate of 19.6% per year. The adjustment parameter was significant. This suggested that an equilibrium exists in the long run.

### 5.3 Conclusions and Recommendations

This research concluded that agricultural output contributes to the GDP of Somalia significantly. Results from the empirical analysis and based on the various tests conducted, the study concluded that agricultural output, industry value addition, service value addition, gross capital formation, and employment in agriculture could be an engine for Somalia's economic growth. As anticipated, the agricultural output positively influenced economic growth in both the short run and long run.

Against the above backdrop, the study found that employment in agriculture considerably affects the GDP; hence the study recommends that the Somalia government should provide with employees modern agricultural training skills and education opportunities. Furthermore, Somalia can double the share of agricultural output contribution to GDP because Somalia has fertile land suitable for agriculture, and if the sector gets improvement, growth will be inevitable.

Somalia's government ought to invest heavily in agriculture with a focus on promoting diversification and the provision of extension services. Somalis ought to be encouraged to think of agriculture as a gamechanger.

Modern production technologies and agricultural extension services must be quickly introduced and supported by the government to upgrade the traditional practices as well as encourage bigger enterprises and multinational companies to invest in the sector, which would bring skills, employment, and economic growth.

Government should have a plan towards valued addition instead of exporting raw agricultural products as it will encourage investors, promote economic development, and, most importantly, increase employment. Therefore, the Somali government ought to channel resources toward the expansion of agriculture with an eye on increasing productivity and public acceptance of agriculture.

Finally, the government should continue to invest in the agriculture production sector through budgetary allocation, as the sector is undoubtedly significant in Somalia's economy.

**5.4 Study Limitation**

Availability of data became challenging, especially some of the variables were not accessible in the public domain.

**5.5 Areas of Future Consideration**

This research could not investigate all aspects of agricultural output in relation to the national and regional levels in Somalia. The author suggests that other variables, rather than the ones used in the study, should be tested to investigate the critical sectors that can support the agricultural output so that agricultural output can best influence the economic growth of Somalia. Furthermore, the study used secondary data drawn from different sources, as discussed in chapter three, limited to the selection of six variables to ascertain their impact on economic growth in the last five decades. Therefore, the perspectives from which agriculture is viewed should be broadened for holistic scrutiny.

Finally, despite its limitations, this paper provides insightful information and an opportunity for researchers, policymakers, and investors to further contribute to the sector and the execution of proper impactful agricultural policies for enhancing the agricultural output in Somalia.

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