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THE EFFECT OF GOVERNMENT AGRICULTURAL EXPENDITURE ON THE NON-COCOA SECTOR ON ECONOMIC GROWTH IN GHANA

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MUSTAPHA BABA ABDUL- AZIZ

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THE EFFECT OF GOVERNMENT AGRICULTURAL EXPENDITURE ON THE NON-COCOA SECTOR ON ECONOMIC GROWTH IN GHANA

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(Economics and Entrepreneurship Option))

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THESIS SUBMITTED TO THE DEPARTMENT OF AGRICULTURAL AND FOOD ECONOMICS, FACULTY OF AGRICULTURE, FOOD AND CONSUMER SCIENCES ECONOMICS, UNIVERSITY FOR DEVELOPMENT STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF PHILOSOPHY DEGREE IN AGRICULTURAL ECONOMICS

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DECLARATION

Student

I hereby declare that, this thesis is the result of my own work and that it has previously not been submitted for the award of any other degree in this University or elsewhere.

Candidate's Signature: …………………… Date: …………………

Name: Mustapha Baba Abdul-Aziz

Supervisors

We hereby declare that the preparation and presentation of the thesis was duly supervised

in accordance with the guidelines on supervision of thesis laid down by the University for

Development Studies.

Principal Supervisor

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ABSTRACT

Despite a renewal of the commitment in Malabo 2014 through the Malabo Declaration, Africa spends less per capita on agriculture than other areas of the globe, and just a few of the nations hit the Maputo objective of 10%. This implies that investment levels are still inadequate, as evidenced by the relationship between agricultural GDP and the intensity of government spending. The yearly average rate of growth regarding land productivity for the agricultural sector in general has averaged 3.3% per annum, driven mainly by the noncocoa subsector with a growth rate of 3.7% unlike that of the cocoa subsector which has a growth rate of 1.0 percent. To unravel the asymmetric effects of government agricultural sector spending patterns for policy making, this study assessed the effect of government agricultural expenditure on the non-cocoa sector on economic growth. Annual time series data from 1961 - 2019 on study variables was analysed using linear and nonlinear Autoregressive Distributed Lag Models. The result showed that, in the long-run whiles noncocoa sector spending positively influence growth, cocoa sector spending and financial development negatively affect growth. However, in the long-run, noncocoa sector spending and exchange rate positively influence growth whiles inflation, financial development and cocoa public spending inhibit growth. The study concludes that there exists a unidirectional causality between noncocoa sector spending and growth where it is only noncocoa sector spending that Granger causes economic grow and not the other way round. The study recommends that government should provide adequate budgetary allocation to the due to its positive influence on growth. There must also be adequate supervision of flagship programmes such the Planting for Food and Jobs to ensure they yield the needed results.

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DEDICATION

This work is dedicated to my wife, children and the entire family.

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LIST OF ACRONYMS

ADC	Agricultural Development Corporation
ADF	Augmented-Dickey Fuller
AIC	Akaike Information Criterion
AMSECs	Agricultural Mechanization Service Centers
ARCH	Auto regressive conditional heteroscedasticity
ARDL	Autoregressive Distributed Lag
ARIMA	Autoregressive Integrated Moving Average
AU	African Union
BIC	Bayesian Information Criterion
CAADP	Comprehensive Africa Agriculture Development Programme
CAGD	Controller and Accountant General Department
CEPA	Center for Policy Analysis
CPI	Consumer Price Index
CUSUM	Cumulative Sum
CUSUMSQ	Cumulative Sum of Square
DOLS	Dynamic Ordinary Least Squares
ECM	Error Correction Model
FAO	Food and Agriculture Organisation
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GMM	Generalised Method of Moments
GSS	Ghana Statistical Service

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GTE	Government Total Expenditure
HDI	Human Development Index
IRF	Impulse Response Function
HQIC	Hannan-Quinn Information Criterion
LAC	Latin American and Caribbean
LCU	Local Currency Units
MoFA	Ministry of Food and Agriculture
NAFCO	National Food Buffer Stock Company
NARDL	Nonlinear Autoregressive Distributed Lag
NEPAD	New Partnership for Africa's Development
PFJ	Planting for Food and Jobs
PP	Phillips-Perron
TFP	Total Factor Productivity
TFPG	Total Factor Productivity Growth
UNDP	United Nations Development Programme
VAR	Vector Autoregressive
VEC	Vector Error Correction
WDI	World Development Indicators

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CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Governments all around the globe have traditionally placed a high priority on food security and agricultural development. The dual sector thesis of Arthur Lewis has considerably benefited discussions about the importance of agriculture as economic expansion advances (Lewis, 1954). According to this idea, in order to boost its production and subsequently economic output, the modern or industrial sector exploits the surplus labor in the primary sector or agricultural sector as a significant source of growth. This capital comes from savings. As the economy witnesses an expansion in the industrial sector, there is an associated decrease in the percentage by which the agricultural sector contributes to economic growth. This growth accounting process generally implies that there is the need for labour to move from rural settings to urban milieus with a consequent reduction in the populations of rural settings relative to the national population (De Sormeaux & Pemberton, 2011). Scholars (including Benin, 2014) have defined agricultural sector expenditure as the total government expenditure on forestry and logging, crops and livestock, tractors, cocoa production and marketing, fishing, fertilizers and other chemicals, and tools, as well as the distribution and marketing of output from state farms.

Several commitments have been made across the globe to enhance progress in the agricultural sector. Despite government commitments to increase agricultural investment due to its critical role, some segments of the sector remain underfunded, limiting their potential to develop as a nation. This is particularly true for Africa's sub-Saharan region (Fan & Rosegrant, 2008).

The African Union's Heads of State and Government acknowledged in 2003 that more public expenditure on agriculture was required across the continent. This drove them to establish a political commitment – the Maputo Declaration – to dedicate a minimum of 10% of total public spending to agriculture under the Comprehensive Africa Agriculture Development Programme (CAADP) (Brüntrup, 2011). While raising spending to 10% will assist to boost agricultural development, it has been evidenced that in Sub-Saharan Africa, many nations have failed to meet the Maputo commitment (FAO Monitoring, 2013). But understanding how public money is spent makes a lot of sense.

Furthermore, the Malabo Declaration, adopted in 2014, reiterated the commitment African leaders made to the CAADP (AU, 2014). The proclamation contained pledges to eliminate poverty and food insecurity, increase intra-regional commerce, improve climate resilience, and, in keeping with the Maputo Declaration a decade ago, at least 10% of the nation's resources must be used to advance the agricultural industry.

Despite that there was a renewal of the commitment in 2014 through the Malabo Declaration, Africa spends less per capita on agriculture than other areas of the globe, and just a few of the nations hit the Maputo objective of 10%. This implies that investment levels are still inadequate, as evidenced by the relationship between agricultural GDP and the intensity of government spending. This does not, however, always suggest the absence of commitments from political actors. Governments have found it difficult to fulfill the objective due to fiscal limitations caused by low

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revenue growth, high debt levels, and many sectors vying for limited resources (AU, 2014).

According to Los and Gardebroek (2015), the recent economic success in a number of developing African nations may have highlighted the link between agriculture and growth. Agriculture is frequently promoted as a useful tool and a crucial sector for growth in numerous influential development reports (World Bank, 2007).

While financial allocations to agriculture are essential, so is the relevance of the expenditure incurred to promote the sector (Akroyd & Smith 2007). There are worries expressed in this respect regarding the reduction in funding for promoting research in agriculture, infrastructural projects and transferring knowledge in favor of regular activities (FAO 2014; Goyal & Nash, 2017).

Sector budgets should, in theory, strike a good relationship between spending to increase the sector's potential to expand, such as infrastructural projects or farmer knowledge, and spendings that are completely done in the same period, such as operating costs or subsidies (Mogues *et al.* 2015; Benin & Tiburcio 2018). A stable, strong and efficient agricultural sector would allow a country to feed its increasing masses, create job opportunities, generate foreign exchange and feed industries with raw materials. There is a multiplier effect in the agricultural sector whereby it has a great effect on the social and economic wellbeing of a people and its industries due to the several purposes that it serves (Ogen, 2007).

Taking into account how agriculture affects the expansion of the economy, there has been consensus but to what degree? That is the point where there is a departure in

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views. Then, the debate on the contribution of agriculture in attaining sustained growth is yet to be settled. The presumed nexus between agriculture and growth is, therefore, a topic that has faced extensive debate (Los & Gardebroek, 2015).

The agriculture industry, however, has demonstrated over the past few decades that it is unavoidable when discussing the variables impacting growth, particularly in the developing globe.

Ghana's economy is primarily agricultural, with agriculture employing around 29.75 percent of the workforce (Index mundi-Ghana Economy Profile, 2019). As a result, agriculture remains one of the most reliable methods to enhance the well-being of many Ghanaians, particularly in rural regions. AU NEPAD (2010) asserts that public expenditure is concerned with the transfer of public resources from government sources to various economic sectors. This is generally caused by market failure and the resulting necessity to provide products and services. As a result, the African Union's New Partnership for Africa's Development (NEPAD) has said that African leaders signed the Maputo Declaration in 2003, committing to spend 10% of their budgetary allocations to the agricultural sector in an attempt to attain an annual growth rate of 6% in the sector (AU NEPAD, 2010).

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Despite this long-standing pledge to expenditure, Ghana's budgetary allocations to agriculture remains far under 10% for the past decade. These allocations have been in the areas between 1 and 2 percent (CAGD 2016), 6 to 8 percent (FAO 2014) depending on the accounting standards used (MoFA 2017). Given the overwhelming statistics that agricultural expenditure in countries in the developing generates large returns (Mogues *et al.* 2015), Ghana's comparatively poor performance in

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agriculture between 2007 and 2017 might be attributed to inadequate spending levels. Agricultural GDP growth has been half that of the non-agricultural sectors, at 4.3 percent each year (MoF 2018). The poor have borne the brunt of this sluggish agricultural expansion. In recent years, rural poverty has risen, particularly in northern Ghana (GSS 2018 cited in Aragie *et al.*, 2019).

The insufficient budgetary allocations to the agricultural sector have contributed to different manifestations in the sector. For instance, it looked that the GDP growth was static yet rather unpredictable. Due to agriculture's disastrous growth of -2.0% in 1990, the GDP only grew at a relatively slow rate of 3.3%. The following year, agricultural growth increased to 4.7%, and GDP increased to 5.3%. (CEPA, 1996). Similar to 1992, when agriculture had a poor year and saw a 0.6% decline in growth, the GDP only increased by 3.9%. In 1993, agricultural output increased by roughly 2.8% as a result of increased production of food and animals, contributing to a 5.0% increase in real GDP overall (Nyanteng & Seini, 2000).

Meanwhile, in the midst of inadequate agricultural sector spending, the non-cocoa subsector's proportion of in Government Total Expenditure (GTE) has decreased over time, from about 8% per year in 1960–1990 to barely 2.5 percent per year during the Comprehensive Africa Agricultural Development Programme period (Benin, 2019). This is a glaring lack of focus on a sector that has the potential to improve the lives of many Ghanaians, particularly rural residents, by lowering unemployment, inequality, and other issues.

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1.2 Problem Statement

In contemporary times, there has been rising worries regarding the continual decline in the performance of agricultural to national output growth, particularly in the developing world. While it is often noticed that the development of a country goes along with a poor performance of agriculture to increasing national output, quite recently, this drop has rather been steeper instead of gradual. This drop has been consistent not just in economies in the developing world, but in advanced economies including the United States. Yamashita (2008) has observed this phenomenon with statistics from Japan that the influence of agriculture on national growth dropped by 8% from 1960 to 2005.

The agriculture sector in 2020 contributed 18.85% as against 28.26% by the manufacturing and the services sector contributing the 45,19% to GDP (Statista-Ghana Share of economic sectors in the Gross Domestic Product from 2011 to 2021, 2022).

Government spending is the major tool adopted by countries particularly in the developing world to achieve significant growth which is key to attaining development on sustainable basis. The growth of the economy engenders in improved living standards of the populations through the provision of improved housing, infrastructure, health, agricultural output and food security and education services (Loto, 2012). Almost all sectors across countries in the developing world require national funding yearly. For instance, the component of the Maputo Declaration of 2003 on agriculture demanded leaders of African countries to raise their spending on the agricultural sector by a minimum of 10% of nations' budgets

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(New Partnership for Africa's Development (NEPAD), 2011). Investigating the effects of the various government expenditure components on the expansion of the economies of various nations is therefore vital in the context of competing public needs for state funding.

Benin (2016) has observed that with regards to meeting the commitment of Maputo Declaration target of apportioning a minimum of 10% of a nation's budget to agriculture, Ghana has not been able to fulfill that pledge, despite other reports that demonstrate the contrary due to the confusion that characterize separating normally the expenditure items of the government and those of state corporation like the Ghana Cocoa Board (Benin, 2014). Focusing on just the overall public sector spending on the noncocoa subsector, the proportion of government expenditure on agriculture as a proportion of overall public spending was estimated to be around just 2.1% from 2001 to 2008 and 2.8 percent from 2009 to 2012. This falls short of even meeting African standards (Benin & Yu 2013), particularly since it capture all the food staples within the economy. When spending by the Ghana Cocoa Board is capture in public expenditure on agriculture, and spending on other corporations of the government are captured among overall government spending, Benin (2014) estimates the portion to be around 3.8–5.3%, which still defies the commitment in the Maputo Declaration of 10 percent agricultural sector spending.

Generally, the focus of policies and spending in agriculture has been more on the cocoa subsector to the neglect of the noncocoa subsector. Considering the period 1961 to 2012, public spending on the agricultural sector varied as the cocoa subsector spending growth averaged about 3.7% per annum, relative to –0.3%

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spending growth for that of the noncocoa subsector. The proportion of spending on the cocoa subsector as a proportion of the subsector's agricultural output was 57.6% annually, compared to just 3.7% annually for the noncocoa subsector. The annual average rate of growth in land productivity for the agricultural sector as a whole was 3.3%, driven mostly by the noncocoa subsector with a growth rate of 3.7% as opposed to the cocoa subsector which had a growth rate of 1%. (Benin, 2014).

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Furthermore, another reason that justifies the continual interest in examining the nexus between the growth and public spending is on the basis that there are lots of contentions in past empirical literature. Belgrave & Craigwell (1995) investigated the long-term influence of public spending on growth of the economy of Barbados using data between the years 1969 and 1992, which was analysed employing the Engle Granger co-integration technique. The results demonstrated spending on the agricultural sector, capital, road, health, housing and community and health sectors to positively influence growth.

On the contrary, Brooks & Loevinsohn (2011) indicated that unpredictable seasonal nature of production in Ghana's agricultural sector has improved over the past few decades as a result of the emergence of enhanced research and technology in the agricultural sector. Despite this, the agricultural sector is still characterized by poor output and insufficient national budgetary allocations to the sector (Resnick, 2018). For instance, in 2004, the budgetary allocation of only 1.3% to promoting the agricultural sector was deeply at divergence with the commitment of 10% of overall national expenditure as stipulated in the Maputo Declaration in 2003. Despite the relentless efforts at promoting agriculture to enhance the growth of the Ghanaian economy, productivity of the sector still remains quite discouraging. It has observed that Ghana's transitioning into services and manufacturing economy from the hitherto raw-material extraction economy, has witnessed an agricultural sector that is rapidly failing to remain a significant determinant of growth in Ghana, unlike the services sector. This has become very glaring particularly in the aftermath of 2006 after the country discovered oil (Resnick, 2018).

Several empirical studies have evidenced that the agricultural sector either influence growth negatively, positively or have insignificant effect (Kuznets, 1966; Becker *et al.*, 1990; Matsuyama, 1992; Rosegrant & Evenson, 1995, Coelli & Rao, 2005). For example, Tiffin & Irz (2000) noted that there exists no profound evidence that backs the general idea that agricultural sector spending is a key determinant of growth in general. Trimmer (2005) also found a link between reducing poverty and productivity of agriculture and noted that at the provincial level, agricultural sector growth accounted for two-thirds of reduced poverty.

Failure to go further to deepen understanding about the response of Ghana's economic growth to shocks in non-cocoa sector government spending as documented studies (such as Djokoto, 2011; Enu, 2014; Mohan *et al.*, 2014; Okine & Remziye, 2018; Mutaka, 2019; Geiger *et al*., 2019; Mohammed *et al.,* 2020) have failed to do will not give an adequate insight into the complete effects of the re-current and capital expenditure to the non-cocoa subsector on economic growth. In effect, this current study closed this gap as it used the impulse response model to properly render this problem so as to enable government appreciate the

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consequences of frequent shocks in budgetary allocations to the non-cocoa subsector in Ghana.

Then again, even though there are some few related previous empirical studies (Mohan *et al*., 2014; Okine & Remziye, 2018; Mutaka, 2019; Mohammed *et al*., 2020), yhey only evaluated the short- and long-term relationships between agricultural and economic growth in Ghana. but this study goes beyond that to specifically examine the influence of government agriculture expenditure on economic growth and the asymmetric effects of public agricultural spending on growth. Doing this in the present study is novel as the positive effect may differ from the negative effect of agricultural sector spending on growth. The authors also employed the total growth of the agricultural sector rather than the Government of Ghana's budgetary allocation to the non-cocoa sector to specifically evaluate its contribution to growing the economy. Therefore, understanding the asymmetric effects of agricultural sector spending will policy making in the sector. Hence, it is within this context that this study intends to assess the effect of the non-cocoa subsector agricultural expenditure effect on economic growth in Ghana using data from annual time series data from 1961 to 2019.

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1.3 Research Questions

1.3. Main research question

What is the influence of government expenditure on non-cocoa agricultural subsector on the growth of the Ghanaian economy?

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1.3.2 Specific research questions include:

1. What is the trend in government sectoral spending in Ghana from 1961 to 2019?
2. What are the short and long run effects of government agriculture spending on non-cocoa subsector on Ghana's economic growth?
3. What is the causal relationship between government agricultural spending on non-cocoa subsector and economic growth in Ghana?
4. How does Ghana's economic growth respond to shocks in government agricultural sector spending on non-cocoa subsector?
5. What are the asymmetric effects of government spending on non-cocoa subsector on Ghana's economic growth?

1.4 Research Objectives

This study aims to assess the effect of government agricultural expenditure on the non-cocoa subsector on the growth of the Ghanaian economy.

1.4.1 Specifically, it is to

1. Examine the trend in government sectoral spending in Ghana from 1961 to 2019.
2. To estimate the short and long run effect of government agricultural spending on non-cocoa subsector on Ghana's economic growth.
3. To determine the causal relationship between government agricultural spending on non-cocoa subsector and economic growth in Ghana.
4. To examine the response of economic growth to shocks in government spending on non-cocoa subsector in Ghana.

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5. To examine the asymmetric effects of government spending on non-cocoa subsector on economic growth in Ghana

1.5 Scope of the Study

Ghana is the subject of this study because of its efforts to encourage agricultural development and its contribution to economic growth. The size of the sample and period are based on the data available for agricultural sector spending, economic growth and the other control variables. The study assesses trend, short and long-term association between non-cocoa agricultural sector spending and growth. The study also examines the influence of non-cocoa agricultural sector spending on growth, as well as the response of growth shocks to non-cocoa subsector government investment as well as the asymmetric effect (both positive and negative effects) of non-cocoa subsector of government spending on agriculture on growing the Ghanaian economy. The period under consideration of this work is 1961- 2019.

1.6 Significance of the Study.

Given the increasing need to modify agriculture, particularly the non-cocoa subsector in Ghana, it is practically necessary to study the nexus between government spending on agriculture (non-cocoa) and growing the Ghanaian economy. Study findings would feed policy makers especially in the agricultural sector with a clear nature of the short and long-term linkage as well as the asymmetric effect of government agricultural spending on economic progress.

The basic Wagner's law on public spending, according to Wagner & Weber (1977) states that, "it is economic success or development that causes the relative size of the public sector to grow". As a result, this theory fundamentally says, according to

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Paparas *et al*. (2019), that "causality goes from economic growth to government expenditure." In spite of the application of the Wagner's theory in studies across countries employing both cross-sectional and time series data, testing this theory in the case of non-cocoa subsector public expenditure effect on Ghana’s economic progress is yet to be tested. This present study covers this literature gap by testing the Wagner’s theory of public expenditure growth.

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In addition, the majority of comparable empirical research analyze just the short- and long-term relationships between high agricultural production and economic growth in Ghana but this study goes beyond that to specifically assess the asymmetric effects of public spending on non-cocoa subsector of the agricultural sector on growth. Consequently, this study is a major contribution to the existing studies in the area. The study is set to affirm or debunk the assertions of earlier scholars on the topic of agricultural development and other related topics. Moreover, the study is set to generate new set of findings which are relevant to future researchers interested in exploring similar topics.

1.8 Organization of the study

The Chapter One (1) illustrated an introduction capturing the background, problem statement, research questions and objectives and significance of the study. Chapter Two (2) contained a review of relevant and related literature. Chapter Three (3) presented the methodology of the study; this included model specification, detailed discussion of the variables and data utilised in the study. Chapter Four (4) was on results and discussions: the chapter discussed the results from the study. Lastly, the

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conclusions of the major findings and recommendations, and suggestions for further research were presented in Chapter Five (5).

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CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

An overview of public spending on the agricultural sector in Ghana is provided in this chapter, along with a good theoretical assessment of the major theories that drive the research. Empirically, the review includes research on both the correlation between public spending on agriculture and growth as well as the causal relationship between public spending on agriculture and economic growth. A summary of the review that identifies the numerous gaps in the literature comes at the review's conclusion.

2.2 Overview of the Agricultural Sector Expenditure in Ghana

The policies of the Convention People's Party administration, after independence, led by Dr. Kwame Nkrumah, lasted up to 1966 and were guided by the general growth objective of fast industrialisation, which was largely funded by agricultural taxes. An Agricultural Development Corporation (ADC) was established to promote the growth of crops for industries (mainly rubber, sugar cane, oil palm, and cotton) to feed the ambitious local industries that were being created, as well as export goods (particularly cocoa) to earn foreign currency. As a result, the majority of agricultural sector spending went to ADC, which expensed it on subsidized input (tractors, tools, fertilizers and other chemicals) as well as distribution and marketing of output from state farms (Stryker, 1990; Dappah, 1995).

In the afterwards of ADC’s compelled closure that happened in 1962, the government created cooperatives and state farms to replace the projects by ADC and

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the stations of the ministry due to massive debts and failed large-scale production and marketing operations. Price restrictions, input and credit subsidies, and mandatory allocated credit were all utilized to keep the government's heavy hand in producing, distributing and marketing agricultural output (Stryker 1990; Dappah, 1995). In all, 105 state farms were established (42 of which were inherited from ADC) cultivating land size of around 22,396 hectares at the era Nkrumah was removed from office in 1966, with 62% used for permanent crop production (mostly banana, oil palm, rubber, coconut, sugar cane, cotton, and kola nut) and the rest of the 38% used for food crop production (mostly rice and maize) (Austin & Luckham 1975). These teo crops has been the most widely cultivated and consumed crops in Ghana (Abukari et al., 2019). Agriculture expenditures rose at a yearly average growth rate of 2.3% from 1961 to 2005, with expenditures on cocoa rising at a higher pace (3.8%) than spending to promote the noncocoa subsector combined (1.0%). The spending value as a percentage of agricultural production in each subsector was significantly greater 30.1% more for cocoa than for non-cocoa (12.7 percent). Land productivity increase in the agricultural industry generally averaged 2.4% per annum, with noncocoa subsector growth (2.1%) being lower than cocoa subsector growth (2.4 percent) (3.1%) (Austin & Luckham 1975, Abukari et al., 2022).

Diao *et al*. (2019) revealed that public agricultural investment between 1961 and 2012 was disaggregated into the noncocoa and cocoa subsectors. The cocoa subsector has received the majority of overall spending, whereas the noncocoa subsector, embodying overall national basic essentials, has been overlookedAgriculture has received less than 10% of overall government spending each year since 1961, and in contemporary times, the proportion has just been

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averagely 2 to 3%, which is below standards set even in Africa. In addition, the country has invested scanty resources to complement improvements in road and other relevant infrastructure in rural settings. The influence of public expenditure on agricultural productivity growth is then estimated using econometric studies, as well as understanding of the marginal returns to national spending on the noncocoa and cocoa subsectors and by kind of national spending.

Benin *et al*. (2012) has further noted that there have been regional inequalities in the allocation of agricultural sector expenditure as the central and southern regions of the nation receive the lion's share of spending on agriculture across regions in the noncocoa subsector, while the northern regions receive the least. The order of highest receiving regions being Volta area, the Eastern, Ashanti, and Brong-Ahafo regions, had the most MoFA expenditure, whereas the Upper-West and Upper-East regions received the lowest. The amount expended per person in the north is more than in the south, but the amount expended per hectare of land area in the north is lower.

Over time, empirical findings have continued to support conflicting viewpoints on this contentious subject. Ghana's economic growth is linked to rising public spending, which has sparked a lot of debate over the consequences for the country's economic growth. Ghana's growth rate was (3.3 percent) in 1960, 3.7 percent in 2000, and 7.9 percent in 2010 in real terms. Despite this, governmental spending is mostly debt-supported, primarily through foreign loans. Since 1980, the aggregate final government spending as a percentage of GDP has been rising continuously, reaching highs of 11.16 percent in 1980, 9.3 percent in 1990, and 10.17 percent in

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2000, 10.36 percent in 2010, and 19.16 percent in 2015 (World Bank, 2019). Furthermore, because the government's spending is mostly supported by foreign debt, Ghana's foreign debt-to-GNI ratio has risen dramatically, 56.29 percent in 2015, up from 31.59 percent in 1960 (World Bank, 2019).

According to Curtis & Adama (2013), government spending is focused on multi-purpose project development strategies that include integrated facilities to generate power, irrigation, controlling floods, recreation and navigation. Administration of multi-purpose development project affairs and services; loans, subsidies, or grants to support efforts in building, operating, maintaining, or upgrading multipurpose development projects; producing and disseminating general information, documenting technical information, and statistics on project affairs and services.

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2.3 Theoretical Framework

Adolf Wagner (1980) created the Wagner's principle, which states that throughout the industrial revolution, the percentage of public spending as a percentage of overall national spending grows as the nation's real GDP per capita increases. This principle was earlier stated by Wagner & Weber (1977), that “it is economic success or development that causes the relative size of the public sector to grow”. As a result, this theory fundamentally says, in the words of Paparas *et al*. (2019) that "causality goes from economic growth to government expenditure." Wagner's theory continues to be experimentally examined for a number of nations throughout the world, employing cross-sectional and time series dimensional data. Empirical testing of this rule has produced findings that varied significantly from nation to country, and even from model to model within the same country. Regarding the correlation between national revenue and government spending, there are basically two schools of thought.

According to Adolph Wagner, government spending grows faster than the output of the economy. He drew it from empirical results on progressive, primarily Western European industrializing countries, where he looked at changes in the ratio of government spending to per capita real income (Black & colleagues, 1999: 87)

According to Wagner, there are three reasons wants a bigger increase in government spending than the growth in economic production on behalf of a country's inhabitants' needs. To begin with, demand for services like as health and education grows faster than per capita income, implying that citizens have a larger than one income elasticity of demand for these services. Second, in order to maintain an environment that promotes economic growth, the government must expand its efforts and, as a result, its expenditures in the areas of law, protection, and administration. Finally, market failures such as monopolies, which may be the outcome of a high capital investment need, necessitate costly government intervention. (Black & colleagues, 1999: 88)

Wagner's "law" assumes an organic state model in which each person may only have importance as a component of the overall organism (Shadbegian, 1999). Furthermore, the model assumes strong income elasticities of demand, growing per capital incomes, technical and institutional developments, a democratically administered state, and, as previously said, rising per capital incomes (Black *et al.*, 1999). When the modern industrial society emerges, then the people's need for

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developing society from governments will increase, much like industry's acceptance of social responsibility.

Adolph Wagner, a German economist, was the inspiration for Wagner's law of state, sometimes known as the rule of growing public spending (1835–1917). He noticed this phenomenon from the onset in Germany and subsequently in other states. The idea implies that, as the revenue of a country increases, so will public expenditure. According to the legislation, when the industrial sector grows, there is a resultant increase in the portion of government spending in GDP:

According to Wagner's law, when people vote, free market capitalism develops into a welfare state for continuous rise in the provision of social services as general levels of income increases in the overall economy. Richard Musgrave, regardless of some uncertainty, has formally interpreted Wagner's proposition in the following:

As progressive countries experience industrial growth, the share of the government as a percentage of the entire economy increases. The increase in public spending is induced by three factors, including (i) public social activities, (ii) protective and administrative measures, and (iii) welfare activities, according to Wagner. The ensuing information seems to be a considerably very extensive version of Wagner's original idea.

Retirement insurance, natural disaster relief (internal or external), environmental protection programs, and other socio-political roles increase with time. Economic: As research and technology progress, there is a rise in state funding for science, technology, and other investment programmes, among other things. Historical: the

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state employs state to take care of eventualities, making the entire public debt as well as interest to increase; i.e., debt service expense increases.

The classical school of thinking, which upholds Wagner's law, is the first. It argues that, in the long term, the development of the economy results in higher public expenditure. This school of thinking considers public expenditure to be an endogenous element, or an outcome, instead of a factor inducing the overall development of the economy. This indicates that if real income increases, the percentage of public expenditure relative to economic growth increases as well. In a nutshell, Wagner's law asserts that growth of public spending occurs at a higher rate relative to national production. The implication of this is that as the income of a country increases, so does public expenditure so as to meet national demand for administrative, protective and social functions. This perspective means that public expenditure has a tendency to hinder growth of the economy because of the reality that the operations of the public sector might be inefficient at times.

The Keynesian school of thinking, on the other hand, has the exact opposite viewpoint to Wagner's law. Keynesian economists contend that there is a direct causal link between government spending and economic growth. Keynesian economists therefore view government expenditure as an exogenous factor that may be used as a policy instrument to induce an economy to grow. This idea indicates that the public sector contributes highly in speeding up the development of the economy, and a long-term growth is anticipated to be influenced by a larger government. They claim that the public sector crucially influences the resolution of the competing social and private interests as well as guiding growth and

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development in a socially optimal direction. Again, in highly monopolized nations where fully developed insurance, capital, and information markets are lacking, public sector spending can improve input and output markets and produce large spillover benefits for the private sector (Jahan *et al*., 2014).

Many empirical studies have been done on this issue, but with varied results, due to the substantial consequences of public spending on growth. Despite the fact that most studies on developed nations, such as Al-faris (2002), Narayan *et al*. (2008), and Kumar *et al*. (2012), provided significant evidence for Wagner's rule, other authors, such as Ghali (1999) and Ravn et al. (2012) could not find any evidence that Wagner's law is supported. They rather found evidence that backed up Keynes' theory that government spending produces national income. In addition, a thorough examination of Wagner's law's implications for emerging nations revealed conflicting results. Despite the fact that Ansari *et al*. (1997), Attari & Javed (2013), and Hamdi & Sbia (2013) discovered a significant connection between growth and public spending, Huang (2006), Nakibullah and Islam (2007), and Babatunde (2011) found the opposite. Methodological differences, such as model parameters and estimating techniques, are one of the main causes of these conflicting results.

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2.4 Empirical review

2.4.1 Review of Government Agricultural Spending and Economic Growth Relationship

Most empirical studies reveal positive, negative and inconclusive implications of public agricultural expenditure on growth. Depending on the kind of policies that governments employ, the agriculture sector may have an impact on growth that is

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either beneficial or negative (Johnston, 1970). As a result, this section makes an effort to review empirical studies on the effects of public agricultural spending on economic growth.

2.4.1.1 Positive effects of Government Spending on growth of the economy

The focus of the literature review shifts to the benefits of government expenditure on economic growth in this part. Justice (2012) assessed the implications of FDI on promoting food security in Ghana. His conclusion was that the efforts to raise Ghana's economic growth as well as raise national income above population growth may not result in the country being food secured unless those effects are directed to increasing government expenditure on agriculture through financing of food security programmes. He further concluded that the benefits of FDI in the agricultural sectors cannot be discounted but widening public expenditure in the sector is necessary to raise agricultural output particularly among smallholder farmers. This study, though, did not clearly highlight the connection between public agricultural expenditure and growth, it implicitly implied that investment in the agricultural sector directly promotes growth of the economy. In the Turkish context, investment in the contruction of irrigtion dams withnessed an increase in the total factor productiivty of the agricultural sector (Abukari et al., 2016).

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Wangusi & Muturi (2015) studied the long-term contribution of agricultural spending in raising productivity in Kenya's agriculture. The authors employed a descriptive research design as well as analysed data implementing a regression model. The study indicated that government expenditure in the agricultural sector had a robustly promotes the productivity in the agricultural sector. From the

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findings, the authors made the recommendation that government should engage in guided increase of spending in the agricultural sector since that could raise productivity in the sector.

By employing an Ordinary Least Squares regression, Tochukwu (2012) studied the consequence of agricultural sector spending on growth, and found that the association was significantly positive. Interestingly, in a subsequent study, Awan (2015) demonstrated an inverse association between agricultural sector spending and growth in the developing world whereas that relationship was found to be positive for countries in the advanced economies. Awan and Aslam (2015), likewise, also realised that there was spending on the agricultural sector promoted growth in the long-term. The authors reached this conclusion after employing Johansen co-integration and a Vector Error Correction (VECM) approach covering 1980 to 2012.

Al-Fawwaz (2016) assessed the long-run effect of public spending on growing the Jordanian economy using data from 1980 to 2013. He demonstrated that not only overall public spending but current public spending positively influence growth, and this is in line with the Keynesian model.

Hua (2016) investigated the implications of public educational expenditure for the growth of the Chinese economy and realised a robust and direct link between public educational spending on growth. This conclusion was consistent with earlier empirical findings by Bose *et al*. (2007) in economies of the developing world. Bose *et al*. (2007) panel study of 30 economies from the developing world for the periods 1970s to 1980s by considering disaggregated public spending. The authors revealed

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that public spending and overall educational sector investments are critical to growth.

Olabisi & Elizabeth (2012) employed the vector autoregressive approach in their study and noted that public educational spending highly contributes to growing the Nigerian economy. However, by concentrating on how growth is impacted by public spending on agriculture, Ditimi *et al*. (2011) employed a multivariate cointegration approach in their study and noted that such expenditures promote growth while the impact of government spending on health, education, transport and communication did not find any evidence that they support growth in Nigeria.

The direction and type of causation between government spending and other factors were studied by Ebaidalla (2013) regarding the Sudanese economy, implementing the Granger causality test and the error correction model (ECM) with data between the years 1970 and 2008. The research discovered a long-term connection between Sudanese government spending and growth, and the direction of the causality run from public spending to growth both in the long and short terms.

Musaba *et al*. (2013) examined the long-term relationship between government sectoral spending and economic growth in Malawi using annual data from 1980 to 2007. The data was analysed using a cointegration analysis and error, and the results revealed lack of any short-term association between sectoral spending and growth. However, there was long-term link between the two variables. Whereas spending on the agricultural sector and defence was robustly and positively linked to growth, educational, social intervention programmes, health, transportation and communication posed a significantly negative association with growth. In another

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study on East Africa, Gisore *et al*. (2014) researched the consequences of public expenditure in growing an economy and realized that national spending on defence and health significantly and positively influence growth. Conversely, agricultural and educational sectoral spending did not have any implications for the growth of the economy.

Chu *et al*. (2018) analyzed how the elements of government spending patterns are composed are axssociated with growing an economy in the framework of the endogenous growth model with an isolation of public expenditure into productive and unproductive components. Using panel data from 37 high-income nations and 22 low- to middle-income countries for the period 1993 to 2012, the authors found from their GMM and OLS fixed effects estimation techniques that as governments move their expenditure away from unproductive national spending to productive economic activities, government expenditure generates impressive rate of growth in both low to middle-income and high-income economies. Also, they noted in both low- to middle-income and high-income economies, public spending was more strongly connected with greater growth levels over the long run.

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In a recent study in France, Ozatac *et al*. (2018) assessed the long-term equilibrium link between growth, labour, capital and public spending on education using data from 1970 to 2012. The authors implemented the Johansen co-integration test, and noted that the variables revealed a long-term association. That is, labour, capital and public spending on education are key factors influencing growth in the long-term in the country. Results of the Granger causality test indicated a bidirectional long-run causality between growth and public spending. Furthermore, there were long-run

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unidirectional causalities which moved from public educational expenditure and labour to growth as well as from public spending and labour to capital.

In an earlier study, Adamu & Hajara (2015) evaluated the long-term effect of government investment in Nigeria's economic growth employing annual data from 1970 to 2012, and found that though the influence of public spending on capital projects positively influenced growth but the effect was not robust whereas public spending on recurrent expenditure robustly and positively impacted growth. Similarly, Bahaddi & Karim (2017) evaluated the consequences of government spending on growing the Moroccan economy by implementing the Johansen's co-integration approach. Their study found that good governance, especially in public spending activities, is critical to enhancing the economic performance of Morocco, and this attests to the Keynesian theory.

In a country-specific study, Berihun (2014) looked at the consequence of public investment on Ethiopia's growth employing data between the years 1975 and 2013, with a special emphasis on sectoral spending on health, defense, agriculture and education. The author empirically evidenced that public spending on the agricultural sector adversely influenced growth whiles that on education and health had positive implications for growth.

Earlier on, Alshahrani & Alsadiq (2014) interrogated the public investment and growth connection in Saudi Arabian by employing the VECM. They found that both public and private investments as well as spending on the health sector accelerate long-term growth whereas defense, education and housing are inhibiting long-run growth.

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Al-Fawwaz (2016) measured the long-term implication of government expenditure for growth of the Jordanian using data between 1980 and 2013. The author analysed the data using a multiple linear regression model, and also found that there is overall public spending induces growth. This supports the Keynesian model, and thus recommended that public spending on capital items should be encouraged since it induces growth of the different sectors of the economy.

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Muhammed (2015) investigated how the various components of public spending could influence the growth of the Ethiopian economy by relying data between 1975 and 2011. His study focused on government spending on trade and industry, health and agriculture and revealed that these expenditure items robustly affected growth. Despite this, public transportation and communications spending had no impact on Ethiopia's economy as it expanded. Similarly, Bargicho (2016) analyzed the influence of public spending as well as tax on boosting economic activities in Ethiopia sampling data for the years between 1980 to 1981 and 2013 to 2014 and realized that long-term spending as well as direct taxes have a robustly inverse implication for real growth whereas public spending on capital projects and indirect taxes positively and robustly influenced real growth, which finally confirmed the Keynesian theory.

2.4.1.2 Negative effect of government spending on economic growth

The association between public spending and economic development, according to Akpan (2005), Romer (1990), Gregorious and Ghosh (2007), has sparked a series of debates. For instance, results from a Granger causality test illustrated a one-way causation from agricultural sector spending on value addition to growing the economy (Edwins, 2017). Etea and Obodoechi (2018) noted a long-run association between higher output from the agricultural sector due to public spending in enhancing growth Nigeria. The authors used Johansen co-integration, the Vector Error Correction model and the variance decomposition test. Both authors found that public spending in agriculture positively affect growth.

In Ghana, Dadson & Sackey (2018) studied how foreign direct investment (FDI) in agriculture could influence the expansion of the nation's economy by employing secondary data from the World Development Indicators. The data was analysed using Granger causality test as well as Error Correction Model (ECM). The authors found that FDI in the agricultural sector generated a significant influence on growth in Ghana. However, national expenditure inversely influenced growth. Though their study covered a gap in the literature by assessing how FDI in the agricultural sector could affect growth, FDI transmission of the effect of the agricultural sector to growing Ghana’s economy does not constitute the interest of this present study.

Asiedu (2013) also examined the long-run effect of liberalizing trade on growth by using the autoregressive distributed lag model for analysing data from 1986 to 2010. The author found that opening an economy up to international trade creates a robustly positive consequence for growth in the long-term. He further indicated that growth rate of population and capital accelerated growth in the short and long terms. FDI was discovered to have an inverse long-term effect on growth but the influence of inflation was not found to be robust.

Adams & Atsu (2014) examined the role of predominant aid dependency in growing an economy by utilising the autoregressive distributed lag (ARDL) model to analyse

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data covering the years 1970 to 2018. The study realized that trade openness had inverse influence on expansion in economic activities in the long-run whiles capital formation positively and significantly impacted growth, the effect of financial development was insignificant though positive both in the short and long term. Overall public expenditure also had an insignificantly direct influence on growth in the short-run though with a significantly positive influence in the long-run.

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Nasiru (2012) assessed the association between public investment patterns (separated into recurrent and capital) and growth of the Nigerian economy between the years 1961 and 2010. He analysed the data using the bounds test approach. The results demonstrated a lack of any long-run association between public spending and growing the economy.

Endale (2007) investigated how defense spending affected Ethiopia's economic growth adopting random effects model and empirically evidenced that defense spending had an inverse effect on real growth. Implementing the vector error correction model (VECM), Kebede (2015) evaluated the long-term influence of public spending on growing the economy of Ethiopia and demonstrated that public energy expenditure positively and significantly influenced on growth whiles the development of the road sector insignificantly impacted growth.

In developing economies, Hajamini & Falahi (2014) investigated the long-run consequence of public spending as a percentage of national output on growth by implementing a threshold panel model to data on 21 low-income economies and 11 low-middle income economies for the years 1981 and 2007. The study verified the existence of nonlinear association, where the threshold share of public spending for

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the low and low-middle income economies is 16.2 and 16.9% with the confidence intervals of (13.7–17.3%) and (16.5–16.9%), respectively. The study further revealed that, aside going beyond the threshold, the consequence of public spending on growing an economy shifts from being direct but not significant to being inversely robust. Though, this was a very interesting study, it failed to focused particular attention on to understand the government agricultural spending influence on growth in Ghana.

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Sakyi *et al*. (2015) looked at how FDI and openness to trade aid in enhancing growth in developing countries by employing yearly time series data for the period 1970 to 2011, which was analysed using the ARDL model. They found that openness to trade, FDI and system of governance without interaction had strong direct influence on growing economies whiles the interaction of FDI and openness to trade showed an insignificant though positively influence growth. Furthermore, they found that the interaction of exports and FDI directly and strongly influenced long-term growth. Again, trade openness also demonstrated a positive and robust influence on long-term growth.

Using data from South Sudan, Guandong & Muturi (2016) examined the relationship between government spending and growth and discovered that spending on infrastructure, security, and productive economic activity had a favorable impact on growth whereas public spending on the social services sector adversely impacted growth.

Subsequently, Garoma & Mekonnen (2018) researched the influence of national expenditure in promoting growth in Ethiopia employing data from Ethiopia's

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National Bank and Finance and Economic Cooperation Ministry from 1975 to 2015. Results from the Johansen cointegration test and the VEC model indicated that public spending on general services significantly and negatively influence growth.

Using the ARDL model on time series data from 1970 to 2013, Mireku *et al*. (2017) assessed the association between openness to trade and volatility of growth of economies. The study indicated that openness to trade positively and significantly affect expansion in short-term and long-term economic activities. The authors found that liberalizing and developing the financial sector had no robust positive and negative consequence on growth respectively in the long-term though in the short-term, they all had a robustly adverse growth effect. Also, exchange rate (inflation) was found to have direct but no strong effect in enhancing economic activities.

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2.4.1.3 Causal Link between Government Spending and Growth

After reviewing works on the public agricultural expenditure-growth dynamics, the idea of the nature of causality between public agricultural sector expenditure and growth, if causality exists at all, is imperative even though the literature lacks a definite consensus.

In a contemporary study, Epaphra & Mwakalasya (2017) also evaluated the consequence of FDI in agriculture on growth in Tanzania employing yearly data between 1990 and 2015 and capturing other growth determinants such as trade liberalization, inflation rate, exchange rate, population, and other control factors. The data was analysed using OLS and the findings showed that FDI in agriculture in Tanzania had no significant impact on growth even overall FDI inflows in the economy positively affected growth. The authors concluded that spending on the

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agricultural sector did not yield any benefits for growth despite the being the largest employer in the economy.

In an earlier study, Izuchukwu (2011) examined the long-term consequence of agricultural expenditure in Nigeria on the expansion of the nation's economy. By employing data between 1986 to 2007 from the WDI and the Nigerian Central Bank, and analysing it using a regression model, the researcher found that public agricultural spending directly promote growth much like domestic savings and FDI. More specifically, these growth determinants accounted for 81% of the changes in growth. The researcher therefore recommended that the Nigerian government raise agricultural expenditure through the financing of research in the sector since it was thought to be influential in increasing exports and raising the country's competitiveness in global commodity markets.

In Malawi, Musaba *et al*. (2013) focused their study on the long-term effect of public spending on various sectors of the economy on growth by employing annual time series data between 1980 and 2007. Results from the data analysis using the Error Correction Model indicated that public expenditure on the sectors including agriculture, transport and communication, education, social protection, defence and health had some interesting relationships. In the short-run, the study observed no link between public spending on the various sector and growth. However, the long-term results found a robust and positive consequence of public spending on agriculture and defence on growth. Interestingly, the spending on health, education, transport and communication and social protection negatively influenced growth.

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Hence, they recommended judicious use of resources devoted to various sectors in order to achieve growth.

De Sormeaux & Pemberton (2011) identified the determinants inducing the consequence of spending on agriculture on growth among selected Latin American and Caribbean (LAC) countries that fall within the medium category of the UNDP Human Development Index (HDI). They hypothesised that determinants impact how much agriculture contributes to fostering growth that are related to boosting economic wellbeing and the competitiveness of the agricultural sector. The study used panel data between 1980 and 2009, and this was analysed using Random Effects panel regression model. Results of the study found that inflation, rural population, FDI, life expectancy and agricultural sector spending had a significant impact on the growth of the sampled nations.

In a related study within the Ghanaian context, Enu (2014) determined the long-run implication of sectoral spending for growth using data for the period 1996 to 2006. The sectors were the service, industry and agricultural. The growth effects of the agricultural sub-sectors such as fishery, forestry, cocoa and crops and livestock were also assessed. Regression modeling was used to analyze the data, and the results show that output from the agricultural sector positively affects growth in a significant manner with 0.3033 compared to the other sectors like service output of 0.2834 and that of industry output growth of 0.3033. Also, the findings revealed that the various subsectors of the agricultural sector were also found to strongly and positively significant influence growth. Hence, the cocoa subsector much like the noncocoa subsector was discovered to have a substantial impact on growth. The

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author recommended that spending on these sectors should continue despite the commercial exploration of oil. Though this was a similar study, the author did not use public expenditure on the various subsectors to understand the growth effects of government's sectoral budgetary allocations. Furthermore, apart from the fact that the study was conducted in 2014 and a number of government spending through government agricultural sector policies have emerged over the period, the study used 1996 - 2006 which is not current enough. Then again, there are arguments against the use of OLS in time series estimations since that can generate spurious results. This present intends to use time series models on annual spending information on the agricultural sector for the period 1961 -2019 to overcome the identified flaws.

A recent study by Okine & Remziye (2018) assessed the roles of the service, industrial and agricultural sectors in promoting growth in Ghana using data from 1984 to 2013. Using a regression model, data was analyzed, and the findings revealed that a 1% rise in the agricultural sector growth will result in growth by 0.248%. Additionally, a 1% increase in the growth of the services sector will result in a 0.472% increase in economic growth. Finally, a 1% increase in industrial sector growth will result in a 0.32% increase in economic growth. The conclusion drawn was that the services sector contributes greatly to the entire growth of the economic activities. It was recommended that high growth of the Ghanaian economy can be achieved when more attention is paid to the services and agricultural sectors. This can be attained through the allocation of significant resources to the sectors. Also, government should remove all structural constraints in facilitating the development of the agricultural sector because of its significant role in creating employment and promote economic growth and development. This can be done by modernizing the

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agricultural sector and supporting farmers with subsidies as well as incentives that are adequate enough to motivate cocoa farmers, for example. This was an interesting study but also faced similar data and model estimation technique flaws as cited in the work of Enu (2014) above.

In one of the very recent studies in Ghana, Mohammed *et al.* (2020) examined the relationship between the expansion of economic activity and the increase in agricultural productivity, employing monthly data from 1960 – 2016. Their research utilized the Johansen Maximum Likelihood co-integration and the VECM, and indicated the existence of long-run association between growth of the agricultural sector and the growth of the Ghanaian economy. In particular, they found from the Granger causality test that agricultural output causes growth but not the reverse. The implication is that growth in agriculture remains crucial to growth in Ghana, and emphasizes the need for policies that targeted the poor to overcome the constraints that bedevil the sector. This was an interesting study but failed to used current data on government expenditure on the non-cocoa subsector to estimate its growth effects. Its conclusions about current government agricultural sector spending programme are also in doubt as the data was not current enough to capture those programmes.

Mutaka (2019) investigated the determinants of the measure of total factor productivity in the Ghanaian agricultural sector using yearly data between 1961 to 2014 for aggregated livestock and crops. Total Factor Productivity (TFP) was measured employing the Solow index technique of the conventional growth accounting method. The author applied the ARDL model to determine the existence

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of a long-term relationship between the variables. In particular, the author used the Stock-Watson's Dynamic Ordinary Least Squares (DOLS) model with the measured TFP Growth to account for the impacts of various climatic and macroeconomic determinants of expansion in agricultural activities. The data suggested that the TFG of the country's agricultural dropped by 3.71% within the period of the study with a yearly growth rate of -0.07%. The study further revealed that trade openness, human capital, rainfall and infrastructural development have a robust and positive impact on TFPG. On the contrary, inflation, per capita income, as well as exchange rate strongly but inversely influenced TFP growth. Overall, the results demonstrated that policies that promote price stability, human capital development, stabilize the exchange rate, curb drought and enhance trade openness will yield higher output from the agricultural sector with a consequence of promoting the country's growth. This was a contextual study much like the present study but it interested in the determinants of public agricultural spending and growth.

In his analysis of the long-term impact of agriculture spending on economic growth, Mitchell (2005) concluded: "In today's world, the agriculture sector acts as a catalyst, accelerating the pace of restructuring and diversified economy that is less reliant on the supply of foreign agricultural products or raw materials to economic growth and sustainable development." The agriculture industry provides a substantial contribution to national progress in terms of increasing government income, infrastructure development, standard of living, and GNP. Mitchell (2005) goes on to say that economic theories do not always produce correct results when it comes to the effect of governmental expenditure on economic growth over the long run. Most analysts believe that in certain cases, a low level of government spending would

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stimulate economic expansion, while in other cases, a high degree of public expenditure would be preferable.

Mohan *et al.* (2014) assessed the implications of research spending in agriculture and climate change on growth of Ghanaian regional economies. The study used panel data between 2000 and 2009. A Malmquist index was employed to estimate growth in productivity in agriculture, including decomposition components efficiency change and technical change. Specifically, the factors influencing productivity growth were assessed s fixed effects regression model. The study found that the positively robust determinants of growth were infrastructure, climate variability and spending on agricultural research and development. It was therefore recommended that to achieve sustainable agriculture in the country, there should be more public spending on new technologies in agricultural production.

Moussa (2018) examined the factors influencing economic growth especially the agricultural sector spending in Republic of Benin utilising time series data from 1970 to 2016. Results from their co-integration analysis revealed that agricultural sector spending and human capital development have a long-run association with growth. Again, according to his findings, increased spending on the agricultural sector robustly increase growth and better the living standards of the people.

Iddrissu *et al.* (2015) explored the long-term link between FDI and agricultural productivity in Ghana employing data between 1980 and 2013. Results from the Johansen cointegration test demonstrated that FDI inversely influence growth in the agricultural sector in the long-term though has a positive association in the short-term. A declining currency was likewise found to have a negative long-term impact

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on agricultural sector growth, whereas trade openness had a strong and beneficial impact on the industry's growth. The authors made the recommendation that there should be enhance efforts by government increase efforts to increase the inflow of FDI to the agricultural sector in ways that will not hamper the local economy through capital flights and significant repatriations of profits.

Djokoto (2011) used annual data from 1966 to 2008 to conduct research on the nexus between the expansion of FDI into agriculture and the expansion of agriculture in Ghana. The Granger causality result showed that increasing FDI of the agricultural sector promotes the sector's growth and has the potential to enhance the overall economic expansion. Also, Using data from 1995 to 2009, Djokoto (2013) evaluated the long-term effects of state investment in agriculture, notably the cocoa subsector, to the growth of the Ghanaian economy. According to the findings, public expenditure on the agriculture sector has a significant and favorable impact on economic growth. This current study, on the other hand, evaluates the long-run effects of public agricultural investment on growth, using extensive data from 1961 to 2019.

From 1983 to 2011, Chandio *et al*. (2016) evaluated the impact of government spending on agriculture on the development of the Pakistani economy. The Johansen Co-integration test and Ordinary Least Square (OLS) approach were implemented for data analysis. The Johansen Cointegration test revealed a long-term nexus between public agricultural investment, agricultural output, and economic growth. The findings of the regression suggested that agricultural output and government spending had a major impact on long-term economic activity.

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Geiger *et al*. (2019) in a Ghanaian context, studied growth factors by employing growth regressions and structural change decompositions. The study concluded that the function of structural change in promoting growth has been hampered by the migration of surplus labor from the agricultural sector to other sectors, where it remains unproductive. The authors also stated that the primary growth drivers in Ghana since 2000 have been infrastructure and finance sector development. A benchmark analysis indicated that those determinants of growth should be prioritized in policy making but that the government should pursue stabilization policies in the immediate term.

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Uzuner *et al*. (2017) evaluated the influence of public invesmtment on the expansion of economic activities. According to Adolph Wagner's hypothesis, a rise in public expenditure would have a substantial impact on growth. Endogenous growth theories, on the other hand, assert that the public sector has direct or indirect impact over the expansion of economic activities. Utilizing the Johansen co-integration test and the Granger causality test, they assess and validate Wagner's argument on the impact of current, investment, and transfer expenditures on Turkey's economic performance from 1975 to 2014. The long-term association between the factors confirms Wagner's rule, whereas public expenditures have a considerable beneficial influence on growth.

Benin *et al*., (2012) evaluate the returns of agricultural productivity to various forms of national investment throughout Ghana's major agroecological zones employing district- and regional-level data on national spending and data on household production. The results demonstrate that various public goods and services offered in the agricultural, rural transportation, health, and educational sectors have a considerable impact on agricultural output. A 1% increase in government agricultural spending is associated with a 0.15% increase in labor productivity in agriculture, according to a benefit-cost ratio of 16.8. Feeder road spending comes in second (with a benefit-to-cost ratio of 5) and health care spending comes in third (around one hundredth of the value). Agriculture production was shown to be inversely correlated with formal schooling. For each of the four agro-ecological zones, the estimated marginal impacts and returns differ.

2.4.1.4 Other determinants of economic growth

From the Euro area, Hatmanu *et al*. (2020) investigated how real exchange rate, monetary policy interest rate, as well as the business environment affects economic activities in Romania. The study found from the ARDL short-run model that interest rates have a significantly adverse effect on growing an economy whiles that of exchange rate is strongly positive. They further revealed that the business climate factor yielded mixed effects on growth. They therefore, recommended that exchange and interest rates should be the focus of policy in achieving sustainable growth.

According to Asogwa *et al*. (2019), empirical studies on the effect of government expenditure on growth in numerous nations throughout the world have produced varying estimates of the optimal level of public spending to be between 15 and 30% of national GDP. These empirical works unveiled the maximum government size for the different economies adopting the theoretical framework of Armey Curve Hypothesis which postulates there exists a maximum government size that can optimise growth. Previously, the overall spending of government has been below

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that of current years in Ghana and Nigeria. The result of this has to make the size of government of these economies large enough to achieve impressive growth. However, this has not been the characteristic of these economies. Using time series data from 1981 to 2016, the authors employed a concave parabolic model from the origin that highlights the Armey curve model to experimentally prove both the existence of the Armey curve hypothesis and the optimal public spending in Nigeria and Ghana. The study indicated that there was the existence of the Armey curve hypothesis both in Ghana and Nigeria. In contrast to Ghana, it was discovered that the Armey hypothesis has a stronger statistical impact in Nigeria. In Nigeria and Ghana, respectively, the maximum government size was determined to be 12.5% and 7.3% of GDP. This suggests that in order to reach the maximum growth of 3 trillion Naira and 4.3 million respectively, the governments of Ghana and Nigeria are advised to spend 12.5% and 7.3% of their GDP, respectively. According to the report, these governments must cut spending in order to increase the size of their governments in order to achieve the kind of effective and efficient growth that every nation aspires to.

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Musaba *et al*. (2013) looked at the major macroeconomic factors affecting the growth of the Ghanaian economy from 1970 to 2011 by implementing the Johansen method of cointegration. The study's findings revealed that physical capital and foreign aid both had a significant and favorable impact on growth. In the long-term, labour force, FDI, foreign aid, inflation, physical capital, military rule and public spending are key factors affecting growth in the country. Again, in the short-term, FDI and public spending are key factors influencing growth. Furthermore, the results showed a unidirectional causality between labour force and physical capital, foreign

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aid and physical capital, physical capital and FDI, physical capital and military rule, physical capital and inflation, labour force and FDI, inflation and labour force, FDI and foreign aid. More so, the study found a bidirectional causality between inflation and FDI.

2.5 Conceptual Framework on the effect of noncocoa sector spending on economic growth in Ghana

The conceptual framework for this study is designed from the review of theoretical literature which resulted in the conceptual framework as captured in Figure 2.1 which shows the association between variables that cannot be isolated as they are interdependent on one another. Consequently, the theories underpinning the study, as earlier indicated, are the Wagner's theory and the Keynesian's theory on public spending and growth. The Wagner's theory was earlier stated by Wagner & Weber (1977), that "it is economic success or development that causes the relative size of the public sector to grow". As a result, this theory fundamentally says, in the words of Paparas et al. (2019), that "causality goes from economic growth to government expenditure." Conversely, the Keynesian school of thinking, on the other hand, has the exact opposite viewpoint to Wagner's law. Keynesian economists believe there is a causal association between public expenditure and growth. As a result, Keynesian's regard government spending as an exogenous element that may be utilized as a policy tool to induce an economy to grow.

Again, in highly monopolized nations where fully developed insurance, capital, and information markets are lacking, public sector spending can improve input and output markets and produce large spillover benefits for the private sector (Jahan *et al.*, 2014). These theories help to construct the link between public expenditure

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patterns and growth in economic activities despite the divergent views on the direction of causality. Hence, these theories were adopted to handle the research questions of noncocoa sector spending and how it can broaden economic activities in Ghana.

The context of this study is the consequence of the Maputo and the Malabo Declarations by Africa to commit to an annual budgetary allocation of not less than 10% to the agricultural sector. However, this commitment has not been upheld according to (Benin, 2014) to sustain growth in the agricultural sector and its consequent support for growth of the economy. As a result, this study intends to examine the trend in public expenditure to the noncocoa sector, in particular, and how it is a determinant to the growth of the Ghanaian economy.

Again, numerous studies on public expenditure and growth exist with some contrasting views. Ansari et al. (1997), Attari & Javed (2013), and Hamdi & Sbia (2013) found a substantial link between growth and public expenditure, Huang (2006), Nakibullah and Islam (2007), and Babatunde (2011) found the opposite. Despite these, to understand the perceive impact of noncocoa sector spending on growth requires that the determinants of growth are examined. These include cocoa and noncocoa sector spending, inflation, financial development, and exchange rate.

Public expenditure, according to the Wagner's theory and Keynesian's School of Thought have relationship with growth. This relationship manifests in both the short run and the long run as studies including Nasiru (2012), Asiedu (2013), Adams & Atsu (2014) and Kebede (2015). The direction of causality of the expenditure-growth relationship has also been demonstrated in the literature (including

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Izuchukwu, 2011; De Sormeaux & Pemberton, 2011; Musaba et al., 2013; Epaphra & Mwakalasya, 2017). However, despite the studies, there has not been any single study at the time of this current study on the relationship and the long-term influence of government agricultural spending on growing Ghana's economy using annual time series data on public spending on the agricultural sector, specifically on non-cocoa subsector using rigorous econometric techniques such as ARDL model.

Also, political instability and unstable economic policies especially government fiscal policies on agricultural sector have implications for growth of the economy. Consequent to this, it is relevant then to examine how different a rise in noncocoa sector spending on growth could vary from the effect of a decline in noncocoa sector spending on growth. Within this context, it is therefore relevant to examine the effects of national expenditure on the agricultural sector, especially non-cocoa subsector, on economic growth both in the short run and long run, the shocks and asymmetric effects of noncocoa sector spending on growth using linear and nonlinear ARDL model in Ghana with current annual data from 1961 to 2019.

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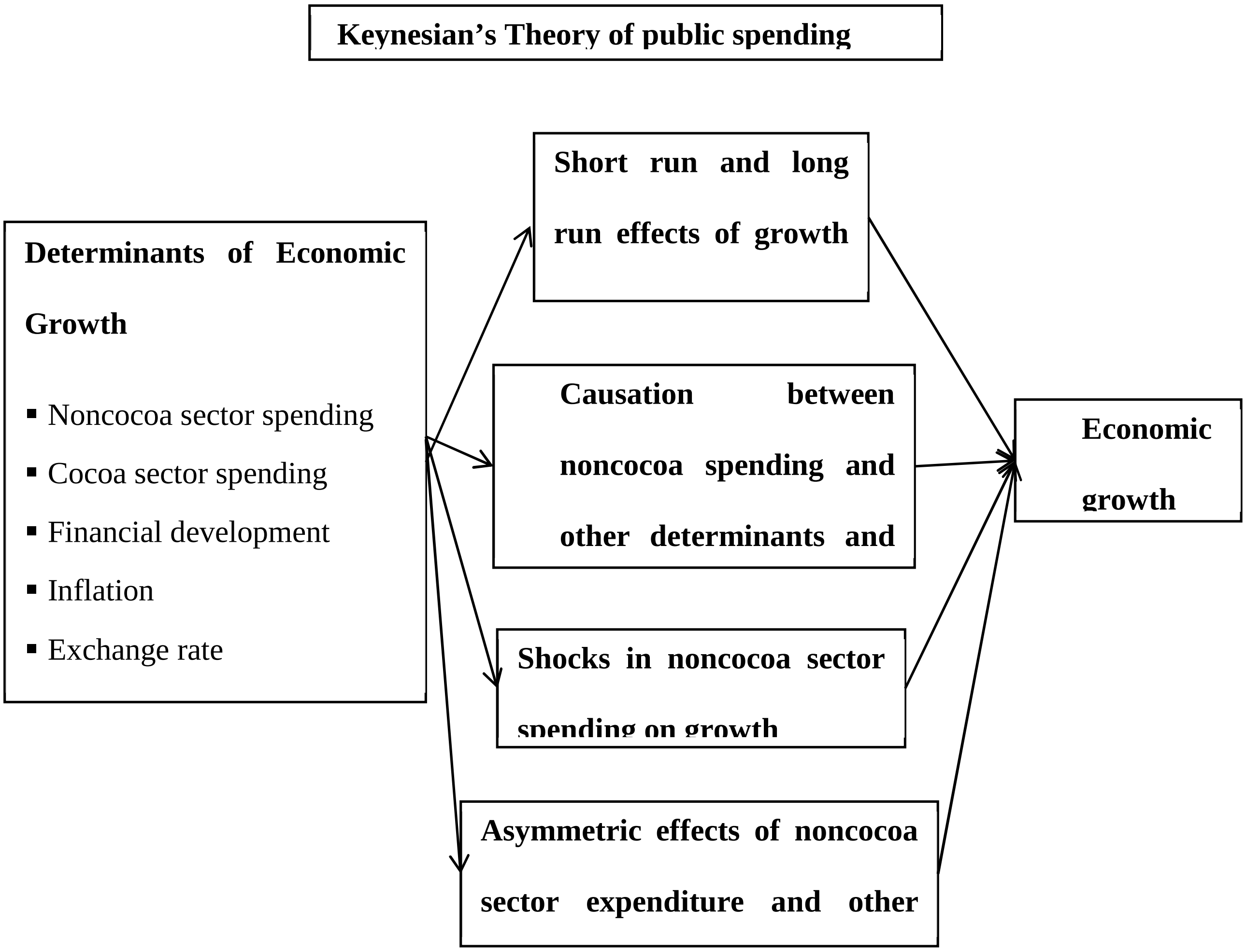

Figure 2. 1: Conceptual Framework

Source: Author's construct, 2022.

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2.6 Summary and gaps from the literature review

There is an expanding body of research on the long-term effects of public agricultural expenditure growth, including both the beneficial and detrimental effects on economic growth (Djokoto, 2012; Tochukwu, 2012; Wangusi & Muturi, 2015; Awan, 2015; Awan and Aslam, 2015). (Romer, 1990; Akpan, 2005; Gregorious & Ghosh, 2007; Edwins, 2017; Etea & Obodoechi, 2018; Dadson & Sackey, 2018).However, despite the studies, there has not been any single study at the time of this current study on the relationship and the long-term influence of government agricultural spending on growing Ghana's economy using annual time series data on public spending on the agricultural sector, specifically on non-cocoa subsector using rigorous econometric techniques such as ARDL model. In order to fill that vacuum, this study uses actual annual data from 1961 to 2019 in Ghana to examine the effects of national spending on the agricultural sector, particularly the non-cocoa subsector, on economic growth.

Lastly, though studies (such as Mitchell, 2005; Izuchukwu, 2011; Musaba *et al*., 2013; Mustapha & Enilolobo., 2019; Epaphra & Mwakalasya, 2017) outside Ghana and Ghanaian studies (including Djokoto, 2011; Enu, 2014; Mohan *et al*., 2014; Okine & Remziye, 2018; Mutaka, 2019; Geiger *et al*., 2019; Mohammed *et al*., 2020) have looked at the causal association between national agricultural spending on the growth of the economy, none of them has focused on up to date (1961 to 2019) data on non-cocoa subsector public expenditure to estimating its effects on the growth of the Ghanaian economy. None of those research also focused on analyzing the shocks to Ghana's non-cocoa subsector public spending and how they affect the country's economic growth in an asymmetric way using impulse response and nonlinear ARDL models. The current study, which looks at the relationship between governmental spending on non-cocoa subsector and its consequences on economic growth in Ghana, fills this vacuum.

Overall, even though the review does not claim to be very thorough, it has revealed the scholarly gaps that the current study will fill. It has also informed the choice of

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the data analytical methods as well as provided empirical evidence to allow for adequate interpretation of the current study's findings.

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CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter lays focus on the methods that were employed to attain the objectives of examining the influence of government expenditure on non-cocoa subsector on growing the economy. Specifically, the first section emphasizes on the specification of the model used for the study. The second section involves variable description and measurement as well as the expected impact of the determinants. In the next section, there is a discussion of the estimation technique with emphasis on the ARDL model, also known as the Bounds Test which was used to fit the models of the study. Impulse response and nonlinear ARDL models are also specified. The last section details the type and data sources employed in this study.

3.2 Research Design

The study used a quantitative methodology, notably using time series dimension and an explanatory research design since the main goal of the study was to deepen understanding on the implications of public expenditure on non-cocoa subsector effect on economic growth. The research approach was mainly quantitative analysis made possible with the use of secondary data to quantitatively analyze the patterns in the nexus between growth and government investment in non-cocoa subsector.

3.3 Data Type and Sources

The study looks the long-term effects of public spending on non-cocoa subsector on the growth of the Ghanaian economy employing time series data for the period between 1961-2019. The data for models in this study were extracted from the WDI.

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The response variable is the value of GDP of Ghana. Specifically, the data on the independent variables, that is, public spending on non-cocoa and cocoa subsectors measured by overall public spending in constant 2006 GHS, million, came from various sources (Stryker, 1990; IMF, 1998, 2005; Kolavalli *et al*. 2012; Controller and Accountants General Department (CAAGD), 2012 to 2018; IFPRI; 2015). Data on other explanatory variables including inflation, financial development, and exchange rate were sourced from World Development Indicators (World Bank, 2021).

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3.4 Model Specification

To conduct an empirical analysis of public expenditure on non-cocoa subsector and growth linkage in Ghana, the study specified the general functional form of the model as:

$$LNGDP_t = f(\text{LNNONCOCOA}_t, \text{LNEXCR}_t, \text{LNINFL}_t\ LNCOCOA_t, FINDEV_t) \ldots\ldots\ldots\ldots\ldots\ldots 3.1$$

Where *LNNONCOCOA* denotes log of noncocoa sector spending, *LNEXCR* represents log of exchange rate, *LNINF* is log of inflation (this proxies for macroeconomic stability), *LNCOCOA* is log of cocoa sector spending, and *LNFINDEV* is financial development.

From (3.1), an econometric model is deduced and empirically, the particular model for estimating economic growth for Ghanaian economy is written as:

$$GDP_t = \beta_0 + \beta_1 LNNONCOCOA_t + \beta_2 LNEXC_t + \beta_3 LNINFL_t + \beta_4 COCOA_t + \beta_5 LNFINDEV_t + \varepsilon_t \ldots 3.2$$

Where: β_s are the parameters that the study estimates and ε_t denotes the error term.

Equation (3.2) represents the long-run equilibrium linkage.

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3.5 Variable Descriptions and Expected Signs

This section describes the dependent and independent variables and their expected signs.

Table 3. 1: Variables and expected signs

Variable	*Description*	*Measurement*	*Expected sign*
LNGDP	Gross Domestic Product	Gross National Expenditure	+
LNCOCOA	Cocoa subsector spending	Total annual cocoa sector expenditure (GHC)	+
LNNONCOCOA	Noncocoa subsector spending	Total annual noncocoa sector expendiure (GHC)	+
LNTEXP	Total Government Expenditure	Government expenditure on both cocoa and noncocoa sectors (GHC)	+
LNEXCH	Exchange rate	Official exchange rate (LCU per US$)	+/-
LNINFL	Inflation	Consumer price index (annual %)	-
LNFINDEV	FINANCIAL DEVELOPMENT	Domestic credit to private sector (% of GDP)	+

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3.5.1 Economic Growth (GDP)

Rutherford and Tarr (2002), defined economic growth basically as the rise in the overall or per capita GDP of an economy. This is usually quantified by a rise in real GDP and brought about by a rise in the supply of determinants of production or their productivity. GDP simply denotes the overall volume of overall services as well as goods manufactured over specified time frame. This study measures economic growth in US dollars by using the log of GDP by following Pandya & Sisomba (2017).

3.5.2. Exchange Rate (*EXCH*)

This is measured using data on the nominal official exchange rate expressed in annual average of Local Currency Units (LCU) per US$ and it is expected that the local currency appreciates in value because of the significant flow of foreign currency into country. It promotes economic growth even though that could also be a sign of the Dutch disease syndrome. Therefore, exchange rate is expected to positively ($B_2 > 0$) influence economic growth. The study's use of an exchange rate proxy is based on research by Ibrahim and Alagidede (2017; 2018).

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3.5.3 Inflation (*INF*)

This is basically understood as the persistent rise in overall price level of services as well as goods over specified period. This study considers consumer price index (CPI) for inflation as measured by Ibrahim & Alagidede (2017; 2018). It is measured in units of cost of goods and services annual percentage changes. This study proxy inflation to the overall measure of the stability of the macroeconomy, hence inflation is considered to be inversely associated to economic growth $B_4 < 0$.

3.5.4 Public sector spending on cocoa and non-cocoa subsectors (*TEXP)*

Public sector spending on cocoa and non-cocoa subsector (expenditure in constant 2006 GHS, million) is measured by the total public spending on cocoa production and marketing for the cocoa subsector and crops and livestock, fishing, forestry and logging, tractors, fertilizers, other chemicals, and tools as well as distribution and marketing of output from state farms for the noncocoa subsector. It is thought that it will positively ($B_6 > 0$) influence the growth of the economy, as empirically evidenced by Wangusi & Muturi (2015), Tochukwu (2012) and Awan & Aslam

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(2015). The proxy for public spending on non-cocoa subsector is the spending in constant 2006 GHS, million as adopted by Stryker (1990) and Benin (2016).

3.5.5 Financial Development (*FINDEV*)

Financial development is quantified by local economic credit advanced to the private sector by banks (% of GDP) as measured by Ibrahim & Alagidede (2017; 2018) and it is also thought that it will positively ($B_7 > 0$) influence economic growth. Domestic credit is defined as credit allocated by the financial sector, which includes all gross credit received by various sectors but excludes net credit granted by the federal government. Domestic credit to the private sector is stated as a proportion of GDP and is measured in US$ units.

3.6 Estimation Techniques

3.6.1 Unit Root Test (Stationarity Test)

The mean, variance, and covariance for stationary data are required by contemporary economic literature on the regression of time series analysis. Hence, unit root testing is conducted to prevent spurious regressions. Spurious regression results in analysing economic phenomenon are inappropriate and is not adequate to be considered in policy analysis. In view of this, it is imperative to conduct stationarity test to ascertain the integration order to ensure the selection of an appropriate estimator. To this end, the study employed the Augmented-Dickey Fuller (ADF) approach developed by Dickey & Fuller (1979) and Phillip-Perron (PP) test. The choice of these two tests is to achieve some variable consistency.

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3.6.1.1 Augmented Dickey Fuller (ADF) Test

Dickey & Fuller (1979) developed the ADF test to address the challenges with the Dickey-Fuller test. Its development came with the idea of observations of time series following a random walk. With an autoregressive process which has an order of one,

$$Y_t = \alpha_1 Y_{t-1} + \delta_t \text{.........................}(3.3)$$

where δ_t connotes a white noise sequence, having a zero mean with a constant variance. If α_1 =1, then (3.3) is a not stationary process. The basic idea behind the ADF test is to regress Y_t on its lagged value Y_{t-1} and determine if the estimated α_1 s statistically equates one or not. Deducting Y_{t-1} from each side of equation (3.3), the equation then becomes

$$\Delta Y_t = \gamma Y_{t-1} + \delta_t \text{.........................}(3.4)$$

where $\gamma = \alpha_1$ -1 and $\Delta Y_t = Y_t - Y_{t-1}$. Practically, rather than finding the estimate of equation (3.3), instead equation (3.4) is estimated and the null hypothesis of γ =0 against the alternative $\gamma \neq 0$ is tested. If γ =0, then α_1 =1, implying that the data series for the period have a unit root. Rejecting the null hypothesis or not depends on the Dickey-Fuller critical values. The Dickey-Fuller test assumes uncorrelated error terms. Aside this, the Dickey-Fuller test errors usually reveal elements of serial correlation. In handling this issue, the ADF test adds to the regression equation, the lags of the first difference series to ensure the error term is white noise and therefore the regression model transforms into

$$\Delta Y_t = \gamma Y_{t-1} + \sum_{i=1}^{n} \alpha \Delta Y_{t-1} + \delta_t \text{.........................}(3.5)$$

Including the intercept and time trend, equation (3.5) transforms into

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$$\Delta Y_t = \alpha_0 + \eta_t + \gamma Y_{t-1} + \sum_{i=1}^{n} \alpha \Delta Y_{t-1} + \delta_t \text{.........................(3.6)}$$

Where α_0 is a constant, η_t is the coefficient on time trend series, $\sum_{i=1}^{n} \alpha \Delta Y_{t-1}$ connotes the sum of the lagged values of the dependent variable ΔY_t. The test statistic for the ADF test is defined as

$$F = \frac{\gamma}{SE(\gamma)},$$

where $SE(\gamma)$ represents the standard error of the least square estimate of γ. The decision is to reject the null hypothesis if the test statistic is above the critical value (Nasiru, 2013).

3.6.1.2 Phillip-Perron (PP) Test

The PP test is a substitute model to confirm or otherwise the presence of unit root in a data series over a period. Phillips and Perron developed this in 1988. This test helps to identify the existence of autocorrelation as well as heteroscedasticity in the residual term δ_t nonparametrically. The PP test statistic, tests the null hypothesis of non-stationarity against the alternative of stationarity. The PP test consists of the follwing estimated models

$$Y_t = \rho + \beta Y_{t-1} + \delta_t \text{.........................(3.7)}$$

We could exclude the intercept from the model and add a time trend which will lead to $Y_t = \alpha_t + \beta Y_{t-1} + \delta_t$.........................(3.8)

The PP test consists of two test statistics regered to as the Phillips Z_φ and Z_τ with the definitions

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$$Z_{\varphi} = n(\varphi_n - 1) - \frac{1}{2}\frac{n^2\sigma^2}{s_n^2}(\lambda_n^2 - \gamma_{0,n}) \text{..................(3.9)}$$

and

$$Z_{\tau} = \sqrt{\frac{\gamma_{0,n}}{\lambda_n^2}} \times \frac{\varphi_n - 1}{\sigma} - \frac{1}{2}(\lambda_n^2 - \gamma_{0,n})\frac{n\sigma}{\lambda_n s_n}, \text{...............(3.10)}$$

where $\gamma_{j,n} = \frac{1}{n}\sum_{i=j+1}^{n}\delta_i\delta_{i-j}$, where $j = 0$, then $\gamma_{j,n}$ is a maximum likelihood estimate of the variance of the error terms, whereas for $j > 0$, is an estimate of the covariance between two error terms j periods apart.

$\lambda_n^2 = \gamma_{0,n} + 2\sum_{j=1}^{q}\left(1 - \frac{j}{q+1}\right)\gamma_{j,n}$, if the error terms are not correlated,

$\gamma_{j,n}$=0 for $j > 0$, then $\lambda_n^2 = \gamma_{0,n}$.

$s_n^2 = \frac{1}{n-k}\sum_{i=1}^{n}\delta_t^2$ is an unbiased estimator of the variance of the error term, k is the number of independent variables in the regression, q is the number of Newey-West lags to use in the calculation of λ_n^2 and σ.

3.6.2 Co-integration Test

Co-integration test is implemented to arrive at the statistical intuition as to whether a long-run link among factors exists. According to Granger & Newbold (1974), applying OLS or any other related techniques for non-stationary time series could generate spurious results. Thus, the test results of the regression could display that a strong association exists between the given factors, which in fact are not correlated. Similarly, two or more factors may form long-run equilibrium linkage despite they may be out of equilibrium within the short-term. Hence, in view of these issues, Engle & Granger (1987) developed a two-step co-integration test approach based on

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OLS to examine the association among non-stationary factors. To attain study objectives, the ARDL approach for testing co-integration was used.

3.6.2.1 Auto-Regressive Distributed Lag (ARDL)

An ARDL model uses the principle of OLS which can be implemented for both non-stationary time series and for time series with mixed order of integration (Pesaran *et al.*, 2001). Thus, the ARDL approach is applicable to regressors of I (1) and or I (0) (ibid). Furthermore, Ghatak & Siddiki (2001) asserted the efficiency of the ARDL model in cases of a smaller sample size. Furthermore, the approach allows for various variables with varied optimal number of lags which is non-applicable in the Johansen-type of models. Therefore, the ARDL Bound testing approach is grounded on the OLS method to verify the presence or the other way round of a long-term association among the factors. This is implemented by performing an F-test for the joint robustness of the coefficients of the lagged levels of the factors.

3.6.3 Error-correction Model

Now, having tested for the long-term equilibrium association that exists among the factors, we go ahead to check for the short-term dynamic parameters using ECM. The ECM helps reconcile the long-run and short-run behavior of the economic factors that are used in the model. Also, the ECM is made up of the error -correction term in the independent variables. This is incorporated in the estimation procedure to gain all the missing long-term information in the original estimation process.

Below is the error correction version of the ARDL model:

$$\Delta Y_t = \vartheta_0 + \sum_{i=1}^{p} \beta_i \Delta Y_{t-i} + \sum_{i=1}^{p} \phi_i \Delta X_{t-1} + \sum_{i=1}^{p} \varepsilon_i Z_{t-i} + \tau_1 Y_{t-1} + \tau_2 X_{t-1} + \tau_3 Z_{t-1} + \mu_t \quad (3.11)$$

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Where, the right-hand side of the equation with β, ϕ and ε shows short-term dynamics of the model whereas the right part with τ_s connotes long-term association. The null hypothesis in the equation is $H_0 = \tau_1 + \tau_2 + \tau_3 = 0$ this implies the non-existence of long-term association. More specifically, the ARDL co-integration test which specifies the *ECM* is based on the equation below:

$$\Delta GDP_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta INFL_{t-i} + \sum_{j=1}^{q} \beta_{2j} \Delta EXCR_{t-j} + \sum_{k=1}^{q} \beta_{3k} \Delta FINDEV_{t-k} + \sum_{l=1}^{q} \beta_{4l} \Delta LNCOCOA_{t-l} + \sum_{m}^{q} \beta_{5m} \Delta LNNONCOCOA_{t-m} + \lambda ECM_{t-1} + \mu_t \text{.................(3.12)}$$

Where, Δ represents the first difference operator and the null hypothesis of no co-integration or no long-term association among the variables is formulated as follows: $H_0 = \lambda_1 + \lambda_2 + \lambda_3 + \lambda_4 + \lambda_5 = 0$. The short-term dynamic coefficients of the model's convergence to equilibrium is represented by β_i while ECM_{t-1} is the error correction model. The *ECM* coefficient, λ, estimates the adjustment speed to ascertain equilibrium in the case of fluctuations to the system.

Also, *INF* represents the rate of inflation, *EXCR* show exchange rate, *FINDEV* represents financial development, *LNCOCOA and LNNONCOCOA* represent government expenditure on cocoa and non-cocoa subsector, Δ denotes first different, 't' denotes the period of time, ECM shows the Error Correction Term and μ illustrates error term. Furthermore, the model specified would meet the prescription made by Narayan critical values of upper I(1) Bound values at 5% significance level. Hence, the ensuing hypothesis would be evaluated in an orderly way, i.e.,

H_0: $\phi 1 = \phi 2 = \phi 3 = \phi 4 = \phi 5 = 0$

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H_1: $\phi 1 \neq \phi 2 \neq \phi 3 \neq \phi 4 \neq \phi 5 \neq 0$

By failing to reject the alternative hypothesis, the results establish that there exists long-term link between the factors in the model, and also the estimated coefficient would be within the upper I (1) bounds value of Narayan's critical values of 5% significance level. Then, the error correction term is determined to ascertain estimates of the adjustment coefficient to arrive at a particular point of equilibrium.

3.6.4 Granger Causality

In connection with the third study objective, where the study seeks to assess the casual linkage between public investment in the agricultural non-cocoa subsector and growth, the study used the method developed by Granger (1969) and the Vector Autoregressive (VAR) model. When two variables X and Y are co-integrated, it implies that there exist any of the following three linkages: X influences Y, Y influences X and finally X and Y influence each other. The latter shows a bidirectional relationship while the first two shows a unidirectional relationship. In effect, Granger (1969) causality test argues that if the present and lagged values of X enhance the forecast of the future value of Y, then one can say X 'Granger causes' Y. Below is the simple Granger causality model:

$$\Delta Y_t = \sum_{i=1}^{m} \alpha_i \Delta Y_{t-i} + \sum_{j=1}^{n} \beta_j \Delta X_{t-j} + \varepsilon_{1t} \text{...........}(3.13)$$

$$\Delta X_t = \sum_{i=1}^{m} \varphi_i \Delta X_{t-i} + \sum_{j=1}^{n} \gamma_j \Delta Y_{t-j} + \mu_{1t} \text{...........}(3.14)$$

Where Y_t represents GDP and X_t represents public spending on the agricultural non-cocoa subsector (all are integrated of I(1) from the unit root test), *m* and *n* are

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the optimal lag lengths, i and j represents time trends and ε *and* μ represents the error terms.

Now, equation 3.13 represents that the present value of ΔY_t (GDP) is associated with previous values of itself and that of ΔX_t (noncocoa sector spending). In the same vein, equation 3.14 shows that ΔX_t (public spending on the agricultural non-cocoa subsector) is associated with the past values of itself and that of ΔY_t (GDP).

The null hypotheses in equation 3.13 is $\beta_j = 0$, this implies that 'Δpublic spending on the agricultural non-cocoa subsector does not Granger cause ΔGDP'. Likewise, the null hypothesis in equation 3.14 is $\gamma_j = 0$, and this states that 'ΔGDP does not Granger cause Δ public spending on the agricultural non-cocoa subsector. Hence, rejecting or otherwise of the null hypothesis H_0 depends on the F-statistic.

3.6.5 Lag Order Selection

In conducting cointegration test or estimating a VAR model, a very crucial step is to identify the appropriate lag order. Three lag order selection techniques were adopted in this study which vary by intensity of the penalty they exert for finding the optimal lag. The researcher employed Bayesian Information Criterion (BIC) (Schwarz, 1978), Akaike Information Criterion (AIC) (Akaike, 1974), and Hannan-Quinn Information Criterion (HQIC) (Hannan and Quinn, 1979) to find out the optimal lag order. These criteria are given by

$$AIC = \ln\left|\sum\nolimits_u (p)\right| + \frac{2}{T} pK^2,$$

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$$BIC = \ln\left|\sum_{u}(p)\right| + \frac{\ln(T)}{T}pK^{2},$$

$$HQIC = \ln\left|\sum_{u}(p)\right| + \frac{2\ln(\ln(T))}{T}pK^{2}, \ldots\ldots\ldots\ldots\ldots(3.15)$$

where T refers to the counts of data observations, p is the lag order, $\sum_{u}(p) = T^{-1}\sum_{t=1}^{T}\varepsilon_t\varepsilon_t$ is the residual covariance matrix without degree of freedom corrected from the model and K refers to model parameters. The BIC and HQIC are consistent estimators and pick models that have less parameters when there is a large sample size than the AIC (Schwarz, 1978; Hannan-Quinn, 1979). The lag order that has the least values regarding these criteria are highly prefered.

3.6.6 Impulse Response

Regarding the objective four, the study goes a step further than earlier contributions and specifically employs VAR with interaction terms that models public spending on the agricultural non-cocoa subsector and economic growth as functions of each other and allows relationships between the endogenous variables to vary with potential determinants of the economic growth. The framework can then be used to calculate impulse response functions.

In a VAR system, examining the estimated coefficients on subsequent lags fails to provide enough information about the dynamic associations among the factors within the system. Instead, it is relevant to trace out the response of the system to usual random shocks that represent positive residuals of one standard deviation unit in each equation in the system. Hence, Sims (1980) proposes the adoption of impulse

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response and variance decomposition to help in attaining this logical interpretation of the VAR system.

Assuming a 2-variables VAR (1) model specified as

$$\begin{bmatrix} x_{1t} \\ x_{2t} \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} x_{1t-1} \\ x_{2t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} \quad \text{……………………………….. (3.16)}$$

A disturbance in ε_{1t} has an immediate and direct effect on x_{1t}. In period $t+1$, that disturbance in x_{1t} influences x_{1t-1} via the first equation and also influences x_{2t-1} via the second equation. These influences work through to period $t+2$, and so on. Hence, a random shock in one innovation in the VAR sets up a chain reaction over time in all factors in the VAR. Impulse response functions compute these chain reactions.

3.6.7 Nonlinear ARDL Model

But regarding the asymmetric effects of public spending on the agricultural non-cocoa subsector on economic growth in Ghana, nonlinear ARDL cointegration method developed by Shin *et al*. (2014) is adopted to determine the long and short-run asymmetry linkages. Basically, the theoretical model is specified as follows:

$$y_t = \alpha^+ x_t^+ + \alpha^- x_t^- + \varepsilon_t \qquad (3.17)$$

where a^+ and a^- connote the long run parameter and x_t is the vector regressor which is explained as: $x_t = x_0 + x_t^+ + x_t^-$ (3.18)

where x_t^+ and x_t^- – represent the positive and negative partial sums for:

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increases... $X^{+} = \sum_{j=1}^{t} \Delta X_j^{+} = \sum_{j=1}^{t} \max(\Delta X_j, 0)$ and decreases... $X^{-} = \sum_{j=1}^{t} \Delta X_j^{-} = \sum_{j=1}^{t} \min(\Delta X_j, 0)$ in (X_t).

Second, the study estimates the modified ARDL model to analyze the asymmetric effects of noncocoa sector spending on growth. The theoretical model is described as follows:

$$\Delta Y_t = \beta_0 + \sum_{i=1}^{p-1} \lambda_i \Delta Y_{t-i} + \sum_{i=0}^{q} \delta_i^{+} \Delta X_{t-1}^{+} + \sum_{i=0}^{q} \delta_i^{-} \Delta X_{t-1}^{-} + \rho Y_{t-1} + \phi^{+} X_{t-1}^{+} + \phi^{-} X_{t-1}^{-} + v_t \ldots\ldots\ldots (3.19)$$

On the other hand, given this, the nonlinear ARDL has the capacity to assess whether the positive fluctuations of the explanatory factors (especially public spending on the agricultural non-cocoa subsector) have the same influence just like the negative shocks on the dependent variable as captured in the following empirical model.

$$\begin{aligned}\Delta LNRGDP_t = {} & \beta_0 + \sum_{i=1}^{p-1} \lambda_i \Delta LNRGDP_{t-i} + \sum_{i=0}^{q} \delta_1^{+} \Delta ININFL_{t-1}^{+} + \sum_{i=0}^{q} \delta_1^{-} \Delta LNINFL_{t-1}^{-} + \sum_{i=0}^{q} \delta_2^{+} \Delta LNEXCR_{t-1}{}^{+} \\ & + \sum_{i=0}^{q} \delta_2^{-} \Delta LNEXCR_{t-1}{}^{-} + \sum_{i=0}^{q} \delta_3^{+} \Delta LNFINDEV_{t-1}{}^{+} + \sum_{i=0}^{q} \delta_3^{-} \Delta LNFINDEV_{t-1}{}^{-} + \sum_{i=0}^{q} \delta_4^{+} \Delta LNCOCOA_{t-1}{}^{+} + \\ & \sum_{i=0}^{q} \delta_4^{-} \Delta LNCOCOA_{t-1}{}^{-} + \sum_{i=0}^{q} \delta_5^{+} \Delta LNNONCOCOA_{t-1}{}^{+} + \sum_{i=0}^{q} \delta_5^{-} \Delta LNNONCOCOA_{t-1}{}^{-} + \rho LNRGDP_{t-1} + \\ & \phi_1{}^{+} LNINFL_{t-1}^{+} + \phi_1{}^{-} LNINFL_{t-1}^{-} + \phi_2{}^{+} LNEXCR_{t-1}^{+} + \phi_2{}^{-} LNEXCR_{t-1}^{-} + \phi_3{}^{+} LNFINDEV_{t-1}^{+} + \phi_3{}^{-} LNFINDEV_{t-1}^{-} \\ & + \phi_4{}^{+} LNCOCOA_{t-1}^{+} + \phi_4{}^{-} LNCOCOA_{t-1}^{-} + \phi_5{}^{+} LNNONCOCOA_{t-1}^{+} + \phi_5{}^{-} LNNONCOCOA_{t-1}^{-} + v_t \ldots\ldots\ldots (3.20)\end{aligned}$$

where LNINFL, LN*EXCR*, FINDEV, COCOA and LNNONCOCOA are as previously defined in the ARDL model, δ_1^{+}, δ_1^{-}, δ_2^{+}, δ_2^{-}, δ_3^{+}, δ_3^{-}, δ_4^{+}, δ_4^{-}, δ_5^{+} and δ_5^{-} are the short-run coefficients of the

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model. ϕ_1^+, ϕ_1^-, ϕ_2^+, ϕ_2^-, ϕ_3^+, ϕ_3^-, ϕ_4^+, ϕ_4^-, ϕ_5^+ and ϕ_5^- refer to the long-run coefficients for the variables.

3.6.8 Bounds test for Asymmetric Long-run Cointegration

Similar to ARDL bounds test, NARDL bounds test is also a joint test of all lagged one-period levels of X^+, X^-, and Y. F-test of Pesaran *et al* (2001) or Narayan (2004) is used to conduct, which is appropriate if a small sample size, n, is used to test the hypothesis $H_0: \rho = \phi^+ = \phi^- = 0$. Alternatively, t-test of Banerjee *et al* (1998) could be used to test if: $H_0: \phi = 0$ and $H_A: \phi < 0$ which indicates no symmetric correlation between variables. The decision rule is: If the H_0 (of no cointegration) is rejected, then the conclusion is that the factors are cointegrated in the midst of asymmetry

For the NARDL long-run asymmetric coefficients, we calculate the NARDL long-run levels asymmetric coefficients by: Dividing the negative of the coefficient of X_t^+ (i.e. ϕ^+) by the coefficient of Y_{t-1} (i.e. ρ): $\frac{-\phi^+}{\rho}$ and also, by dividing the negative of the coefficient of X_t^- (i.e. ϕ^-) by the coefficient of Y_{t-1} (i.e. ρ): $\frac{-\phi^-}{\rho}$. That is, we test $H_0: \frac{-\phi^+}{\rho} = \frac{-\phi^-}{\rho}$ against $H_1: \frac{-\phi^+}{\rho} \neq \frac{-\phi^-}{\rho}$. If the p-value of the computed test statistic is below 5%, the H_0 is rejected and we conclude this to be the evidence that support long-term asymmetry. Short-run asymmetry test is carried out

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by testing $H_0 : \sum_{i=1}^{q-1} \delta_i^+ = \sum_{i=1}^{q-1} \delta_i^-$ against the alternative $H_1 : \sum_{i=1}^{q-1} \delta_i^+ \neq \sum_{i=1}^{q-1} \delta_i^-$. The decision rule is the same as the long-run asymmetric test. If the p-value of the test statistic is below 5%, the H_0 is rejected and a conclusion is drawn that there is evidence that supports short-run asymmetry. We depict the graphs of the asymmetric cumulative dynamic multipliers, which illustrates the pattern of the dependent variable, y_t, to a new equilibrium following a positive and negative unit change in the independent variables, x_t^+ and x_t^- respectively.

The derivation of the cumulative dynamic multiplier effects of x_t^+ and x_t^- on Y are evaluated as:

$m_h^+ = \sum_{j=0}^{h} \frac{\partial Y_{t+j}}{\partial X_t^+}$, and $m_h^- = \sum_{j=0}^{h} \frac{\partial Y_{t+j}}{\partial X_t^-}$, respectively for h = 0,1,2… where, if h $\rightarrow \infty$, then $m_h^+ \rightarrow \frac{-\phi^+}{\rho}$ and $m_h^- \rightarrow \frac{-\phi^-}{\rho}$

3.6.9 Diagnostics and Stability Tests

A stability test is performed to test the stability of the estimated regression equations within the sampled years specified as 1961-2019. Usually, the practice requires the study to conduct diagnostic as well as stability tests to find the robustness of the model implemented. To determine the stability of the estimated coefficient in the context of rising sample size is the aim of this test. The fundamental goal is to assess whether the estimations will vary in large samples or be fixed over a given time. The approach of cumulative sum (CUSUM) test prescribed by Brown *et al* (1975) was employed to check the stability of the evaluated model. The coefficient estimates are

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perceived to be stable if the CUSUM plot is in the interval of 5% level of significance (illustrated by two lines).

Auto regressive conditional heteroscedasticity (ARCH), serial correlation, heteroscedasticity test and residual normality test statistics are adopted for the test of diagnostics. The study adopted Breusch-Godfrey serial correlation LM test and Breusch-Pagan-Godfrey test to test for autocorrelation and heteroskedasticity respectively. The null hypothesis tested for non-existence of autocorrelation and heteroskedasticity while the alternative hypothesis tested for existence of autocorrelation and heteroskedasticity. Where the F-statistics computed shows a probability value of statistical significance, H_0 is rejected and concluded that there exists autocorrelation and heteroskedasticity in the model. Alternatively, if the F-statistics computed reveals a probability value of statistical insignificance H_0 is not rejected and we conclude that there exists no autocorrelation and heteroskedasticity in the model. Lastly, to check for normality of distribution of the variables or otherwise, the Jarcque-Bera test is performed to assess the distribution properties of the variables used in the models.

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CHAPTER FOUR

DATA ANALYSIS AND INTERPRETATION

4.1 Introduction

This section presented an overview of the analysis and discussion of study results as detailed in this chapter. It captured descriptive statistics and correlation matrix on the variables employed in model estimations. It also examined the trend in rate of GDP growth and growth rates in public spending on the noncocoa subsector of agriculture in Ghana. The chapter also generates the unit root tests. Consequently, the chapter estimated and interpreted the linear and non-linear ARDL models, the bounds test, co-integrating relationship and Granger-causality test among the variables. Lastly, stability and residual diagnostic tests were performed.

4.2 Trend Analysis

In terms of the first study objective, the patterns of growth of government spending on the noncocoa and cocoa subsectors of the agricultural sector as well as the growth rate in GDP in monetary terms in Ghana from 1961-2018 is presented in Figure 4.1.

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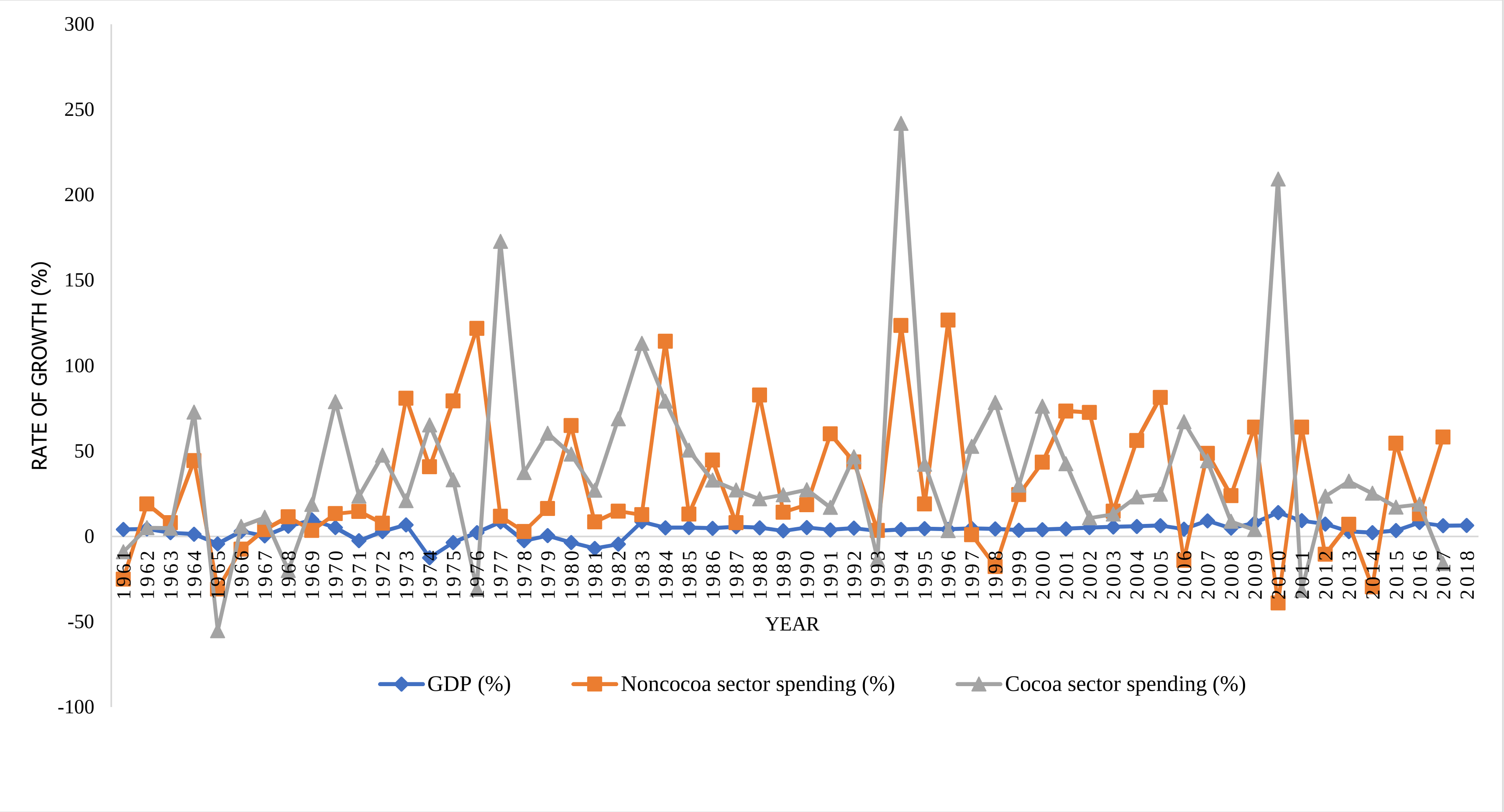

Figure 4. 1: Annual Growth rate of government spending noncocoa and cocoa subsectors and GDP growth rate, 1961-2018

Source: Author’s computation, 2022.

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The purpose of the trend analysis was to offer comprehensive understanding of how the noncocoa and cocoa subsectors have been performing on growth of the economy for the study period. This further gives a visualisation of the possible relationships among the three main variables.

Economic growth experienced a relatively stable growth rate from 1961 to 1962 until 1963 when it started declining and had a significant dip in 1965. This severe drop in the performance of the GDP in 1965 could be attributed to the overthrow of Kwame Nkrumah which dumped the country in socioeconomic and political turmoil. The performance gathered steam again and assumed an uptrend from 1966 till another drop in 1971 and worst drop within the sampled period to about 12.4% in 1974, all due to the political instability that affected the decade. The growth rate of the economy was generally stable in 1986 in the aftermath of the implementation of Structural Adjustment Programme that intended at ensuring the liberalisation of the economy and inducing investment. It is estimated that the economy witnessed an average rate of growth of 5% between 1986 and 2008. Considering the period between 2008 and 2012, real GDP growth was at an average rate of 8%. Quite recently, the economy has seen the most tremendous real GDP growth in 2011 of 14% which is the highest in the country's economic history. This remarkable economic growth rate is underpinned by the large commercial quantities of oil production which took effect at the tail end of the year 2010. This led to a general neglect of government focus on the noncocoa subsector of the economy.

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In terms of state spending on cocoa and noncocoa subsectors of the economy, they both witnessed an upward growth from 1961 to 1964 before there a sharp decrease in 1965. However, spending on the cocoa sector has widely been ahead of the noncocoa subsector. This trend is clear from the years 1968, 1970, 1972, 1974, 1977, 1991, 1994, 1998, 2010 among others as illustrated in Figure 4.1. Again, most of the overall expenditure has been in the cocoa subsector, whereas the noncocoa subsector, which consists of the entire food staples of the country, has not been promoted. National expenditure on the agricultural sector has not been up to 10 percent of its overall spending in majority of the years since 1961, and quite recently, the share, on the average, has been around just 2 to 3 percent, which falls below the standards even in Africa (Diao, *et al*., 2019).

Again, even though on the average, between 1994 and 2013, the noncocoa crop sector grew well. Particularly, Diao, *et al*. (2019) has noted that crops such as roots and tubers and others (4.9 percent and 5.6%, respectively grew well within that period. The manner in which the noncocoa sector has been performing, and especially of food staple crops, is very impressive compared to other African countries. The growth in food staple crops production has successfully kept pace with that of the growth of the population (around 2.5% a year) and increasing per capita incomes (around 2.9%), and with the exception of little wheat imports (which is unsuitable for domestic growth) and rising rice importation, the country has generally been self-sufficient in food staple crops (Diao, *et al*. (2019). Consequently, in 2007, the government began to focus on noncocoa subsector by taking some proactive steps. Some of these were reintroducing subsidies on fertilizers, creation of subsidized Agricultural Mechanization Service Centers (AMSECs), establishing

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Block Farms that are supported with various subsidies on inputs as well as extension, and stabilizing prices of farm output through the creation of the National Food Buffer Stock Company (NAFCO) (Diao, *et al*., 2019, Abukari et al., 2021).

4.3. Summary statistics

Table 4.1 illustrates the summary statistics showing different characteristics of the distribution and nature of the data on the variables employed in the ARDL and nonlinear ARDL analysis.

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Table 4. 1: Summary Statistics of the distribution and nature of the data on the variables employed

Statistic	*GDP*	*COCOA*	*NONCOCOA*	*INFL*	*EXCH*	*FINDEV*	*TEXP*
Mean	US$18.6 billion	905.2478	135.4295	26.4869	0.7086	8.3306	1040.6770
Median	US$12.1 billion	2.8961	0.9789	20.0414	0.0326	7.8885	3.8750
Maximum	US$57.3 billion	8570.4340	1249.123	123.0612	5.2174	15.8275	9359.8890
Minimum	US$7.25 billion	0.0016	0.0021	-3.8784	7.14E-05	1.5423	0.0041
Std. Dev.	1.36E+10	2057.1020	266.7264	22.1660	1.2830	4.3810	2298.9710
Skewness	1.4186	2.4506	2.190603	2.0115	2.1505	0.1774	2.3821
Kurtosis	3.8483	7.86642	7.497107	8.2157	6.7207	1.7042	7.5606
Jarque-Bera	21.5586	115.2862	95.26244	106.6642	79.5069	4.3620	105.1168
Probability	0.0000	0.0000	0	0.0000	0.0000	0.1129	0.0000
Sum	1.10E+12	52504.3700	7854.91	1562.724	41.8050	483.1728	60359.29
Sum Sq. Dev.	1.07E+22	2.41E+08	4055148	28497.09	95.4732	1094.0050	3.01E+08
Observation.	59	58	58	59	59	59	58

Source: Author’s computation, 2022.

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In particular, the standard deviation shows the variables mean variations. A low standard deviation suggests high proximity of the data point to its mean, whiles high standard deviation shows that the data point widely spread out over its mean values. From Table 4.1, in the summary statistics, all the data points on the variables generally have low standard deviation. This shows stable long-term values of noncocoa subsector national investment and growth.

The statistics reveals that on the average noncocoa subsector spending (*NONCOCOA*) is GHc 135.4295 million whiles GDP averages US$18.6 billion. On the other hand, total public spending on both cocoa and noncocoa sector spending was an average of GHc 1040.677 billion. The low GDP growth rate is accounted for by multifaceted economic and environmental factors. These include poor resource conservation mechanism, easy environmental laws, bad governance, instability in the political system, etc., which affects the country's strive to investing adequately in the noncocoa sector as well as sustainable policies to promote the sector. On average, cocoa sector spending (*COCOA*) averaged about GHc 905.2478 million. The financial factors averaged including inflation being 26.4869% whiles exchange rates averaging around GHc 0.70856 per US$ and financial development had an average value of 8.3306% of GDP. The 58 observations in government expenditure was due to non availability of data for 2019.

4.4: Stationarity Analysis of the Variables

Mostly, a number of time series factors have their series not being stationary and therefore employing them in the model could result in spurious regressions (Granger, 1969). Unit root test is critical in analysing time series data especially in

ARDL and nonlinear ARDL models. Accordingly, ADF unit root test is performed to see if the variables have unit root or not as illustrated in Table 4.2.

Table 4. 2: Unit Root Test (Using ADF and PP Tests)

Panel A: Level

Variable	**Augmented Dickey Fuller (ADF)**		**Philips Perron (PP)**	
	Constant No Trend	Constant Trend	Constant No Trend	Constant Trend
Data period: 1961 – 2019				
EXCH	-0.4021	-1.9595	-0.1280	-1.8247
INFL	-3.7295***	-3.5960**	-3.5035**	-3.3228*
FINDEV	-0.9995	-1.5251	-1.0223	-1.5479
TEXP	-5.8618***	-3.6843**	-7.3788***	-9.1694***
COCOA	0.2506	-2.7817	0.2425	-2.8157
GDP	3.177592	-0.1647	-3.1776	-0.3186
NONCOCOA	0.2692	-2.7588	0.3202	-2.7352

Panel B: First Difference

Variable	**Augmented Dickey Fuller (ADF)**		**Philips Perron (PP)**	
	Constant No Trend	Constant Trend	Constant No Trend	Constant Trend
Data period: 1961 – 2019				
EXCH	-4.2933***	-4.2467***	-4.1909***	-4.1419***
INFL	-9.8526***	-8.4843***	-11.0516***	-14.2525***
FINDEV	-7.0620***	-7.0473***	-7.0317***	-7.0160***
TEXP	-3.0924**	-23.4004***	-15.5977***	-27.7611***
COCOA	-8.6886***	-8.6327***	-8.5948***	-8.5474***
GDP	-4.9011***	-5.7375***	-4.9011***	-5.5830***
NONCOCOA	-8.5756***	-8.4942***	-8.5106***	-8.4360***

*The null hypothesis indicates the series is non-stationary, or has a unit root. Rejecting the null hypothesis for both PP and ADF tests is dependent on the MacKinnon critical values. *, ** and *** represent rejecting the null hypothesis of non-stationary at 10%, 5% and 1% significance level, respectively.*

Source: Author's computation, 2022

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All variables of focus in this study were tested for unit root, and they were noted to have unit root at levels both without trend and with trend except inflation (*INFL*). As a result, entire study variables that showed the presence of unit root at levels were first differenced in order to ascertain the integration order of such faactors. The need for their inclusion or exclusion from the ARDL model is important as it is a requirement that all variables must not be unit root at most first difference before they can be included in a model estimation. After first difference all the variables were found to be stationary both without trend and with trend at 1% significance level employing both the ADF and PP tests. Hence, the study applied the *ARDL* and *nonlinear ARDL* methodology to estimate the model.

4.5 Impact of Noncocoa Sector Spending on Economic Growth in Ghana

To evaluate the influence of public spending on the noncocoa sector on growth, both linear and nonlinear ARDL models were estimated. Moreover, the estimation of both ARDL and NARDL models, was due to the fact that there are no *a priori* reasons to believe that increases and decreases in public investment on the noncocoa subsector of the agricultural sector will have the same growth implications. Again, it is worth noting that the estimation of these models was done with and without the inclusion of total government expenditure on both cocoa and noncocoa subsectors.

4.5.1 Models One (1) and Two (2): ARDL and NARDL Models Without Total Expenditure

The models one (1) and two (2) illustrates models illustrate estimates of the ARDL and NARDL models without total government spending on cocoa and noncocoa subsectors of the economy. As a result, both cocoa and noncocoa sector spending

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are entered into the ARDL and NARDL models as individual explanatory variable to isolate the individual consequences of the national investment on these two subsectors of total public spending on both subsectors. The bounds test for cointegration, long-term results, short-term results and diagnostic tests, for model one, are presented as follows.

4.5.1.1 Bounds Test for Cointegration

After the stationarity test to ensure the requirement that overall study factors are at most I(1) is met, the next attempt in implementing the ARDL and NARDL analyses without total agricultural sector spending. To verify the possible occurrence of co-integration or long term equilibrating link between noncocoa sector spending and economic expansion is to run the bounds test for cointegration as in Table 4.3.

Table 4. 3:Results of the Bound Test for Cointegration for ARDL and NARDL models without total public agricultural sector spending

ARDL Bounds test. Null hypothesis (H0): No long-run relationships exist.				
Critical Value	***F-Statistic Value***		***Bounds*** ***Unrestricted intercept and no trend***	
			I(0)	***I(1)***
Noncocoa subsector government spending led economic growth	9.9797	99 %	3.06	4.15
		95 %	2.39	3.38
		90 %	2.08	3.00
NARDL Bounds test. Null hypothesis (H0): No long-run relationships exist.				
Critical Value	***F-Statistic Value***		***Bounds*** ***Unrestricted intercept and no trend***	
			I(0)	***I(1)***
Noncocoa subsector government spending led economic growth	4.7452	99 %	2.41	3.61
		95 %	1.98	3.04
		90 %	1.76	2.77

Source of critical values: Pesaran *et al*. (2001).

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The idea of this is to evaluate the null hypothesis of no co-integrating vector against the alternative that there is one co-integrating vector. The outcomes of the ARDL and NARDL Bounds test (Table 4.3) show that for the ARDL model, the F-statistical value (9.9797) is greater than the critical threshold levels of 1%, 5% and 10%. Also, regarding the NARDL model, the F-statistical value (4.7452) is also above the critical threshold levels of 1%, 5% and 10%. Hence, the study rejects the H_0 of no cointegration, and as a result confirm the presence of long-term relationships as the estimated F-statistic is above the upper critical bound, with reference to Narayan (2005) developed critical values.

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4.5.1.2 Long-run Equation Results of ARDL and NARDL Models without Total Agricultural Sector Spending

To understand the long-term association between growth of the economy and noncocoa sector spending and the control variables, the study further estimated the long-term coefficients employing ARDL and NARDL Strategy. The maximum lag order was selected using AIC (Akaike Information Criterion). For the ARDL model, it was picked as ARDL (1, 0, 1, 2, 3, 2) and for the NARDL model, it was selected as NARDL (2, 1, 1, 0, 1, 2, 1, 1, 3, 0, 3), which is the implications of individual investment in the cocoa and noncocoa subsector spending on growing the economy. The results are shown in Tables 4.4 and 4.5.

The long-run results of linear ARDL approach as shown in Table 4.4 indicate that both the cocoa (*LNCOCOA*) and noncocoa sector spending *(LNNONCOCOA*) independent determinants were not strong in the long-run. The coefficient of the noncocoa spending was, however, positive indicating that the sector contributes economic growth unlike the cocoa sector spending which was found to inhibit growth of the economy as it carried a negative coefficient.

Again, the results further established that though the control variable of inflation, financial development and exchange rate were not statistically significant, they carried their expected signs. That is, inflation was found to negatively affect growth, financial development was noted to positively influence growth whiles improvement in exchange rate was found to have a direct implication for growing the economy of Ghana.

However, despite that the signs of the effects of the explanatory variables were largely as initially expected, the total lack of significance of these determinants of growth casts some doubts on the efficiency and consistency of the linear ARDL results. This assertion draws its justification from an observation by Oryani *et al*. (2020) that the sole implementation of linear ARDL model estimation fails to robustly generate consistent results, and that employing nonlinear ARDL model estimation technique resolve this anomaly in estimating linear ARDL models.

In other words, the linear ARDL model differs from that of the non-linear ARDL model in the following: (1) the capacity of the latter to isolate the negative and positive long-run implications of the determinants on the dependent variable, and (2) the capacity of nonlinear model to prevent likely associations among the variables of the study from being ignored by checking the hidden co-integration among the determinants and dependent variable (Khan *et al*., 2021). Despite these, both models possess some strengths compared to traditional techniques (Johansen & Juselius, 1990): (1) appropriate to use even with a small sample size (Rafindadi &

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Ozturk, 2016), (2) not affected by autocorrelation and endogeneity issues (Akalpler & Hove, 2019), (Alam & Quazi, 2003), (3) the capacity to assign various lag lengths to various variables (Rahman & Kashem, 2017) and (4) easy to implement and explain the results due to the single equation set nature of it.

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Table 4. 4: Estimated Long-run Coefficients using ARDL and NARDL Approaches without Total Government Spending on the overall Agricultural sector

	(I) ARDL	(II) NARDL
	Dependent variable: Economic growth	
Independent Variables	Coefficient	Coefficient
LNNONCOCOA	0.5021 (0.4275)	
LNNONCOCOA_POS	-	0.2457*** (0.0751)
LNNONCOCOA_NEG	-	-0.4657*** (0.1248)
LNINFL	-0.5646 (0.3401)	
LNINFL_POS	-	-0.0382 (0.0444)
LNINFL_NEG		-0.0970 (0.0649)
LNFINDEV	0.4999 (0.3070)	
LNFINDEV_POS	-	-0.0420 (0.1378)
LNFINDEV_NEG	-	0.2819* (0.1498)
LNEXCR	0.0469 (0.1991)	
LNEXCR_POS	-	0.1013 (0.0620)
LNEXCR_NEG	-	-1.2296 (1.2316)
LNCOCOA	-0.3388 (0.4652)	

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LNCOCOA_POS	-	-0.1767**(0.0767)
LNCOCOA_NEG	-	0.0397 (0.0397)
C	24.7457***(1.8967)	
		22.6547***(0.1291)

Note: *i*. *, **, *** represent 10%, 5% and 1% level of significance respectively.

ii. Parentheses, ( ) are standard errors; abbreviations POS and NEG indicate positive and negative partial sums.

Source: Author's computation, 2022.

Table 4. 5: Error Correction Representation for the Selected Linear ARDL Model without Total Expenditure on overall Agricultural spending

	(I)	(II)
	ARDL	NARDL
Independent variables	**Dependent variable: Economic growth.**	
	Coefficient	**Coefficient**
D(LNGDP(-1))		0.3466*** (0.0662)
D(LNINFL)	-0.0229*** (0.0080)	
D(LNINFL_NEG)		-0.0126* (0.0073)
D(LNFINDEV)	-0.0261 (0.0210)	
D(LNFINDEV(-1))	-0.0850*** (0.0232)	

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D(LNFINDEV_POS)		-0.0007 (0.0223)
D(LNFINDEV_POS(-1))		-0.0595*** (0.0206)
D(LNFINDEV_NEG)		0.0014 (0.0311)
D(LNEXCR)	0.0692*** (0.0202)	
D(LNEXCR_NEG)		-0.4504** (0.2012)
D(LNEXCR(-1))	0.0319 (0.0221)	
D(LNEXCR_NEG(-1))		-0.6588*** (0.1631)
D(LNEXCR(-2))	0.0652*** (0.0188)	
D(LNEXCR_NEG(-2))		0.9905*** (0.1587)
LNNONCOCOA	0.5021 (0.4275)	
D(LNNONCOCOA_POS)		0.0283** (0.0113)
D(LNNONCOCOA_NEG)		-0.0351** (0.0352)
D(LNCOCOA)	-0.0112 (0.0135)	
D(LNCOCOA_POS)		0.0163 (0.0112)
D(LNCOCOA_NEG)		0.0296 (0.0240)
D(LNCOCOA(-1))	-0.0311** (0.0136)	
D(LNCOCOA_NEG(-1))		0.0059 (0.0232)
D(LNCOCOA_NEG(-2))		0.0718*** (0.0212)

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*CointEq(-1)**	-0.0702*** (0.0078)	
*CointEq(-1)**		-0.2775*** (0.0313)

Notes: *i. ARDL: ECM = LNGDP - (0.5021*LNNONCOCOA-0.5646*LNINFL+0.4999*LNFINDEV + 0.0469*LNEXCR-0.3388*LNCOCOA + 24.7457)*

*ii. NARDL:ECM=LNGDP-(0.2457*LNNONCOCOA_POS-0.4657*LNNONCOCOA_NEG-0.0382*LNINFL_POS-0.0970*LNINFL_NEG-0.0421*LNFINDEV_POS + 0.2818*LNFINDEV_NEG -0.1767**LNCOCOA_POS + 0.0397*LNCOCOA_NEG + 0.1013*LNEXCR_POS - 1.2296*LNEXCR_NEG + 22.6547*)*

iii. *, **, *** represent 10%, 5% and 1% level of significance respectively

iv. Parentheses, ( ) are standard errors; abbreviations POS and NEG indicate positive and negative partial sums.

Source: Author's computation, 2022.

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Interestingly, most studies (including Wangusi & Muturi, 2015; Awan, 2015; Awan & Aslam, 2015; Edwins, 2017; Etea & Obodoechi, 2018; Dadson & Sackey, 2018) that sought to assess the consequence of spending on agriculture growth have all relied entirely on the estimates linear ARDL model to make policy recommendations to governments of different countries around the globe. This gap is therefore closed in this present study as it further estimates the nonlinear ARDL model in this section.

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With regards to the NARDL model results for the long-run without total spending on the agricultural spending, of the five (5) explanatory variables incorporated in the model, three (3) determinants were strong whiles two (2) were not significant. The variations in these results for the ARDL and NARDL models confirm earlier assertions about the consistent and robustness of the NARDL model in bringing out long-run cointegration between variables when ARDL fails to do so. Also, the elasticities of the positive and negative implications of the NARDL model results were not the same implying asymmetry in the positive and negative effects of the determinants on the dependent variable, economic growth, thus further justifying the fitting of the NARDL model.

Table 4.4 illustrates that in the long-term the consequence of national investment in the noncocoa subsector in Ghana has asymmetric results. That is, negative noncocoa sector spending effect on growth differs from that of positive noncocoa sector effect. The long-run coefficient for the positive noncocoa sector effect is positive 0.2457. The implication is that in the long-term, increasing noncocoa sector spending leads to a rise in economic. More specifically, a 1% rise in noncocoa sector spending causes a 0.25% rise in growth. Similarly, the negative influence of noncocoa sector spending on growth is - 0.4657 which signifies that a contraction in noncocoa sector spending by 1% is capable of reducing the growth of the economic by 0.47%, holding other factors constant. These findings connect clearly with the the Keynesian school of thinking that there is a causal association between national investment and growth. As a result, Keynesian's regard national investment as an exogenous element that may be utilized as a policy tool to induce an economy to grow. This idea indicates that the public sector contributes highly in speeding up economic development, and a bigger government is expected to influence growth in the long-term. They claim that the public sector crucially influences the resolution of the competing social and private interests as well as guiding growth and development in a socially optimal direction (Jahan *et al*., 2014).

According to Table 4.4, a 1% increase in financial sector development (*FINDEV)* decreases economic growth *(LNGDP)* by 4%, even though it is not statistically significant, while the growth of economy rises by 0.28% in response to 1% decline in financial development (*FINDEV).* This result is incompatible with our expectation, as the study expects that smoothing out private credit delivery system to the private sector including farmers in the noncocoa sector should enhance growth. However, this inconsistency with expectation is not much surprising and could have resulted from household's misapplication of credit facilities and the mounting levels of nonperforming loans that have characterized the banking sector for many years now.

An increase in cocoa sector spending results in an inverse influence growth as illustrated in Table 4.4. The long-term coefficient, -0.1767, implies that economic

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growth would decline by 0.18% due to 1% increase in cocoa sector spending. This was revealed to be robust at 5% level of significance. Also, surprising, the economy grows at 0.04% for any 1% decline in cocoa sector spending in Ghana. These surprising results highlight the fact that the current management of the cocoa where syndicated loans are contracted every year to facilitate the buying and selling of cocoa beans hampers the country's economic growth. More so, the results demonstrate that proper policy initiatives and implementable programmes coupled with adequate and proper monitoring in the noncocoa sector could leverage the sector as a major driver of growth. This finding is in line with that of Awan (2015) who found an inverse association between agricultural sector spending and growth in countries from the developing world whereas a positive association was found in advanced economies. Awan & Aslam (2015), likewise, also noted a positive long-run link between agricultural sector spending and growth.

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4.5.1.3 Short-run Equation Results of ARDL and NARDL Models without Total Agricultural Sector Spending

The short-run results of the linear ARDL without total government are presented in this section. The study has shown in Table 4.5 that the first difference of the factors used in the model is denoted as D and represents the short-term findings as well as their associated tests of significance.

The notion *ECM (-1)* is defined as the delayed residue that originates from the long-term equilibrium equation. Bannerjee *et al* (1998) revealed that the very robust error correction term also implies to the presence of a stabilised long-term association. Results in Table 4.5 reveal that, the *ECM (-1)* coefficient for the ARDL model is negatively signed and very robust at 1% implying economic growth converging to the equilibrium position, the error-correction process converges to equilibrium path every year. The robust and appropriate sign of the error correction coefficient further establishes the existence of a long-term equilibrium relationship between the growth of the economy and determining factors captured in the model. The coefficient is –0.07 and signifies that the divergence from the long-term growth of the economy is rectified by 7% within the model by the following year. That is, the very robust error correction term implies that 7% of disequilibrium effect from the past year is rectified in the present year. This finding shows that the adjustment speed is reasonably high in the model. On the other hand, the *ECM (-1)* coefficient for the NARDL model is also negatively signed and very robust at 1% implying economic growth converging to the equilibrium position, the error-correction process converges to equilibrium path every year. The coefficient is –0.2775 and signifies that the divergence from the long-term growth of the economy is rectified by 0.28% within the model by the following year.

Inconsistent with the ARDL long-run results, at 1% level of significance, inflation inversely but strongly affect growth such that a 1% rise inflation decreases economic growth by 2 percent whereas in the NARDL model, a 1% rise in inflation resulted in .013% decline in the growth of the economy. The negative inflation and economic growth linkages are consistent with Mutaka (2019) that inflation has a significantly high inverse long-run effect on TFP growth.

Furthermore, short-term results for the ARDL model from Table 4.5, showed that financial development (*FINDEV*) presents interesting and robust effects on the

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growth of the economy. The current year's financial sector development has significant effect on growth and one percent increase in current financial sector development decreases current growth of the economy by 0.027 percent. For the NARDL model results, a positive increase in financial development (*FINDEV*) results in 0.07% decrease in economic growth whiles a decline in financial development by 1% results in a growth of the economy by 0.14%. Though the results of the short-term implication of financial development for growth demonstrate that higher levels of development in the financial sector hinder the growth of the economy in both the ARDL model and the NARDL model. These results are akin to that of the long-term effect of financial development on growth in the NARDL model, and could be explained with the credit diverting factor but the differences in the short-run elasticities in the ARDL model and the NARDL model implies the existence of asymmetry in the effects. The result, though, is inconsistent with the long-term results of development of financial-growth association but the finding is associated with the findings of Geiger *et al*. (2019) who studied growth determinants in Ghana and concluded that even though financial development and infrastructure have higher potentials for growth in the long-run but in the short-term, government should pay more attention to stabilization policies.

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Dissimilar to the ARDL results of the long-run, current exchange rate (*EXCH*) was ascertained to negatively and robustly influence growth at 1% significance level. Specifically, the findings showed that for every one percent appreciation in the domestic currency, growth of the economy rises by 0.07 percent, *ceteris paribus*. This contrast sharply with the results of the NARDL model which generally found exchange appreciation to have an inverse consequence on growth. On the other hand, the NARDL results imply that with the current dependence of the economy on the agricultural sector for most of its foreign exchange, higher appreciation of the local currency will despair the needed FDI that is needed to add value to the raw agricultural produce to attract more foreign exchange and to industrialise the economy. This result is logically consistent with the status quo of the economy but does not sit well with that of Hatmanu *et al*. (2020) who noted that in the short-run in Romania reasonable levels of exchange significantly improved economic growth. The findings illustrate that in the short-term, growth is positively affected by the exchange rate. Yusuf (2015) had earlier established that exchange rate contains some relevant information to forecast the future path of growth in the economy of Nigeria.

In terms of the short-term implications of the noncocoa sector spending on growth, the ARDL model did not find any significant effect at all conventional levels of significance. Though it had the expected positive implication on growth, also, as earlier noted the consistency of the linear ARDL results need to be confirmed by that of the nonlinear ARDL results to have a clear picture of the policy effects of noncocoa sector spending in enhancing economic growth. Hence, on the flipside, the NARDL model results illustrate that a 1% rise in spending on the noncocoa sector was characterised by 0.03% whiles a contraction in spending on the noncocoa sector by 1% resulted in a 0.035% decline in growth. Once again, this demonstrates the existence of asymmetric effects since the results of the ARDL and NARDL models were not the same and the elasticities of the NARDL model of the positive and negative effects were not the same. These results are in line with that of Justice (2012) who noted that in a developing country, Ghana investment in the agricultural sector directly promotes growth. The same findings were found by Tochukwu

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(2012), Wangusi & Muturi (2015) and Awan & Aslam (2015) who have all found, after employing various econometric models, that in the developing world, agricultural sector positively affects economic growth.

Again, from Table 4.5, contrary to the ARDL long-run results, the short-term revealed that the previous year's cocoa sector spending has an inverse but strong influence on current growth in economic activities. More specifically, a rise in previous year's cocoa sector by one percent, current economic growth falls by 0.03 percent. On the other hand, the NARDL results demonstrate that the direction of effect of cocoa sector spending on growth in the short-term is positive for both positive and negative effects. In particular, previous year's cocoa sector spending had a robust and direct growth implication at 1% significant level. It had a coefficient of 0.0718 which interprets that a 1% rise in national investment in the cocoa production leads to a 0.07% rise in economic growth, *ceteris paribus*. Focusing on the results of the NARDL model suggests that as the country transits from the short-term to the long-term, management of the cocoa sector deteriorate as the policies and modalities in managing the cocoa sector in the face increasing global demand as well as competition is getting worse. The positive short-run influence of cocoa sector spending on growth is consistent with the Ghanaian case as Enu (2014) noted that the cocoa subsector is critical to Ghana's growth and overall progress. Therefore, he recommended that the cocoa subsector remains a major policy interest despite drilling oil in commercial quantities.

4.6 Granger Causality Test

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There is empirical evidence of the presence of long-term associations between cocoa and noncocoa sector spending and growth of the economy even though cocoa sector spending effect on growth is not significant as Table 4.6 illustrates.

Table 4. 6: Pairwise Granger Causality Test

Sample: 1961 2019 Lags: 2

Null Hypothesis:	***Obs***	***F-Statistic***	***Prob.***
LNCOCOA does not Granger Cause LNGDP	57	2.22019	0.1188
LNGDP does not Granger Cause LNCOCOA		1.30796	0.2791
LNNONCOCOA does not Granger Cause LNGDP	57	4.58141	0.0147
LNGDP does not Granger Cause LNNONCOCOA		1.74617	0.1845

Note: *, **, *** represent 10%, 5% and 1% level of significance respectively

Source: Author's computation, 2022.

The results demonstrate that there is Granger causality but it unidirectional. The results indicated the existence of long-term causal association between noncocoa sector spending and growth (based on the F-statistics and *p-values*). As highlighted, the study was unable to reject the null hypothesis of no Granger causality between economic growth and cocoa sector spending since cocoa sector spending fails to Granger cause growth at all conventional significance levels and likewise growth was not revealed to Granger cause cocoa sector investment in the long-term.

Contrarily, in the long-term, results indicate the presence of unidirectional causality between noncocoa sector spending and growth. This confirms the finding of a long-

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term link between cocoa sector investment and the growth. As seen in Table 4.6, the null hypothesis that noncocoa sector spending does not Granger cause growth is rejected. On the other hand, the study failed to reject the null hypothesis of growth fails to Granger cause noncocoa sector spending. The conclusion is that with the cointegration between noncocoa sector spending and growth of the Ghanaian economy, there is unidirectional causality and the direction of causality runs from noncocoa sector spending to growth of the economy and not the other way round. This finding confirms that of Djokoto (2011) who evaluated the granger causality between Ghana's spending on agriculture and FDI growth, and concluded that the increasing openness of the agricultural sector could stimulate the sector's growth and create a potential to boost growth of the overall economy. Also, Edwins (2017) Granger causality test revealed a one-way causality from agricultural sector spending to growth of the Nigerian economy and his findings similar that of Etea & Obodoechi (2018) who later also noted a co-integrating link between national agricultural investment and Nigeria's economic expansion.

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4.7 Diagnostic tests for ARDL and NARDL without Total Expenditure

4.7.1 Diagnostic Test

Again, the ARDL and NARDL models estimated in this study were then passed through residual tests concerning serial correlation (Breusch-Godfrey Serial Correlation LM tests), Normality (Jarque-Bera test), and Heteroscedasticity ('Breusch-Pagan-Godfrey' test) to ascertain model validity. The study model passes through the diagnostic tests as the results are illustrated in Table 4.7.

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For the ARDL model, the p-values of the $\chi 2$ stipulate support of no serial correlation and heteroscedasticity. The results demonstrate that no first-order serial correlation exists given the values of the chi-square and ***p-values*** of 0.7002 (0.5030) fail to reject the null hypothesis i.e. absence of serial correlation exist among the study variables. The study further indicates absence of heteroscedasticity as the Chi-square and P value of 0.7882 (0.6752) fails to reject the null hypothesis of homoscedasticity. The results further demonstrate normally distributed residuals given the Jarque-Bera test value of 0.0111 (0.9944) is above 0.05 and hence the null hypothesis of normally distributed residual cannot be rejected, as shown in Figure 4.2. The Adjusted R^2 = 0.9971 of the ARDL implies that 99.71% of the overall growth variation is caused by public investment in the noncocoa sector and control variables.

In terms of the NARDL model, to inform policy directions and cogent empirical estimation, all diagnostic results indicated failure to reject the null hypothesis of absence of serial correlation, white heteroscedasticity, and normal distribution of the residuals. The coefficient value (Adjusted R^2 = 0.9986) of the NARDL shows that noncocoa sector spending and the control variables caused the speedy adjustment to the equilibrium of the growth model for both the long and short term in one equation.

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Table 4. 7: Diagnostic tests

	ARDL		NARDL	
Diagnostic Test	χ^2	***Probability***	χ^2	***Probability***
Breusch-Godfrey Serial Correlation LM test	0.7002	0.5030	0.236086	0.7913
Breusch-Pagan-Godfrey Heteroskedasticity test	0.7882	0.6752	1.740544	0.2759
Jarque-Bera test	0.0111	0.9944	0.7460	0.6887
Adjusted R^2	0.9971		0.9986	

Note: *, **, *** represent 10%, 5% and 1% level of significance respectively

Source: Author's computation, 2022.

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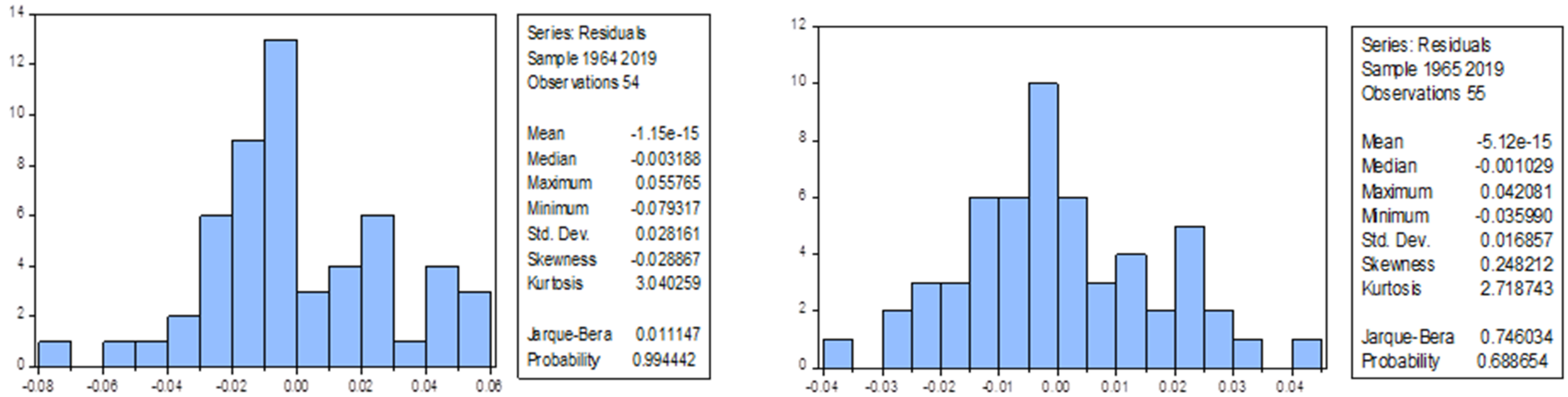

Panel A: Normality plot of ARDL model

Panel B: Normality plot of NARDL model

Figure 4. 2: Normality plots for ARDL and NARDL models

Source: Author's computation, 2022.

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4.7.2 Stability Test

All diagnostic tests have been done including stability tests. So, the stability conditions of the ARDL and NARDL models are shown below in Figure 4.3. These are the CUSUM and CUSUMSQ tests which are usually illustrated graphically as in Figures. 4.3 below.

The validity of the estimate of the statistic is asssessed under the null hypothesis that highlights the stability of the association curve in an interval (Bresson and Pirotte, 1995) given by two straight lines. The CUSUM test is then employed for checking the stability hypothesis of the long-term linkage between economic growth and its determining factors, especially noncocoa sector spending. It is observed that the curves of the CUSUM and CUMSQ tests are well within the confines of the confidence interval at the 5% threshold for the ARDL model.

Furthermore, for the NARDL model, Figures 4.3 demonstrate that the cumulative sum of square (CUSUMSQ) and cumulative (CUSUM) recursive residual test statistics are also in accepted ranges at 5% significance. Therefore, it shows stability of the graphical plots of the series in the error correction model (*ECM*). The implication is that the chosen model to assess the linkage between growth and its determining factors is stable.

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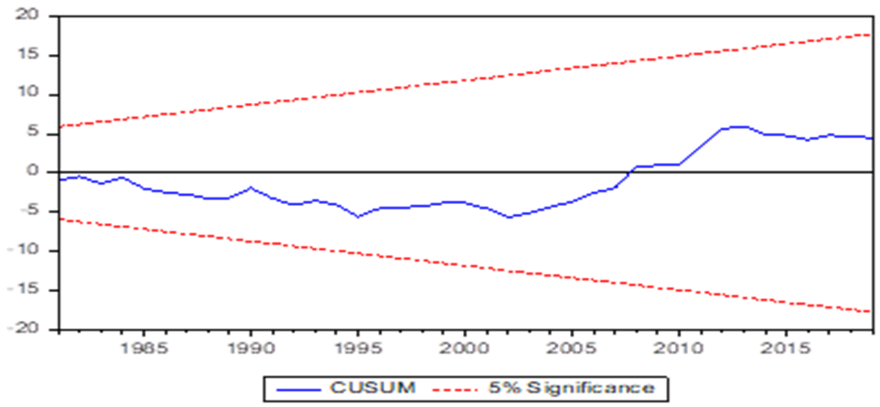
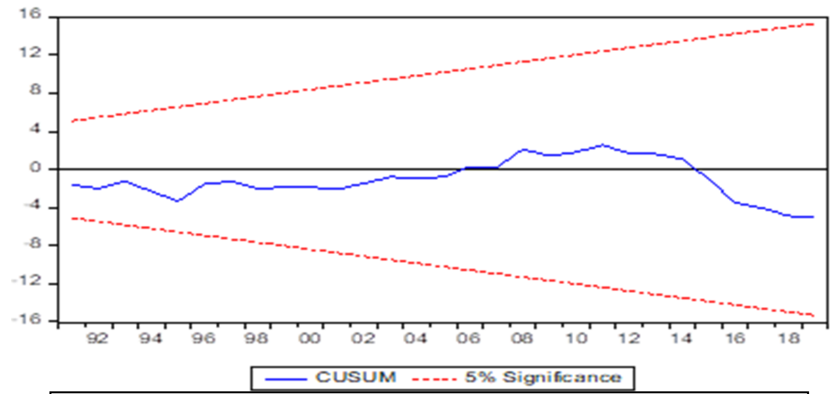
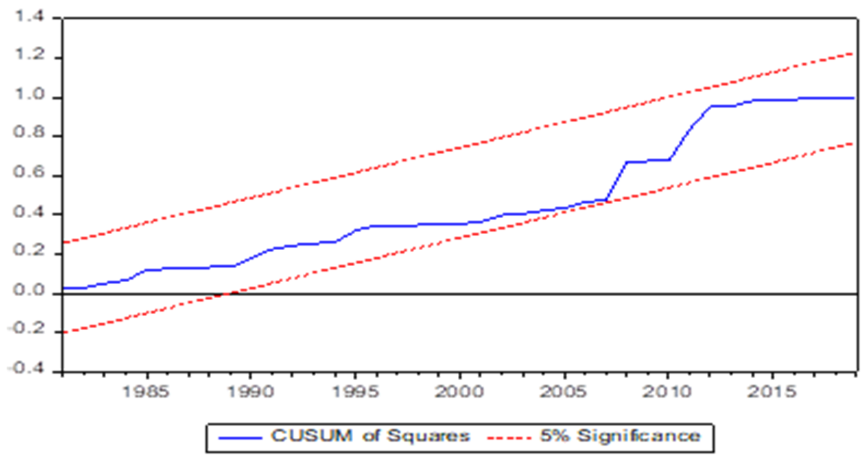


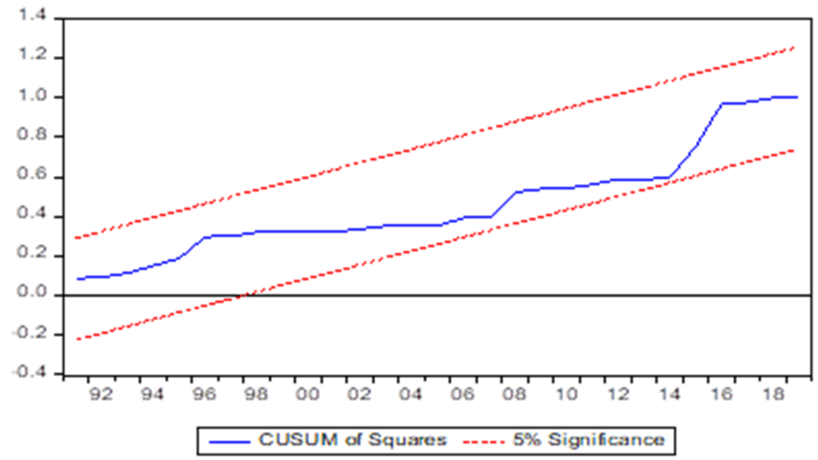
CUSUM plots for the ARDL model's stability tests.



CUSUM plots for the NARDL model's stability tests.



CUSUMSQ plots for the ARDL model's stability



CUSUMSQ plots for the NARDL model's stability

Figure 4. 3: Stability tests for the ARDL and NARDL specifications

Source: Author's computation, 2022

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4.8 Dynamic multipliers

The conventional ARDL technique usually generates complicated results that are not easily interpretable. Philips (2018) has offered a better flexible method to reduce the uneasiness that come with the interpretation of the results from the conventional ARDL. Philips' (2018) procedure dynamically induces the implications of a change in the weak exogenous regressor and how that change 'flows' via the dependent variable over time depending on stochastic simulation technique. The dynamic multiplier graph evaluates the adjustment of asymmetry in long-term because of negative and positive explanatory variables' fluctuations.

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Consequently, the dynamic multipliers plots were generated for the various explanatory variables. That is, deducing from the black solid line of the dynamic multiplier plots (Figure 4.4) thaacct a 1% rise in financial development decreases the short-run GDP by less than 1% and this converges to about -0.08 % in the long term. In the same way, considering the black-dashed line, it is obvious that a 1% decrease in financial development reduces short-run growth by less than 1% and this converges to about -0.23% in the long run. Again, the net consequence of financial development (thick red-dashed line) is negative both in the short run and in the long term, decreases in the short term, and finally converges to about -0.32% (Figure 4.4).

Again, in Figure 4.4 simulates the shocks in exchange rate effect on growth of an economy. It can be seen that a 1% shock (rise) in exchange rate in the short-term results in a less than 1% decline in growth which converges to around 0.1% in the long-term. Likewise, a 1% decrease in exchange rate raises growth by more than 1% in the short-run but finally falls to converge at 0.7% in the long-run. Overall, the net

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effect of exchange rate on growth is positive both in the short-term and in the long-term, it rises in the short-run and finally comes to 1.5%.

In terms of inflation, the results reveal that a 1% inflation rise reduces short-run growth by less than 1% which finally converges to 0.046% whiles a decrease in inflation by 1% increases short-term growth by less than 1% and converges to 0.108% in the long-run. Generally, the asymmetric plot or net effect of inflation is positive both in the short-run and long-run, whereby it rises in the short-run and converges to 0.082% in the long-run.

With regards to noncocoa sector spending, Figure 4.4 indicates that a shock by raising spending on the noncocoa sector by 1% raises short-run growth but by less than 1%, and it converges to 0.21% in the long-run. In the same way, a decline in noncocoa sector spending by 1% rises short-run growth by less than 1% and this converges to about 0.37%. Overall, the net effect of noncocoa sector spending is both positive both in the short-run and long-run where it initially rises in the short-run and subsequently converged to 0.45%. Positive and negative change curves showed existence of asymmetric adjustment of economic growth to negative and positive noncocoa sector spending shocks at a particular time. Generally, the dynamic multiplier graph results show that the negative noncocoa sector spending fluctuations have more growth implications in the long run relative to the positive noncocoa sector spending shocks but demonstrating the existence of positive asymmetry in the long run some extent since the net effect is positive. The results evidence a positive link exists between noncocoa sector spending and growth. That is, the negative fluctuations in noncocoa spending has a positive link with growth.

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Lastly, concerning the cocoa sector spending, it was found that a 1% shock of spending increases in the sector reduces short-run growth by less than 1% and converges to -0.14% in the long-term. Similarly, a shock of 1% decline in cocoa sector spending also reduces short-term growth by less than 1%, converging to about -0.08 in the long-run. Generally, the net effect of cocoa sector spending on growth is negative both in the short-run and long-run. It decreases sharply in the short-run and finally gets a convergence figure of -0.19.

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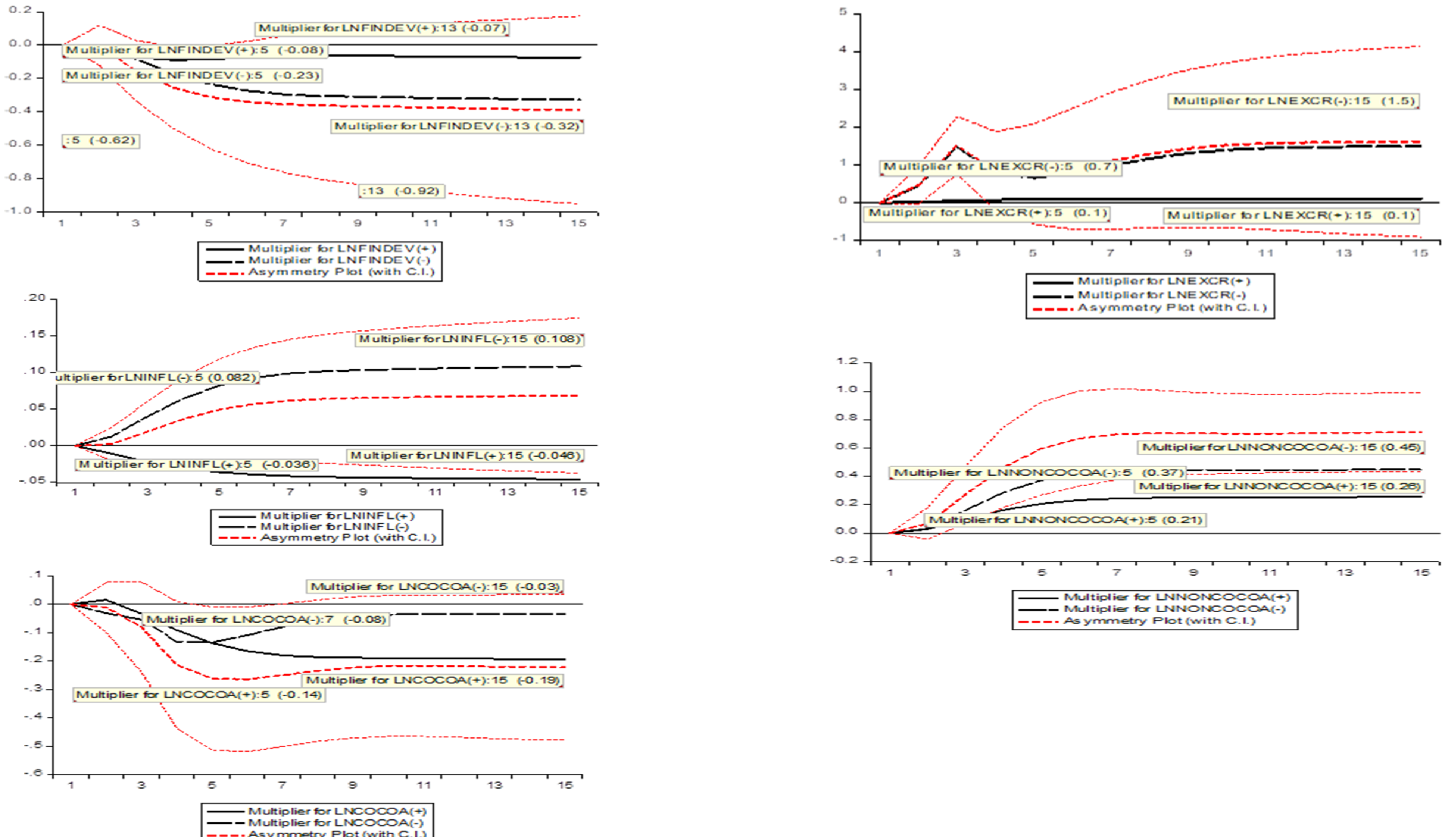

Figure 4. 4: Dynamic multiplier graph.

Note. *LNFINDEV: Financial development; LNEXCR: Exchange rate; LNINFL: Inflation; LNCOCOA: Cocoa sector expenditure; LNNONCOCOA: Noncocoa sector spending. The horizontal axis illustrates years and the vertical axis indicates the magnitude of both types of shocks*

Source: Author's computations, 2022

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4.9 Impulse Response Function of cocoa and noncocoa sector spending shocks on growth

Figure 4.5 illustrates the plot of the results gathered through the generalized IRFs estimations for the whole sample. These plots were generated for the cocoa and noncocoa sector effects on growth. The plot of the impacts of noncocoa sector spending on growth in Ghana across the 10-year horizon is reflective of positively robust feedback whiles that of the cocoa sector was negative. This is consistent with the finding from Djokoto (2011), Iddrissu *et al*. (2015) and Geiger *et al*. (2019) that for developing countries including Ghana increase spending on the noncocoa agricultural subsector significantly induces economic growth. The response that comes after a 10% standard deviation of the noncocoa sector spending shows 0% of economic growth and peaks at 1.2% returns after nine years.

Also, for economic growth, the shock of the spending on the cocoa sector exhibits negative responses throughout the ten-year period by initially drooping in the first two years and peaking to around 0.00, though still exhibiting negative responses. Since the orthogonalized impulse responses of the cocoa sector spending reverts to almost zero after the third-period, it implies the long-run effect of cocoa sector spending shocks is transitory. On the other hand, noncocoa sector spending shows a clear path of positive growth effect on economic growth after the third year.

Consequently, non-linear measures of the both cocoa and noncocoa sector spending shocks yield similar cases of statistical significance of their impacts just like the linear cocoa and noncocoa investment fluctuations.

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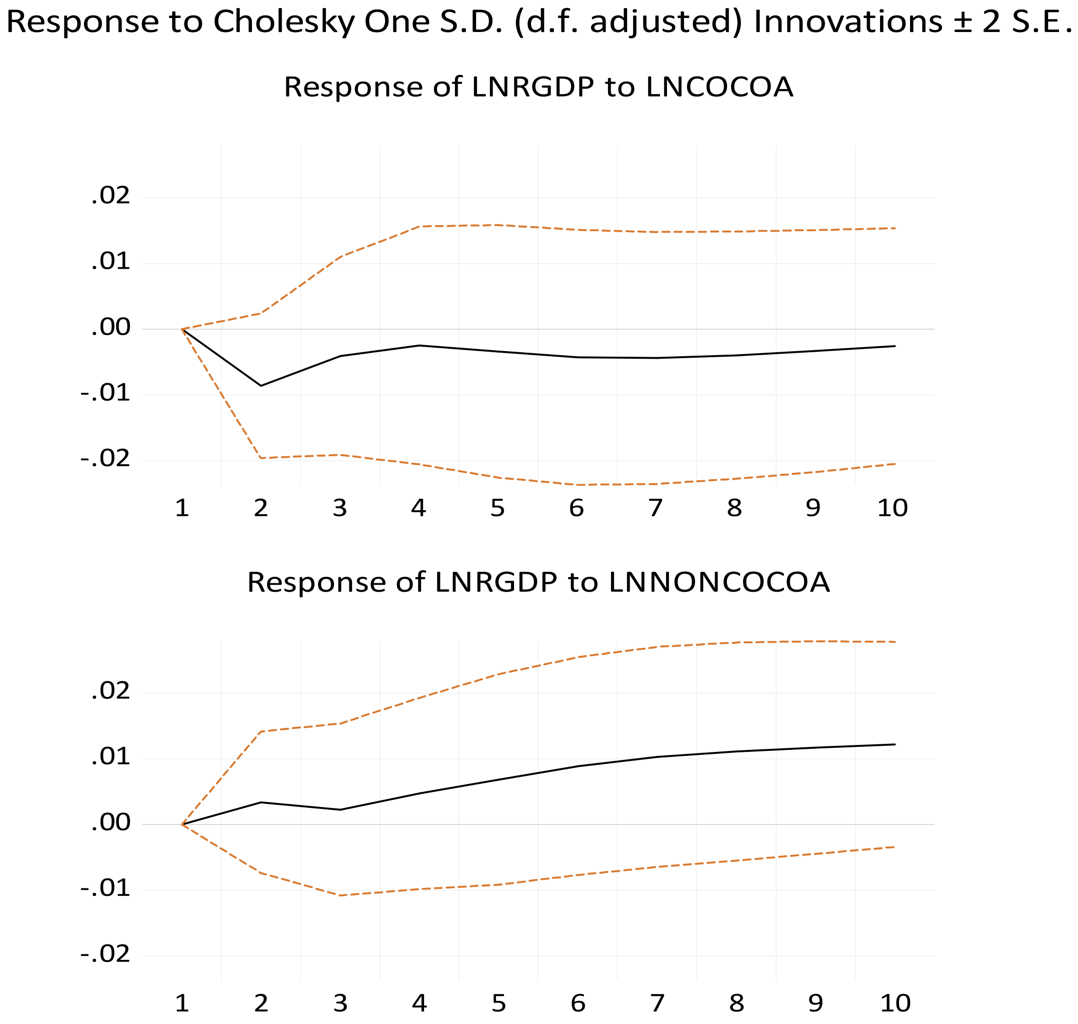

Figure 4. 5: Generalized IRFs of economic growth to a unit (one standard deviation) shock to cocoa and noncocoa sector spending: 1961 to 2019

4.10. Model Three (3) and Four (4): ARDL and NARDL Models with Total Expenditure

To ensure consistency and robustness of the results of noncocoa sector spending on growth, national investment in the cocoa and noncocoa subsectors was included in the growth model to replace public spending on the individual areas of cocoa and noncocoa subsectors. Here too, both the ARDL and NARDL models were estimated to assess their significance. The results are shown below.

The models three (3) and four (4) illustrate, respectively, estimates of the ARDL and NARDL models with total national investment in the entire agricultural sector of the economy. As a result, both cocoa and noncocoa sector spending are entered into the ARDL and NARDL models as a single explanatory variable in order to find the combined effect of public investment on these two subsectors. The bounds test for cointegration, long-run results, short-run results and diagnostic tests, for model one, are presented as follows.

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4.10.1 Bounds Test for Cointegration

Here too, to estimate the ARDL and NARDL models with total agricultural sector spending by way of testing for the possible occurrence of co-integration or long run equilibrating association between total agricultural sector spending and growth of the economy is to run the bounds test for cointegration as in Table 4.8.

Table 4. 8: Results of the Bound Test for Cointegration for ARDL and NARDL models with total public agricultural sector spending

ARDL Bounds test. Null hypothesis (H0): No long-run relationships exist.				
Critical Value	***F-Statistic Value***	***Bounds Unrestricted intercept and no trend***		
			I(0)	***I(1)***
Noncocoa subsector government spending led economic growth	8.3994	99 %	3.29	4.37
		95 %	2.56	3.49
		90 %	2.2	3.09
NARDL Bounds test. Null hypothesis (H0): No long-run relationships exist.				
Critical Value	***F-Statistic Value***	***Bounds Unrestricted intercept and no trend***		
			I(0)	***I(1)***
Noncocoa subsector government spending led economic growth	4.2505	99 %	2.62	3.77
		95 %	2.11	3.15
		90 %	1.85	2.85

Source of critical values: Pesaran et al. (2001).

The outcomes of the ARDL and NARDL Bounds test (Table 4.8) indicate that for the ARDL model, the F-statistical value (8.3994) is greater than the critical threshold levels of 1%, 5% and 10%. Also, regarding the NARDL model, the F-statistical value (4.2505) is also higher than the critical threshold levels of 1%, 5% and 10%. Hence, the rejection of the H_0 of no cointegration; which represents the presence of long-term relationships as the estimated F-statistic is higher than the upper critical bound, with reference to Narayan (2005) developed critical values.

4.10.2 Long-run Equation Results of ARDL and NARDL Models with Total Agricultural Sector Spending

In this context too, to understand the long-term association between growth of the economy and total public agricultural spending and the control variables, the study further estimated the long-term coefficients employing ARDL and NARDL Strategy. The results are shown in Tables 4.9 and 4.10.

The maximum lag order was chosen using AIC (Akaike Information Criterion). For the ARDL model, it was selected as ARDL ARDL (1, 1, 3, 2, 0) and for the NARDL model, it was selected as NARDL (2, 0, 1, 3, 1, 0, 3, 0, 1), which is the consequence of total spending on agriculture on growth. In all four explanatory variables were entered into the model including the total spending on the agricultural sector and the control factors, inflation, financial development and exchange rate. The results of estimating the long-run and short-run coefficients using optimal ARDL and NARDL equations are showed in Tables 4.9 and 4.10.

For the inflation variable, in Panel A and B of Table 4.9, the long-term elasticities are negative and strong at the 5% level and 1% level in the ARDL specification and

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in the NARDL Specification respectively. These results suggest that worsening inflation decrease growth. However, the values of the long-term elasticities are 0.4229 and 0.1227 for the ARDL model and for the NARDL model, respectively. These coefficients are significantly different from each other signifying the need for the NARDL model after estimating the ARDL.

For the financial sector development variable, in Panel A of Table 4.9, the long term coefficient is positive and not strong at all conventional levels in the ARDL specifications but significant and negative at 5% significance level in the NARDL model. The study found a long-run coefficient of -0.2638 for the positive effect and 0.7632 for the negative effect on of financial development on growth for the NARDL model. These results suggest that though there are strong improvements in the development of the financial sector, there are still some rigidities in the sector. Furthermore, these results are a reflection of the findings of Ibrahim & Alagidede (2017; 2018) who found potentials of financial development in enhancing economic growth but this study presently found that there is more to be done to convert the negative influence of financial development on growth to potentials.

Finally, in the long term, the ARDL model results showed that total spending on the agricultural sector positively influence growth with a coefficient of 0.0923. This interprets that a 1% rise in total agricultural sector results in 0.09% rise in growth, *ceteris paribus*. This is robust at 5% significance level. Similarly, in the NARDL model, a positive change in total agricultural sector spending has a positive impact on growth (coefficient 0.0495), showing that a 1% rise in total public investment on the agricultural sector increases growth by 0.05%. On the flipside, the study also

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found that negative shocks to public agricultural spending positively influence growth (with 0.1597). This positive sign of the two effects on growth demonstrate that both negative and positive changes in overall agricultural sector spending increase economic growth. Even though, total agricultural sector spending was not significant in the NARDL model, it shows that the agricultural sector remains an anchor to economic expansion. Studies such as Musaba et al. (2013), Enu (2014) and Okine & Remziye (2018) also found a positive influence of agricultural sector spending on long-term growth.

4.10.3 Short-run Equation Results of ARDL and NARDL Models with Total Agricultural Sector Spending

The short-run results of the linear ARDL with total government are presented in this section. The study has shown in Table 4.10 that the first difference of the factors used in the model is denoted as D and represents the short-term findings as well as their associated tests of significance.

From Table 4.10, it is revealed that, the *ECM (-1)* coefficient for the ARDL model is negatively signed and very robust at 1% implying economic growth converging to the equilibrium position, the error-correction process pivots to equilibrium path every year. The coefficient is –0.0903 and signifies that the divergence from growth in the long-term is rectified by 9% within the model by the following year. That is, the very robust error correction term implies that 9% of disequilibrium effect from the past year is rectified in the present year. This finding shows that the adjustment speed is reasonably high in the model. On the other hand, the *ECM (-1)* coefficient for the NARDL model is also negatively signed and very robust at 1% implying

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economic growth pivoting to the equilibrium position, the error-correction process converges to equilibrium path every year. The coefficient is –0.1393 and signifies that the divergence from long-term growth is rectified by 13.93% within the model by the following year.

In Table 4.9 and 4.10, the study estimated the symmetric and asymmetric effects of the inflationary rate on Ghana's growth. Looking at the short-run coefficients, it can be realized that they are correctly signed and are robust at 10% and 1% levels of significance for the ARDL model and NARDL model respectively. In the Table 4.9, the inflationary rate elasticity to growth is -0.0151% in the ARDL model. Consequently, an increase in inflation of one percent decreases the growth by 0.015% in the short-run. With regards to the NARDL, the coefficient is -0.0316, implying that a 1% rise in inflationary rate exerts an inverse and robust effect on short-term growth by reducing it by 0.032%, *ceteris paribus*. This empirical result indicates that the higher prices reduce domestic consumption, consequently, reducing general production of goods and services.

In the short-term, financial development has a negative influence on growth (from lag 0 to lag 1) even though the effect of lag 2 was positive. However, lag 1 implications of financial development on growth was robust at 1% level with a coefficient of -0.0713. Conversely, the results of the NARDL model indicated that financial development effect on economic growth was entirely negative (from lag 0 to lag 3), and these inverse influences revealed that any negative and positive changes in financial sector development impedes growth. On the flipside, a positive change in financial development hinders growth (coefficient -0.0740 at lag 1) and

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significant at level 5%; similarly, financial development (positive shock) decreases economic growth (at lag 2 with coefficients −0.0526) at 10% significance level whiles a negative shock also decreases growth (at lag 2 with coefficients –0.0840) at 5% significance level. These findings are inconsistent with that of Elhannani (2013) who found that development in the financial sector spurs growth of the economy. However, the finding complements that of Erdoğan *et al*. (2020) investigated the link between the long-run effect of exports from natural resources on growth of economies and the extent of financial deepening. They evidenced that for the first regime, where financial deepening is under the rate of 45%, the rise in exports from oil has no effect on growth. In the second regime, where financial deepening above the rate of 45%, a unit rise in the exports of oil brings about 7% rise in the growth in economic activities. The implication is that at the current emerging level of Ghana's financial development, characterized by high non-performing loans and high interest rates, financial deepening has an adverse long-term growth implications.

Considering Model (I) in Panel A, ARDL results of the short-run, exchange rate (*EXCH*) was ascertained to negatively and robustly influence growth at 5% significance level. Moreover, the findings showed that in the NARDL model generally found exchange appreciation to have an inverse consequence on growth. The study results showed that the coefficients of exchange rate in the NARDL models are strongly positive at 1 percent significance level. Hence, the findings reveal that, should exchange rate appreciates, growth will robustly decrease, other factors held constant. This is inimical to growth as it could lead to the so-called Dutch Disease syndrome. The Dutch disease phenomenon asserts that economies

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that are well-endowed with huge natural resources generate significant revenue from natural resource exports to the international markets and within that context the local currency appreciates in value because of the significant flow of foreign currency (Erdoğan *et al*. 2020). Hence, though it could lead to more Foreign Direct Investment, it points to the likelihood of the preseence of the Dutch disease in Ghana. The consequence of the appreciation of the Ghanaian cedi is that exports of various commodities from the economy becomes relatively expensive on the world market whiles imported products become less expensive. The economy loses its price competitiveness in the world market and the resultant effect is that output contracts.

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Total agricultural sector spending is strong and direct in the ARDL in the short-term as it was in the long-term and has maintained its significance and positive effect. On the other hand, total agricultural sector spending is also identified to have a direct and strong short run effect though with insignificant long-term impact as shown in Model (II). The short-run coefficient of negative effect of total spending on the agricultural sector (*LNTEXP_NEG)* is significant at 5% while the long-run coefficient of the negative effect of total spending on the agricultural sector (*LNTEXP_NEG)* is not significant unlike that of the results of the ARDL model. This suggests the existence of both long-term and short-term asymmetry between the total public agricultural spending and growth. This revelation is line with Elhannani (2013) who revealed that government development expenditures spur the growth in economic activities.

Table 4. 9: Estimated Long-run Coefficients using NARDL Approach with Total Government Spending on the overall Agricultural sector

Independent variables	***(I)*** ***PANEL A: ARDL***	***(II)*** ***PANEL B: NARDL***
	Dependent variable: Economic growth	
	Coefficient	***Coefficient***
LNINFL	-0.4229** (0.1744)	
LNINFL_POS	-	-0.1227 (0.1051)
LNINFL_NEG	-	-0.3878*** (0.1124)
LNFINDEV	0.2638 (0.1797)	
LNFINDEV_POS	-	-0.2351 (0.2841)
LNFINDEV_NEG	-	0.7632** (0.3339)
LNEXCR	-0.0516 (0.1126)	
LNEXCR_POS	-	0.0904 (0.0995)
LNEXCR_NEG	-	-3.1817 (2.7174)
LNTEXP	0.0923** (0.0450)	
LNTEXP_POS	-	0.0495 (0.0616)
LNTEXP_NEG	-	0.1597 (0.2033)
Symmetrical C	24.1005*** (0.9604)	
Asymmetrical C	-	23.1483*** (0.3804)

Note: *i*. *, **, *** represent 10%, 5% and 1% level of significance respectively.

ii. Parentheses, ( ) are standard errors; abbreviations POS and NEG indicate positive and negative partial sums.
Source: Author’s computation, 2022.

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Table 4. 10: Error Correction Representation for the Selected ARDL and NARDL Models with Total Expenditure on overall Agricultural spending

Independent variables	***(I)*** ***ARDL***	***(II)*** ***NARDL***
	Dependent variable: Economic growth	
	Coefficient	***Coefficient***
D(LNGDP(-1))		0.1566* (0.0892)
D(LNINFL)	-0.0151* (0.0089)	
D(LNINFL_NEG)	-	-0.0316*** (0.0095)
D(LNFINDEV)	-0.0078 (0.0238)	
D(LNFINDEV_POS)	-	-0.0117 (0.0264)
D(LNFINDEV(-1))	-0.0713*** (0.0241)	
D(LNFINDEV_POS(-1))	-	-0.0740** (0.0272)
D(LNFINDEV(-2))	0.0298 (0.0232)	
D(LNFINDEV_POS(-2))	-	-0.0526* (0.0295)
D(LNFINDEV_NEG)	-	-0.0840** (0.0330)
D(LNEXCR)	0.0195 (0.0191)	
D(LNEXCR_NEG)	-	-0.0033 (0.2409)
D(LNEXCR(-1))	0.0427** (0.0198)	
D(LNEXCR_NEG(-1))	-	-0.5216*** (0.1864)
D(LNEXCR_NEG(-2))	-	1.0059*** (0.1874)
D(LNTEXP)	0.0923** (0.0450)	
D(LNTEXP_NEG)	-	0.0557**(0.0220)
*Symmetrical CointEq(-1)**	-0.0908*** (0.0121)	
*Asymmetrical CointEq(-1)**		-0.1393*** (0.0191)

Notes: *i. ARDL: ECM = LNGDP - (-0.4229*LNINFL + 0.2638*LNFINDEV -0.0516*LNEXCR +0.0923*LNTEXP + 24.1005)*
*ii. NARDL:ECM== LNGDP - (-0.1227*LNINFL_POS -0.3878*LNINFL_NEG -0.2351*LNFINDEV_POS + 0.7632*LNFINDEV_NEG + 0.0904*LNEXCR_POS -3.1817*LNEXCR_NEG + 0.0495*LNTEXP_POS + 0.1597*LNTEXP_NEG + 23.1483)*
iii. *, **, *** represent 10%, 5% and 1% level of significance respectively.
iv. Parentheses, ( ) are standard errors; abbreviations POS and NEG indicate positive and negative partial sums.
Source: Author's computation, 2022.

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4.11 Granger Causality Test

In terms of the Granger Causality between total agricultural sector spending and growth, there is empirical evidence of the presence of no long-term associations between total spending on the agriculture and growth of the economy even though total spending on the agricultural sector is significant as Table 4.11 illustrates.

Table 4. 11: Granger Causality Test of Total Agricultural Sector Spending and Growth

Sample: 1961 2019. Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
LNTEXP does not Granger Cause LNGDP	30	0.36071	0.7007
LNGDP does not Granger Cause LNTEXP		0.49978	0.6126

Note: *, **, *** represent 10%, 5% and 1% level of significance respectively
Source: Author's computation, 2022.

The findings demonstrate that there is no Granger causality. The results did not evidence any long-term causal association between total agricultural sector spending and growth (based on the F-statistics and *p-values*). As indicated, the study could not reject the null hypothesis of absence of Granger causality between economic growth and total national agricultural investment since total agricultural sector spending fails to Granger cause growth at all conventional levels of significance and likewise growth was not revealed to Granger cause total agricultural sector investment in the long-term.

4.12 Diagnostic tests for ARDL and NARDL with Total Expenditure

4.12.1 Diagnostic Test

For the ARDL model, the p-values of the $\chi2$ stipulate that there is support for no serial correlation and heteroscedasticity. That is, The chi-square and p-values of 0.8830 (0.4214) do not disprove the null hypothesis that the research variables do

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not serially correlate. The analysis also reveals that there is no heteroscedasticity because Table 4.12's Chi-square and P value of 2.6610 (0.1110) do not allow for the rejection of the null hypothesis of homoscedasticity. As shown in Figure 4.6, the results also supported the null hypothesis of normally distributed residuals because the value of the Jarque-Bera test, 0.8547 (0.6522), is above 0.05 and cannot be rejected. According to the Adjusted = 0.9964 of the ARDL, public spending on the entire agricultural sector and control factors account for 99.64% of the overall variation in economic growth.

All diagnostic findings for the NARDL model also point to failure to reject the null hypothesis in the absence of serial correlation, white heteroscedasticity, and normal distribution of the residuals. The value of the NARDL's coefficient (Adjusted = 0.9979) showed that the total expenditure in the agriculture sector and the control variables quickly adapt the economic growth model's equilibrium in both the short run and the long run using the same equation.

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Table 4. 12: Diagnostic tests

	ARDL		NARDL	
Diagnostic Test	χ^2	***Probability***	χ^2	***Probability***
Breusch-Godfrey Serial Correlation LM test	0.8830	0.4214	0.4345	0.6512
Breusch-Pagan-Godfrey Heteroskedasticity test	2.6610	0.1110	0.7055	0.7884
Jarque-Bera test	0.8547	0.6522	3.2275	0.1991
Adjusted R^2	0.9964		0.9979	

Note: *, **, *** represent 10%, 5% and 1% level of significance respectively

Source: Author's computation, 2022.

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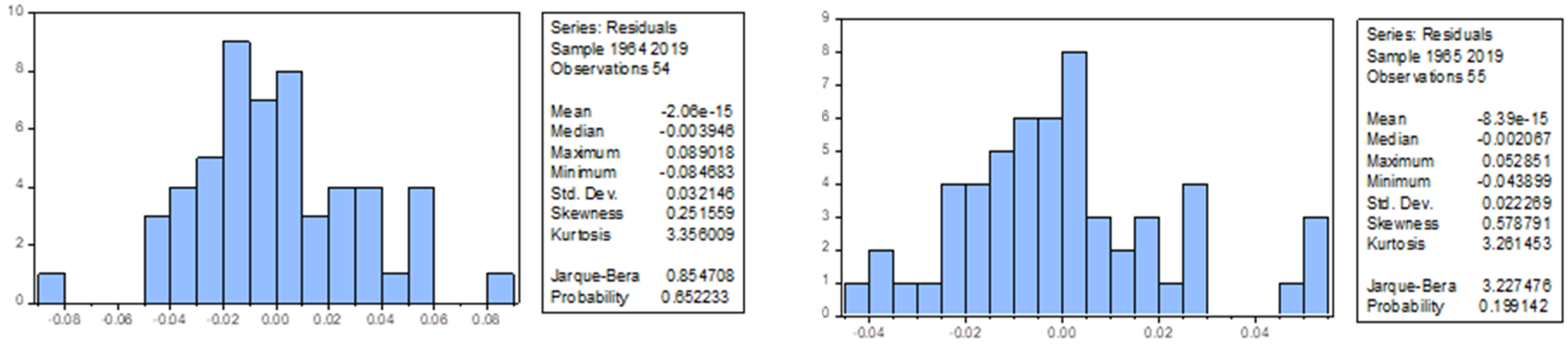

Panel A: Normality plots of ARDL model

Panel B: Normality plots of NARDL model

Figure 4. 6: Normality plots for ARDL and NARDL models
Source: Author's computation, 2022

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4.12.2 Stability Tests

All diagnostic tests have been done including stability tests. So, the stability conditions of the ARDL and NARDL models, the CUSUM and CUSUMSQ tests which are usually illustrated graphically as in Figure 4.7 below.

The CUSUM test is used to test the stability hypothesis of the long-term relationship between economic growth and the factors that determine it, particularly total spending in the agriculture sector. For the ARDL model shown in Figures 4.7A and 4.7C below, it is shown that the curves of the CUSUM and CUMSQ tests are substantially within the bounds of the confidence interval at the 5% level.

Additionally, Figures 4.7B and 4.7D for the NARDL model show that the cumulative sum of square (CUSUMSQ) and cumulative (CUSUM), respectively, test statistics of the recursive residuals, likewise fall inside the threshold range at 5% significance. As a result, it demonstrates the consistency of the series' graphical plots in the error correction model. The model selected to evaluate the relationship between growth and the other influencing factors is implied to be steady.

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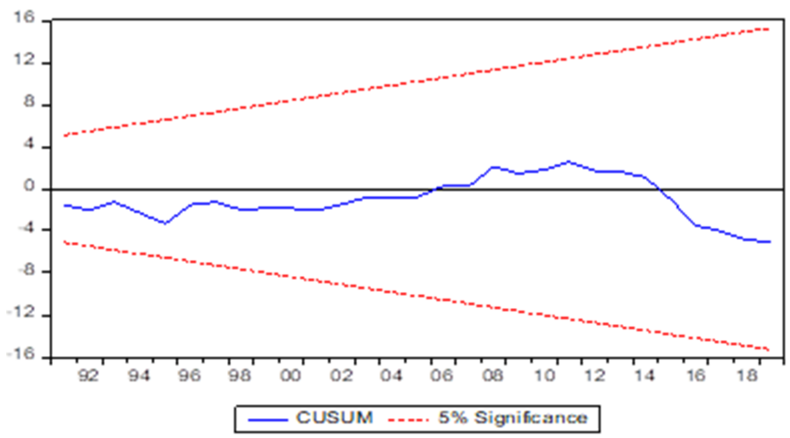

Figure 4.7A. CUSUM plots for the ARDL model's

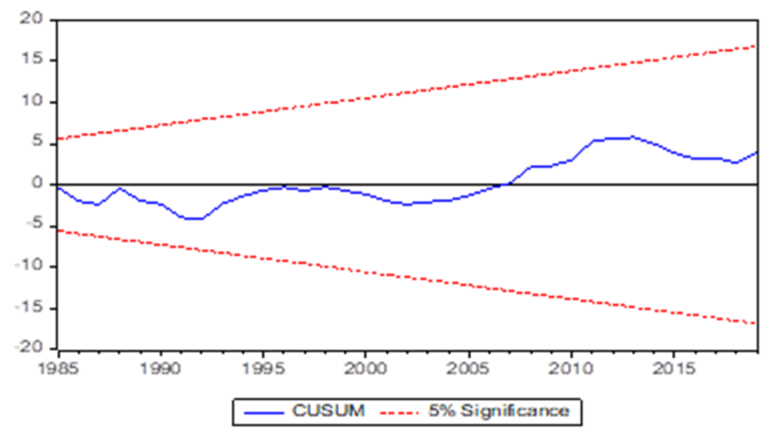

Figure 4.7B. CUSUM plots for the NARDL model's

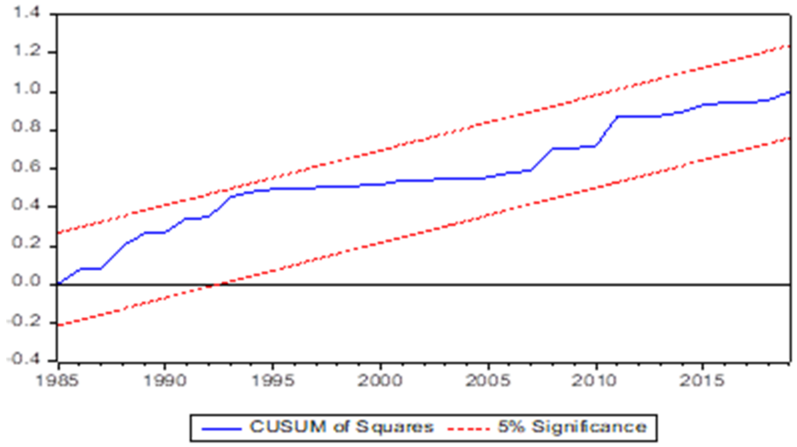

Figure 4.7C. CUSUMSQ plots for the ARDL model's

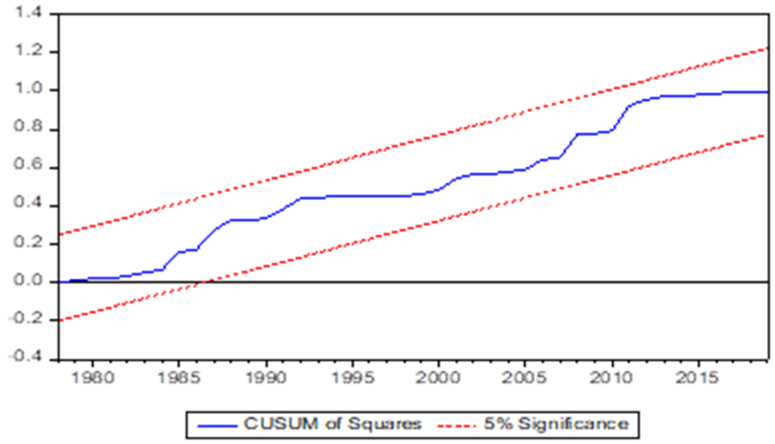

Figure 4.7D. CUSUMSQ plots for the NARDL model's stability tests.

Figure 4. 7: Stability tests for the ARDL and NARDL specifications
Source: Author's computations, 2022

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4.13 Dynamic multiplier Graph

Plots for dynamic multipliers were created for the total amount spent on the agricultural sector variable as a result. In other words, the black solid line of the dynamic multiplier plots (Figure 4.8) shows that an increase in overall spending on agriculture by 1% results in a short-run growth increase of less than 1% and a long-run growth increase of roughly 0.03%. A 1% reduction in overall public spending on the agricultural sector also reduces short-run growth by less than 1%, and this converges to roughly -0.14% in the long run, as shown by the black-dashed line. It's interesting to note that the net effect of overall spending in the agriculture sector (thick red dotted line) is negative both in the short and long runs, declines in the short run, and finally converges around -0.10%. (Figure 4.8). The net effect suggests that total expenditure on the agriculture sector, when included in the model, would have a negative impact, much to how investment on the cocoa sector, when combined with spending on non-cocoa sectors, will have a positive impact on growth. Practically speaking, this means that spending in the non-cocoa sector has a greater positive impact on GDP than spending in the cocoa industry does. To address any irregularities in the cocoa sector, a robust policy reaction is necessary.

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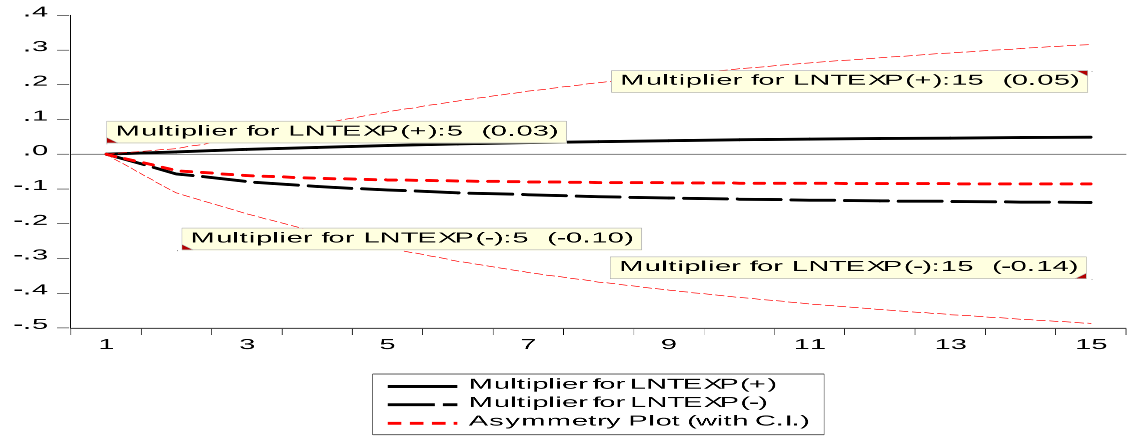

Figure 4. 8: Dynamic multiplier graph.

Note. *LNTEXP: Total agricultural sector spending. The horizontal axis indicates years and the vertical axis illustrate the magnitude of both types of shocks*

Source: Author's calculations, 2022

4.14 Impulse Response Function of total agricultural sector spending shocks on growth

Again, to enable the study of the dynamic features of the model, impulse response function (IRF) analysis was implemented, employing the Cholesky decomposition. The IRF is the dynamic response of growth as the dependent variable to the total agricultural sector spending variable contained in the ARDL and NARDL models, for a standard deviation shock in the system. The IRF plot is shown in Figure 4.9. It is clear that the response of innovation to a one standard deviation shock in total agricultural sector expenditure is positive and generally significant. The overall positive impact emerges from total expenditure on the agricultural sector, especially the noncocoa subsector, to innovation. The response that follows a 10% standard deviation of the total agricultural sector spending indicates 0% of economic growth in the first year but gradually rises over the years to peak at 0.06% returns after nine years.

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The outcomes are in line with the co-integration estimations. The overall detrimental impact of the cocoa industry on growth is what explains the lower economic impact of the total agriculture spending influence on growth. This stems from the fact the noncocoa subsector from the results demonstrated significantly positive effect on growth. As a result, non-linear measures of the total agricultural sector spending shocks give identical instances of strong consequences just like the linear total agricultural spending fluctuations.

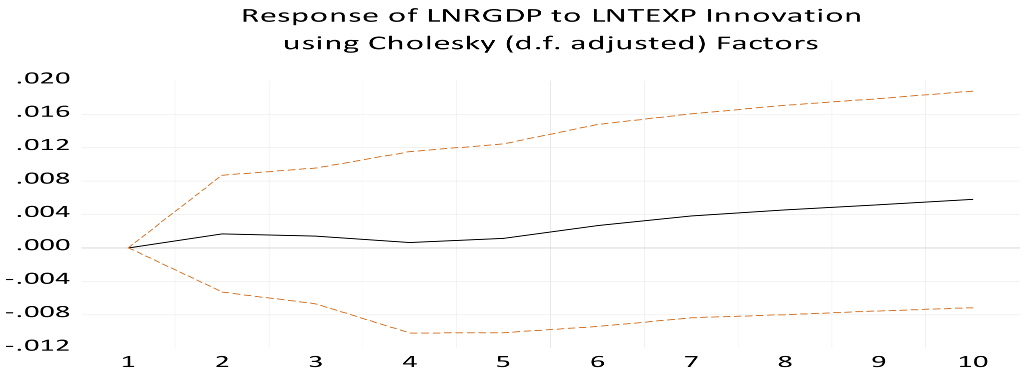

Figure 4. 9: Generalized IRFs of economic growth to a unit (one standard deviation) shock to total agricultural sector spending: 1961 to 2019

4.15 Correlation Matrix

The study sought to establish the associations among the factors. Table 4.13 highlights correlation matrix for reference.

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Table 4. 13: Correlation Matrix of Determinants of Economic Growth

Probability	LNGDP	LNCOCOA	LNEXCR	LNFINDEV	LNINFL	LNNONCOCOA
LNGDP	1					
LNCOCOA	0.9333	1.0000				
LNEXCR	0.9063	0.9884	1.0000			
LNFINDEV	0.6814	0.5368	0.5655	1.0000		
LNINFL	-0.0333	0.1470	0.1044	-0.4540	1.0000	
LNNONCOCOA	0.9355	0.9959	0.9821	0.5485	0.1551	1.0000

Source: Author’s computation, 2022.

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Table 4.13 further illustrates the association estimates and found that economic growth *(LNGDP)* has both positive and negative correlation with factors, including cocoa sector spending (r=0.9333), exchange rate *(LNEXCR)* (r=0.9063), financial development (*FINDEV*) (r=0.6814) and noncocoa sector spending *(LNNONCOCOA)* (r=0.9355). On the other hand, growth *(LNGDP)* is negatively correlated with inflation *(INFL).* The results show that the lowest correlation coefficient is between GDP growth rate *(LNGDP)* and inflation (INFL) which is -0.0333 while the highest correlation coefficient was between cocoa *(LNCOCOA*) and noncocoa *(LNNONCOCOA*) sector spending which is 0.9959. The second highest correlation coefficient is between exchange rate (*LNEXCR)* and cocoa sector spending *(LNCOCOA*) (r=0.9884) and then followed by that between exchange rate *(LNEXCR*) and noncocoa sector spending *(LNNONCOCOA*) (r=0.9821). These may raise multicollinearity suspicions but the NARDL model internal mechanism automatically corrects multicollinearity since NARDL model estimates are not generated when explanatory variables are highly collinear. Hence, multicollinearity did not pose any significant impact on the results of the study.

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CHAPTER FIVE

SUMMARY, CONCLUSION, RECOMMENDATIONS AND AREAS FOR FUTURE RESEARCH

5.1 Introduction

This section captures the summary of the findings, conclusion and recommendations. Based on the recommendations offered in this study policy formulations could be made. Areas for future research have also been proposed.

5.2 Summary of Empirical Findings

There has been widespread belief that investing in non-cocoa sectors is necessary for economic progress, especially in developing nations. This belief has dominated national socio-economic discourse as to whether Ghana has been undergoing policy paralysis on the noncocoa sector over the past decades or not. Building on the existing literature on the agricultural sector- growth linkages, This study aimed to evaluate the effect of non-cocoa sector investment on economic growth in Ghana between 1961 and 2019. The study examined the the trend in government sectoral spending in Ghana from 1961 to 2019, determine the impact of government agriculture spending in the short- and long-term on non-cocoa subsector on Ghana's growth, determine the causal link between public agricultural expenditure on non-cocoa subsector and growth in Ghana, examine the response of growth to fluctuations in public spending on non-cocoa subsector in Ghana and finally, to assess the asymmetric effects of public spending on non-cocoa subsector on growth in Ghana. Findings that emerged from the study are summarised below:

- Apart from the noncocoa sector spending that was insignificant in the ARDL model, the rest of the variables including inflation (*LNINFL)*, financial development *(FINDEV)*, exchange rate *(EXCR)*, cocoa and noncocoa sector spending were all found to determine growth of the economy in the short-run.
- The Error Correction term (*ECM-1)* confirms a significant, long-run association between noncocoa sector spending as well as the control variables and economic growth.
- The bounds test using the ARDL approach confirms a long-term linkage between noncocoa sector spending and the control variables and growth of the economy. Whiles in the ARDL model no variable was found to significantly influence growth, variables including cocoa (*LNCOCOA*) and noncocoa (*LNNONCOCCOA)* and financial development were found to influence long-run growth in the NARDL model.
- Noncocoa sector spending Granger Causes growth in economic activities but economic growth fails to Granger Cause noncocoa sector spending. Hence, growth of the economy does not have a feedback effect through to noncocoa sector spending.
- Lastly, the study performed both stability tests such as CUSUM and CUSUMSQ and residual tests including the normality test, heteroscedasticity test, model misspecification test and the serial correlation test have all shown the absence of statistical defects and that the coefficients are unbiased and efficient.

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5.3 Conclusion of Study

From the findings, it can be concluded that determinants of growth in economic activities include: noncocoa sector spending (*LNNONCOCOA*), inflation (*LNINFL)*, financial development *(FINDEV)*, exchange rate *(EXCR)*, cocoa sector spending (LNCOCOA) both in the short run and the long run.

Specifically, in the long-run whiles noncocoa sector spending positively influence growth, cocoa sector spending and financial development negative affect growth. However, in the long-run, noncocoa sector investment and exchange rate positively influence growth whiles inflation, financial development and cocoa public spending inhibit growth.

The Error Correction term (ECM) is statistically strong and inverse and the implication is that there is a long-term correlation between noncocoa sector spending and growth of the economy. The ECM also has a coefficient of 0.0702, in the ARDL model, which implies that if there is a shock to the Ghanaian economy, there is 7.02% to be corrected annually. On the other hand, in the NARDL model an ECM with a coefficient of 0.2775 also implies that 27.75% correction of any shock in the economy. That is, the coefficients of the ECM connect the short run and long run by correcting the disequilibrium every year. The ECM is also negative implying that there is convergence of the variable to stability in the long run.

The study concludes that there exists a unidirectional causality between noncocoa sector spending and growth where it is only noncocoa sector spending that Granger causes economic grow and not the reverse. This highlights the need for government to effectively manage noncocoa sector so as to boost economic activities. The study further concludes that since cocoa sector spending has an inverse and robust impact on growth, it implies that improvement in cocoa sector policies could partly boost economic activities in the country.

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5.4 Recommendations

From the study results, the ensuing policy recommendations are offered. Since from the findings, it was established that noncocoa sector spending (*LNNONCOCOA*) and macroeconomic variables such as exchange rates (*LNEXCR*), inflation (*LNINF*) and financial development (*LNFINDEV*) are the main determinants of growth, it implies that proper adoption of economic policies for managing noncocoa sector spending and achieving improve macroeconomic stability can lead to a rise in economic activities. noncocoa sector to promote growth.

- The study recommends that since noncocoa sector spending positively affects growth, government should not just strive to increase budgetary allocations to flagship programmes such the Planting for Food and Jobs and other programmes that target the growth of the noncocoa sector. Instead, government must ensure continuous and effective monitoring and supervision of the sector.
- The Ministry of Food and Agriculture must ensure that subsidize fertiliser smuggling outside the country is firmly curbed with harsh penalties for culprits of such practices.

- Also, programmes to enhance the performance of the noncocoa sector should be devoid of politics to encourage participation especially in rural settings otherwise the potentials of the noncocoa sector to promoting growth will be thwarted.
- The study further recommends that Government should relook at the current policies and management of the cocoa sector to turnaround its negative implications for growth into potentials. The annual routine of government of securing syndicated loans with high interest to embark on cocoa purchases and sales should be reviewed. Instead, Ministry of Finance through the Ghana COCOBOARD should develop schemes to promote private sector partnerships and domestic bank lending to cocoa farmers to enhance the growth of the sector with minimal cost. The current proposed initiatives to give scholarship packages for wards of cocoa farmers and build a reliable pension scheme for the farmers should be executed and made sustainable to attract more potential cocoa farmers.
- Since financial development adversely affect growth, within the agricultural sector, the existing structure, that is the Agriculture Development Bank with a mandate to promote agriculture should be revitalised by government with supervision from the Bank of Ghana. The Bank of Ghana should facilitate and monitor the bank to open small branches in rural areas that will employ the Village Savings and Loans (VSLA) in delivering credit to smallholder farmers who are often left out of the financial system.

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5.5 Limitations and Suggestions for future research

The existing secondary data for specific Government of Ghana expenditure on both the cocoa and non-cocoa subsectors of the agricultural sectors from 2012 to 2019 was not readily available and had to be compiled by the researcher from data on different agricultural sector cost items from the Controller and Accountant General's Department. This has a potential of data computational errors which could impair the conclusions of the study. However, this limitation was adequately dealt with by following Benin (2014) comprehensive approach to compiling government expenditure on the agricultural sector for the various subsectors.

Future research should examine the mediating role of institutional quality in the noncocoa sector spending-growth relationship to clearly determine whether poor institutional quality accounts for the performance of the government agricultural spending on the agricultural sector on growth in Ghana. Other variables such as financial development could also assessed to ascertain whether they have any mediating role in the noncocoa sector spending and growth relationship. Again, future studies could look at the effects of noncocoa sector spending volatility on growth of Ghana's economy and the effect of public spending on noncocoa sector or nontraditional crops in a wider geographical setting such as Africa. Furthermore, given that the variables in the study were mainly financial variables, subsequent studies could include non-financial variables such education or human capital development in studying the influence of noncocoa sector spending on growth of in Ghana so as to have a comprehensive picture of its drivers as that will be desirable to supplement the findings of this research.

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Subsequent studies could also look at the implications of cocoa sector expenditure on Ghana's growth to look for any divergence in the findings.

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