UNIVERSITY OF CAPE COAST

THE EFFECTS OF MACROECONOMIC INDICATORS ON AGRICULTURAL COMMODITY PRICES IN SUB-SAHARAN AFRICAN (SSA) COUNTRIES

SOLOMON ARTHUR

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BY

SOLOMON ARTHUR

Thesis submitted to the Department of Finance of the School of Business, College of Humanities and Legal Studies, University of Cape Coast, in partial fulfillment of the requirements for the award of Master of Commerce degree in Finance.

MARCH 2025

DECLARATION

Candidate's Declaration

In this thesis, I hereby certify that no portion of this work has been submitted for credit toward another degree at this university or any other. It is the product of my own original study.

Candidate's Signature…… Date: ……

Name: Solomon Arthur

Supervisor's Declaration

I hereby certify that the thesis was prepared and presented under supervision in compliance with the University of Cape Coast's criteria for thesis supervision.

Supervisor's Signature…… Date……

Name: Dr. Seyram Kawor

ABSTRACT

Through agriculture, SSA countries contribute enormously to the international market regarding food security. However, the agricultural sector in SSA has become vulnerable due to external shocks and has affected commodity prices as well as the economic stability of member countries. With food prices being projected to increase by 14.84% from 2022 to 2023, concerns have been raised about welfare in SSA regarding rising poverty, food insecurity, and geopolitical tensions in the near future. This made it necessary for this study to investigate how interest rates, exchange rates, and the price of crude oil affect the prices of agricultural commodities in Sub-Saharan African nations. In order to achieve the study's objectives, we used the fixed effect estimating technique, which was supported by Hausman-Wu's test, and data on 16 African nations from the World Bank and UN Food and Agricultural Organization databases covering the years 2009–2022. The study discovered that the price of crude oil and the exchange rate had a major impact on the price of agricultural commodities. The inverse relationship between interest rates and agricultural commodity prices, however, was not supported by any statistical data, according to the study. Therefore, it is recommended that governments in SSA countries must have balanced monetary policies, targeted agricultural credit programs, promote regional trade and currency agreements and encourage investment in alternative energy sources to reduce interest rates exchange rates and crude oil price effect on the agriculture sector.

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The greatest thanks goes to my uncles, Benjamin and John who made it all worthwhile by always supporting and encouraging me. I also express my appreciation to my wife, Theodora and my friend Dickson who consistently gave me timely and constructive feedback throughout writing of this thesis.

DEDICATION

To my dad and grandmother all blessed memories

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LIST OF ACRONYMS

SSA	Sub-Saharan Africa
AfCFTA	African Continental Free Trade Area
UNCTAD	United Nations Conference on Trade and Development
IMF	International Monetary Fund
LIC	Low-Income Countries
CRB	Commodity Research Bur

CHAPTER ONE

INTRODUCTION

The study's main goal is to shed light on the connection between agricultural commodity prices and macroeconomic factors. The study specifically looked at how the price of crude oil, interest rates, and exchange rates affected the price of agricultural commodities. The fundamental ideas and definitions that support the research are introduced in this chapter. It begins with a brief background that explains the study's motivation, followed by problem statement, research questions, and hypothesis. Finally, the study's justification is presented.

Background to the Study

Among the leading reasons cited for the unstable economies of low-income countries, is fluctuation in agricultural commodity prices because agriculture is the backbone of these economies, typically of Sub-Saharan African (SSA) countries (IMF, 2018). The impact of agricultural commodity prices on low-income countries (LICs) and their potential to either increase or decrease poverty has been highlighted by international organizations such as the World Bank, the United Nations Conference on Trade and Development (UNCTAD), the International Monetary Fund (IMF), and a number of academics (Addison et al., 2016).

LICs depend heavily on the export of agricultural commodities and are not spared economic hardships amidst unpleasant price fluctuations. Ogundipe et al. (2019) supported this assertion by adding that most LICs' key source of income in foreign currencies (Addison et al., 2016).

is the export of unprocessed agricultural commodities, hence they frequently face unstable commodity prices, balance of trade deficits, devaluation of home currency and the net effect is macroeconomic instabilities.

On average, the contribution of agriculture to the GDP of LIC countries was found to be between 20% - 30% (World Bank, 2021). In addition, it is a leading contributor to the balance of payments in LIC economies and wields a greater potential to promote overall economic growth in the sub-region as the sector hosts over 60% of total employment in SSA as well serves as the livelihood support unit for about 90% of the rural community dwellers (Ogundipe et al., 2019). Further, Giller (2020) argued that to match up with the natural growth rate of urban dwellers in LICs and to ensure national food security, policies need to be implemented to increase the supply of agricultural commodities to make nutritious food available, accessible, and affordable. This suggests that the stability of the economy of LICs largely depends on agriculture as they depend on agriculture for survival, sustainable development, and employment. Price differences in agricultural commodities have been identified as the determining factor in the LIC country's varied economic growth over time.

Consistent with economic theory, Agricultural commodity prices, just like any normal good are dictated by supply and demand dynamics.

. The interplay of market demand and supply determines how high or low the price of a particular agricultural commodity can be, and as such, volatility in market prices signals economic instability (Antwi et al., 2021). Volatility in prices can be caused by either internal or external factors. Internal

factors such as an increase in per capita income resulting from growth in GDP increase the demand for agricultural commodities. Usually, the period is short for supply to increase since agriculture in LICs is primarily rainfall driven. Therefore, demand exceeds supply in that period and prices are forced to rise. With reference to an open economy, such rises in the prices of domestic agricultural commodities serve as an incentive for businessmen to import similar commodities from other countries and it puts pressure on the exchange rate of the domestic country. However, imports tend to stabilize or lower domestic commodity prices, which, according to Ingutia and Sumelius (2022), raise the standard of living for the poor and ensure domestic food security. Consequently, macroeconomic factors are essential for explaining fluctuations observed in price of agricultural products. However, this study focuses on crude oil prices, interest rates, and exchange rates because it has been discovered that these variables possess a stronger impact on agricultural commodities' prices (Guellil et al., 2016).

Scholars over the years have been interested in the exchange rate since it affects a country's economic performance, and as defined by Ismaila (2016), it is the rate at which a nation exchanges its currency for another. Also, because many LICs' economies are dependent on advanced economies like the US, they are particularly vulnerable to the exchange rate policies that are put in place by those advanced economies (Ismaila, 2016). In addition to establishing a connection between domestic and foreign nations through the exchange of commodities, the exchange rate also reveals how competitive a nation's exchange power is on the global market. Further, it offers a support system to manage internal and external macroeconomic balances. According

to Harri et al. (2009), fluctuations in exchange rates have been recognised as one of the major factors influencing domestic agricultural commodity prices. As a result, the devaluation or appreciation of a nation's currency has a significant impact on the nation's economic performance.

Similarly, Liefert (2009) asserts that the exchange rate's ability to affect prices can act as both an incentive and a deterrent for producers of agricultural commodities. Amidst currency depreciating in the domestic country, domestic producers whose production is targeted at exports benefit a lot from the situation since the price they receive for their produce becomes relatively higher. They receive payment in foreign currency which now is higher than the domestic currency. This serves as an incentive to export the majority of their produce at the expense of the domestic country. On the other hand, importers lose a lot since their currency relative to the country they are importing from is lower, so they pay more. The loss is, however, transmitted to the final consumer through higher commodity prices.

In addition, agricultural production is capital-intensive and most of the technologies used are imported (Zhao et al., 2018). Eventually, fluctuations in the exchange rate can either reduce or increase agricultural commodity prices through the cost of imported inputs. According to empirical research, weak exchange rate policies and programs are the cause of the agriculture sector's slow and stagnant growth in LICs (Gilbert, 2010; Baffes & Haniotis, 2010).

Abbott et al.(2008) noted that the local currency losing value, which is a result of the growing current account deficit due to exchange rate impacts, is a contributing factor to the increase in oil prices. Moreso, escalation in production costs caused by rising oil prices as well as higher demand for

agricultural products that require more biofuel production results in increased prices for agricultural commodities because of cost-push factors. Consistent with Abbott et al. (2008)'s assertion, Rezitis (2015) argued that because the production of agricultural commodities necessitates the use of crude oil, the price of crude oil influences the prices of the good through the cost of inputs. As crude oil prices rise, substitution effects emerge, prompting producers to increase biofuel production due to its lower cost and higher profitability. This, in turn, drives up the prices of agricultural commodities used as biofuel inputs. Additionally, the global market has experienced a growing demand for agricultural goods from low-income countries (LICs). Consequently, the observed correlation between oil prices and agricultural commodity prices may stem from heightened demand linked to international trade rather than direct price transmission from crude oil to agricultural markets, as some scholars suggest (Wang et al., 2014).

Real interest rates also play a crucial role in shaping agricultural commodity prices (Campos, 2019). Frankel (2014) notes that a 1% rise in real interest rates leads to a 6% decline in the Commodity Research Bureau (CRB) price index. Similarly, Scrimgeour (2010) finds that a 1% increase in interest rates results in a 5% drop in commodity prices. Multiple empirical studies support this inverse relationship between interest rates and agricultural commodity prices. However, Campos (2019) presents a different perspective, suggesting a U-shaped relationship, where the impact of real interest rates on commodity prices shifts at a threshold of -1.45. Specifically, if real interest rates fall below -1.45, agricultural commodity prices decrease by 8.1%, whereas if real interest rates are at or above -1.45, prices increase by 3.4%.

Further, Akram (2009) also added that whenever there is a change in the real interest rate due to interest rate shocks, agricultural commodity prices rise in response, which may cause them to overshoot. Thus, a sudden decline in interest rates will cause the price of agricultural commodities that are already on the market to rise more than anticipated. This is known as overshooting, which equates the fall in interest rates with the increase in agricultural commodity prices.

The production of agricultural commodity, by definition, is intrinsically unpredictable throughout the year, whereas demand for staple food is more consistent, especially in LICs (FAO, 2019). The price of cereals and other main food commodities, including palm oil has seen two global spikes: one in 2007-2008 and the second in 2010-2011 and they have been consistently higher than they were between the 1980s and the turn of the century (FAO, 2021). However, the current trend suggests that the fluctuations of agricultural prices are on an upward spiral towards the levels experienced in the last two global hikes. Particularly, cereals, vegetable oil and dairy had been fluctuating but on an upward trend for more than a year, and they were more than 40% higher in October 2021 than they were a year earlier (FAO, 2021) as shown in the chart.

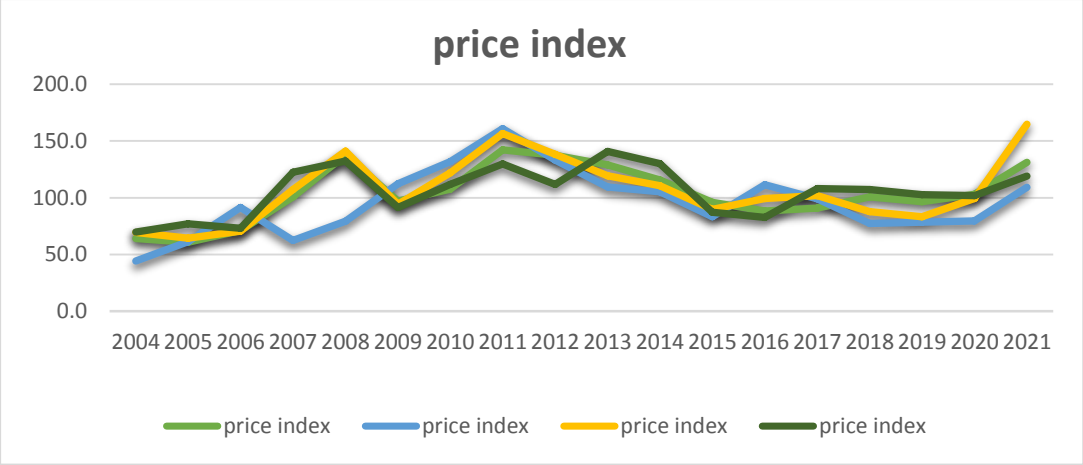

Figure 1: Global agricultural commodity prices from 2004 to 2021

Source: FAO FFPI, 2022.

Volatility in agricultural food prices is particularly an important subject in SSA countries as most households devote a significant part of their money on food, thus higher food prices have a substantial impact on household budgets (World Bank, 2021). Also, SSA farm households operate on a small-scale and sell their produce on the market and act as net buyers. Most small-scale farm households rely entirely on the sale of agricultural food commodities to meet their daily necessity needs as well as expenses on health and educational needs. Food price volatility thus plays a direct role in the poverty dynamics in SSA countries (Yigezu et al., 2015).

Food security is greatly impacted by agricultural food costs at the household and national levels. Higher prices create economic constraints which can fuel sentiments of deprivation that can lead to conflict. Riots have been linked to rising food prices in 14 African nations (Berazneva & Lee, 2013). Europe, Asia and America. It is essential to understand the subtleties of the prices of agricultural commodities and the variables that lead to such

changes in SSA countries given the impact that food prices have on food security and their propensity to have a negative social and economic impact.

The study's scope and coverage are unique in the literature since it will concentrate on the SSA, a sub region that is primarily agrarian, while the majority of the literature concentrates on the Eastern world and developed nations whose economies differ structurally from SSA's. Additionally, this research adds to the body of literature by integrating data from the period up to the current health pandemic period, which is not adequate in the available literature. A period scholars have projected that may cause food prices to increase (Agyei et. al, 2021).

This study is driven by the idea that to achieve the Sustainable Development Goals (SDGs) 1 and 2 of the UN, which are poverty elimination, zero hunger, and food security, the World Bank has established that agriculture is the major driver in achieving these goals. Thus, it is important to ensure that efforts are directed to ensure the sustainability of this critical sector for citizenry. However, the health pandemic and political conflicts among countries across the globe have led to increasing food prices, evidence of the soaring food inflation for which Africa is no exception. This has led to projections of increased poverty and worsening inequalities among the citizenry and member countries. Therefore, it is essential to understand the macro-economic determinant of agricultural commodity hikes and how stakeholders can formulate policies from the outcome to improving the general good of citizens.

Statement of the Problem

SSA countries contribute enormously to the international market regarding food security. Not only is agriculture in SSA crucial for global food security, but it also serves as a means of livelihood for a significant number of people. However, the agricultural sector in SSA has become vulnerable due to external shocks such as the compounding effects of Covid-19 global pandemic, political and regional conflicts like the Russia and Ukraine conflict and climate-related challenges have affected commodity prices as well as strained the economic resilience of member countries (Unsal et. al., 2022; World Bank, 2022).

For instance, the effect of Covid-19, led to a global upward of food prices by 25% and this coincided with a 19.3% increase in food prices from 2020 to 2021 relative to the period between 2011 and 2012, in SSA. This has been the biggest spike in the cost of staple foods since the 2008 global food and financial crises as presented in the graph (Unsal et al., 2022).

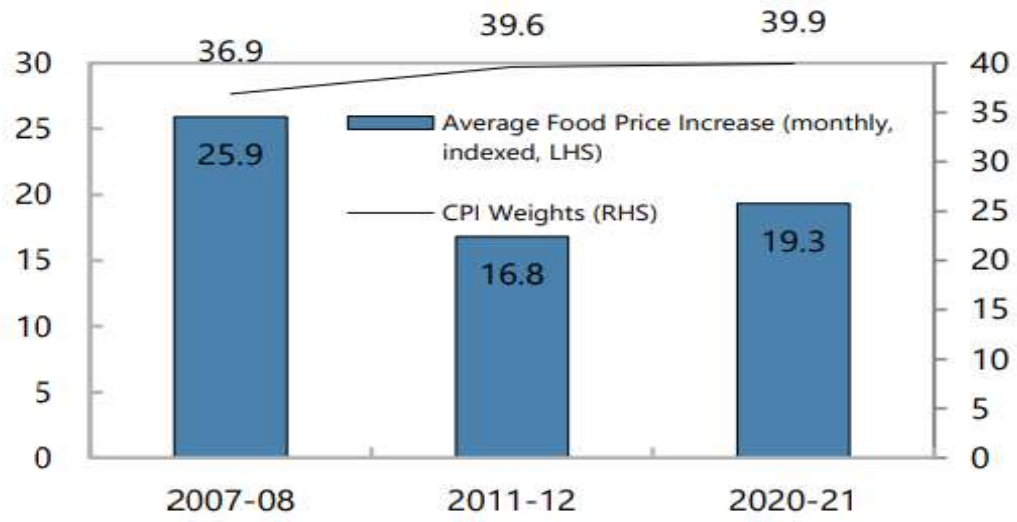

Figure 2: Average food prices from 2007 to 2021 in SSA

Source: Unsal et al. (2022)

In addition, the global commodity prices outlook indicates that primary commodities like cereals among other food crops have their prices index increasing by 14.84% from 2021 to 2022 (IMF, 2023). Espitia et al. (2020) observed that there has been a decline in food exports globally and a rise in food costs, particularly for emerging nations that depend significantly on food imports.

Similarly, the political conflicts particularly the Russia-Ukraine conflict have adversely affected agriculture commodity prices in SSA primarily due to the destruction of the supply chain of notable commodities that are important staples, such as maize, sorghum and wheat in the sub-region. SSA countries are net importers of agricultural commodities with Russia and Ukraine being major exporters of grains hence the conflict has led to a shortage in supply of these commodities causing a shock in the commodity market and affecting the price. For instance, Ukraine's cereal exports to SSA have drastically declined, with the region's share plummeting from 10% to 3% (FAO, 2022; World Bank, 2022). Again, as a result of the increased risk and logistical difficulties in the Black Sea region, a vital center for grain exports, it has created a supply gap estimated at 30 million metric tons of wheat, maize, and oilseeds in Africa leading to increased prices and scarcity of these staples and this situation according to the African Development Bank will reduce Africa's GDP by $7 billion (AfDB, 2023). Also, with Russia being a significant global exporter of fertilizers, farmers in SSA were impacted by a 250% increase in fertilizer prices brought on by sanctions and trade limitations on Russian exports (World Bank, 2022).

According to Antwi-Agyei and Stringer (2021), considering the labor-intensive nature of agricultural production and distribution systems and the dependence on grain imports, SSA is expected to see greater consequences from the pandemic and the political conflict on food prices. This has raised concerns about welfare in SSA as economic projections made by Akyüz (2022) which indicates that poverty, food insecurity, and geopolitical tensions among other problem are to be expected in SSA shortly. Reason that poverty in Africa has been predominantly rural, with about 75% of the poor people residing in rural regions and relying on agriculture for food and their livelihood (Mahembe & Odhiambo, 2021).

A report by IFAD (2015) indicated that the surge in food prices during 2008-2009 pushed nearly 100 million people into poverty. A further projection by IMF (2022) indicates that the food situation in SSA is expected to affect 140 million people who will experience acute food insecurity. This situation will derail member countries' effort to achieve sustainable development goals (SDG) 1 and 2, which speak of eradicating extreme poverty and zero hunger by 2030.

To aid policies and programmes that will reduce food security to a minimum, there is a need to study how macroeconomic variables drive agricultural commodity prices. Therefore, it can be said that this study is timely.

It is worth noting that prior empirical works (Pal, 2023; Campos, 2020) examined the impacts of interest rates on agricultural commodity prices. Other strands of research (Adil et al. 2022; Baffes & Dennis, 2013) also focused on how exchange rate impacts agricultural commodity prices. Other prior studies (Balcilar et al., 2016; Liu 2014; Du et al., 2011) have also explored the effects

and relationship that exist between agricultural commodity prices and crude oil prices.

Despite the dearth of empirical studies in literature on the topic, the contribution of the effect of macro-economic variables on agricultural commodity prices is constrained. Most of the studies (Ezeaku et al., 2021; Mo et al., 2018; Wei Su et al., 2019; Hatzenbuehler et al., 2016; Arezki et al., 2014) in literature employed data on the Asian and advanced economies which are heavily services and industrial based economies in contrast to SSA which is largely an agrarian sub-region and as such SSA is expected to experience a greater consequence of any impact on agriculture commodities and thus the need to explore the scope and location.

However, a handful of investigations that have examined the factors that influence food prices were conducted more than a decade ago in 2008 and 2012 when food prices recorded their highest index and coincided with the global financial crises. (Akram, 2009; Abbott et. al, 2008; Anderson & Brückner, 2012; Baffes & Dennis, 2013; Berazneva & Lee, 2013). It is therefore imperative to conduct a study into agricultural price hikes, especially in the wake of the recent health pandemic and the political conflicts between countries that have affected the supply chain of agricultural goods leading to a rising food price index similar to the 2008 crisis period.

Therefore, this study seeks to fill this gap by offering a comprehensive examination of how interest rates, exchange rates, and crude oil prices affect agricultural commodity prices in SSA for potential policy ramifications.

Purpose of the Study

The primary aim of this study is to look at the determinants of agricultural commodity prices in some selected Sub-Saharan African countries.

Research Objectives

Specifically, the study aims to:

1. analyse the effect of interest rates on three agricultural commodity prices.
2. determine the effect of exchange rates on three agricultural commodity prices.
3. examine the effect of crude oil prices on three agricultural commodity prices.

Research Hypothesis

The study seeks to test the following hypotheses;

1. H_0: interest rate has no influence on agricultural commodity prices.

   H_1: interest rate has an influence on agricultural commodity prices
2. H_0: exchange rate has no effect on agricultural commodity prices

   H_1: exchange rate has an effect on agricultural commodity prices
3. H_0: crude oil price has no effect on agricultural commodity prices

   H_1: crude oil price has an effect on agricultural commodity prices

Significance of the Study

Sub-Saharan Africa is a net importer of agricultural commodities. An increase in the price of the commodities will have an adverse effect on the budget of these importers. While there have been studies on food crises in the past, recent research has mostly concentrated on the connectedness of these

agricultural commodities. Against this background, this present research will add to the body of literature by investigating the economic variables influencing agricultural commodity pricing.

First, this study is timely because recent reports have projected that the COVID-19 outbreak would raise prices of food and other finished agricultural goods. Secondly, the new trade alliance formed in Africa seeks to remove trade barriers in the form of tariffs on commodities. This situation means the pricing of commodities will be influenced by the economic fundamentals of the exporting countries; hence, the findings from this study will assist policymakers in devising comprehensive models that will help stabilise the economy. Also, market participants will be informed about the effects of their taste for foreign commodities on the general price levels of agricultural commodities.

Limitations of the Study

The initial constraint was the selection of control variables. The frequency with which the data was provided was another key restriction of this analysis. Several variables from the large agricultural commodity literature were included in the regression analysis. However, due to the scarcity of data in SSA, the study agreed on three commodity prices. Despite this limitation, the study contributed to closing one of the gaps in the drivers of commodities prices in SSA.

Organisation of the study

The study is divided into five chapters. Chapter 1 covers the study's introduction, which includes the study's brief background history, key problems, its rationale and objectives, research hypothesis, significance, and

limitations. Chapter 2 and 3 present the review of relevant literature and theories that underpin the study respectively, whereas chapter 4 focuses on results and findings from the data analysed. With a summary, conclusion, and recommendations, chapter five concludes the study.

CHAPTER TWO

LITERATURE REVIEW

The focus of the study is to examine the determinants of agricultural commodity prices. A review of the link between interest rates, exchange rates, crude oil and the prices of agricultural products are presented in this chapter. In addition, appropriate theoretical and empirical reviews of relevant literature are included in this chapter. The first part explores the conceptual framework and theoretical concepts, whereas the second part explores empirical literature, and the last part draws a conclusion on the relevant literature reviewed.

Conceptual Framework

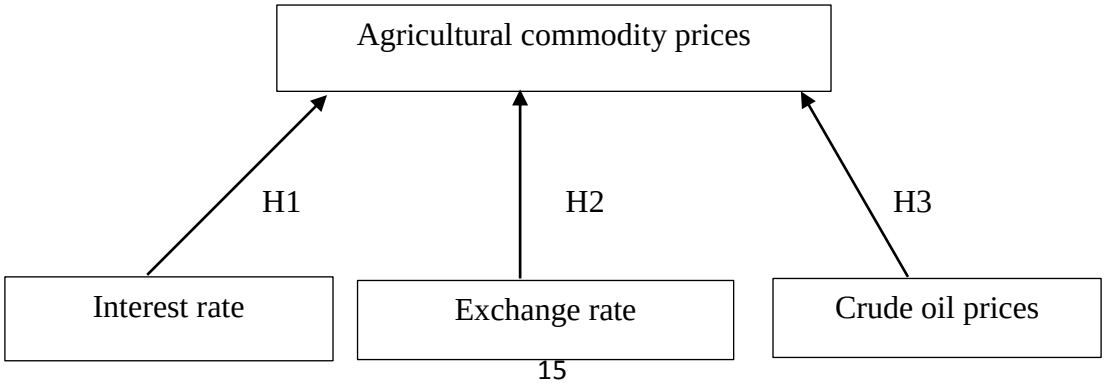

Figure 3: Relationship between agricultural commodity prices and macro-economic variables

Source: Author's construct (2023)

From the framework, if interest rates rise, agricultural producers may find it more expensive to borrow money, which could result in lower output or higher production expenses. The interest rates that central banks set have a direct impact on how much it costs farmers, agribusinesses, and other agricultural industry participants to borrow money. The expenses of agricultural production, investment choices, and the overall profitability of agricultural activities can all be impacted by changes in interest rates. For policymakers, investors, and farmers to make educated choices about production, marketing, and resource allocation, it is essential to understand the nexus that exists between interest rates and agricultural commodity prices in SSA.

As a result, fluctuations in cost structures can influence the pricing of agricultural goods, causing corresponding adjustments. The existing literature suggests an inverse relationship between real interest rates and agricultural commodity prices. Campos (2019) argues that although a definitive theoretical explanation for this relationship has yet to be established, it is likely linked to market participants' expectations and risk-taking behavior. Changes in exchange rates, particularly for export-oriented goods, can have a substantial impact on the prices of agricultural commodities in SSA countries. Agricultural items may become more affordable to overseas consumers due to a depreciation of the local currency, which could lead to higher demand and pricing. The reverse outcome can occur if the local currency appreciates. The

markets for agricultural commodities may experience price transmission effects as a result of such changes in exchange rates. Exchange rates have a big impact on agricultural commerce and prices, especially how the local currency is valued in relation to the major international currencies. A depreciation of the local currency can improve export competitiveness and raise the price of agricultural commodities, which is advantageous to local farmers. On the other hand, the currency that is gaining can make exports less competitive and push down prices. To assess how currency fluctuations influence the competitiveness and profitability of the agricultural sector, it is crucial to examine the interaction between exchange rates and agricultural commodity prices in Sub-Saharan Africa (SSA). Poonyth and van Zyl (2000) emphasize that exchange rate changes significantly affect agricultural commodity prices in SSA countries.

Crude oil plays a vital role in the development of both agriculture and transportation. Variations in crude oil prices can alter the cost structure of agricultural production by affecting fuel and transportation expenses. As a result, shifts in crude oil prices can have a direct impact on agricultural commodity prices. In recent years, sharp fluctuations in crude oil prices have had significant repercussions on the global economy. Many SSA nations depend on imported oil and petroleum products, which are essential for agricultural activities, making the sector highly sensitive to oil price changes. The relationship between crude oil prices and agricultural commodity pricing in SSA is critical, as it influences key inputs such as fertilizers and insecticides, along with production and transportation costs. Understanding this connection is essential for evaluating the agricultural sector's vulnerability

to global oil market trends. Ali et al. (2012) pointed out that rising crude oil prices can substantially impact the commodity market by driving up biofuel production and increasing agricultural production costs

Theoretical Review

The study's guiding theories are reviewed in this section. It comprises hypotheses that connect interest rates, the value of the currencies, and the cost of crude oil and agricultural products. The section specifically examines the price transmission theory, which links changes in the pricing of connected marketplaces or goods, and the concept of supply and demand.

Price Transmission Theory

The theory of price transmission, also known as cost pass-through, investigates the connection between changes in prices in connected marketplaces or items. It specifically looks into the impact that changes in the price of one commodity or market have on the costs of associated products or marketplaces. It is frequently used to examine how various economic factors interact with one another as well as how price changes go from producers to consumers along the supply chain. When there are connected markets like in the case of agricultural commodity markets, where changes in the pricing of inputs, alternatives, or related commodities can have an impact on the prices of finished goods, the idea of price transmission is particularly pertinent. In this regard, the study can examine how shifts in interest rates and exchange rate affect the costs of agricultural commodities in SSA nations. Mundlak and Larson (1997) emphasised that the majority of agriculture commodity price changes in the world are transmitted, and they are the main factor influencing changes in domestic prices.

Theory of overshooting

The theory of overshooting, also known as the Dornbusch overshooting model, describes how exchange rates might respond to monetary policy changes more sharply than the long-term equilibrium would imply. It contends that changes in the foreign exchange rate do not immediately affect the prices of goods in the economy. Instead, they first have an impact on other variables, such as the bond, money and derivatives markets, and these other factors such as the financial markets and money market impact the prices of goods. The argument in this theory explains that exchange rates have an impact in determining prices of agricultural commodities. Because many SSA nations are net importers of food and also depend on exporting their primary agricultural products in their raw state for income, changes in exchange rates may cause excessive swings in commodity prices. For example, import prices may overshoot due to a sudden devaluation of the local currency, increasing the cost of commodities in the local market.

Similarly, changes in monetary policies such as adjustments in interest rates by the major importing economies can lead to shift the capital flow. Foreign investors may be influenced to redirect their investment to their home country instead of buying bonds and other financial assets in SSA countries leading to a fall in foreign currency stock. This intends to affect the ability to import food for local consumption due to inadequate forex and subsequently impact agricultural commodity prices.

Demand and Supply

Understanding the effects of interest rates, exchange rates, and crude oil prices on the prices of agricultural commodities in Sub-Saharan African

(SSA) nations requires a basic understanding of demand and supply. The economic theory of demand and supply is based on the connection between the amount of a good or service that customers can afford and the quantity they are willing to purchase (demand) and the quantity that producers are prepared and able to sell in the market (supply) at a particular price. A basic economic theory that establishes the equilibrium price of products and services, including agricultural commodities. Macroeconomic factors including GDP growth, inflation, population growth, income levels, interest rates, and exchange rates affect supply and demand in Sub-Saharan Africa (SSA), which affects agricultural prices. Because agricultural commodities are limited in supply in the short run, an increase in demand will cause prices of such commodities to increase. SSA's rising population and urbanization has increase the demand for food through increased income levels (FAO, 2020).

For instance, growing incomes in Kenya and Nigeria have raised the demand for maize and rice significantly, which has led to price increases for the commodities (World Bank, 2021). Also, when a currency depreciates, imports become more costly, and consumers switch to local alternatives putting pressure on the available stock and forcing its prices to rise. Similarly, high interest rates mean a high borrowing cost and finance cost which will deter farmers from taking loans for agricultural inputs and investment in crop production. This situation will lead to a reduction and or no change in the supply of agricultural commodities leading to shortages and competition for the scarce commodities and causing a higher price on the commodities.

Transmissions

Interest rates significantly affect the economy as a whole. influencing both the supply and demand dynamics of agricultural products. Interest rate fluctuations can affect costs of borrowing, investment decisions, and consumer spending. Low interest rates make borrowing less expensive, which encourages more investment in agriculture and allied businesses, potentially increasing agricultural supply and production. In contrast, higher interest rates might result in less investment and consumer expenditure, which would impact the market for agricultural goods. Gibson and Kaufman (1968) came to the conclusion that roughly speaking, aggregate income or production and money supply are the main drivers of interest rate changes on the supply and demand sides, respectively.

Exchange rates describe how much one currency is worth in relation to another. There are different ways that exchange rate fluctuations may have an impact on agricultural commodity pricing in SSA nations. For instance, a depreciation of the local currency might boost exports' competitiveness, stimulating a rise in demand for domestically produced agricultural products on global markets. On the other side, a stronger local currency would result in cheaper imports, which would impact the local market's demand for domestically produced agricultural goods. Empirically, it has been discovered that exchange rates only play a small part in tying agricultural goods together (Musunuru, 2017).

Changes in the cost of crude oil have the ability to exert an indirect impact on the pricing levels of agricultural commodities in SSA countries. Production and transportation costs are impacted by oil prices which can then

affect the price of agricultural inputs like gasoline, fertilizer, and pesticides. Greater oil prices can result in higher production costs, higher supply costs, and even changes in the availability of agricultural goods. SSA nations that export oil may also see variations in income levels as a result of changes in oil prices, which might affect their domestic demand for agricultural goods. Vo et al. (2019) and Ali et al. (2013) provide empirical evidence supporting the transmission of crude oil price changes to agricultural commodities. They assert that the crude oil market plays a crucial role in influencing price fluctuations and contributing to the volatility of agricultural commodity prices.

Empirical Review

Many Sub-Saharan African (SSA) nations' rely heavily on the agriculture industry as a major employer and a large contributor to GDP (World Bank, 2021). Numerous factors, such as local and global economic situations can influence the pricing of agricultural goods in the SSA. Among them, interest rates, currency rates, and the cost of crude oil have an effect on all been identified as having a significant influence on food prices.

Examining the body of knowledge on the influences of interest rates, currency fluctuations, and crude oil prices on the costs of agricultural products in Sub-Saharan Africa is the goal of this review of the literature. To determine the crucial connections, mechanisms, and elements that influence these interactions, the study analyses and synthesises the results of earlier investigations. Also, the study wants to draw attention to any gaps in the literature and offer advice to policymakers, academics, and other interested parties who want to comprehend and take advantage of the opportunities and challenges brought about by the dynamics of interest rates, currency exchange

rates, and crude oil prices in the context of SSA's agricultural commodity markets.

Determinant of agricultural commodities prices in SSA

Exchange rate

In a study from Adil et al. (2022), the research focused on Pakistan's particular situation while examining the connection between exchange rates, oil prices, and the costs of food. The research emphasizes the exchange rate's intermediary role in connecting the costs of food and oil. It examines several agricultural commodities, barley, flax, oats, chickpeas, sugarcane, and corn are combined into a Composite Index (CI) for the study. Using Principal Component Analysis (PCA), which aids in condensing data from several variables into a single index, this index was generated. In this study, mediation strategy is used in conjunction with the Seemingly Unrelated Regression (SUR) model. This allows the study to analyze the indirect impact of exchange rates on food costs through oil prices. The findings suggest a positive relationship between exchange rates, food prices, and oil prices. Additionally, the study reveals that oil prices have a favorable influence on food prices, particularly when exchange rate fluctuations are considered. Accordingly, the analysis supports the idea that the exchange rate mediates the relationship between the cost of food and oil to some extent.

In his study, Musunuru (2017) looked at the dynamic relationships between grain, meat, and the value of the dollar. There is no proof that the research variables' cointegrating correlations exist, according to the findings of the Johansen cointegration tests. Also, except corn and lean hogs, most of the examined commodities displayed unidirectional causality. The vector

autoregression (VAR) model's findings demonstrate that the historical prices of meat and grains have an effect on the current prices. Exchange rates are found to have a modest impact when linking agricultural commodities. This study period spanned from January 1993 to December 2016, hence the generalizability of the findings is limited to that duration.

Additionally, according to Baffes and Dennis (2013), there exists a statistically significant relationship between shifts in the price of food and the currency rate with the price of rice showing the highest correlation. The authors explain the weak relationship between maize prices and the US dollar as a structural result of US dominance in maize production. The most dominant producers of maize are not structurally found in African nations. SSA nations are characterized by currency instability and imported inflation. Based on these factors, the study concludes that fluctuations in exchange rates significantly influence the cost of maize.

Alam and Gilbert (2017) argue that exchange rates have a significant and lasting impact on the price dynamics of agricultural goods. Their analysis explores how monetary policies and other macroeconomic disruptions contribute to fluctuations in agricultural commodity prices. They made use of the FAVAR (Factor Augmented VAR) and dynamic factor model frameworks. Throughout the study's period of January 1991 to May 2014, monthly data were used. The uniqueness of this study is that it examines each commodity separately, allowing for the incorporation of fundamentals unique to each commodity, such as the level of inventory, which is a key factor in determining the price of a commodity analyzed within a structural VAR (Vector Autoregression) framework. To thoroughly investigate the extent of

price correlation and assess the impact of macroeconomic disturbances on this correlation within a factor-augmented VAR (FAVAR) model, this research integrates a vast collection of agricultural commodity prices.

Interest rate

Pal (2023) examines the effects of traditional monetary policy, namely alterations in the interest rate on reserves, on the pricing dynamics of agricultural commodities. To conduct an investigation on this matter, an analysis is performed on monthly data from the United States spanning from October 2008 to July 2019. This analysis utilizes a vector autoregression model. The research findings indicate a negative correlation between the interest rate on reserves and the prices of maize, sorghum, and cotton. However, these results are primarily applicable to the U.S. agricultural sector and may not necessarily reflect the conditions in SSA due to climatic differences.

Campos (2020) investigates the presence of asymmetric relationships between agricultural commodity prices and real interest rates. Using quarterly data from the first quarter of 1983 to the fourth quarter of 2014, the study analyzes U.S. interest rates and agricultural commodity prices. It employs a testing strategy and a fixed-effect panel threshold model, ultimately confirming an inverse relationship between real interest rates and agricultural commodity prices. However, the research focuses solely on wheat, corn, and soybeans, meaning the findings could differ if a broader range of agricultural products were considered.

According to a study by Akram (2009), increases in real interest rates cause the price of commodities to rise noticeably. Moreover, it is worth noting

that in reaction to variations in interest rates, the cost of oil and manufacturing inputs may display excessive fluctuation tendencies. His study's findings further revealed that rising commodity prices are a result of a declining dollar. It has been discovered that significant portions of changes in commodity prices can be attributed to shocks to the dollar's value and interest rates. This study investigates whether dropping real interest rates and currency values contribute to rising commodity prices, as well as whether overshooting behaviour occurs when real interest rates fluctuate. The analysis makes use of structural VAR models, which were created using quarterly data from 1990 Q1 through 2007 Q4.

Crude oil prices

Balcilar et al. (2016) applied the Granger causality test to examine the relationship between oil prices and agricultural commodity prices specifically soybean, wheat, sunflower, and maize in the South African context. The study analysed daily data from April 19, 2005, to July 31, 2014, capturing price fluctuations of Brent crude oil, corn, wheat, sunflower, and soybeans. Agricultural commodity prices were sourced from the Johannesburg Stock Exchange, while Brent crude oil prices were obtained from the U.S. Department of Energy. An initial linear causality analysis revealed that fluctuations in crude oil prices did not have a significant impact on agricultural commodity prices. These results were nevertheless considered misleading because of structural flaws and nonlinear dependencies between the variables under consideration. Nevertheless, the aforementioned problems were effectively mitigated through the utilisation of the nonparametric Granger causality test in quantiles. When variables have fat-tailed distributions, this

method is especially useful since it takes structural breaks, nonlinear relationships, and causality into account beyond mean estimations. The study's findings show that the conditional distribution's various quantiles exhibit varied patterns of oil price fluctuations' effects on the cost of agricultural goods. Compared to the rest of the data findings, the influence on the distribution's tails is notable as being less severe, and the strongest impact is not seen at the median. The analysis disproves the neutrality hypothesis, which holds that oil prices in South Africa have no impact on the cost of agricultural goods and shows that this link depends on particular market phases.

In his study published, Liu (2014) analyzed the interdependence between agricultural commodity markets and crude oil markets. The findings indicate strong volatility cross-correlations across all lag lengths, as well as significant linear return cross-correlations at longer lag lengths. The study employed detrended cross-correlation analysis (DCCA) to examine the persistence of return cross-correlations in different agricultural commodities. It further revealed that cross-correlations in returns exhibited persistence for corn and soybeans, whereas they showed anti-persistence for oats and soybeans. In contrast, empirical evidence demonstrated that the cross-correlations of volatility exhibited a consistent level of stability during the entire time frame being examined. According to the results, the cross-correlations are not very strong. However, they remain statistically significant for shorter temporal intervals when employing a nonlinear cross-correlation metric. Findings of this research had ramifications for the early 2000s, particularly in light of the 2006-2008 food crisis that served as a catalyst for this research.

Du et al. (2011) investigated potential relationships between oil price volatility and agricultural markets, as well as the impact of various factors on crude oil price fluctuations. Using stochastic volatility models, the study analyzed weekly futures prices for wheat, maize, and crude oil from November 1998 to January 2009. The researchers estimated model parameters using Bayesian Markov chain Monte Carlo methods. The results showed that petroleum inventories, scalping, and speculative activity were largely responsible for the explanation of variations in oil prices. The study also revealed the following characteristics of crude oil price dynamics: mean-reversion, a negative correlation between price and volatility, volatility clustering and irregular compound jumps. Additionally, the study found evidence of spillover volatility in the wheat, corn, and crude oil markets, especially after the fall of 2006.

Neff et al. (2011) further assert that agricultural commodity prices and crude oil prices exhibit a positive correlation. They emphasized that as oil prices increase, the costs associated with fuel, transportation, and energy-intensive farming practices also rise.

Zafeiriou et al. (2018) employed the ARDL cointegration approach to examine the relationship between crude oil and agricultural commodity markets, specifically the futures prices of crude oil-corn and crude oil-soybean. The study confirmed that crude oil prices significantly influence the cost of agricultural products used in ethanol and biodiesel production. Their findings have practical implications, providing policymakers with valuable insights into the linkage between agricultural and energy markets. This understanding can help promote the use of bioethanol and biodiesel by

shaping policies that respond to fluctuations in crude oil prices. The use of futures prices, which take into account all information available and are better suited to detecting demand, supply shocks and spillovers than real prices, is another significant feature of the study. This method, which increases the validity of the results, is what makes their study novel. The study period also includes both extremely low and highly high crude oil prices, showing that biofuels cannot completely replace crude oil and may not protect economies from the volatility of energy prices.

Koirala et al. (2015) utilised advanced methodologies and high-frequency data to investigate the relationship between energy and agricultural commodity prices. The study found a significant and positive connection between energy futures prices and agricultural commodities, indicating a strong linkage between the two markets. As a result, the findings suggest that rising energy prices directly contribute to the upward movement of agricultural commodity prices.

Other determinants

Addison et al. (2016) conducted a study on nine Sub-Saharan African countries that heavily depend on specific agricultural commodities as key sources of economic revenue. Using a structural non-linear dynamic model, the study analysed the impact of price shocks on agricultural commodities. A key aspect of their research was examining whether the selected countries' per capita GDPs responded differently to sudden increases or decreases in agricultural commodity prices. The findings suggest little evidence to support the notion that unexpected price fluctuations have significantly different effects on per capita income.

In 2008 study, Dewbre and De Battisti (2008) identified barriers to agricultural development and the eradication of poverty that could be eased by more effective domestic and international policy. They focus on looking at trends in output, factory utilisation, and productivity when analysing agricultural performance. They investigate both domestic and foreign price distortions, alongside the effects of government spending on agriculture that is funded through aid. The findings suggest that as the GDP per capita rises, there is a corresponding increase in the prices of maize and rice. The release of this report was supervised by the OECD. This shows that the OECD agrees with the information and conclusions.

To shed some insight on the significance of GDP in determining the pricing of agricultural commodities, (Ertern & Ocampo, 2013) conducted research on the decomposition of actual commodity prices using the BP filtering approach. Their study revealed evidence of four super-cycles, each lasting 30 to 40 years and spanning the years 1865 to 2009, with amplitudes 20 to 40% higher or lower than the long-term trend. Super-cycles in non-oil commodity prices tracked global GDP trends, demonstrating that demand was their main driver. For oil prices, however, causation went in the reverse direction, indicating that changes in other variables had an impact.

Feijó et al. (2016) argue that interest rates play a crucial role in determining investment rates, while financialization negatively affects the accumulation of physical capital. Their study also highlights a link between higher levels of gross capital formation and downward pressure on maize and rice prices in the context under investigation. The study's major focus is on determining how Brazil's continued high-interest rate affects growth,

particularly in light of how it affects investment choices. The researchers used the Generalised Method of Moment (GMM) method to carry out the investigation. In 2019, Dupraz and Guyomard concluded that an increase in the hectares of arable lands leads to a reduction in their respective prices. They looked into the connection between the Common Agricultural Policy (CAP) and its effects on ecology and climate.

Bayramoglu (2014) argued that agricultural product prices and employment in the sector are related. He studied the relationship, if any, between agricultural employment and the price hikes of Turkey's agricultural products. From 2006 to 2009, using the VAR method, the study was conducted. Therefore, in terms of the Turkish economy, the findings can only be generalized to this period.

Solaymani (2022) found that while rising agricultural commodity prices negatively impact output, employment, and exports across all farm sectors, they contribute to an increase in Malaysia's real GDP and investment. The study analyzed the effects of reduced government spending, declining global oil and agricultural commodity prices, and their broader impact on Malaysia’s economy, including poverty levels. Using the most recent Malaysian input-output table from 2010, the research applied a computational general equilibrium (CGE) model to simulate four different scenarios. The study’s key contribution lies in comparing the effects of recent declines in global oil and food prices on both Malaysia’s overall economy and its agricultural sector.

According to Lee's research from 2018, as food demand increases, an increase in food costs causes a reallocation of manpower and capital from the

manufacturing sector to agriculture. The study discovered a positive link between the labour force and agricultural commodity prices during times of unfavourable agricultural productivity shocks. The study used an instrumental variable method, 118 countries' worth of data, and a static general equilibrium model with two sectors. As a result, many other nations with comparable features can use the study's findings.

In 2021, Agyei et al. conducted a study to examine the impact of the COVID-19 pandemic in Sub-Saharan Africa (SSA) on the prices of corn, millet, foreign-imported rice, and native rice. The researchers utilized dynamic panel data models, incorporating macroeconomic controls, and adopted the general technique of moments estimation. The study found that fluctuations in exchange rates, food inflation, and crude oil prices negatively impact food product costs. The sample consisted of all SSA nations with sufficient data from March to September 2020.

Mujuru and Obi (2020) examined the relationship between cultivated land area and the financial performance of maize and cabbage producers. Using a purposive sampling strategy, they selected 158 participants, including irrigators and household gardeners, from various study sites. Data analysis was conducted to identify key factors influencing farm income and food security.

The study applied a maximum likelihood estimator, integrating a seemingly unrelated regression (SUR) model with a one-way error-correcting model. The findings revealed diverse associations, highlighting the significance of geographical location, type of agricultural activity, and income levels in shaping food security. Additionally, the study identified a strong correlation between cultivated land area and crop prices, indicating an inverse

relationship between agricultural commodity costs and the availability of arable land.

In his study, Adom (2014) employed three analytical models to examine the determinants of food availability within the context of Ghana as well as the underlying causes of unsustainable food access. The results indicated that several factors including energy prices, both domestic and international interest rates, local pricing, and the exchange rate, exert a detrimental influence on food availability, crop productivity, and arable land. Conversely, the liberalization of agricultural commerce and an increase in real income have a positive effect on these variables. The analysis further supports the idea that the individual effects of energy prices and human capital outweigh their combined impact. However, when considering multiple factors—such as local and global interest rates, inflation, crop output, arable land, currency rates, agricultural trade liberalization, and income—it becomes evident that their collective influence surpasses their individual contributions.

According to the access model, domestic interest rates, currency exchange rates, and oil prices negatively impact food security, with the effect of oil prices being particularly pronounced. While exchange rates, interest rates, and income have broader economic implications, their specific effects remain significant. The stability model highlights that positive economic developments, such as wage growth, enhance access to sustainable food sources. However, rising oil prices and currency depreciation pose additional challenges to food security.

Takeshima and Liverpool-Tasie (2015) propose a theoretical framework suggesting that programs aimed at increasing fertilizer usage have only a

limited effect on grain price growth rates, particularly during the period from post-planting to post-harvest stages. They looked at how a fertilizer subsidy program affected Nigeria's grain prices' seasonal growth rates by employing an instrumental variables methodology. Additionally, this study employs data acquired from the Living Standard Measurement Survey-Integrated Survey on Agriculture (LSMS) conducted in the months following planting and harvesting in the years 2010 and 2011, respectively. In order to distinguish between replacement and expansion impacts, Chembezi used a single equation method and a two-step procedure to determine Malawi's smallholder farmers' demand for fertilizer and the output response (maize and tobacco) in 1990. The price of fertilizer has little statistical impact on the production of tobacco and maize, according to this study. However, the cost of these agricultural goods has a big impact on how much fertiliser is used.

In 2016, Rehman et al carried out a research endeavour aimed at exploring the connection between cotton crop production, agricultural gross domestic product (AGDP), cotton crop area, and fertiliser utilisation in Pakistan spanning the years from 1970 to 2015. The data gathered for the study underwent rigorous analysis using various statistical approaches such as the co-integration, Augmented Dickey-Fuller (ADF) test, and Ordinary Least Squares (OLS) technique. The findings suggested a long-term relationship between Pakistan's agricultural gross domestic product and key factors related to cotton production, such as the quantity of cotton produced, the area under cotton cultivation, and the amount of fertilizer used in cotton farming. Their findings further demonstrated a positive association between the production of cotton and fertilizer usage and Pakistan's agricultural GNP, nevertheless, a

negative correlation was observed between the extent of cotton production and the Agricultural Gross Domestic Product (AGDP). Rehman et al's study concentrated on cotton output, therefore results for crops like maize and rice would be different.

Chapter Summary

This chapter discussed theoretical concepts and empirical studies pertinent to the study. The theoretical concepts of price transmission, demand, and supply provide a framework for understanding how many factors, including interest rates, exchange rates, and the fluctuation in crude oil prices have the potential to influence the pricing of agricultural commodities in Sub-Saharan African countries. These variables may affect the agriculture product supply and demand, causing price changes that may have an effect on the local agricultural industry as well as the economy as a whole. Previous empirical works have also highlighted the importance of these determinants in determining agricultural commodity prices.

CHAPTER THREE

RESEARCH METHODS

Introduction

This study examined the influence of interest rate, exchange rate, and crude oil price on agricultural commodity prices in selected SSA countries. This chapter constitutes the methodological approach used to answer the research questions. Additionally, it comprises the following: econometric estimating technique, theoretical model, empirical model specification, variable definition, measurement, research paradigm, research approach, research design, study area, data sources, and data processing tool.

Research Paradigm

A research paradigm refers to the established methodology for conducting research that has been validated through practical application over time. This study adopts a post-positivist approach, which emerged as a critique of positivism by emphasising that knowledge is probabilistic and subject to change rather than absolute. Unlike strict positivism, which assumes that reality can be fully observed and measured, post-positivism acknowledges the limitations of human perception and the influence of social and contextual factors on knowledge formation (Phillips & Burbules, 2000). Post-positivists acknowledge that absolute truth is unattainable, and all knowledge is probabilistic and subject to revision. The post-positivist paradigm is appropriate for studies that acknowledge the complexity of social and economic issues while still requiring empirical validation. It enables researchers to employ mixed approaches to improve the dependability of findings, test theories, and admit uncertainty.

Research Approach

The term research approach refers to the various methods that researchers employ to collect and examine data. Every researcher must make this fundamental yet important choice when conducting research, according to Saunders and Bezzina (2015). This choice can be "a mono method research approach" (qualitative or quantitative) or "a mixed methods research approach" (a combination of qualitative and quantitative methods). A researcher is considered to be using a single research method when they only employ one approach for data collecting and one approach for data analysis. According to Saunders and Bezzina (2015), a mixed method is a research strategy that blends qualitative and quantitative components.

Quantitative approach of research involves assessing existing knowledge, theory, and principles through generating hypotheses, collect data, analyse it, and interpret it, the. When all of the questions or hypotheses are correct, quantitative research is said to be used. According to Bryman (2016), the quantitative method to research progresses in six steps. Make a hypothesis, question, or premise that can be tested. Next, draw some conclusions from the literature. Following the formulation of the assertions, their justification is assessed by contrasting them with existing theories. This is to determine whether it advances knowledge; if so, these hypotheses are tested through data analysis. The theory is flawed and ought to be dropped or changed if the analysis's findings conflict with the assumptions, and vice versa.

A qualitative approach differs from a quantitative one in that it relies on observations to support its findings (Sekaran & Bougie, 2016). The first step in qualitative research involves gathering data to identify a phenomenon,

followed by the development of a theory, often in the form of a conceptual framework (Bryman, 2016). Rather than being rooted in positivism, this research approach is based on an interpretive philosophy.

Saunders and Bezzina (2015) advocate for the use of qualitative methods over quantitative ones when characterizing a phenomenon. Additionally, Sekaran and Bougie (2016) highlight that qualitative research is often regarded as a methodology that emphasizes rigor and thoroughness in data collection, allowing for the direct acquisition of fresh primary data from its source. Unlike quantitative research, which typically involves large samples, qualitative research focuses on small sample sizes to facilitate in-depth data collection and analysis.

The use of this technique demonstrates the researcher's independence from the study, allowing for a complete objective examination of phenomena of interest. It is therefore beneficial in carrying out a study that entails examining the longitudinal and cross-sectional units of analysis, and also useful in discovering crucial significant links between study subjects.

Research Design

Sekaran and Bougie (2016) define research design as a blueprint or framework that outlines how collected data should be managed and utilized in a study. It encompasses various stages of data collection, the selection of appropriate sampling techniques and instruments, and strategies for addressing time and financial constraints. According to Kothari (2004), these factors play a crucial role in shaping the research design and ensuring the study's effectiveness.

Sekaran and Bougie (2016), as well as Saunders and Bezzina (2015), identified three types of study designs: exploratory, descriptive, and explanatory. According to the authors, exploratory designs are typically used by researchers when there is scant or no knowledge on how earlier scholars dealt with study factors (Sekaran & Bougie, 2016; Saunders & Bezzina, 2015). An explanatory design was used by researchers because finding cause-and-effect links between the variables was the goal of the study. To put it another way, an explanatory design was employed because the study's goal was to ascertain how one variable related to another.

Study Area

The study focuses on the Sub-Saharan African (SSA) region, which lies south of the Sahara Desert and encompasses Central Africa, East Africa, Southern Africa and West Africa. Geographically, the United Nations (UN) defines Sub-Saharan Africa as including not only countries fully located within this region but also those with portions of their territory extending into it. However, the exact number of countries classified under SSA varies depending on the organization, such as the UN, WHO, or World Bank, typically ranging between 46 and 48 nations.

The African Union (AU), on the other hand, recognises all 55 African nations and categorises them into five distinct geographic regions. The term "Sub-Saharan Africa" is often used to distinguish this region from North Africa, which falls under the Middle East-North Africa (MENA) classification due to its cultural and political affiliations with the Arab world. While Comoros, Djibouti, Mauritania, Somalia, and, at times, Sudan are members of

the Arab League, they are also commonly considered part of Sub-Saharan Africa.

With the exception of Djibouti, SADR, Somalia, and Sudan, 46 of Africa's 55 countries are classified as "sub-Saharan" by the UN Development Programme. Because the region has a sizable agricultural sector and a sizable section of its population works in agriculture, Sub-Saharan Africa was chosen as the best location for the study. For employment, income, and food security, agriculture plays a significant role in many of the region's countries. Studying how variables like interest rates, exchange rates, and crude oil prices affect the prices of agricultural commodities in this region would therefore give important insights into the dynamics of agricultural Africa's sub-Saharan region is particularly susceptible to outside shocks and changes in the price of commodities globally.

The economics of Sub-Saharan African nations, notably their agricultural sectors, can also be significantly impacted by changes in exchange rates and world prices of crude. The sensitivity and resilience of agricultural product prices in the region can therefore be better understood by researching the interaction between these variables, making this field of research important from a policy standpoint.

Sources of Data Collection

The study utilized secondary data from the database of Food and Agricultural Organisation (FAO) and the World Development Indicators (WDI), covering the period from 2009 to 2022. The selection criteria for Sub-Saharan African nations aimed to ensure that the study's findings would be sufficiently representative, given their potential policy implications.

The primary criterion for country selection was data availability. Consequently, 16 Sub-Saharan African countries were included in the study out of a total population of 48. The selected nations were Angola, Burundi, Côte d'Ivoire, Gambia, Ghana, Guinea, Kenya, Malawi, Mali, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Togo, and Zambia.

Data Processing Tool Analysis

Stata version 14.0 was used to process the data and estimate the specified models. The Fixed Effects Model was employed after a validation test was conducted. The Hausman-Wu test showed the Fixed Effect estimation technique was appropriate for the study over the Random Effect estimation technique. At a 5 per cent significance level, estimates from the Fixed Effects model that are appropriate and efficient under the null hypothesis were accepted. The cluster robust VCE was used to control the possible relationship between firm mistakes over time.

In addition to lowering the likelihood of estimation bias, panel data gives the researcher access to both cross-sectional and time-series dimensions and can be used to account for unobserved heterogeneity. Panel regression analysis using Stata Version 14.0 was utilized to determine the determinants affecting agricultural commodity prices in Sub-Saharan Africa. Tables were used to display the study's findings.

Theoretical Model Specification

The study hypothesized from the price transmission theory that the prices of agricultural commodities possess a form of relationship with interest rate, exchange rate, crude oil prices, and other factors as shown in equation (1).

$Agric\_Price_i = f(Int, Exch, Crude, Z)$ …… (1)

It follows from equation (i) that $Agric\_Price_i$ is the price of agricultural commodity i; maize, rice, and palm oil. Empirical studies (Campos, 2020; Pal, 2023) have established that interest rates have an inverse relationship with agricultural commodity prices. Further, Exch refers to the exchange rate and it also exhibits a positive relationship with agricultural commodity prices (Musunuru, 2017; Adil et al., 2022). Crude oil prices, represented as crude in equation (1), have a positive relationship with agricultural commodity prices. Z denotes other factors that influence agricultural product prices.

Estimation Technique

The Fixed Effects Model is used to estimate the model specifications. Using the Hausman-Wu test, the appropriateness of the Fixed Effect Model or the Random Effect Model was decided. At a 5% significance level, an estimator (Fixed Effects model) was selected that is efficient and consistent with the null hypothesis. The cluster robust VCE was utilised to take into consideration the probable correlation between firm mistakes over time.

The Fixed Effect Estimation Technique

The Fixed Effect (FE) estimation technique operates using the Ordinary Least Squares principle but allows the individual specific unobserved characteristics to affect the dependent variable. Contrary to the OLS, which becomes ineffective when one or more covariates are correlated with an unobserved factor, the FE assumes different intercepts and error terms for each of the covariates, thereby allowing individual heterogeneities to influence the dependent variable.

The fixed effect (FE) estimation technique also deals with endogeneity by eliminating time-invariant variables and accounts for unobserved heterogeneity which can be correlated with the explanatory variables in a model. The FE model performs well in cases where N (cross-sections) is large, but T (time periods) is small as it is the case of this study,

The fixed-effect technique is more robust to model misspecification and provides an accurate estimate of parameters while being less sensitive to model outliers, in contrast to the GMM technique.

Fixed Effect model is often preferred over GMM when dealing with small panel data, unobserved heterogeneity, and endogeneity, mainly from omitted variables

Consider the fixed effect model below.

$Y_{\text{it}} = X'_{it}\beta + U_{it}$ and $U_{it} = \alpha_i + \varepsilon_{it}$ for i=1,...,N; t=1,...,T .....(2)

For the FE model to produce consistent and efficient estimates, the following assumptions about the error term (ε_{it}) must hold.

1. The error term must be a white noise (as in linear regression).

   $E(\varepsilon_{it}) = 0$, $E(\varepsilon_{it}\varepsilon_{is}) = \sigma_\varepsilon^2$ if i=j, and $E(\varepsilon_{it}\varepsilon_{is}) = 0$ if i≠j

FE is inappropriate if the error terms are linked since you need to model the relationship and make sure the inferences are accurate (probably using random effects). This serves as the primary justification for the Hausman test.

2. Strictly exogenous individual effect α_i

$E(\alpha_i) = 0$, $E(\alpha_i\alpha_j) = \sigma_\alpha^2$ if i=j, and $E(\alpha_i\alpha_j) = 0$ if i≠j

Fixed Effect technique makes the notion that these individual time-invariant traits are distinct from one another and must not be associated with other individual features. Every entity has unique characteristics. As a result,

there should be no correlation between the entity's error term and the constant (which represents unique qualities).

3. No correlation between individual effect and the error term ε_{it}.

$E(\alpha_i \varepsilon_{it}) = 0$

4. Correlation between the individual effect and the covariates is allowed.

$E(X_{it}\alpha_i) \neq 0$

After these assumptions have been met, the FE is estimated by introducing dummy variables into the model in equation 2 to obtain equation 3.

$Y_{it} = X'_{it}\beta + D_i\alpha_i + \varepsilon_{it}$ ..... (3)

Where D is a binary variable which takes on 1 if the individual effect exists and 0 if individual effect does not exist. Finally, $\hat{\beta}$, which is an unbiased and consistent estimate obtained using OLS.

Empirical Models Specification

The econometric model used in the study utilised various agricultural commodity prices as the explained variable. The interest rate, crude oil prices, exchange rate, GDP per capita, gross capital creation, labour force, arable land, fertilizer consumption, agricultural employment, and food inflation are the covariates considered in the econometric model. The econometric models to be estimated by the FE estimation techniques are:

$$\text{Maize}_{it} = \gamma_0 + \gamma_1 \text{Int.}_{it} + \gamma_2 \text{GDP}_{it} + \gamma_3 \text{GCF}_{it} + \gamma_4 \text{LF}_{it} + \gamma_5 \text{AL}_{it} + \gamma_5 \text{FC}_{it} + \gamma_6 \text{EA}_{it} + \gamma_7 \text{FI}_{it} + \mu_{it} + v_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

$$\text{Rice}_{it} = \gamma_0 + \gamma_1 \text{Int.}_{it} + \gamma_2 \text{GDP}_{it} + \gamma_3 \text{GCF}_{it} + \gamma_4 \text{LF}_{it} + \gamma_5 \text{AL}_{it} + \gamma_5 \text{FC}_{it} + \gamma_6 \text{EA}_{it} + \gamma_7 \text{FI}_{it} + \mu_{it} + v_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

$$\text{Palmoil}_{it} = \gamma_0 + \gamma_1 \text{Int.}_{it} + \gamma_2 \text{GDP}_{it} + \gamma_3 \text{GCF}_{it} + \gamma_4 \text{LF}_{it} + \gamma_5 \text{AL}_{it} + \gamma_5 \text{FC}_{it} + \gamma_6 \text{EA}_{it} + \gamma_7 \text{FI}_{it} + \mu_{it} + v_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

$$\text{Maize}_{it} = \gamma_0 + \gamma_1 \text{EXR.}_{it} + \gamma_2 \text{GDP}_{it} + \gamma_3 \text{GCF}_{it} + \gamma_4 \text{LF}_{it} + \gamma_5 \text{AL}_{it} + \gamma_5 \text{FC}_{it} + \gamma_6 \text{EA}_{it} + \gamma_7 \text{FI}_{it} + \mu_{it} + v_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

$$\text{Rice}_{it} = \gamma_0 + \gamma_1 \text{EXR.}_{it} + \gamma_2 \text{GDP}_{it} + \gamma_3 \text{GCF}_{it} + \gamma_4 \text{LF}_{it} + \gamma_5 \text{AL}_{it} + \gamma_5 \text{FC}_{it} + \gamma_6 \text{EA}_{it} + \gamma_7 \text{FI}_{it} + \mu_{it} + v_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

$$\text{Palmoil}_{it} = \gamma_0 + \gamma_1 \text{EXR.}_{it} + \gamma_2 \text{GDP}_{it} + \gamma_3 \text{GCF}_{it} + \gamma_4 \text{LF}_{it} + \gamma_5 \text{AL}_{it} + \gamma_5 \text{FC}_{it} + \gamma_6 \text{EA}_{it} + \gamma_7 \text{FI}_{it} + \mu_{it} + v_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (9)$$

$$\text{Maize}_{it} = \gamma_0 + \gamma_1 \text{Crude}_{it} + \gamma_2 \text{GDP}_{it} + \gamma_3 \text{GCF}_{it} + \gamma_4 \text{LF}_{it} + \gamma_5 \text{AL}_{it} + \gamma_5 \text{FC}_{it} + \gamma_6 \text{EA}_{it} + \gamma_7 \text{FI}_{it} + \mu_{it} + v_{it} \ldots\ldots\ldots\ldots\ldots\ldots (10)$$

$$\text{Rice}_{it} = \gamma_0 + \gamma_1 \text{Crude}_{it} + \gamma_2 \text{GDP}_{it} + \gamma_3 \text{GCF}_{it} + \gamma_4 \text{LF}_{it} + \gamma_5 \text{AL}_{it} + \gamma_5 \text{FC}_{it} + \gamma_6 \text{EA}_{it} + \gamma_7 \text{FI}_{it} + \mu_{it} + v_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (11)$$

$$\text{Palmoil}_{it} = \gamma_0 + \gamma_1 \text{Crude}_{it} + \gamma_2 \text{GDP}_{it} + \gamma_3 \text{GCF}_{it} + \gamma_4 \text{LF}_{it} + \gamma_5 \text{AL}_{it} + \gamma_5 \text{FC}_{it} + \gamma_6 \text{EA}_{it} + \gamma_7 \text{FI}_{it} + \mu_{it} + v_{it} \ldots\ldots\ldots\ldots\ldots\ldots (12)$$

where, $Maize_{it}$= Producer Price of maize in USD per ton, $Rice_{it}$= Producer Price of rice in USD per ton, $Palm\ oil_{it}$= Producer Price of palm oil in USD per ton, GDP_{it}= GDP per Capita, GCF_{it}= Gross capital formation, LF_{it} = Labor Force, AL_{it}= Arable Land in hectares, FC_{it}= Fertilizer Consumption, EA_{it} = Employment in Agriculture, FI_{it} = Food price inflation, μ_{it} = represent fixed effect by country, v_{it} = the error term, i = index for countries, and t = index for a period which is in years.

Post Estimation Test

The Hausman test, introduced by Jerry Hausmann, offers a methodology for selecting between the random and fixed effect estimation techniques. To determine the appropriate estimation method, the Chi-square test and p-value are utilised to assess the significance level at % per cent. The

null hypothesis posits that consistent and efficient estimates are produced by the random effect, thereby favouring the random effect under this hypothesis. Conversely, the alternative hypothesis suggests that the fixed effect is consistent, thus favouring the fixed effect estimation (Greene, 2007).

Variable Definition/Measurement, and Source

This section covers the measurement of variables, their prior expectations, and their sources.

Agricultural Commodity Prices

The study selected three agricultural commodities: maize, rice and palm oil as among the most consumed commodities in SSA. Maize and rice as the major staple food commodity in SSA rank in the top three most consumed commodities with palm oil being the most consumed vegetable oil in Africa with a 40% share according to the Food and Agricultural Organisation. The selection of commodities was also predicated on the availability of data in each of the SSA nations. All three agricultural commodities were measured in USD per tonne. The data is sourced from the Food and Agricultural database of the United Nations database.

Interest Rate

It is the rate of interest on loans multiplied by the GDP deflator to account for inflation. Each country has its loan rates and associated terms and restrictions. Data on interest rates is sourced from WDI.

Exchange rate

The study utilised the official exchange rate, which refers to the rate determined by governors of the central bank or recognized exchange markets. This rate is computed as an annual average based on monthly averages, expressed in local currency units relative to the US dollar.

World Oil/Petroleum Prices

Crude oil prices serve as a proxy in this study, represented by the average price of UK Brent crude, measured in US dollars per barrel. The data is sourced from the International Monetary Fund (IMF).

Gross Domestic Product (GDP)

Gross Domestic Product (GDP) refers to the market value of all goods and services produced within a country over a specific period, typically one year. The GDP per capita is used in the study, which is calculated in real terms at 2015 constant prices. The WDI was used to obtain GDP per capita data for the chosen SSA nations.

Labour Force

People aged 15 and above who supply labour hours for the production of commodities throughout a specific period, constituted the labour force in the study. It covers persons who are currently working, active job seekers, and new entrants in the job market. However, it does not include all those working. People who work for free or work on family projects and students are mostly overlooked, as well as those in military forces. The total labour force data for the chosen SSA nations were obtained from WDI.

Arable Land

Arable land (in hectares) includes land under momentary crops (double-cropped regions are counted once), interim pastures for mowing or grazing, kitchen gardens, and land temporarily fallow, as defined by the FAO. Land that has been deserted owing to agricultural changes is not included. WDI was used to obtain data on arable land in the chosen SSA nations.

Fertilizer Consumption

The quantity of plant nutrients consumed for each piece of arable land is referred to as fertilizer consumption (kilograms per hectare of arable land). It includes nitrogen, potassium, and phosphate (including ground rock phosphate) contents. The study excludes animal and plant manures. FAO has embraced the notion of a calendar year for data distribution (January to December). Some nations collect fertilizer data on a calendar year basis, but others collect it on a split-year basis.

Employment in Agriculture

Employment includes individuals from the working population engaged in any activity to produce goods or services for profit, regardless of whether they were actively working during the reference year due to temporary absences or work-time arrangements. Agriculture, hunting, forestry, and fishing are categorized under Division 1 (ISIC 2), Category A (ISIC 3), or Category A (ISIC 4). Agricultural employment is expressed as a percentage of total employment, with data sourced from the World Development Indicators (WDI) for the selected Sub-Saharan African (SSA) countries.

Chapter summary

This chapter outlines the research methodology employed in the study. A quantitative research approach was adopted, aligned with the post-positivism research paradigm. To examine the relationship between agricultural commodity prices and macroeconomic variables, the study utilised the fixed effect estimation technique for analysis. The study area and the rational for its selection were also covered in the chapter. After that, the chapter wraps up by outlining the variables included in the model and where they came from.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

The goal of the study was to investigate the macroeconomic factors that affect the price of agricultural commodities. This chapter discussed the results and findings from data collected regarding the effects of interest rates, exchange rates and crude oil prices on agricultural commodities in SSA.

The study examined the impact of interest rates on the price of agricultural commodities, while its second and third goals evaluated the impact of exchange rates and the price of crude oil, respectively, on the same agricultural commodity prices. This chapter first presented the summary statistics, followed by the panel regression results. The study's results are presented in tables throughout the work.

Descriptive Statistics

The output in Table 1 displays the diverse characteristics of the 16 Sub-Saharan African nations selected between 2009 and 2022. The table presents measures of central tendency and variability for the variables used in the model. The mean values represent the average of each variable, providing an overall indication of their typical levels. The standard deviation captures the dispersion of data around the mean, illustrating the extent to which values deviate from the average over the given time period. Additionally, the range, calculated as the difference between the maximum and minimum values of each variable, highlights the overall spread of the data. The table also includes test of normality of a data set to understand the behaviour of the distribution and whether the given distribution follows a normal distribution behaviour, using skewness and kurtosis.

Table 1: Descriptive Statistics of Variables

Variable	Obs.	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis	Jarque Bera	JB p-value
Maize	170	359.096	287.826	114.6	1732.1	0.826	-0.483	2.934	0.23
Rice	179	484.51	282.891	49.95	1416.8	0.341	-1.214	1.574	0.455
Palm oil	113	1031.145	537.885	81.75	2022.4	0.884	-0.456	3.251	0.197
Interest rate	189	15.318	8.054	4.977	46.011	-0.43	-0.78	0.73	0.69
Exchange Rate	205	1189.464	2287.608	1.405	10439.426	-0.42	-0.79	0.73	0.69
Brent crude	208	75.093	24.214	43.334	112.012	-0.642	-0.342	2.874	0.325

Source: Author's Computation (2023)

The average maize price per ton for the 16 SSA countries is 359.096 with a deviation of 287.826. This shows that the approximate price of a ton of maize in the area is USD 359.09, with just an amount of USD 287.82 in price variations among the 16 countries within the studied period. Again, between 2009-2022, prices of maize recorded an all-time high and low of USD 1732.10 and USD 114.60 respectively. In the same period, the average prices of Rice and Palm oil recorded were USD 484.51 and USD 1031.14 per ton, respectively with USD 282.89 and USD 537.88 per ton as variation in the prices, respectively in the sub-region. Within the period of the study, Rice and Palm oil peaked in price at USD 1416.80 per ton and USD 2022.40 per ton respectively. However, prices of Rice and Palm oil experienced their minimum price fall at USD 49.95 and USD 81.75 per ton respectively.

The average price of crude oil in the world over the period is USD 75.093 per barrel with the minimum and maximum prices being USD 43.33 and USD 112.01 respectively. The variation in crude oil prices over the study period is USD 24.21. Interest rates have averaged 15.32% over the period 2009-2021, with the highest rate in the sub-region at 46.01% and lowest interest rate at 4.97%. It occurred that the variation in the interest rate in SSA is 8.05%. Similarly, the average exchange rate recorded for the sample is 1189.46 of local currency per dollar with the least and highest values as 1.405 and 10439.42 respectively for the selected sample. Its standard deviation is 2287.61.

Table 1 above also includes the normality test values of the data set for the study. The test normality determines if a dataset's or model's residuals

(errors) have a normal distribution. Because parametric models such as OLS, Fixed Effects, and Random Effects assume normally distributed errors, normality is essential in panel data analysis. In Table 1 above, all the economic indicators have negative skewness, indicating that the data is slightly left skewed while all the agricultural commodities are moderately right skewed. All the variables exhibit platykurtic behavior which explains that they have lighter tails compared to a normal distribution. The Jarque-Bera test has p-values more than 0.05, which means that the study fails to reject normality for all variables, an indication that they are not significantly different from a normal distribution.

Table 2: Correlational Matrix

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) Maize	1.000												
(2) Rice	0.534	1.000											
(3) Palm Oil	0.153	0.069	1.000										
(4) Brent crude	0.036	0.051	-0.088	1.000									
(5) Interest Rate	-0.021	0.355	0.084	0.011	1.000								
(6) Exchange Rate	0.099	-0.258	-0.594	-0.069	0.020	1.000							
(7) GDP per Capita	-0.106	-0.057	0.203	-0.012	-0.244	-0.268	1.000						
(8) Gross Capital Fixed Formation	-0.089	-0.084	-0.053	-0.029	-0.054	-0.098	-0.079	1.000					
(9) Labor force	-0.114	-0.048	-0.064	-0.036	-0.029	-0.242	0.481	-0.127	1.000				
(10) Arable land (hectares)	-0.139	-0.131	0.017	0.000	-0.060	-0.183	0.451	-0.148	0.096	1.000			
(11) Fertiliser Consumption	-0.055	0.036	0.167	-0.158	-0.083	-0.326	0.478	0.090	0.154	0.038	1.000		
(12) Employment in Agriculture	0.065	0.208	-0.613	0.067	0.272	0.285	-0.705	-0.001	-0.299	-0.318	-0.307	1.000	
(13) Food price inflation	-0.155	0.069	-0.432	-0.137	0.436	0.189	0.031	0.065	0.195	0.139	-0.035	0.179	1.000

Source : Author's Computation (2023)

Table 2 presents a pairwise correlation of the variables used in the study. Among the highly correlated variables, we can observe a strong positive correlation between rice and maize with a coefficient of 0.534. This indicates that there is a significant association between the prices of rice and maize, suggesting that changes in one commodity may influence the other. Additionally, there is a medium positive correlation between rice and palm oil, as well as between rice and interest rates. These coefficients of 0.069 and 0.355 respectively suggest a moderate relationship between these variables. Moving on to the lower correlated variables, we can see a weak positive correlation between palm oil and exchange rates, as well as between palm oil and GDP per capita. The coefficients of 0.099 and 0.203 respectively indicate a slight association.

Furthermore, there are several variables with weak negative correlations. These include interest rates and maize, exchange rates and rice, as well as labour force and GDP per capita. Although these correlations are small, they still indicate a tendency for the variables to move in opposite directions. It's worth mentioning that the correlation coefficients for the remaining variables are either close to zero or very low, indicating a lack of significant correlation between those pairs.

Overall, this brief analysis of the pairwise correlations highlight the relationships between the highly correlated variables (rice and maize), as well as the moderate correlations involving rice, palm oil, and interest rates. It provides an initial understanding of the interconnections between these variables, and the possibility of multicollinearity, setting the stage for further exploration and analysis.

Estimation and Discussion of Results

The study's findings are summarized in Tables 3, 4, and 5. To determine the most appropriate analytical approach, the Hausman specification test was conducted. The test results indicated that the null hypothesis was rejected at a 1% significance level, leading to the selection of the fixed effects model as the preferred method for analysis.

Table 3: Effect of interest rate on agricultural commodity prices in SSA

	Maize	Rice	Palm oil
Interest rate	.014	-.008	-.008
	(.012)	(.011)	(.007)
Log GDP per capita	1.334**	.981**	.373
	(.52)	(.466)	(.313)
Gross capital formation	-.011*	-.013**	-.001
	(.006)	(.006)	(.003)
Labour force	0.0008	.00008	-.00002
	(.0008)	(.000)	(.0000)
Arable land hectares	-.00007***	-.0002***	-.00017***
	(.0009)	(.0000)	(.0000)
Fertilizer Consumption	.003	-.004	.008***
	(.004)	(.004)	(.003)
Employment in Agric	.028**	.034***	.008
	(.012)	(.012)	(.007)
Food inflation	-.001	.004	-.001
	(.004)	(.004)	(.003)
constant–	-7.076*	-1.673	2.66

	(4.077)	(3.685)	(2.419)
Number of obs	125	132	87
Prob > F	0.000	0.000	0.000
R-squared	0.521	0.517	0.451
F-test	3.652	3.802	6.893

*** *p<.01*, ** *p<.05*, * *p<.1*

Source: Author's Computation (2023)

Table 3 addresses the first research objective, which examines the impact of interest rates on agricultural commodity prices in Sub-Saharan Africa during the study period. The findings suggest that interest rates have a positive effect on maize prices, indicating that higher interest rates may lead to an increase in maize prices. However, interest rates were found to have a negative effect on rice and palm oil prices, implying that as interest rates rise, the prices of these commodities tend to decline. Despite these observed trends, the results were deemed statistically insignificant, meaning that the relationships between interest rates and the prices of maize, rice, and palm oil are not strong enough to be considered conclusive.

From this model, the effect of GDP per capita which was used as a proxy for income levels on all three agricultural commodities was observed to be positive. But it was only significant for maize and rice. Specifically, a percentage increase in GDP per capita increases the price of maize by 1.334 per cent at 5 per cent levels of significance. Similarly, a percentage increase in GDP per capita increases the price of rice by 0.981 per cent at 5 per cent levels of significance. These findings suggest that as the GDP per capita rises, there is a corresponding increase in the prices of maize and rice, indicating a

positive relationship between income levels and the prices of these commodities. This view seems to be consistent with Dewbre and Battisti (2008), Cuddington, and Jerrett, (2008) and Erten, and Ocampo, (2013). As individuals experience an increase in GDP per capita, their disposable income rises, enabling them to allocate more resources to various goods and services. Within the agricultural sector, this heightened purchasing power translates into higher demand for staple crops like maize and rice. Consequently, the surge in demand puts upward pressure on their prices. For instance, individuals with greater financial means may opt for more diverse and nutritious diets, thereby increasing their consumption of maize and rice. This observed positive relationship could be attributed to the increased market integration. As income levels rise, economies tend to become more integrated and connected. This integration can lead to increased trade and market connectivity, facilitating the flow of agricultural commodities across regions and countries. Higher demand from international markets can push up prices.

The analysis revealed an inverse relationship between gross capital formation and the prices of maize and rice, reaching statistical significance at the 10 per cent and 5 per cent levels, respectively. This implies that an increase in gross capital formation is associated with a reduction in the prices of maize and rice. Specifically, the findings indicate that for every unit increase in gross capital formation, the prices of maize decrease by an average of 0.011 units. Similarly, for rice, a unit increase in gross capital formation is associated with a reduction in prices by an average of 0.013 units. These results suggest that higher levels of gross capital formation within the analyzed context are linked to downward pressure on the prices of maize and

rice. Findings from Abel (2003) and Feijo et al. (2016). The implication is that investments or inflows of capital into the production or distribution of these commodities can potentially contribute to a decrease in their prices. The results found a consistent pattern across all three commodities, indicating that an increase in hectares of arable lands leads to a reduction in their respective prices. The study's findings indicate that an expansion in arable land leads to a reduction in the prices of maize, rice, and palm oil, aligning with the evidence presented by Dupraz and Guyomard (2019). The magnitude of these price reductions varies among the commodities: a unit increase in hectares of arable land is linked to an average price decrease of 0.00007 units for maize, 0.0002 units for rice, and 0.00017 units for palm oil.

Additionally, the results suggest that rising employment in the agricultural sector exerts upward pressure on commodity prices. The relationship between employment and maize prices is statistically significant at the 5 per cent level, while the relationship between employment and rice prices is even stronger, being significant at the 1 per cent level. These findings indicate that as more people engage in agricultural activities, the prices of maize and rice tend to increase. However, the study did not find a statistically significant relationship between employment and palm oil prices, suggesting that other factors may play a more dominant role in influencing palm oil prices.

This implies that changes in employment within the agricultural sector do not have a significant impact on the prices of palm oil within the sub-Saharan region, based on the analyzed data. One possible reason for the observed relationship between employment in agriculture and the prices of

maize and rice could be attributed to the labour-intensive approach to production and limited mechanization in the agricultural sector. Maize and rice production often requires a significant amount of labour throughout various stages, such as planting, cultivating, harvesting, and processing. As employment in the agricultural sector increases, it suggests a greater workforce engaged in these labour-intensive activities. The limited mechanization implies that the production process heavily relies on human labour, resulting in increased costs associated with hiring and managing a larger workforce. In such labour-intensive systems, the benefits of economies of scale may be limited. Like the labour force, the analysis of food inflation in relation to the three commodities highlighted no statistically significant association between food inflation and the prices of these commodities. In other words, changes in food inflation had no significant influence on the prices of commodities investigated.

Table 4: Effect of exchange rate on agricultural commodity prices in SSA

	Maize	Rice	Palm oil
Exchange rate	.001	.0001**	0.0005*
	(.000)	(.000)	(.000)
Log GDP per capita	1.441***	.567	.966***
	(.491)	(.472)	(.326)
Gross capital formation	-.015**	-.009*	-.002
	(.006)	(.005)	(.003)
Labour force	-.00003	-.00001	-.0001
	(.000)	(.0000)	(.000)
Arable land hectares	-.00003***	-.00001**	-.00017***
	(.000)	(.000)	(.000)
Fertilizer Consumption	.002	-.003	.005**
	(.004)	(.004)	(.002)
Employment in Agric	.034***	.029***	.014
	(.012)	(.011)	(.007)
Food inflation	.001	.003	-.001
	(.004)	(.004)	(.003)
Constant	-8.299**	1.327	-1.734
	(3.926)	(3.708)	(2.476)
Number of obs	134	141	94
Prob > F	0.000	0.000	0.000
R-squared	0.428	0.521	0.455
F-test	4.144	3.802	7.716

*** *p<.01, ** p<.05, * p<.1*

Source: Author's Computation (2023)

For the second objective, the study examined the impact of exchange rates on agricultural commodity prices and found a positive relationship between exchange rates and the prices of maize, rice, and palm oil. This suggests that as the exchange rate increases, the prices of these commodities also rise, making them more expensive in terms of foreign currency.

While the relationship between exchange rates and maize prices was not statistically significant, the findings suggest that an increase in exchange rates results in a price increase of approximately 0.001 units for maize The study found a statistically significant relationship at the 5 per cent level, indicating that an increase in the exchange rate leads to a 0.0001 unit increase in rice prices. This relationship was even more pronounced at the 1 per cent level, with a 0.0005 unit price increase for rice. Palm oil: The study confirms that higher exchange rates contribute to higher prices for palm oil, although the level of statistical significance was not explicitly stated.

These findings align with Adil et al. (2022), emphasizing that in Sub-Saharan Africa, where many countries rely on imported farming inputs, a rising exchange rate increases the cost of imports, thereby leading to higher agricultural commodity prices.

Additionally, the study explored the impact of GDP per capita (a proxy for income levels) on commodity prices. The analysis revealed a positive relationship between GDP per capita and the prices of maize, rice, and palm oil, meaning that as income levels increase, so do the prices of these commodities. This supports the findings of Dewbre and Battisti (2008), Cuddington and Jerrett (2008), and Erten and Ocampo (2013). The

relationship was statistically significant at the 1 per cent level for both maize and palm oil.

Conversely, the study found a negative relationship between gross capital formation and the prices of all three commodities, suggesting that increased capital investment leads to lower commodity prices. However, this relationship was statistically significant only for maize and rice, meaning that higher levels of investment in capital formation are linked to lower prices for these two crops but not necessarily for palm oil.

Like the results in the first model, the results here found a consistent pattern across all three commodities, indicating that an increase in hectares of arable lands leads to a reduction in their respective prices which is consistent with the findings of Dupraz and Guyomard (2019). Specifically, the findings reveal that for every unit an increase in the hectares of arable lands, there is a corresponding decrease in maize, rice, and palm oil prices. The magnitudes of these price reductions also differ slightly among the commodities.

The analysis conducted also revealed that employment in the agricultural sector had a statistically significant relationship with maize and rice prices, but not with the third commodity (palm oil). However, the relationship between employment in agriculture and all three commodities was positive. This favourable relationship suggests that the rise in employment in agriculture is associated with higher prices for maize, rice, and palm oil. This means that as more people are employed in agriculture, the prices of these commodities tend to rise. This implies that as employment in agriculture increases, there is a tendency for the prices of these commodities to rise. In this model, the results indicated that food inflation and the labour force were

both found to be statistically insignificant factors for all three commodities. This implies that changes in food inflation and the size of the labour force had no significant impact on the prices of the commodities under investigation.

Table 5: Effect of crude oil prices on agricultural commodity prices in SSA

	Maize	Rice	Palm oil
Crude oil	.00022**	.008*	.0003**
	(.001)	(.001)	(.001)
Log GDP per capita	.001***	.00001	.001***
	(.000)	(.000)	(.000)
Gross capital formation	.008	.011*	-.001
	(.008)	(.005)	(.003)
Labour force	.0001	-.00146	-.044***
	(.000)	(.000)	(.000)
Arable land hectares	.00016	-.0046**	-.0044***
	(.000)	(.000)	(.000)
Fertilizer Consumption	.0004	-.003	.003
	(.000)	(.004)	(.002)
Employment in Agric	.023***	.019**	.011**
	(.009)	(.009)	(.005)
Food inflation	.002	.002	-.001
	.004)	(.004)	(.002)
Constant	1.309	5.642***	4.317***
	(.824)	(.843)	(.42)
Several obs.	134	141	94
Prob > F	0.000	0.000	0.000

R-squared	0.59	0.521	0.569
F-test	5.938	3.802	12.195

*** p<.01, ** p<.05, * p<.1

Source: Author's Computation (2023)

The study aimed to examine the influence of crude oil prices on agricultural commodity prices as its third objective. The analysis revealed a positive correlation between crude oil prices and the prices of all three commodities assessed. Specifically, a one-dollar increase in crude oil prices leads to an increase of 0.0022, 0.008, and 0.0003 in the prices of maize, rice, and palm oil, respectively. These findings align with previous research (Liu, 2014; Du et al., 2011; Zafeiriou et al., 2018). The relationship is statistically significant at a 5% level for maize and palm oil and at a 10% level for rice.

Crude oil prices play a crucial role in global economic dynamics, given that oil is a key input across various industries, including agriculture. The observed positive correlation suggests that rising crude oil prices tend to drive up the prices of maize, rice, and palm oil. Several factors contribute to this trend. Firstly, crude oil is essential for the production and transportation of agricultural goods. As oil prices increase, expenses related to fuel, transportation, and energy-intensive farming practices also rise (Neff et al., 2011; Koirala et al., 2015; Adil et al., 2022). These higher costs are then passed on as increased commodity prices. Secondly, fluctuations in crude oil prices affect market conditions and global supply chains. Since many agricultural inputs, such as fertilizers, pesticides, and machinery, are derived from petroleum products, a rise in oil prices leads to increased input costs, which in turn raises commodity prices. Additionally, crude oil price changes

can influence consumer purchasing power and behavior. Higher oil prices result in increased transportation costs, which subsequently raise food distribution expenses.These added costs may be passed on to consumers, resulting in higher prices for agricultural commodities.

Again, in line with the findings of Dewbre and Battisti (2008), Cuddington and Jerrett (2008), and Erten and Ocampo (2013) the results revealed a positive relationship between GDP per capita, which serves as a proxy for income levels, and the prices of agricultural commodities. Specifically, the results demonstrate that an increase in income levels leads to a price increase of approximately 0.001 units for both maize and palm oil. This implies that as income levels rise, the prices of maize and palm oil tend to increase by the stated amount. The analysis revealed an inverse relationship between arable land and agricultural prices. This implies that as the amount of arable land increases, there is a tendency for the prices of agricultural commodities to decrease. However, it is important to note that this relationship was found to be statistically significant only for rice and palm oil, while the significance for maize was not established.

Gross capital formation showed a significant relationship for only rice and exhibited a positive relationship. Labor force also showed a significant relationship for only palm oils and the relationship was negative. The significant level is 1 per cent. The analysis conducted also revealed that employment in the agricultural sector had a statistically significant relationship with the prices of all three commodities. The relationship between employment in agriculture and all three commodities was positive.

Chapter Summary

Grounded on the results presented in this chapter, several conclusions can be drawn regarding the influence of macroeconomic factors on agricultural commodity prices in selected sub-Saharan African (SSA) countries. This chapter examined how interest rates, exchange rates, and crude oil prices impact the prices of maize, rice, and palm oil in the region. The comparative analysis highlights that macroeconomic factors affect agricultural commodity prices differently across the selected SSA countries. Interest rates were found to have a positive effect on maize prices but a negative effect on rice and palm oil prices. Meanwhile, exchange rates had a consistently positive influence on all three commodities. Additionally, crude oil prices exhibited a positive correlation with the prices of maize, rice, and palm oil, underscoring their crucial role in determining agricultural price trends.

This study offers valuable insights into the intricate relationships between macroeconomic variables and agricultural commodity prices in SSA. The findings enhance understanding of the agricultural sector's pricing dynamics and provide important considerations for policymakers and future research in the region.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

Introduction

This section summarizes the research findings on the impact of interest rates, exchange rates, and crude oil prices on agricultural commodity prices. The study focuses on maize, rice, and palm oil, selected based on data availability. Key conclusions derived from the analysis, along with relevant policy recommendations, are presented to help mitigate the predicted negative effects of agricultural commodity price fluctuations on food security in SSA.

Summary

Interest rate, exchange rate and crude oil prices are among the key macroeconomic variables that distort policies targeted at improving food security, as global commodity (cereals and other food crops) prices have been forecasted to increase in the coming years. This raises issues of welfare concerns for SSA countries since they are agriculture and import-dependent.

The study of Akyüz, (2022) indicates that poverty, food insecurity, and geopolitical tensions among other problems are to be expected in SSA in the near future. However, studies that focus on explaining the driving factors of agriculture commodity prices and their effects are mainly based on advanced countries with little focus on SSA as a whole. This, together with the expected positive effect of the AfCFTA, has necessitated our study to contribute to literature and policy making by investigating the effect of interest rate, exchange rate and crude oil prices on agricultural commodity prices in SSA. Specifically, the study examined the effect of;

1. interest rates on agricultural commodity prices.

2. exchange rates on agricultural commodity prices.
3. crude oil prices on agricultural commodity prices.

Furthermore, the study relied on the price transmission theory, the theory of overshooting and the demand and supply concept to achieve its objectives. Two main theories – the price transmission theory and the theory of overshooting– formed the foundation of the study and they all highlight the link between macroeconomic variables and agricultural commodity prices. Due to the quantitative nature of the study, we followed the quantitative research approach which is in sync with the positivist philosophy and with our goal of investigating how macroeconomic variables influence agricultural commodity prices, we adopted the explanatory research design. We relied on the fixed effect estimation technique for our analysis after the Hausman-Wu test proved its superiority over the pooled OLS and the random effect estimation technique given the scope of the study and the date being used.

Summary of Key Findings

The study found that for the periods considered, 2009 to 2022, the average price of maize in SSA was USD 359.096 per ton with a difference of USD 287.826 compared to other countries. Rice had an average price of USD 484.51 per ton with a variance of USD 282.891 compared to other countries, and palm oil was sold at an average price of USD 1031.145 with a variance of USD 537.885 compared to other countries. Further, the average price of crude oil was USD 75.093 and varied with the average price of other countries at an amount of USD 24.214. The average interest rate over the period was 15.13% and the exchange rate was 46.011.

Regarding the main objectives of the study, the first one focused on how interest rates influence agricultural commodity prices in SSA. The study observed that interest rates positively influenced maize prices while negatively affecting rice and palm oil prices. However, no statistical evidence was found to substantiate these relationships.

The study's second objective examined the impact of exchange rates on agricultural commodity prices in SSA. The findings indicate that maize, rice, and palm oil prices have a positive relationship with the exchange rate. This suggests that an increase in the exchange rate makes these commodities more expensive in terms of foreign currency, with a 95% confidence level.

Additionally, the study's third objective explored the relationship between crude oil prices and agricultural commodity prices, revealing a similar positive correlation. At a 95% confidence level, the results support the claim that rising crude oil prices lead to higher costs for purchasing maize, rice and palm oil.

Conclusion

Focusing on interest rates, exchange rates, and crude oil prices, this study examined the influence of macroeconomic variables on agricultural commodity prices. The findings indicate that exchange rates and crude oil prices significantly affect agricultural commodity prices. Crude oil price fluctuations impact transportation costs, input prices, and overall production expenses in the agricultural sector, while exchange rate variations influence market dynamics, import costs, and trade competitiveness. These relationships highlight the interconnected nature of commodity markets and broader macroeconomic dynamics.

Although interest rates may affect agricultural commodity prices through borrowing costs, investment choices, and inflationary pressures, according to economic theory, our analysis does not offer enough statistical support to support this relationship within the parameters of our investigation. This implies that other elements, like global supply chain dynamics, government regulations, and subsidies, can have a greater influence on food prices.

These findings have important ramifications for investors, governments, and other agricultural stakeholders. Gaining insight into how exchange rate volatility and changes in the price of crude oil affect agricultural commodities can aid in the development of more efficient risk management, price stability, and sustainable agricultural development strategies.

Recommendation

Modifications to Monetary Policy for Agricultural Stability

Interest rate is a function of the monetary policy rate and as such any adjustment of monetary policy affects interest rate. In order to avoid excessive interest rate increases that can raise farmers' output costs, central banks through their monetary policy committee should implement balanced monetary policies.

Also, to protect farmers from growing finance costs targeted agricultural loan programs with reduced interest rates ought to be implemented by resourcing dedicated agricultural finance institutions like Agricultural development banks and Exim banks.

Managing Exchange Rates to Maintain Price Stability

Foreign exchange measures that stabilize currency swings and lower the cost of agricultural imports (such as machinery and fertilizers) should be put in place by governments. Again, the effect of fluctuating exchange rates on input costs can be lessened by promoting regional trade agreements and local currency settlements.

Reforms in the Energy Sector to Lower Production Costs

Investments in alternative energy sources, such as biofuels and solar-powered irrigation, can assist lessen reliance on fuel in agriculture, especially since crude oil prices have a beneficial impact on agricultural commodities. This will ensure agriculture production is done sustainably all year round.

Suggestion for Further Studies

Future researchers should consider a panel study of additional agricultural commodities and macro-economic variables, larger datasets or different econometric models to provide more explanation to the projected food shortage and crises in the sub-region and the intricate dynamics affecting agricultural markets.

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