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DETERMINANTS OF FOOD INFLATION IN GHANA

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DETERMINANTS OF FOOD INFLATION

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DECLARATION

STUDENT'S DECLARATION

I, Godwin Quaye, declare that this thesis, with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my own original work, and it has not been submitted, either in part or whole, for another degree elsewhere.

Signature:…….

Date:…….

SUPERVISOR'S DECLARATION

We hereby declare that the preparation and presentation of this work was supervised in accordance with the guidelines for supervision of thesis as laid down by the University of Education, Winneba.

…… (Principal Supervisor)

Signature :……

Date:……

……..... (Co-Supervisor)

Signature:……

Date:……

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DEDICATION

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ABSTRACT

Studies on drivers of inflation have mostly concentrated on determinants of general inflation with drivers of food inflation less explored in the inflation literature and generally non-existent in the Ghanaian perspective which leaves lacuna in literature and incite research. The purpose of this study is in threefold: (i) to investigate the determinant of food inflation, (ii) to examine the association between the determinant of food inflation and inflation, and (iii) to examine the non-linear effect of the determinant of food inflation in Ghana. Secondary time series data from the World Bank from 2000 to 2021 was used. Toda and Yamamoto causality test, bound testing to cointegration, autoregressive distributed lag through the error correction model were employed as the data analysis technique. Results revealed that crude oil price, exchange rate and domestic food supply are the drivers of food inflation in Ghana. Again, there is a positive relationship between crude oil price and food inflation in the long and short run. Conversely, there is a statistically significant inverse association between both exchange rate, domestic food supply and food inflation in both runs. Findings revealed that exponential movement in crude oil price has a significant positive effect on food inflation. Notwithstanding, there is a significant negative effect of non-linear movement in exchange rate and domestic food supply on food inflation. The findings bring new insight to the discourse on inflation. The study implores the government to pursue policies that would strengthen the cedi, resources and farmers through the planting for food and jobs policy.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Inflation, particularly in the food sector, has long been a topic of concern for economies worldwide. It has the potential to influence both the macroeconomic stability of a country and the well-being of its inhabitants (Osei-Asare & Eghan, 2013). Ghana, a West African country known for its diverse and rich agricultural sector, is no exception to these concerns. In recent years, the country has experienced an unprecedented surge in food inflation, causing apprehension among policymakers, researchers, and the general public. Understanding the factors that drive this inflation is crucial for developing effective strategies to manage and potentially mitigate its impact. A number of studies have been conducted to investigate the various factors contributing to food inflation, with an emphasis on global commodity prices, domestic agricultural productivity, currency depreciation, and government policies.

Global commodity price fluctuations have been identified as a key factor affecting food inflation in developing countries including Ghana, as the countries are heavily dependent on imports of essential food items (Jongwanich & Park, 2011; Bhattacharya & Sen Gupta, 2018; Devaguptapu & Dash, 2021). The volatility of global commodity prices has a direct impact on domestic food prices (Adom et al., 2015). The effect of these global shocks on domestic inflation was said to be stronger in low-income countries, implying that Ghana, as a developing economy, may be highly vulnerable to such external shocks. These revelations underscore the importance of enhancing domestic production capacities and implementing effective policies to mitigate the impacts of global price shocks.

Domestic agricultural productivity is another important determinant of food inflation in Ghana. Studies have highlighted the role of inadequate agricultural infrastructure, low investment in research and development, and limited access to credit for farmers as factors constraining agricultural productivity in the country (Ismaya & Anugrah, 2018). Consequently, lower agricultural output results in higher food prices, contributing to food inflation.

Currency depreciation has also been found to influence food inflation in developing economies. A weakening of the local currency against major currencies, such as the US dollar, increases the cost of importing food items, which in turn leads to higher food prices (Roger et al., 2018). Government policies can play a significant role in food inflation, either directly or indirectly. For instance, import tariffs, subsidies, and price controls can affect the prices of food items in the domestic market (Asandului et al., 2021). Additionally, fiscal and monetary policies, such as government spending and interest rates, can influence the general price level in the economy, including food prices (Bleaney et al., 2020; Aimola & Odhiambo, 2021). Lastly, the impact of climate change on food inflation has been acknowledged as an emerging concern. Odongo et al. (2022) found that climate change has a significant influence on food price inflation in Eastern and Southern Africa, as extreme weather events and changes in rainfall patterns adversely affect agricultural production.

In conclusion, the factors affecting food inflation are multifaceted and interconnected. A comprehensive understanding of these factors is essential to inform effective policies and strategies for addressing food inflation and ensuring food security in the country.

1.2 Problem Statement

Inflation represents a significant economic issue that affects both macroeconomic stability and individual purchasing power. Among various types of inflation, food inflation is especially critical, given its direct impact on the standards of living and food security (Odongo et al., 2022). Ghana, a country with a substantial agriculture sector that has made progress in reducing poverty and increasing food production (Pauw, 2022), has witnessed persistent food price inflation in recent years and this has far-reaching implications on its citizens' well-being and general economic stability (International Food Policy Research Institute, 2020; World Bank, 2020). This, therefore, requires a comprehensive understanding of the underlying factors to develop targeted policy interventions toward mitigating its impact on the economy.

A number of potential factors influencing food inflation can be hypothesized based on previous studies in other contexts. These include fluctuations in international food prices (Bhattacharya & Sen Gupta, 2018), changes in domestic agricultural productivity (Ismaya & Anugrah, 2018), variations in exchange rates (Roger et al., 2018), climate change (Odongo et al. 2022) and government policies related to food and agriculture (Asandului et al., 2021; Bleaney et al., 2020; Aimola & Odhiambo, 2021).

Despite studies conducted to understand the general inflationary trends (Mohammed et al., 2016) and the factors affecting it (Roger et al., 2018; Odongo et al. 2022; Asandului et al., 2021; Bleaney et al., 2020; Aimola and Odhiambo, 2021), a noticeable gap was identified in the literature since most of these studies were conducted outside Ghanaian context and many of them focused on inflation in general. In effect, the researcher was unable to sight any study that assessed the impact of factors such as (food import, food

export, budget deficit, interest rate, exchange rate, oil prices, world food prices, money supply, GDP, CO_2 emissions, trade openness and agriculture credit) on food inflation in Ghana. For instance, as Asandului et al. (2021) explored the effect of fiscal policy on inflation and economic activities of post-communist European countries, Aimola and Odhiambo (2021) investigated the impact of public debt on inflation in Ghana. Again, Odongo et al. (2022) studied the impact of climate change on inflation in Eastern and Southern Africa. Identifying and examining these factors is crucial to developing effective strategies for controlling food inflation, which in turn could contribute to improving food security, reducing poverty, and fostering economic development.

Against this backdrop, this research would employ Toda and Yamamoto of Granger Causality Test to assess the causality of factors namely, food import, food export, exchange rate, crude oil prices, domestic food supply, money supply, GDP, trade openness, government expenditure and agriculture credit and further assess their specific long-term effect on food inflation in Ghana using Autoregressive Distributed Lag approach (ARDL). By doing so, this study aims to fill the knowledge gap and provide evidence-based recommendations for policymakers, researchers, and stakeholders interested in mitigating the impact of food inflation in Ghana.

1.3 Objectives of the Study

The purpose of this study is to explore the key factors that drive food inflation in Ghana. To achieve this, the following specific objectives are stated:

1. To explore the factors that cause hikes in food inflation in Ghana.
2. To assess the effect of the causal factors on food inflation in Ghana.

3. To ascertain the nonlinear effect of the causal factors on food inflation in Ghana.

1.4 Research Questions

1. What factors cause rise in food inflation in Ghana?
2. What is the extent of effect of the causal factors on food in Ghana?
3. What is the nonlinear effect of the causal factors on food inflation in Ghana?

1.5 Justification of the Study

This study is of critical importance for several reasons. A comprehensive understanding of these factors will not only contribute to the existing body of knowledge but also inform effective policies and strategies for addressing food inflation and ensuring food security in the country.

To begin with, food inflation has a direct impact on the overall macroeconomic stability of Ghana. High food inflation rates can lead to a higher general inflation rate, which can adversely affect economic growth and investment (Asandului et al., 2021; Bleaney et al., 2020; Aimola & Odhiambo, 2021). By identifying the main drivers of food inflation, policymakers can implement targeted measures to mitigate these factors and promote economic stability. Additionally, high food inflation disproportionately affects low-income households, as they spend a larger share of their income on food (Roger et al., 2017). Addressing food inflation is, therefore, crucial for reducing poverty and ensuring food security among the most vulnerable segments of the population. This study will provide insights into the various factors contributing to food inflation, enabling the development of targeted interventions to mitigate its impacts. Furthermore, understanding the role of domestic agricultural productivity in food inflation is essential for the

development of the agricultural sector in Ghana. As a result, it will provide valuable information for policymakers to design and implement initiatives that promote agricultural productivity and contribute to food security (Ismaya & Anugrah, 2018).

Finally, this study will provide a comprehensive understanding of the complex dynamics affecting food inflation in Ghana. This knowledge will enable policymakers and stakeholders to design more effective and context-specific interventions to address food inflation and its consequences on the economy and the well-being of the population (Odongo et al. (2022).

1.7 Research Delimitation

This study is focused on comprehensively assessing the key factors driving food inflation in Ghana. By implication, the study is delimited to the Ghanaian context. The study is also delimited to factors affecting food inflation without considering the entire inflation basket. Furthermore, the study is delimited to using Granger Causality Test, Autoregressive Distributed Lag approach and document analysis to analyse the collected data, hence a mixed approach was employed. This study relied purely on 20-year secondary data (2003-2022). Despite the failure to incorporate primary data in the analysis, the findings will bring to bear how significant some factors are in influencing food inflation in Ghana which will serve as a basis for policy development and intervention.

1.8 Organization of the Study

There are five chapters in this research work. The background of the study, the statement of the problem, the study's objectives, research questions, significance, delimitation,

limitation, and definition of terms are all covered in chapter one. Chapter two examines current relevant literature on food inflation in order to gain a thorough understanding of the subject. In this chapter, relevant theories and empirical literature are reviewed. The third chapter outlines the research methods. In effect, thematic areas such as research design, population, sample and sampling procedure, data collection instrument, data collection procedures, and data processing and analysis are considered. The fourth chapter bothers on results and discussion. In this chapter, research findings are presented in APA-style tables, interpreted and discussed accordingly. Finally, chapter five centres on summary, conclusions and recommendations. In this chapter, the various research findings are summarized, relevant conclusions and recommendations are made.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter of the thesis delves into an examination of diverse theories that form the foundation of inflation. Additionally, it conducts a comprehensive review of prior research endeavours related to the present study. The objective is to ascertain the breadth of existing work, appraise their respective findings, identify limitations, and assess recommendations put forth by previous researchers for potential avenues of future research. This thorough exploration aims to unveil any gaps in prior studies, contributing to a nuanced understanding of the topic. Subsequently, the conceptual framework will follow the empirical review.

2.2 Theoretical Review

This section of the study is dedicated to the review of theoretical frameworks that were put forth to offer explanations to the concept and the dynamics of inflation. These theories include monetarist inflation theory, Keynesian inflation theory and structural inflation theory.

2.2.1 Monetarist Inflation Theory

The monetarist theory argues that fluctuations in the overall price level are as a result of variations in the money supply in an economy, assuming that the velocity of money and nominal income remain constant as expounded by (Friedman, 1960) and was later advanced by (Friedman & Schwartz, 1963). This idea is encapsulated in the well-known quantity theory of money. According to the monetarist view, the assumption is made that

the velocity of money and income remain constant, as well as the level of real output. Based on these assumptions, it is believed that a 100 percent change in the money supply will result in a 100 percent change in the general price level in the economy, indicating a direct relationship between changes in money supply and the price level in a country like Ghana. According to this theory, inflation is primarily caused by changes in the money supply, and therefore, combating inflation requires implementing a tight monetary policy to reduce aggregate demand. The framework holds that since monetary policies are championed by central banks, a central bank's frequent attempt to manipulate the money supply should be restricted (Danlami et al., 2020). Any central bank that endeavors to upwardly review the quantity of money supply would end up harming the economy than benefit it (Stockhammer, 2008). Again, to the proponent monetary policy is the preferable and efficacious technique as compared to fiscal policy for energizing the economy or minimizing the rate of inflation. The belief that monetary policy should be used to address inflation is based on three key hypotheses: First, it assumes that central banks have the ability to control the money supply.

Second, it considers the money supply as an intermediate target, meaning that by controlling it, central banks can indirectly influence other macroeconomic variables such as inflation. Finally, the theory suggests a separation between monetary factors and real factors in analyzing the economy, emphasizing the importance of monetary policy in addressing inflation independently from other factors. The exposition of the framework concentrates on money supply and inflation in an economy which are captured as variables in the present study. Empirical studies see that of Totonchi (2011); Danlami et

al. (2020) and Osei (2014) have applied the monetarist theory of inflation in their study of inflation dynamics in different geographical settings.

2.2.2 Keynesian Inflation Theory

Keynesians believe that inflation arises when the total demand for goods and services surpasses the overall supply of goods and services at a level close to full employment (DeFina, 1991). In comparing the Keynesian and monetarist approaches, they both acknowledge the concept of potential output. However, the key distinction lies in the interpretation of actual output in relation to potential output. Monetarists argue that actual output always equals potential output, whereas Keynesians view potential output as a theoretical maximum feasible output in the short run. According to the Keynesian approach, inflation arises from excessive increases in total expenditure, such as investment expenditure and government expenditure. These increases create an imbalance between aggregate demand and aggregate supply, leading to an excess demand situation that fuels inflation. Per the Keynesian perspective, if aggregate demand increases due to increment in government's spending, household consumption, exports, or investment, it would result in higher inflation. However, in this view, the real output remains unaffected by these changes in aggregate demand. Scholarly articles see Vaona (2012), McKnight et al. (2020), Jahan et al. (2014) and Gali (2015) have applied the Keynesian theory of inflation in their study of dynamics and causes of inflation.

2.2.3 Structural Inflation Theory

This framework serves as an alternative theory of inflation called structural inflation theory, which provides a slightly different explanation for inflation in developing countries. According to the Structuralists, the primary factors leading to inflation in

developing countries are the increase in investment expenditure and the corresponding expansion of money supply used to finance it (Myrdal & Straiten, 1968). Nonetheless, the Structuralists argue that these factors are only immediate causes of inflation and not the underlying or ultimate causes. The structural theory of inflation has been proposed to provide an explanation for inflation specifically in developing countries, particularly in Latin America. Economists such as Myrdal and Straiten have extensively analyzed inflation in these nations by focusing on the structural characteristics of their economies. Kirkpatrick and Nixon (1976) have recently expanded the applicability of the structural theory of inflation to encompass all developing countries. They have extended the analysis of this theory to provide an explanation for inflation trends observed in a broader range of developing nations. Myrdal and Straiten (1968) contended that using highly aggregative demand-supply models is not appropriate for explaining inflation in developing countries. They have put forth the argument that such models do not adequately capture the complex dynamics and unique characteristics of inflation in these nations (Myrdal & Straiten, 1968). Per the exposition of Myrdal and Straiten, the developing countries lack a well-balanced and integrated structure, resulting in limited substitution possibilities between consumption and production. Additionally, the flow of resources between different sectors of their economies is not smooth and rapid.

Consequently, inflation in these countries cannot be adequately explained solely in terms of aggregate demand and aggregate supply. The prepositions of the framework demonstrate how money supply mediates the inflationary process and increase in expenditure therefore its alignment to the present study. Existing studies such as Riti and

Kumah (2015); Bassey (2019) and Osei (2014) have used this framework in their study of inflation dynamics and determinants.

2.3 Empirical Review

The study by Mndzebele (2021) examined the factors that push food price inflation in the kingdom of Eswatini with data from 2009 to 2020. The author deployed the Gregory Hansen and Autoregressive Distributed Lag model in assessing the study's objectives. Findings revealed that all factors considered in the study exert significant impact on the food prices in Eswatini. The study furthered that a 10% change in the food prices of South Africa leads to 16.1%, 10% rise in crude oil price on the world market increases Eswatini food prices by 56.7% whilst an increment of 17.7% in Eswatini food prices results from 10% increase in global agricultural products. Though the study used monthly data, the period of 2009 to 2020 could be short if the study wants to capture the dynamics of these variables in the long run as acclaimed by the author.

Similarly, Bane (2018) explores the factors that influence inflation in Ethiopia with annual data from 1975 to 2015 by employing the autoregressive distributed lag estimation technique. While the article does not specifically focus on food inflation, it provides some insights into the broader determinants of inflation that could apply to food inflation as well. Bane (2018) identifies several factors that contribute to inflation in Ethiopia, including money supply growth, government expenditure, exchange rate depreciation, and international food and fuel prices. These factors all have a direct or indirect impact on food inflation in Ethiopia. For example, an increase in international food prices could lead to higher import costs for food, which could drive up domestic food prices. Furthermore, Bane (2018) noted that supply-side factors can also contribute to inflation

in Ethiopia. Similarly, a disruption in food distribution channels could lead to shortages and higher prices. The study's consideration of only Ethiopia may serve as a limitation since prevailing conditions in other surrounding countries might have influence on certain economic patterns in Ethiopia therefore its inclusion would lead to comprehensive assessment.

In a similar vein, the article inflation dynamics in Ghana by Osei (2015) provides an in-depth analysis of inflation in Ghana. The author examines the key determinants of inflation in Ghana, including monetary factors, exchange rate movements, and supply-side factors, as well as the impact of inflation on the Ghanaian economy. The article provided an overview of the historical trends in inflation in Ghana, noting that inflation has been a persistent problem in the country since the 1970s. The author then discusses the theoretical framework for analyzing inflation, including the monetarist and Keynesian views of inflation. The study analyzed the determinants of inflation in Ghana using a Vector Error Correction Model (VECM). The study discovered that both monetary and non-monetary factors have a significant impact on inflation in Ghana. Specifically, the author found that money supply growth, exchange rate depreciation, and food prices are all significant determinants of inflation in Ghana. The result of global food prices influencing food inflation in Ghana coincides with the account of Mndzebele (2021) who found world agricultural output as having significant influence on food inflation in Eswatini. The same result confirms the finding ascertained by Bane (2018) in the study that focused on assessing the factors that contribute to general inflation rise in Ethiopia and concluded that global oil shocks lead to rise in inflation in Ethiopia.

The author also examines the impact of inflation on the Ghanaian economy. The author accentuated that inflation can have both positive and negative effects on the economy. On the one hand, moderate inflation can stimulate economic growth by encouraging investment and consumption. Again, high inflation can lead to economic instability, reduce the purchasing power of consumers, and discourage investment (Osei, 2015). The article concludes with a discussion of policy implications. The author put forward that policymakers in Ghana need to adopt a multi-faceted approach to managing inflation, including monetary policy measures, supply-side policies, and fiscal policies. The author also suggests that a coordinated regional approach to managing inflation among African countries could be beneficial practice.

An investigation by Adom et al. (2015) examined the factors contributing to inflation in Ghana, through a more reliable technique that addresses issues of serial correlation in errors and endogeneity in regressors. The study found that money supply, interest rate, and crude oil prices are significant factors affecting inflation in the long term. The indication of crude oil prices as affecting inflation in Ghana confirms the account as put forth by Mndzebele (2021); Osei (2015) whose separate studies found global oil prices as a driver of inflation in Eswatini and Ghana respectively. Additionally, the study shows that there is a significant transfer of inflation between Ghana and Ivory Coast. The enquiry noted that while the initial regression did not demonstrate the expected impact of output growth and policy regime change, after correcting for endogeneity, these factors were found to be significant in affecting inflation (Adom et al., 2015). Also, the investigation found out that the Economic Recovery Programme led to a decrease in inflation, and a focus on increasing support for the agricultural sector could help reduce

inflation. The study suggests exploring alternative, affordable fuel sources to enhance the economy's resilience to adverse shocks in the international crude oil market. Finally, the study recommends developing sound economic policies to make the economy more resistant to external shocks.

Bawa et al. (2016) examined the factors that have contributed to inflation in Nigeria over the past three decades. The authors use time series data from 1981 to 2015 and employed a combination of econometric techniques, including unit root tests, co-integration tests, error correction models, and Granger causality tests, to analyze the dynamics of inflation in Nigeria. The study found that inflation in Nigeria has been largely driven by monetary factors, such as money supply, interest rates, and exchange rate fluctuations, rather than by supply-side factors such as food prices or external shocks.

This finding that inflation in Nigeria is not primary driven by food prices or external shocks is contrary to the findings ascertained by previous studies on the continent see (Osei, 2015; Adom et al., 2016; Mndzebele, 2021) who unanimously alluded that food inflation in Ghana and the kingdom of Eswatini are mostly pushed by food prices as well as external shocks. Also, the research identified several factors that have contributed to the persistence of inflation in Nigeria, including high inflation expectations, poor policy coordination, and the lack of a clear monetary policy framework. The authors suggest that to reduce inflation, the government should adopt a more coherent macroeconomic policy, including fiscal consolidation, and a more independent central bank. The authors alluded that the recent decline in oil prices and the resulting reduction in government revenue have placed significant pressure on Nigeria's macroeconomic stability. The study

suggested that the central government of Nigeria should diversify its economy and reduce its dependence on oil exports to mitigate the impact of external shocks on inflation.

The report by Headey and Fan (2018) aimed to offer a thorough examination of the causes and consequences of the current food price crisis. It draws on the latest research and incorporates both theoretical analysis and empirical evidence. The study assesses various explanations for the crisis, evaluating their compatibility with economic theory and pertinent facts. Through the enquiry, certain explanations were found to be more robust than others. Specifically, the investigation found increasing oil prices, the devaluation of the U.S. dollar, growing demand for biofuels, and certain commodity-specific factors emerge as key drivers of the crisis. The discovery of oil price ss a driver of food price inflation supports the account of Bane (2018); Mndzebele (2021); Osei (2015) whose separate investigations confirmed that oil price is a significant driver of food price inflation in Ethiopia, the kingdom of Eswatini and Ghana respectively.

Davidson et al. (2016) investigated the causes of food price inflation in the United Kingdom with data collected from 1990 to 2013 on a monthly basis. The study used Vector Autoregressive and cointegration estimation to analyze the identified factors to know their impact on food prices in the U.K. The result showed that there exists long term and partial evidence of elasticities for pressure for domestic food, world food commodity prices, the exchange rate and world oil prices. The findings are consistent with the result of previous studies who put forward that hikes in oil price on the world market increases food price inflation (Osei, 2015; Bane, 2018; Mndzebele, 2021). The study pointed out that domestic food demand pressures and food chain cost exert lower

impact on food price inflation in the study's jurisdiction than world food prices, exchange rate and oil prices.

On the other hand, Adil (2021) investigated the factors that contribute to inflation in India, using a bond testing to cointegration approach for the period between 2006 to 2019. The results demonstrated that there is a long-term relationship between inflation and variables such as household survey-based inflation expectation, real output, narrow money aggregate, and interest rates. The study concludes that a combination of structural and monetary factors accounts for inflation in India, with the importance of inflation expectation as a significant explanatory variable supporting the use of inflation forecast by the RBI as an intermediate target in the flexible inflation targeting framework. The study recommends that the RBI conduct a high-frequency inflation expectations survey of households to account for frequent information updates from certain groups of households.

Similarly, Tweneboah and Alagidede (2019) investigated the effects of dollarization on inflation and inflation uncertainty in Ghana for the period 1990 to 2017. The study applied the exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) model together with impulse response and Granger causality tests to explore how dollarization affects the behavior of inflation for the pre-inflation targeting period (January 1990 – May 2007) and post-inflation targeting period 2007 to 2017). The results indicated that dollarization has not played a significant role in the volatility of inflation in Ghana. Also, the enquiry discovered that inflation Granger causes dollarization in both the pre- and post-inflation targeting regimes. Finally, there is a bidirectional causal relationship between inflation and inflation uncertainty following the adoption of

inflation targeting monetary policy. The researchers conclude that although inflation targeting has not presented a significant impact on inflation volatility, it has affected the relationship between inflation and inflation uncertainty in Ghana. The concentration of the study on only Ghana makes it limitation since it lacks generalizability. Again, the study failed to assess the impact of inflation uncertainty on food inflation in Ghana. Moreover, Ghana is not the only country that faces the threat of inflation therefore inclusion of other countries on the continent or sub-region could make the result more accurate and generalizable.

Conversely, Doudo (2022) investigates the long run dynamics of money supply, budget deficit and inflation in Ghana. It also tests the validity of the classical, monetary and fiscal theories of price level within the vector error correction framework. Using quarterly data from 1999 to 2019, the research employed Granger causality test and the vector error correction model (VECM) for the analysis. The results from the VECM show that the budget deficit has a significant positive effect on inflation while money supply negatively affects the inflation rate in the Ghanaian economy. The finding of money supply negatively impacting inflation refutes the finding of previous studies whose study unveiled that money supply positively impacts inflation in Ghana Adom et al. (2015) and in Ethiopia (Bane, 2018). By contrast, inflation exerts a positive and negative effect on the budget deficit and money supply, respectively.

The results from the impulse response function also indicate that inflation responds more positively to budget deficit shocks. However, it tends to respond negatively to money supply (M2) shocks. Also, the budget deficit responds positively (negatively) to inflation (money supply [M2]) shocks. Furthermore, money supply responds positively

(negatively) to budget deficit (inflation) shocks. Based on the weak exogeneity test, the result favours the fiscal theory of the price level in explaining the nexus between money supply, budget deficit and inflation in Ghana. A corollary of the ascertained results indicates that a reduction in government expenditure coupled with restrictive bureaucratic nature of government officials have the tendency of ensuring favourable and stable inflation in Ghana.

Again, the study by Owusu -Ansah (2020) examined the main macroeconomic determinants of house price movements in Accra, the capital of Ghana using the VECM. The results show that the main drivers of price movements in the housing market in Accra are GDP growth, unemployment and interest rates, and there is no long-term relationship between these significant variables and house prices in the country. The study revealed that any short-term disequilibrium is not able to correct itself over the long-term; hence the fundamentals do not explain the price changes in the long run.

Adjei (2018) conducted a study with the objective to investigate the Monetarists' theory on inflation determinants in Ghana by utilizing the ARDL framework to analyze the long-run and short-run relationship between inflation and its determinants with time series data from 1965-2012. The results of the study showed there is a significant positive relationship between inflation and money growth in the economy in both the short-run and long-run periods. This discovery supports the Monetarist theory. The significant positive result between inflation and money supply confirms the assertion of Adom et al. (2015); Bane (2015) who alluded that money supply positively affects inflation in the economies of Ghana and Ethiopia respectively. Notwithstanding, the positive result is

inconsistent with the account of Doudo (2022) whose study in Ghana documented that monetary growth negatively impacts inflation in Ghana.

The study by Makun (2021) investigated the determinants of food inflation in Fiji by developing two inflation models: a domestic factor model and an external factor model. The study dwelled on annual data from 1983 to 2018 and employs the bounds testing procedure within the Autoregressive Distributed Lag model to estimate both short-run and long-run impacts. The analysis provided evidence of a long-run cointegration relationship among the variables in both models. Domestic factors such as per capita GDP have a significant positive impact on food inflation in Fiji. This positive effect of GDP on food price inflation supports the account of (Doudo, 2022) who documented that GDP is a significant driver of inflation in Ghana. Again, money supply has a positive impact on food inflation, while agriculture credit has a negative impact (Makun, 2021). The positive impact of money supply on food inflation in Fiji coincides with the narrative in Ghana and Ethiopia as put forward by (Adom et al., 2018; Bane, 205) however, the account refutes the findings of (Qayyum & Sultana, 2018) who established that money supply negatively affects food price inflation. Surprisingly, the study found domestic food production index as having insignificant effect on food inflation, indicating low production of food products in Fiji. External factors such as oil price, exchange rate, world food price, and food imports also have a significant positive impact on food inflation in Fiji. However, the study pointed out that domestic factors appear to play a more dominant role in food inflation dynamics, except for the exchange rate.

Overall, the findings provide insights into the factors driving food inflation in Fiji and can inform policy decisions aimed at addressing food inflation in the country.

Additionally, the study found that any deviations from the long-run equilibrium path caused by short-run monetary shocks are corrected within one year, indicating a speedy equilibrium adjustment process. This finding is in contravention to the result of Adom et al. (2018) who alluded that the errors created in the short run by the variables that drive food inflation in Ghana are not able to correct itself in the long run. Based on the study's findings, it is recommended that a deliberate monetary policy framework be implemented to target the growth rate of money supply in the economy to effectively manage inflationary pressures and promote growth and stability in the national economy.

Moreover, Qayyum and Sultana (2018) aimed to investigate the variables that influence food price inflation in Pakistan during the period of 1970 to 2017. The enquiry dwelled on annual time series data and linear regression as the data analysis technique. The factors considered to have potential causal effect on food inflation prices are food export, GDP, taxes, money supply and food imports to analyze the food inflation. Estimation through the simple linear regression unveiled that imposed taxes, GDP, food export and food import positively and significantly impact food price inflation. The result of GDP driving up inflation confirms the finding of Owusu-Ansah (2020); Makun (2021) who discovered that GDP growth is a significant driver of inflation in Ghana. However, money supply which combines aggregate money in circulation negatively affects food price inflation (Qayyum & Sultana, 2018). The negative effect of money supply on food on inflation confirms the account of Doudu (2022) who provided evidence that mere growth in money supply does not push up inflation in Ghana.

Nonetheless, the negative result contradicts the findings of Adom et al. (2018) and Bane (2015) who unanimously found money supply as a significant factor that pushes up

inflation in Ghana and Ethiopia respectively. The study noted that GDP, food export/import, and taxes have been a contributor towards high food inflation whereas money supply causes the reduction in the food prices. It is recommended that special attention has to be given to exports and imports (food) along with excess money supply in order to overcome food inflation in Pakistan

The study by Mohammed et al. (2016) presents an econometric analysis of the determinants of inflation in Algeria using an ARDL model considering annual data from 1980 to 2012. The analysis found that in the long run money supply, crude oil prices, nominal and effective exchange rate have a positive impact on inflation, while exchange rate and oil prices have a negative impact. Additionally, the study finds that fiscal policy, as measured by government spending, has a significant impact on inflation in Algeria. However, in the short run only external variables proxied in the study including oil prices, import price and effective and nominal exchange rate exhibit significant influence on inflation. The authors inferred that so long as inflation is a monetary challenge, fiscal and monetary policies cannot be effective on their own. Though the research did not specifically focus on food inflation, it provides insights into the broader factors that influence inflation, which can help in understanding the dynamics and determinants of food inflation.

This study by Louw (2017) used time series econometric techniques to analyze the vertical price transmission in two value chains in South Africa - wheat-to-bread and maize-to-maize meal - and its implications for food inflation. The research revealed that in the wheat-to-bread chain, there is complete price transmission from producer to consumer level, with bi-directional transmission. However, in the maize-to-maize meal

chain, there is incomplete price transmission and prices are determined at the retail level, and transmitted through the chain to commodity level. The findings from this interrogation provide insight into how underlying commodity prices impact final retail prices and contribute to food inflation.

Ngidi (2016) evaluates how food price inflation is linked to poverty in South Africa by reviewing the methods used by institutions that measure it. It examines different ways of identifying food staples and analyzes food prices and trends using CPI data from January 2008 to October 2008. The report concludes that the institutions studied indicate a correlation between higher food price inflation and poverty-related demographic markers, but the traditional CPI measure does not reflect this extensively. The report suggests that this may be due to the calculation methodologies used in the CPI and the time period of the data analyzed. The researcher noted that international literature attributed food price inflation to factors such as climate change, increases in energy costs and speculative activity in financial markets for agricultural commodities (Ngidi, 2016).

Similarly, in the study by Misati et al. (2014), Granger causality and structural vector autoregressive (SVAR) methods were employed to investigate the dynamic relationships between commodity prices, overall inflation, and non-food non-fuel inflation. The findings highlight the significant role of both oil and food prices in influencing measures of inflation. Specifically, the study indicates that within the same VAR framework, food prices have a greater impact than oil prices on overall inflation and non-food non-fuel inflation. However, the effects of oil prices on inflation tend to persist for a longer duration compared to the effects of food prices. This result is consistent with the account of Davidson et al. (2016) who also provided evidence that food inflation is driven by oil

prices in the United Kingdom. Though Davidson's study was on drivers of food price inflation as compared to the Misati whose study concentrates on drivers of broad inflation in an economy, it still provides insight on how the factors that impact food inflation can be explored in the context of Ghana as a developing country.

Additionally, the research demonstrates that the inflationary effects of food and oil prices exert a more substantial influence on non-food non-fuel inflation when compared to the growth rate of money supply (Masati et l., 2014). Furthermore, the study reveals that oil price shocks immediately lead to a depreciation of the exchange rate. Based on these findings, the study suggested several recommendations, including reducing reliance on oil, implementing targeted interventions instead of tax waivers during crisis periods, enhancing measures to improve supply responsiveness, and maintaining a neutral monetary policy stance unless the shocks become entrenched in non-food non-fuel inflation.

In the study by Aimola et al. (2021) the impact of public debt on inflation in Ghana was investigated using annual data from 1983 to 2018. The research employed the Autoregressive Distributed Lag (ARDL) bounds testing approach to cointegration and an Error Correction Model (ECM) to analyze the relationship between public debt and inflation. The cointegrating regression results indicated the existence of a stable long-term relationship between inflation and the explanatory variables, whilst accounting for structural break. The findings revealed a positive and significant influence of public debt on inflation. This finding is consistent with the result of Doudo (2022) whose analysis of dynamics of deficit financing and inflation in Ghana established that there is a positive association between budget deficit and inflation in the country. These results hold true

whether the analysis is conducted in the short term or the long term. The study provides evidence confirming the inflationary effects of public debt in Ghana (Aimola et al., 2021). The authors recommended that the government should exercise caution when considering increases in public debt to mitigate potential volatility in inflation and the associated risks to the economy.

Comparably, Owusu-Ansah et al. (2017) investigated the impact of temporal aggregation on constructing hedonic house price indices in developing markets, using Ghana as a case study. The research methodology involved constructing hedonic price indices at different temporal aggregation levels, including monthly, quarterly, semi-yearly, and yearly indices. Six null hypotheses were tested using F-ratios to assess the effect of temporal aggregation. The findings revealed that temporal aggregation may not be a significant concern when constructing hedonic house price indices in developing markets, particularly due to the typically smaller sample sizes in these markets. Again, the study demonstrated that none of the estimated F-ratios are statistically significant even at a 10% significance level, indicating that temporal aggregation does not have a substantial impact. However, the analysis of mean returns and volatilities reveals that indices constructed at lower levels of temporal aggregation exhibit higher volatility. The researchers noted that the level of transactions can influence the appropriate level of temporal aggregation, highlighting the need to avoid generalizing the temporal aggregation level, as currently observed in the literature.

In a similar direction, Aimola et al. (2021) deployed the Autoregressive Distributed Lag (ARDL) framework to examine the influence of total public debt on inflation in Nigeria from 1983 to 2018. The cointegrating regression results indicated the presence of a stable

long-term relationship involving inflation, total public debt, money supply, interest rate, economic growth, trade openness, and private investment, considering the occurrence of structural breaks. Interestingly, the empirical findings showed that the impact of public debt on inflation is not statistically significant, regardless of whether the analysis is conducted in the short or long run. This result deviated from the account of Aimola (2021) whose study of the same relationship in the Ghanaian perspective found a significant result. Therefore, the study concludes that factors other than public debt are likely to drive inflation in Nigeria.

Again, Saungweme and Odhiambo (2021) aimed to empirically examine the hypothesis that public debt has a substantial influence on inflation in Zimbabwe. The analysis covered the period from 1980 to 2020 and was motivated by recent trends in public debt and domestic inflation in the country. The study seeks to provide guidance for debt-inflation related policies in Zimbabwe, given the alarming signals from these trends and the uncertainty surrounding the effectiveness of fiscal and monetary policies in achieving macroeconomic stability.

Using the Autoregressive Distributed Lag (ARDL) bounds testing procedure for cointegration and an Error Correction Mechanism (ECM), the study incorporated structural breaks to enhance the analysis. The results of the study provided evidence supporting a positive and significant impact of public debt on inflation dynamics in Zimbabwe, particularly in the long run. This suggests that public debt dynamics play a crucial role in the inflationary process in the country. It indicates that fiscal policy is an important factor that affects the effectiveness of monetary policy in Zimbabwe. The discovery of public debt causing inflation in Zimbabwe is a total confirmation to the

findings put forward by Aimola (2021), Doudo (2022) in Ghana however, it deviates from the account of Aimola (2021) in Nigeria (2021). The research implored policymakers to exercise caution when considering increases in public debt, as it has been found to contribute to inflationary pressures.

The paper by Jiang et al. (2015) presents a fresh perspective on the dynamic correlation between money growth and inflation in China using an innovative wavelet analysis. The findings revealed that there are strong, yet not uniform, connections between money growth and inflation during the mid-1990s and the period since the early 2000s. Particularly, since the early 2000s, China's monetary policy has demonstrated more effective management of inflation compared to previous years. When examining the frequency domain, we observe a positive and one-to-one relationship between money growth and inflation in the medium to long term. However, in the short term, this positive relationship deviates due to temporary shocks and significant lag effects. Consequently, we can conclude that in China, the long-term association between M0 growth and inflation supports the modern quantity theory of money (QTM), while the medium-term connection between M1 growth and inflation, as well as M2 growth and inflation, also aligns with the modern quantity theory of money. The findings that money supply growth increases inflation in China confirms the narrative in Ghana, Ethiopia and Nigeria as documented by (Adom et al., 2015; Bane, 2018; Aimola et al., 2021).

Similarly, Unsal et al. (2015) empirically examined the effects of fiscal deficit and broad money M2 supply on inflation in several Asian countries, including Bangladesh, Cambodia, Indonesia, Malaysia, Pakistan, Philippines, Sri Lanka, Thailand, and Vietnam, spanning the period from 1985 to 2012. The researchers utilize two estimation methods,

namely the Pooled Mean Group (PMG) estimation-based error correction model and the panel-differenced GMM (General Method of Moment) Arellano-Bond estimator, to conduct their analysis. The study reveals that the impact of broad money M2 supply on inflation is significantly positive, but only when using the PMG estimation method. On the other hand, fiscal deficit, government expenditure, and interest rate are identified as statistically significant determinants of inflation, irrespective of the estimation method employed. The effect of fiscal deficit fueling inflation confirms the result of Doudo (2022); Saungweme and Odhiambo (2021) in their separate studies that found budget deficit as a significant drive of inflation. Again, the finding on government expenditure as a positive determinant of inflation is consistent with the account of Mohmmed et al (2021) who emphasised that increase in government spending leads to inflation in the economy due to the excess money being put into consumers pocket through the process of buying from the business.

Again, the study by Nguyen et al. (2015) employed a Global Vector Autoregressive (VAR) model to conduct a quantitative analysis of inflation dynamics in Sub-Saharan Africa (SSA). The model takes into account trade and financial connections between economies, as well as the influence of regional and global demand and inflation spillovers. The findings indicated that over the past 25 years, the primary drivers of inflation in SSA have been domestic supply shocks, as well as shocks related to exchange rates and monetary variables. However, the contribution of these shocks to inflation has decreased in recent years. On the other hand, both domestic demand pressures and global shocks, particularly shocks related to output, have played a more significant role in driving inflation over the past decade. This confirms the finding brought to bear by Bane

(2018) in the study that discovered that global shocks significantly affect inflation in Ethiopia.

The study also highlights that country-specific characteristics have an impact on the role of shocks in driving inflation. Factors such as the extent of oil and food imports, vulnerability to weather shocks, the economic importance of agriculture, trade openness, and policy regime all contribute to explaining the influence of shocks on inflation dynamics.

The study by Ojede (2015) sought to determine the main factors behind inflation in developing countries, specifically examining whether it is primarily caused by a decline in productivity or by an expansion of monetary supply. The researchers employ various empirical methods, including growth accounting, non-parametric analysis, and generalized method of moment techniques. The findings of the study demonstrated that inflation in developing countries is primarily driven by monetary expansion. This implies that an increase in the money supply has a significant influence on inflationary pressures. The analysis supports the notion that changes in the quantity of money circulating in the economy play a key role in driving inflation, rather than retrogression in productivity.

Sasmal (2015) conducted a study to unearth the causes of inflation in India applying time series econometric models on time series data pertaining to India. The theoretical explanations and empirical analysis using time series econometrics provided evidence that both an increase in per capita income and supply shortages contribute to price increases. However, there is no long-term relationship found between money supply and agricultural prices. The impact of increasing public expenditure and unfavorable foreign exchange rates on prices is present, but the results are not consistently reliable. This result

confirms the account in preceding studies see that of Makun (2012); Aimola et al. (2021) who provided evidence that gross domestic product increase leads to surge in demand thereby causing inflation. On the other hand, Doudo's (2022) finding that money supply decreases inflation is consistent with this study's finding.

A study investigated the impact of changes in oil prices on inflation in two categories of countries: those with high oil dependency and those with low oil dependency Sek et al. (2015). The research also compares the relative influence of oil price changes with other types of shocks, such as fluctuations in the real exchange rate, domestic output, and exporters' production costs. The pass-through equation is modeled in an Autoregressive Distributed Lag (ARDL) format, and the model is estimated using the pooled mean group method. It was found that in the low oil dependency group, oil price changes directly affect domestic inflation (Sek et l., 2015). This result supports the narrative in extant literature that oil prices are a significant contributor to inflation.

However, in the high oil dependency group, the impact of oil price changes on domestic inflation is indirect, occurring through alterations in the exporter's production costs. The primary factors driving domestic inflation are the real exchange rate and exporter's production costs in the high oil dependency group, while in the low oil dependency group, it is influenced by domestic output and exporter's production costs. The study advised that to mitigate the effects of these shocks, policymakers should consider implementing accommodating monetary policies.

Finally, the study by Okweri and Abu (2017) investigated the effectiveness of monetary policy in addressing inflation in Nigeria. The researchers utilized time series data spanning from 1986 to 2015 and employed the Vector Error Correction Model to

empirically analyze the stated objectives. The findings revealed that monetary policy plays a significant role in curbing inflation up to a certain threshold in Nigeria. However, the impact of monetary policy variables in controlling inflation was weak. This weakness can be attributed to the substantial size of the informal sector, which operates largely outside the purview of monetary policy tools, resulting in a significant economy of currency held outside of banks. Additionally, the ineffectiveness of monetary policy tools can be attributed to their lack of popularity due to financial illiteracy. The study also found that the Monetary Policy Rate (MPR) was not statistically significant, thereby impacting its transmission mechanism to commercial banks' interest rates. This lack of significance is due to the excess reserves held by commercial banks, which diminish the efficacy of the MPR in influencing interest rates and money supply (Okweri & Abu, 2017).

The study made several recommendations, including narrowing the asymmetric corridor around the MPR to address commercial banks' excess reserves, regularly adjusting required cash and liquidity ratios to curb excess reserves, conducting financial literacy campaigns to enhance the popularity of monetary policy tools, and expanding the coverage of commercial banks to reduce the number of unbanked and underbanked individuals, thereby reducing the dominance of the informal sector.

2.4 Conceptual Review and Hypothesis Development

This section of the study presents a conceptual review of the variables under discussion and develops hypotheses based on scientific evidence from extant literature.

2.4.1 World crude oil and food inflation

World crude oil price refers to the monetary value placed on a barrel of crude oil as estimated in United State dollars on the world market. Since fuel is used by countries globally, hikes and any slide changes in its price affect its demand and the price easily exacerbates. Again, any changes in the production level and its supply easily affect its price. The variable is deemed indispensable globally as a crucial determinant of inflation across the globe. Empirical investigation into the factors that cause food inflation in the kingdom of Eswatini found oil prices as a significant positive determinant of food inflation (Mndzebele, 2015; Adom et al., 2015). Again, this account is supported by the investigation carried out by (Davison, 2016; Headey & Fan, 2018) who discovered that world crude oil prices are a significant contributor to inflation. Moreover, studies (Mohammed et al., 2016; Bane, 2018) documented that world oil price significantly fuels inflation. Based on this analogy the present study hypothesizes that;

H1: *Crude Oil (CO) price has a positive statistically significant effect on food inflation in Ghana*.

2.4.2 Money supply and food inflation

Money supply refers to the quantity of money in circulation which combines the aggregate of M2, demand deposit among other measures of money in an economy. The monetary policy pursued by a central bank of a country determines the quantity of money in circulation. This variable according to empirical literature exert considerable positive effect on food inflation in an economy (Bane, 2018; Osei, 2015; Adom et al., 2015; Bawa et al., 206). This assertion of positive significant association between money supply and inflation is confirmed by the scholarly apprehension of (Adil et al., 2021; Adjei, 2018;

Makun, 2021; Mohammed et al., 2016; Masati et al., 2014; Aimola et al., 2021). Notwithstanding, Doudo (2022), Saungweme and Odhiambo (2021) provided evidence that growth in money supply is negatively associated with inflation in an economy. Premised on this exegesis, the current study hypothesizes as fellows;

H2: *Money Supply (MS) statistically and positively affect food inflation in Ghana.*

2.4.3 Budget deficit and food inflation

Budget deficit refers to the condition when the government is unable to finance its projected budget for a specified fiscal year. This phenomenon takes place when the central government fails to mobilize the estimated amount of revenue within an accounting year. This creates a vacuum in government spending leading to abrupt stalling of developmental projects at different levels of completion. In order to get these projects completed and to keep the administration running, the government would therefore resort to alternative ways of ascertaining funds to shore up its available funds to complete its projects and better management of the economy. The act of getting money to keep the government machinery running gives room to contract loans from domestic and external sources. Since these loans are to be repaid to the lender with interest it compels the government to strategize ways of getting funds from the domestic market which often lead to introduction of new taxes and these according to extant literature leads to inflation (Doudo, 2022). Budget deficit otherwise known as deficit financing leads to significant increase in inflation in a country (Bane, 2018; Aimola, 2021; Saungweme & Odhiambo, 2021). This causal and positive relationship between budget deficit and inflation is confirmed by (Doudo, 2022). Per the foregoing, the current study hypothesizes that;

H3: *There is a statistically positive significant effect of Budget Deficit (BD) on inflation*.

2.4.4 Credit to Agriculture and food inflation

Credit to the agricultural sector is a form of advances given to farmers to encourage them and to provide enough capital to enable them to afford farm implementations in order to make their farming activities easier (Bane, 2018). All things being equal farmers who get agricultural credit are expected to engage in large scale production as compared to subsistence farmers who do not get such form of credit. Since this form of credit cushion farmers to produce more, it is expected to reduce food prices in an economy. According to Bane (2018), agricultural credit has a significant negative effect on food inflation. This inverse relationship is confirmed by Makun (2021) who documented that agricultural credit increases food production and has a negative influence on food inflation. According to the above exposition, the present study hypothesizes that;

H4: *There is a negative effect of Agricultural Credit (AC) on food inflation in Ghana*.

2.4.5 Gross domestic product and food inflation

Gross Domestic Product (GDP) according to the Organization for Economic Cooperation and Development (OECD) ~~–~~is the standard measure of the value added created through the production of goods and services in a country during a certain period. As such, it also measures the income earned from that production, or the total amount spent on final goods and services (less imports)" (OECD, 2008). This measurement is done through three main approaches namely expenditure approach which sums the total expenditure of a country, approach, income approach which sums the total income earned by nationals of a country and product approach which sums the total production undertaken by citizens of a country including output by nationals residing in the diaspora. According to

a strand of literature a rise in the GDP of a country means citizens are now engaging in more production and earning more income with high purchasing power therefore can afford enough goods and services. The account furthered that there is a positive effect of GDP on food inflation (Saungweme & Odhiambo, 2021; Qayyum and Sultana, 2018; Makun, 2018). Again, the account of Adjei (2021) on the relationship between gross domestic product and food inflation confirms the positive relationship narrative. On that note the current study hypothesizes that;

H5: *Gross Domestic Product (GDP) has positive and statistically significant effect on food inflation in Ghana*.

2.4.6 Food importation and food inflation

Food import measures the total quantity of food items that are traded between the borders of one country and another. It is the estimate of the total quantity of food commodities bought from outside the shores of a country. The aggregate measure for a country for a year is computed in terms of merchandise. The price of imported food is normally expected to be higher compared to the price of food produced domestically. Mostly food is imported to supplement the local production if a country produces less than it can consume. Studies have shown that since the cost of importation is normally incorporated as part of the final selling price of imported foods it raises food prices leading to food inflation. Therefore, the effect of food import on food inflation is positive (Mohammed et al., 2016). This positive effect of imported food as alluded by Mohammed et al (2016) is confirmed by Qayyum and Sultana (2018) who provided supporting evidence that there is a significant positive effect of imported food on food inflation. Per the above exposition, the present study hypothesizes that;

H6: *Food Import (FI) has a significant positive effect on food inflation in Ghana*.

2.4.7 Food export and food inflation

Food export measures the total quantity of food items that leaves the shores of a country to another country within a specified period either quarterly or annually. This considers the aggregate shipment of food in tones made by a country within a period. The more a country produces, the higher the chances it would sell the excess to the international market. However, shipping of food commodities to the international market without consideration for the local demand leads to shortage of food in the exporting country. This shortage if not immediately mitigated leads to higher price of food items thereby causing high food inflation. Food export is a significant positive driver of food inflation (Qayyum & Sultana, 2018). According to the above exegesis the following hypothesis is put forth by the study.

H7: *Food Export (FE) has a significant positive effect on food inflation in Ghana*.

2.4.8 Exchange rate and food inflation

Exchange rate is the amount at which one currency is traded for the other. Thus, the price of one currency in another currency. The rate at which a country's currency is traded for the other determines the strength of such country's currency as compared to other international currencies. Again, this affects the value of imported goods into a country either food items or non-food items. Exchange rate has been empirically found to have a positive significant effect on food inflation (Osei, 2015; Bawa et al., 2016). The posit that exchange rate exert significant positive effect on food inflation is affirmed by the scholarly work of (Heady & Fan, 2018; Mahammed et al., 2016). Based on the empirical evidence adduced above, the present study hypothesizes that;

H8: *Exchange Rate (ER) has a positive significant effect on food inflation in Ghana*.

2.4.9 Interest rate and food inflation

Interest Rate refers to the cost at which capital is borrowed in a defined economy (Mishkin, 2016). Interest rate is defined as the percentage charged on the amount lent out as loans by surplus spending units and usually done through financial intermediaries (Mankiw, 2014). Interest rate forms part of monetary policy tools used by central banks of countries to control the circulation of money in an economy. It is expected that reduction in interest rate would encourage more businessmen to secure loans to expand their businesses. For the purpose of this investigation, interest rate would be measured using the bank of Ghana monetary policy rate as used in existing studies see (Amoah et al., 2019; Precious & Makhetha-Kosi, 2014). The empirical studies that have incorporated interest rate to know its effect on food inflation has it that food inflation has a positive effect on food inflation (Adom et al., 2015; Bawa et al., 2016). This assertion is supported by the evidence provided by Adil et al. (2021) who documented that interest rate is a positive determinant of food inflation. Per the foregoing discussion, this study put forward that;

H9: *Interest Rate (IR) has a statistically significant positive effect on food inflation in Ghana*.

2.4.10 Domestic food supply and food inflation

Domestic food supply. This refers to the total quantity of food stuff produced and sold on the local market. The higher the food supplied to the local market the lesser the price of these food items (Louw, 2017). Notwithstanding, in a situation where the food supplied to the local market is low and the demand for the local market remains high it creates

shortage thereby driving local food prices high. Preceding studies document that domestic food supply is a positive determinant of food inflation (Osei, 2015; Davidson, 2016). The aforementioned relationship between food inflation and domestic food supply is affirmed by the account as put forward by (Louw, 2017; Adil et al., 2021). Premised on the scholarly apprehension of the cited authors, the current study put forth the following hypothesis.

H10: *Domestic Food Supply (DFS) has a statistically positive effect on food inflation in Ghana*.

2.4.11 Trade openness and food inflation

Trade openness refers to the degree of access a country's border is open to the international market. This measure assesses the rate at which a country allows expatriates to trade in their country. The more a country is open to the international market the more business friendly the country is rated. This encourages and limits the restrictions investors encounter in making cross country investment. Countries with high trade openness attract more foreign direct investment compared to those with less trade openness. With all things being equal a country with high trade openness has high production of goods and services which is found to reduce food cost. Trade openness has a significant positive effect on food inflation (Aimola, 2021). Per the account given above, the study hypothesizes that;

H11: Trade Openness (TO) has a statistically significant positive effect on food inflation in Ghana.

2.4.12 Government Expenditure and food inflation

Government Expenditure refers to the amount of money spent by the government within a specified period. This amount is normally spent on developmental projects and administrative expenses to keep government machinery working such as payment of remuneration, ex-gratia, disbursement to district, municipal and metropolitan assemblies. This expenditure is normally appropriated to the government by the appropriation bill. The more the government spends the more money is released into the economy and individuals and businessmen like road contractors get enough money to spend and this leads to inflation in the economy since individuals have enough money which increases their purchasing power. Notwithstanding, the lower the government spends the less individuals get money in their coffers thereby limiting their purchasing power and reducing inflation pressures (Myrdal & Straiten, 1968; Osei, 2012). Based on the above analogy, the present study hypothesizes that;

H12: *Government Expenditure (GE) has a statistically significant positive effect on food inflation* in Ghana.

The pictorial diagram shows the interrelated relationship between the study variables. In the displayed framework, the independent variables Money Supply (MS), Budget Deficit (BD), Agricultural Credit (AC), Government Expenditure (GE), Interest Rate (IR), Exchange Rate (ER), Food Prices (FP), Gross Domestic Product (GDP), Crude Oil (CO), Food Export (FE), Food Import (FI) are proxied to positively affect the dependent variable Food Inflation (FI).

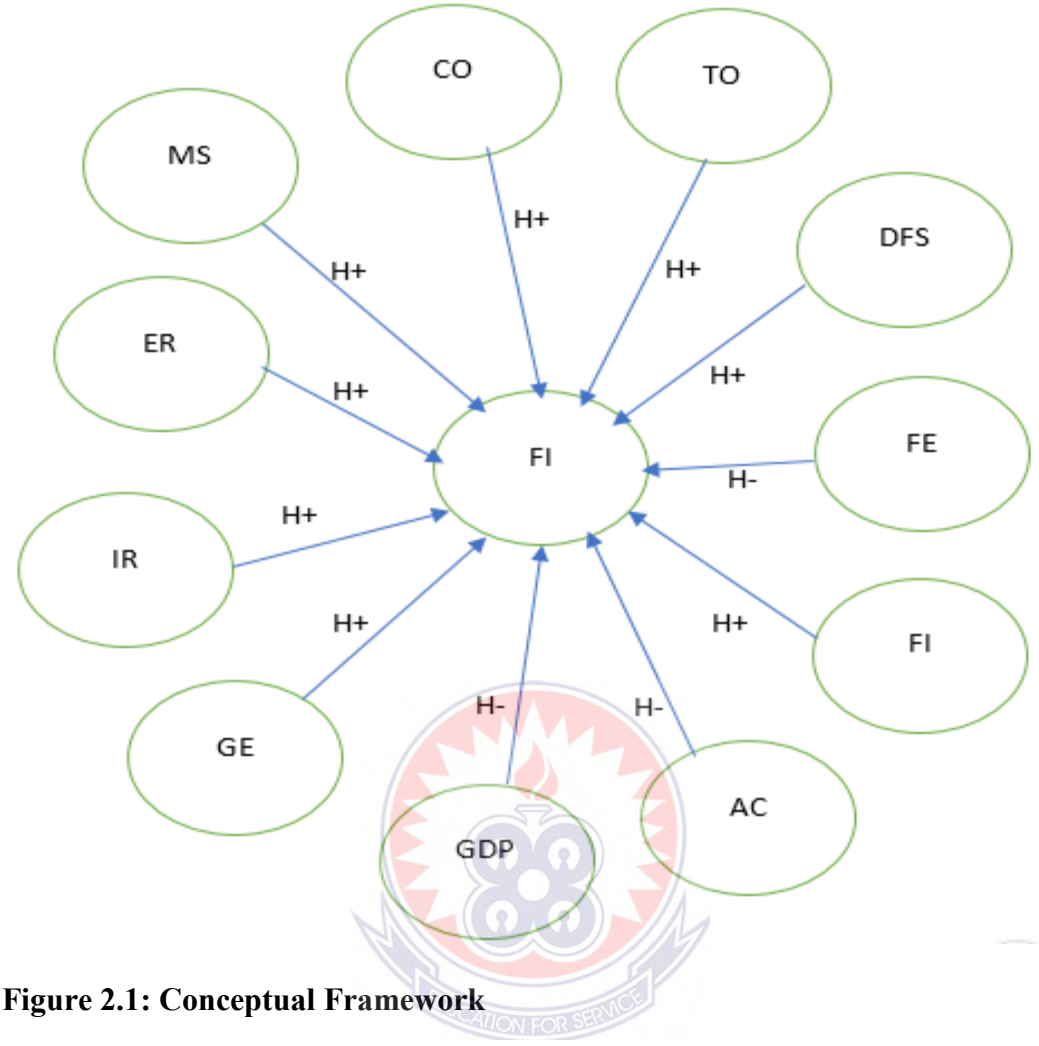

Figure 2.1: Conceptual Framework

Source: Author's Construct

2.5 Conclusion

A thorough review of extant literature demonstrates that a chunk of the studies on drivers of inflation has concentrated on the factors that drive broad inflation in an economy of which myriad of findings were brought to bear see the account of Aimola (2021), Aimola (2021) and Misati (2014), Mohammed et al. (2016) just to mention but few. Again, the preceding studies were mostly conducted outside the sub-region or the continent at large with emphasis on the United Kingdom, India, Pakistan and the likes (Davidson, 2018; Adil et al., 2018; Qayyum and Sultana, 2018).

Also, the few studies that focused on the continent have provided diverse results (Bane, 2018; Mndzebele, 2021, Aimola, 2021, Davison, 2016). Moreover, the known studies in Ghana were conducted by emphasizing on factors that drives inflation in different sectors of the economy such as the housing sector or the construction sector see Doudo (2022); Owusu-Ansah et al. (2017); Owusu-Ansah et al. (2021). This makes it a necessity for an empirical interrogation of this nature to be carried out to unveil the factors that cause food price inflation in Ghana as a developing country that witnessed an astronomical hike in food inflation in the last 6 months as reported by the International Monetary Fund ([IMF], 2022). The present study seeks to assess the following objectives: one; to explore the factors that cause hikes in food inflation in Ghana; two; to assess the effect of the causal factors on food inflation in Ghana and three to ascertain the non-linear effect of the causal variables on food inflation in Ghana. The variables included in the study to test their possible effect on food inflation in Ghana includes Money Supply (MS), Budget Deficit (BD), Agricultural Credit (AC), Government Expenditure (GE), Interest Rate (IR), Exchange Rate (ER), Food Prices (FP), Gross Domestic Product (GDP), Crude Oil (CO), Food Export (FE) and Import.

The present study is built on the structural inflation theory, Keynesian inflation theory and the Monetarist Inflation theory. The methodology employed by the study includes causal design, quantitative approach and positivism philosophy as well as Toda and Yamamoto granger causality test and the Autoregressive Distributed Lag Model (ARDL) as data analysis techniques.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter presents and describes the research design, research approach, study population, sample and sampling technique, data collection description and data analysis technique. This chapter is important in scientific research as it lays down the procedures for the study in order to give subsequent researchers the direction on the techniques and to understand the findings as well as replicate it if needed.

3.2 Research Design and Approach

Nachmias and Nachmias (2014) asserted that research design is a logical model of proof devised to carry out a study. In furtherance, Yin (2018) opined that research design is a blueprint that ideally provides linkage between the research questions and the information to be gathered and how to be analyzed. Research design can therefore be termed as a sequential blueprint on how planned research is to be carried out, operationalizing elements in a way that can be measured and how end results from the empirical test will be interpreted. Premised on the credence adduced by Nachmias and Nachmias (2014), Yin (2018), the study would deploy causal research design otherwise known as explanatory design. Causal research design is a research design that assesses the possibility of one variable (Independent) affecting the other variable (dependent) (Creswell, 2009; 2014). Thus, the explanatory or the comparative design allows researchers to examine the cause-and-effect associations that prevail between variables while giving room for assessing the extent of the effect. The descriptive design was

adopted by the study because it sought to collect data and analyze it objectively without any direct manipulation by the author. Again, the adoption of the explanatory design is anchored on the study's objective of assessing the possibility of causal relationship between the study variables and further examine the effect of the independent variables on food inflation in Ghana. This research adopted a quantitative approach as it involves a systematic empirical interrogation into which factors cause the dependent variable under consideration (Creswell, 2009). Thus, data gathered on the variables from the respective sources would be analyzed quantitatively based on ascertained results to draw conclusions and inferences. The study used a quantitative approach because it seeks to determine the factors that cause food inflation in Ghana. Again, the research deployed a quantitative approach toward its exploration premise on the objective of the study to assess the effect of the causal variables on food inflation in Ghana. Again, the quantitative approach was preferred because the data under consideration are all measured in quantitative terms. Deploying this approach in conducting a study allows for generalization of conclusions to a broader spectrum.

3.3 Research Philosophy

The study would adopt the positivism philosophy. Park et al. (2020), adjudged that positivism as a concept is reliably grounded on measurable counts that results in statistical analyses. It is well acknowledged that positivism as a research philosophy is in accordance with the empiricist advocate that knowledge comes from human exploration. It is composed of an atomistic and ontological view of the real world as made up of discrete, observable variables and occurrences that interact in an identifiable, determined and in regular manner. The scholar judged that continuous scientific exploration leads to

knowledge discovery (Park et al., 2020). The resultant knowledge serves as a foundation upon which scientific explanations offered by scientists to events that take place in the real world are premised on. Deploying empirical research mechanisms such as relational, measurement and control stems from a positivist approach. This gives room for the adoption of the positivism philosophical approach toward this study. In the account of Park et al (2020), adopting a positivism approach to a study eliminates and restricts any external human interference during the course of the study and sets the researcher as an independent entity to the study. The use of the positivist philosophy is adjudged to be more appropriate when the concepts under consideration includes variables that are measured in quantitative terms and the objectives of the study involves assessing the interplay among such study's variables (Collis & Hussey, 2014). In reference to the present study, the variables Money Supply (MS), Agricultural Credit (AC), Government Expenditure (GE), Exchange Rate (ER), Gross Domestic Product (GDP), Crude Oil (CO), Food Export (FE), Food Import (FI) are all estimated in quantitative terms whist the prime motive of the study is to assess the interlay and their influence on food inflation. This in the first place supports the adoption of the positivist philosophy in the study since the present study is concerned with assessing the causal effect of the presumed variables on food inflation.

This signifies that to make the audience of a study understand that the researcher is independent of the population, a positivist philosophized study can be structured and analyse data from a database the researcher has no relationship with, business or any form of dealing being formal or informal. Under such circumstances, the author is only mandated and interested in the available information for accurate judgement and

conclusions. In conjunction to the above description, it was adjudged that the use of deductive approach to data analysis and conclusion is the generic rule of the positivism philosophy (Crowther & Lancaster, 2015). This study is premised on the positivist philosophy since the researcher will objectively use data retrieved from various data repositories to deduce meaningful conclusions and inferences without giving room for any external or internal human manipulation. The focus of the study which is centred on examining the intended influence of the various determinants on the dependent variables contributed to the adoption.

3.4 Data and Sources of Data

For research purposes, data is classified as the raw and unprocessed information or variables that can be manipulated or processed to yield dependable results for drawing conclusions, making inferences and for extrapolation purposes (Kumar, 2015). This supports the assertion made by (Kothari, 2007). Data are classified into two main categories namely primary and secondary data. The study would use secondary annual time series data. The use of secondary data is essential because its usage has been proffered to reduce pre analysis exercise such as data cleaning process. Again, secondary data is assumed to be of high quality provided it is retrieved from a trusted source. The data period would span from 2000 to 2022. This data period was considered based on the assertion made by Rashid (2020) that using a data covering a period of 10 years and above is capable of producing accurate and reliable results as confirmed by Gadzo (2018); Forson et al. (2021); Asiamah (2023); Gadzo et al. (2019) and Oduro et al. (2022).

Again, the 22 years was considered because the last two decades have seen abrupt variations in macroeconomic variables including those captured in the present study. For instance, inflation experienced astronomical hikes by moving from 4.9% in 1999 to 40.2% in 2000 further worsened to 41.5% in the following fiscal year; it recorded a sharp decline to 9.4% in 2002. Again, same variable stood at 17.1% in 2015, 17.5% in the next year and declined to singles numbers in 2018, 2019, 2020 and 2021 however soared to 40.7% in the last quarter of 2022 fiscal year according to International Monetary Fund (IMF, 2022) and World Development Indicators (WDI, 2022). Also, monetary supply experienced a structural break due to the global financial crunch that hit the world in 2009 through to 2009. Furthermore, money supply stood at 34% in 2002 and 30% as at the close of the 2020 accounting year. Crude oil price on the other hand just like that of the considered variables has recorded hikes in price per barrel during and post covid-19 era. The variables taken into consideration for data collection for the study are Money Supply (MS), Agricultural Credit (AC), Government Expenditure (GE), Exchange Rate (ER), Gross Domestic Product (GDP), Crude Oil (CO), Food Export (FE), Food Import (FI), Trade Openness. These variables are proxied to positively affect the dependent variable Food Inflation (FI).

Table 3.1: Summary of Variables and data sources

Theoretical Underpinnings	Variable	Description	Sources
Monetarist theory	Inflation	Persistent increase in prices of goods and services over a period of time	WDI
	Money supply	The quantity of money in circulation	WDI
Keynesian theory	Inflation	GDP The value of production of good and services in a country within a fiscal period	WDI
Structural inflation theory	Money supply		WDI
	Government expenditure	The amount of money spent by a central government within a fiscal year	WDI

Source: Author's compilation

3.5 Data Analysis Technique

In the first place the study would deploy Toda and Yamamoto granger causality test to assess the causal relationship between the study variables. The Toda and Yamamoto granger causality test is an econometric technique that allow researchers to examine the causal relationship between variables (Granger, 1969; Toda & Yamamoto, 1995). The Toda and Yamamoto granger causality test is an upgraded version of the ordinary granger

causality test that is capable of normalizing the presence of unit root process in a data set as confirmed by (Forson & Janrattanagul, 2014; Misati et al., 2014). The tool assesses the presence of unidirectional or bi-directional relationship among variables. The multivariate granger causality adopted to examine the presence of causal association between food inflation and the money supply, government expenditure, budget deficit, food import, food export, agricultural credit, crude oil, interest rate, exchange rate and per capita income proxied with GDP is represented in the equation below as adapted from the formulation by (Forson et al., 2015).

$$FI_t = \alpha_1 + \sum_{i=1}^{\rho} \beta_{2i} X_{t-i} + \mu_{1t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

$$\sum_{i=1}^{\rho} \beta_{3i} X_{t-i} = \alpha_4 + \sum_{i=1}^{\rho} \beta_{5i} FI_t + \mu_{2t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where: FIt denote the food inflation rate considered at time t, X refers to all the exogenous factors captured in the study, in this case Money Supply (MS), Agricultural Credit (AC), Government Expenditure (GE), Exchange Rate (ER), Gross Domestic Product (GDP), Crude Oil (CO), Food Export (FE), Food Import (FI) Domestic Food Supply (DFS) to assess their possible causality on food inflation. The coefficient $\beta_2 i$ and $\beta_3 i$ predict the time series effect of the exogenous variables thus, money supply, government expenditure, food import, food export, agricultural credit, crude oil and exchange rate whilst β_{5i} represent the time series effect of food inflation. The i represent the number of observations whilst p denotes the last or the *nth* lag observation taken into consideration. The signs α_1 and α_4 are the y-intercept, μ_{1t} and μ_{2t} are the error terms.

Per the stipulated equations, the condition for rejecting the null hypothesis that the causality test of money supply, government expenditure, budget deficit, food import, food export, agricultural credit, crude oil, interest and exchange rate does not cause food inflation in Ghana is based on a significant level of 5%.

The study would further subject the variables that would be found to cause food inflation in Ghana into further analysis to examine their effect on food inflation in Ghana. The second data analytical tool to be employed in examining the aforementioned effect is Autoregressive Distributed Lag (ARDL) technique. The Autoregressive Distributed Lag Approach (ARDL) as credited to Pesaran et al. (2001) is a linear data analysis method that requires the lag of the dependent and independent variables are both contemporaneous connected in the model. This analytical method would be deployed to analyze the data collected from the various sources in order to test and answer the second hypothesis formed by the study. The Autoregressive Distributed Lag (ARDL) is a time series econometric tool that is used to analyze time series data since it includes various methods for bound testing to cointegration, long run and short run relationship between variables of interest through the Error Correction Model. This feature has been proven to examine the intended association by Saungweme and Odhiambo (2021). The efficacy of the ARDL tool to accurately reveal the real association between study variables has been affirmed by empirical studies (Aimola et al., 2021; Adjei, 2018; Saungweme & Odhiambo, 2021).

3.5.1 Estimation Model

The multivariate linear model would be deployed by the study to examine the linkage between the regressors and the regressand. The model is adapted based on the objectives

set by the study that sought to establish the effect of the independent variables on food inflation. Per the linear model a number of mathematical equations are put forward to guide the second objectives of the study. The model equation assessing the effect of the causal variables on food inflation are stated below.

$$FI_{t-1} = f(MS, GE, BD, FI, FE, AC, CO, IR, GDP, ER) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

$$FI_t = \beta_0 + \beta_1 MS_t + \beta_2 GE_t + \beta_3 TO + \beta_4 FM_t + \beta_5 FE_t + \beta_6 AC_t + \beta_7 CO_t + \beta_9 ER_t + \beta_{10} DFS_t + \beta_{11} GDP_t + \mu_{3t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

$$FI_t = Y_0 + Y_1 MS_t^2 + Y_2 GE_t^2 + Y_3 BD_t^2 + Y_4 FI_t^2 + Y_5 FE_t^2 + Y_6 AC_t^2 + Y_7 CO_t^2 + Y_8 IR_t^2 + Y_9 ER_t^2 + Y_{10} DFS_t^2 + Y_{11} GDP_t^2 + \varepsilon_{4t} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (5)$$

Where: *t* denote time

β_0 is constant

Y_0 *is constant*

Y_{1-11} is slope

ε is error term

Inflation

MS denote Money supply

GE represent Government Expenditure

FI Food Import

FE Food Export

AC Agricultural credit

CO crude oil

TO Trade Openness

EX Exchange Rate

GDP Gross Domestic Growth

DFS is Domestic Food Supply

The choice of the Autoregressive Distributed Lag (ARDL) estimation technique is based on the strength of the technique as compared to other conventional estimation tools. These strengths are; the Autoregressive technique is a robust and consistent estimator with small and large data samples. Again, the Autoregressive technique is efficient in estimating both long and short run effects by combining the lag and substituting the error lag terms. This is represented on the equation below.

$$\begin{aligned} FI_t &= \gamma_1 \sum_{i=1}^{\rho} FI_{t-1} + \gamma_2 \sum_{i=0}^{k} TO_{t-1} + \gamma_3 \sum_{i=0}^{k} FM_{t-1} + \gamma_4 \sum_{i=0}^{K} FE_{t-1} \\ &+ \gamma_5 \sum_{i=0}^{K} AC_{t-1} + \gamma_6 \sum_{i=0}^{K} CO_{t-1} + \gamma_7 \sum_{i=0}^{K} EX_{t-1} + \gamma_8 \sum_{i=0}^{K} GDP_{t-1} \\ &+ \gamma_9 \sum_{i=0}^{K} GE_{t-1} + \gamma_{10} \sum_{i=0}^{K} DFS_{t-1} + \gamma_{11} \sum_{i=0}^{K} MS_{t-1} + \propto_1 FI_{T-1} + \propto_2 TO_{T-1} \\ &+ \propto_3 FE_{T-1} + \propto_4 FM_{T-1} + \propto_5 AC_{T-1} + \propto_6 CO_{T-1} + \propto_7 EX_{T-1} + \propto_8 GDP_{T-1} \\ &+ \propto_9 GE_{T-1} + \propto_{10} DFS_{T-1} + \propto_{11} MS_{T-1} \\ &+ \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6) \end{aligned}$$

Also, the model does not require conformity of order of variables, making it applicable to variables with different orders thus, variables with order I (0) and I (1). Furthermore, the ARDL technique is capable of normalizing serial correlation and endogeneity problems in time series analysis.

Finally, the error correction terms can be estimated through a linear transformation. The equation for this is displayed below.

$$FI_{t-1} = \gamma_1 \sum_{i=1}^{\rho} FI_{t-1} + \gamma_2 \sum_{I=0}^{k} TO_{t-1} + \gamma_3 \sum_{I=0}^{k} FM_{t-1} + \gamma_4 \sum_{I=0}^{k} FE_{t-1} + \gamma_5 \sum_{I=0}^{k} AC_{t-1} + \gamma_6 \sum_{I=0}^{k} CO_{t-1} + \gamma_7 \sum_{I=0}^{k} EX_{t-1} + \gamma_8 \sum_{I=0}^{k} GDP_{t-1} + \gamma_9 \sum_{I=0}^{k} GE_{t-1} + \gamma_{10} \sum_{I=0}^{k} DFS_{t-1} + \gamma_{11} \sum_{I=0}^{k} MS_{t-1} + ECT_{t-1} + \varepsilon_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (7)$$

3.5.2 Robustness Checks

Robustness checks are statistical tests conducted to assess the suitability of a data for carrying out a specified research analysis. Premised on the objectives and the time series data under consideration the study would perform notable time series robustness checks such as cointegration, stationarity and heteroskedasticity test.

3.5.2.1 Unit root Test

Unit root process is a condition in statistical data when there is a random walk in the dataset. This condition takes place when the variance of a series varies abruptly over time and is referred to as non-stationery. Non-stationarity of a data means that such data is unpredictable and the autoregressive parameter of the series is equivalent to 1. Research data that is found to be non-stationary is likely to produce spurious results as argued by (Forson & Janrattanagul, 2014). The present study would deploy the Augmented Fuller Dickey (ADF) and Philip-Perron test to assess the stationarity of the variables. The adoption of these unit root testing tools at the expense of others is as a result of the tools ability to accurately examine the stationarity of time series as confirmed by empirical studies see (Forson & Janrattanagul, 2014; Asiamah, 2023).

3.5.2.2 Heteroskedasticity Test

Heteroskedasticity is a condition in statistical data when the variance across all values of X are not equal. Thus, the differences in the error terms are not the same across all variables. In statistical research, data for analysis are preferred to be homoscedastic thus the variance across all values of X are equal. Failure to achieve this leads to the problem of heteroskedasticity. Heteroskedasticity testing tool like the Bresch Pagan test would be deployed to test this condition.

3.5.2.3 Cointegration Test

A cointegration test is a test carried out in statistical analysis to examine the order at which variables move together. For the purpose of this study, the bound testing would be deployed to test the level at which the variables cointegrate. The adoption of this test tool is as a result of its empirical use by (Adjei et al., 2018; Saungweme & Odhiambo, 2021; Aimola et al., 2021).

3.6 Ethical Consideration

The study would observe all internationally accepted best practices governing conduct of ethical research. Thus, the study would acknowledge all sources where information regarding this study is ascertained. Nguyen (2021) advocates that in collecting information for research purposes, authors should ensure that this practice is carried on in an ethical manner. Again, the study would be conducted in accordance with principles and guidelines governing thesis writing in University of Education, Winneba ([UEW], 2018).

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter of the study presents the results ascertained from the various test conducted to assess the possible causality of the sampled variables and the effect of the various causal variables exhibiting significant influence on food inflation in Ghana. This chapter gives room for the findings of the study to be compared with that of extant literature.

4.2 Descriptive Statistics

In every statistical analysis, it is necessary to explore the characteristics of the variables under consideration before carrying on any empirical test. The assessment of the normality and the characteristics of variables are done through the descriptive test. Per the descriptives Table 4.1, Government Expenditure (GE) registered the highest average. Domestic Food Supply (DFS) recorded the third highest average of positive 84.07, which was next to Gross Domestic Product as followed by real effective Exchange Rate (EXR). The variable that recorded the second lowest mean was Food Inflation. This presupposes that food inflation has been low meanwhile the variable has experienced a soar recently leading to public outcry in Ghana. The indication of food inflation being low in Ghana is opposite to the reality in the Ghanaian perspective.

The highest maximum value was recorded by government expenditure whilst money supply showed the least maximum value. An indication that the money supply has been low in Ghana over the studied period. The lowest minimum value registered by gross domestic product signifies that the Ghanaian economy has been slagging in terms of

growth. Except for Trade Openness (TO) and Money Supply (MS) which recorded negative skewness, the remaining variables were positively skewed. The kurtosis measure showed that all the variables recorded fewer values indicating the absence of a heavy tail distribution. On the deviation of the variables from the center part of the distribution, all variables showed less dispersion from the mean point of their distribution. The measure of normality of the dataset was checked based on the Jarque normality test which tests the null hypothesis that the series is normal with a rejection level of p-value less than 0.05 significance level. Aside from food inflation which registered a Jarque Bera probability of less than 0.05, the remaining variables recorded probabilities above 0.05, an indication that the series is normally distributed. Based on this, the study fails to reject the null and concludes that the series is normal and a justification for further parametric tests.

4.3 Correlation Matrix

In statistics, correlation is a measure used to assess the relationship between a variable and any other variable in a series. The correlation used in the study is the Pearson Product moment of correlation. According to previous studies, a correlation of 0.7 and above indicate the presence of multicollinearity Aboagye-Otchere and Boateng (2023) whilst another strand of literature asserts that a correlation value of 0.8 and above shows the presence of multicollinearity Hair et al (2020). Per Table 4.2, the study recorded a moderate correlation with positive and inverse values with the lowest of 0.090 which was registered between food import and food inflation. Since almost all the correlations are less than the 0.7 threshold the study concluded that the series has the expected correlation that warrants further analysis. This is in line with the correlations recorded by Hair et al.

(2020); Dekowski et al. (2023) who recorded similar correlations of less than 0.07 and confirmed the absence of multicollinearity in their studies.

Table 4. 1: Descriptive Statistics

	CO	DFS	EXR	FE	FI	FIF	GDP	GE	MS	TO
Mean	63.78286	84.07	8.88E+01	30.12567	16.44349	16.29244	118.2083	9.20E+10	28.08066	58.72857
Median	61.51	84.03	8.86E+01	29.97675	16.10235	12.37192	62.002	4.64E+10	28.16617	61.6
Maximum	111.63	118.31	1.10E+02	52.01391	20.78035	41.5095	391.941	3.06E+11	34.10823	67.8
Minimum	24.45	52.1	6.82E+01	16.67668	12.75922	7.14364	6.25	2.56E+09	21.95276	46.5
Std. Dev.	28.89507	21.00957	1.27E+01	9.155008	2.43445	9.62894	122.9244	1.00E+11	3.421917	8.17815
Skewness	0.31215	0.09985	0.013798	0.550961	0.411935	1.670805	0.993371	0.955668	-0.06265	-0.35293
Kurtosis	1.938165	1.727583	1.986776	2.820726	2.044913	4.822313	2.677204	2.566168	1.982698	1.349305
Jarque-Bera	1.327587	1.451559	0.898961	0.986711	1.392083	12.67629	3.544921	3.361241	0.919279	2.820164
Probability	0.514894	0.483947	0.637959	0.610574	0.498555	0.001768	0.169914	0.186258	0.631511	0.244123
Sum	1339.44	1765.47	1.86E+03	572.3877	345.3133	342.1413	2482.374	1.93E+12	589.6939	1233.3
Sum Sq. Dev.	16698.5	8828.038	3.21E+03	1508.655	118.5309	1854.33	302208	2.01E+23	234.1903	1337.643
Observations	21	21	21	19	21	21	21	21	21	21

Source: E-views Estimate

Table 4. 2:Correlation Matrix

	CO	DFS	EXR	FE	FI	FIF	GDP	GE	MS	TO
CO	1									
DFS	0.349861	1								
EXR	0.115735	-0.6922	1							
FE	-0.54244	-0.6034	0.358221	1						
FI	-0.05342	0.34717	-0.45834	0.047909	1					
FIF	-0.62369	-0.67597	0.018687	0.325081	-0.09088	1				
GDP	0.047499	0.927178	-0.75669	-0.4688	0.387055	-0.49987	1			
GE	0.044403	0.924926	-0.75771	-0.47103	0.384639	-0.4928	0.999077	1		
MS	-0.30245	-0.50414	0.29425	0.258315	-0.05522	0.376347	-0.47379	-0.4938	1	
TO	0.530446	0.949016	-0.61034	-0.72949	0.243338	-0.65701	0.791483	0.790324	-0.44751	1

Source: E-views Estimate

4.4 Stationarity Test

The stationarity test is a pre-estimation robustness check conducted to ensure that the mean of the variables in the series is without a random walk. In time series forecasting, a model cannot forecast the future outturn of a series on a non-stationary variable. It is the test used to convert a non-stationary series to stationary as alluded by Ibrahim et al. (2022) and Dekowski et al (2023). To ensure time series data is without unit root, several statistical tests have been proposed and used over the years. This study dwells on the two main tests thus the Philip-Perron (PP) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests to verify the stationarity of the series. The KPSS test is a time series stationarity test that tests the null hypothesis that the series is stationary. The PP test, on the other hand, is a unit root testing approach that tests the null hypothesis that the dataset is not stationary which is rejected at the 5% level of significance. A series with a p-value of less than 0.05 shows rejection of the null and acceptance of the alternative whilst a series with a p-value of greater than 0.05 shows failure to reject the null and conclude the distribution is non-stationery.

This means that though both tests are used to check stationarity, they mirror opposite assumptions. By implication, a rejection of the PP test null hypothesis should mean acceptance of the KPSS test assumption. The series was subjected to the PP test and KPSS test at levels with constant and trend, the result showed that none of the variables was stationary at level for the PP test. Meanwhile, the use of the KPSS test found most of the variables recording weak significant values depicting stationarity at levels. This led to testing at the first difference for both approaches, all sampled variables registered significant prob-values through the PP test. Again, the KPSS test found all the variables

recording strong t-statistics which means that the variables were stationary with mixed order of integration of both orders I (0) and I (1) as presented on Table 4.3. This result is plausible since the application of the ARDL estimation technique still functions properly with variables that are integrated with mixed order of I (0) and I (1). This also gives room for conducting long run cointegration tests.

Table 4. 3: Stationarity result

	PP Test					KPSS Test		
Variable	**Level**		**1st Difference**		**Order**	**Level**	**1st Difference**	**Order**
	t-Statistic	**Prob.**	**t-Stat**	**Prob**		**t-Statistic**	**t-Statistics**	
CO	-1.46	0.84	-4.3659	0.013**	(1)	0.452**	0.386***	(0)
DFS	-2.117	0.533	-5.7236	0.001***	(1)	0.638**	0.166**	(0)
EXR	-2.044	0.574	-3.985	0.028**	(1)	0.3807*	0.322***	(1)
FE	-1.748	0.726	-5.6562	0.002***	(1)	0.3848*	0.2202***	(1)
FI	-2.954	0.148	-15.22	0.000***	(1)	0.366**	0.195**	(0)
FIF	-3.001	0.134	-8.2576	000***	(1)	0.528**	0.231***	(0)
GDP	2.375	1.000	-2.6915	0.025**	(1)	0.5813**	0.481***	(0)
GE	-0.049	0.995	-6.0732	0.001***	(1)	0.580**	0.480***	(0)
MS	-2.007	0.593	-5.571	0.001***	(1)	0.347*	0.409***	(1)
TO	-0.665	0.974	-3.0266	0.015**	(1)	0.586**	0.316***	(0)

Source: E-views estimate (2023). Note: *, ** and *** denote significance at 10%, 5% and 1%.

4.5 Lag Length Selection

In statistical analysis, lag length is the number of previous years' observations that is required to compute an estimation (Granger, 1965). Lags are the appropriate number of past observations of regressors and regressand that need to be included in a model. The process of selecting the maximum lag length involves fitting different models with various lag lengths and computing the Akaike Information Criterion (AIC) or Bayesian

Information Criterion (BIC) for each model. The lag length that yields the lowest chosen information criterion value is considered the best choice for the model. Aside from the use of AIC and BIC, there are other conventional lag length selection criteria used in statistical studies. These include Schwarzman Information Criterion (SIC), Lagrange Multiplier (LM), Hanan Quin (HQ), and Feasible Production Error (FPE). All the aforementioned lag length selection criteria were deployed by the study through the Vector Autoregressive (VAR) approach. Results showed a maximum lag length of 2, the lag length of 2 was accepted because there was a consensus among all the information criteria showing a maximum lag of 2. Though the various criteria supported the lag length of 2, the study principally dwelled on the HQ technique. The result for the VAR lag length selection is presented in Table 4.4 whilst the result for the Vector Autoregressive estimate is presented in Appendix 1.

Table 4. 4:VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-9423.407	NA	6.31e+30	99.29902	99.46992	99.36825
1	-3597.008	10978.16	41925.93	39.02113	40.90099	39.78264
2	-2479.714	1987.607*	0.944667*	28.31278*	31.90160*	29.76656*
3	-2464.602	25.29360	2.356056	29.20633	34.50411	31.35238
4	-2446.709	28.06358	5.816926	30.07062	37.07735	32.90894
5	-2425.106	31.60849	14.18080	30.89585	39.61155	34.42645
6	-2398.411	36.24810	33.92224	31.66749	42.09215	35.89037
7	-2364.526	42.44619	78.64500	32.36343	44.49705	37.27858
8	-2320.193	50.86631	172.7803	32.94940	46.79197	38.55682

Source: E-views estimate (2023).

4.6 Causality Test

When studying relationships among variables, researchers adopt a causality test, if causality is found, it means that changes in one variable are directly influencing changes in the other variable (Granger, 1969; Toda & Yamamoto, 1995). However, if no causality is found, it suggests that the two variables may not have a significant cause-and-effect relationship, and other factors might be more influential in driving the underlying variable which is food inflation in Ghana in this context. To examine the determinants of food inflation in Ghana, the study deployed the Toda and Yamamoto causality test otherwise known as the Wald test. Toda and Yamamoto causality test is a time series causality testing technique developed by (Toda & Yamamoto, 1995) which is an upgraded version of the conventional Granger causality test advanced by (Granger, 1969). The Toda and Yamamoto causality test was adopted by the study due to the strength of the technique in overcoming problems associated with time series data such as random walk as confirmed by (Forson & Janrattanagul, 2014). Again, the use of the Toda and Yamamoto causality test still proves efficient in examining causality among series that is not stationary as confirmed by the empirical study (Asiamah, 2023). The causality test is anchored on the null hypothesis that the sampled causal variables do not cause the effect variable which is rejected at the 5% significance level. A causality p-value of less than 0.05 means rejection of the null whilst a causality p-value of greater than 0.05 means failure to reject the null. The result of the causality test is presented in Table 4.5, findings revealed that out of the sampled variables in the study, the real effective exchange rate recorded a p-value of 0.017 which indicate significance at the 5% level.

Per this result, the null hypothesis that the real effective exchange rate does not granger cause food inflation in Ghana is rejected thus the alternative is accepted and concludes that the real effective exchange rate granger causes food inflation in Ghana. On the other hand, when the real effective exchange rate was substituted into the estimation as the dependent variable, food inflation recorded a p-value of 0.267 see the result in Appendix 2. Premised on this result, the study fails to reject the null and concludes that food inflation in Ghana does not granger cause the real effective exchange rate. According to the causality result Table 4.5, Domestic Food Supply (DFS) Granger causes food inflation in Ghana based on the p-value 0.005*** registered by the DFS. The alternative hypothesis that domestic food supply causes food inflation in Ghana is accepted upon rejection. However, when DFS was substituted into the estimation as the effect variable, FIF recorded a p-value of 0.586 which depicts the failure to reject the null hypothesis and signifies the absence of causality from FIF to the domestic food supply. This leads to the conclusion that there is unidirectional causality from domestic food supply to food inflation in Ghana. On the causality between crude oil price and food inflation in Ghana, crude oil showed a p-value of 0.037** which means that the null hypothesis of no causality is rejected and the alternative of presence of causality is accepted. Food inflation registered a p-value of 0.512 upon instituting crude oil as the dependent variable. Since the p-value of 0.512 as presented in Appendix 2 is greater than 0.05, the study fails to reject the null and adds that food inflation does not granger cause crude oil prices. This leads to the overall conclusion that there is unidirectional causality from crude oil to food inflation in Ghana.

Trade openness showed a p-value of 0.169, the significance level of 0.05 is less than this value premised on this, the study fails to reject the null and concludes that trade openness does not granger cause food inflation in Ghana. Money supply when substituted as the dependent variable recorded a p-value of 0.865 as presented in Table 4.5 which leads to the failure to reject the null and conclude that money supply does not granger cause food inflation in Ghana. Similarly, food inflation was found not to cause money supply in Ghana after the rejection of the alternative hypothesis. Government expenditure demonstrated a p-value of 0.274 per Table 4.5 which is way above the rejection level of 5% leading to the rejection of the alternative hypothesis and adding that government expenditure does not granger cause food inflation. On the other hand, food inflation recorded a p-value of 0.728 which indicates the failure to reject the null and conclude an absence of causality from food inflation to government expenditure.

Gross domestic product revealed a p-value of 0.353, based on this the alternative hypothesis is rejected and adds that gross domestic product does not granger cause food inflation in Ghana. Food inflation on the other side was found not to cause gross domestic product. Food import registered a causality probability of 0.583 signalling no causality on food inflation. Similarly, food inflation per Appendix 2 recorded a p-value of above 0.05 leading to the rejection of the alternative hypothesis and conclusion that food inflation does not granger cause the price of imported food. According to Table 4.5, food export had a p-value of 0.999, since this value is above the rejection level of 0.05, the study fails to reject the null and conclude that food export does not granger cause food inflation in Ghana. Likewise, for food inflation which also recorded a p-value of greater than 0.05

per Appendix 2, the study fails to reject the null and conclude that there is no causality between food export and food inflation.

Table 4. 5:Toda and Yamamoto Causality test

Dependent variable: FIF			
Excluded	**Chi-sq**	**df**	**Prob.**
TO	3.559627	2	0.1687
MS	0.289493	2	0.8652
GE	2.591611	2	0.2737
GDP	2.080920	2	0.3533
FI	1.078631	2	0.5831
FE	0.000142	2	0.9999
EXR	5.103725	2	0.017**
DFS	10.75175	2	0.005***
CO	6.618897	2	0.037**
All		16	---

Source: E-views estimate (2023). **Note** *, ** and *** denote significance at 10%, 5% and 1%.

4.7 Long Run Cointegration

Cointegration in statistical analysis demonstrates the movement of variables in the long run. Availability of cointegration in a series means that the variables correlate in the long run. It is an assessment test carried on to establish whether a series cointegrate in the long run to warrant long-run regression test using appropriate estimation technique mostly through the ARDL. The cointegration test is built on the null hypothesis that the series is not cointegrated against the alternative that there is cointegration (Ibrahim et al., 2022). This is rejected or accepted per the lower and upper bound test critical values against the F-Statistics critical value at a 5% level of significance. The null is accepted if the critical value of the F-Statistics at the 5% level is less than the lower bound value of the bound

test. On the other hand, the null is rejected if the critical value of the F-statistics at 5% is greater than the upper bound value indicating the presence of cointegration. According to the result, as presented in Table 4.6, the critical value of the F-statistics of 6 was greater than the upper bound value of 3.28. Per this result, the study rejects the null hypothesis that there is no cointegration and concludes that there is cointegration. Again, on the Model 2 estimation, the result showed an F-statistics critical value of 6 as against upper and lower bound values of 2.38 and 2.27 respectively. Per the foregoing, the study rejects the null hypothesis and concludes on Model 2 that there is cointegration. The ascertained result gives room for the conduct of a long run ARDL test. The result of the cointegration test is presented in Table 4.6.

Table 4. 6: Bound testing to Cointegration

Models	Bound test F-stat	5% critical value	Remarks
Food Inflation Model			
fif = f(co, dfs, exr, fi, ge, gdp)	6	Upper (3.28) Lower (2.27)	Cointegration exist
fif = f(co-sq, dfs-sq, exr-sq, ge, fi, gdp)	6	Upper (2.38) Lower (2.27)	Cointegration exist

Source: E-views estimate (2023).

4.8 Heteroskedasticity Check

Heteroskedasticity is a phenomenon in time series data that is said to be present when the variance of the series is not equal across all values of X (Ibrahim et al., 2022). Heteroskedasticity, also known as heteroscedasticity, is a term used in statistics and econometrics to describe a situation where the variability of a variable is not constant across its range of values. In simpler terms, it means that the spread or dispersion of the

data points changes as the value of the independent variable(s) changes (Ibrahim et al., 2022). To assess the presence of heteroskedasticity in a series several testing approaches have been propounded including the conventional Breusch-Pagan-Godfrey test, Autoregressive conditional Heteroskedastic (ARCH) test among others. The research dwelled on the Breusch-Pagan-Godfrey test in checking for heteroskedasticity which tested the null hypothesis that the series is homoscedastic at a 5% significance level. A p-value of less than 0.05 leads to the rejection of the null and acceptance of the alternative. Nevertheless, a p-value greater value than 0.05 implies acceptance of the null and the conclusion that the series is homoscedastic. According to the Breusch-Pagan-Godfrey heteroskedasticity result presented in Table 4.7, the p-values of 0.108 lead to the failure to reject the null and conclude that the series is homoscedastic.

Table 4. 7:Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.602628	Prob. F(10,194)	0.1082
Obs*R-squared	15.64275	Prob. Chi-Square(10)	0.1103

Source: E-views estimate (2023). **Note** *, ** and *** denote significance at 10%, 5% and 1%.

4.9 Stability Test

The stability test is an assessment test conducted in time series analysis to ensure the model used in the estimation is stable and capable of yielding reliable results (Ibrahim et al., 2022). Through the use of recursive estimates such as CUSUM and CUSUMSQ, the stability of a model can be measured. The study deployed the two aforementioned tests to assess the stability of its models based on the credence given by empirical study see (Ibrahim, 2022; Dekowski et al. 2023). The CUSUM and CUSUMQ estimates presented

in Figure 4.1 reveals that the distribution falls within the 5% critical margin which signifies that the model is stable.

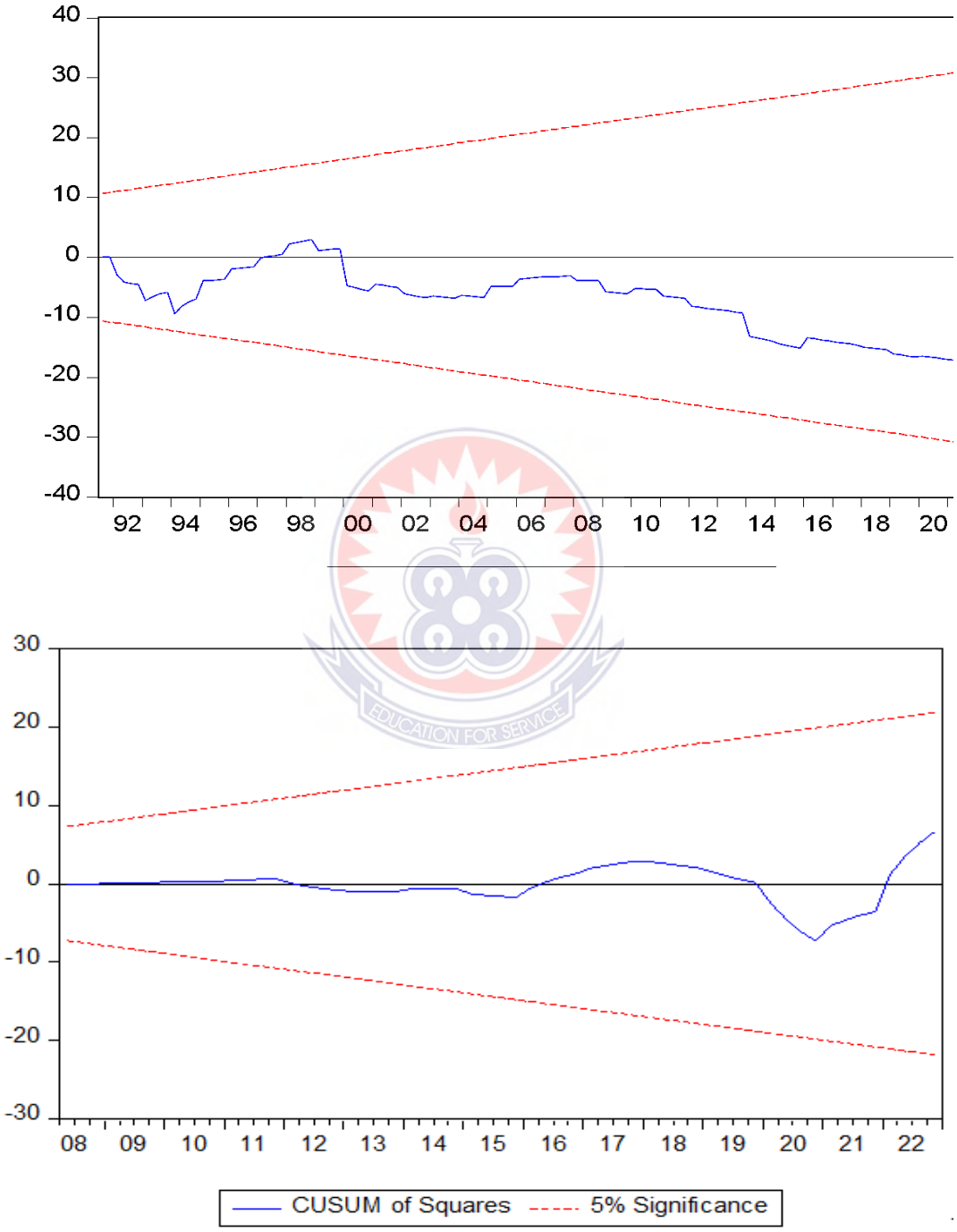

Figure 4 1: Stability test

4.10 Relationship between Food Inflation (FIF) and determinants of food inflation in Ghana.

To examine the relationship between the determinants of food inflation and food inflation in Ghana, the study relied on the ARDL estimation technique which is efficient in both small and large sample datasets and can examine both the short and long-run effects of regressors on a regressand. The approach has the strength of normalizing time series-associated problems like serial correlation, autocorrelation among others as confirmed by (Dekowski et al., 2023; Ibrahim et al., 2022). The study conducted both short and long run estimations based on two Models. The first Model examines the linear effect of the ascertained determinants of food inflation whilst Model 2 examines the exponential effect of the determinants on food inflation to unravel the true effect when there is non-linear increase in these variables as experienced in Ghana.

Per the objective of the study, all variables that were found not to granger cause food inflation were eliminated from the regression test as the interested variables. This point out that the main variables of focus in the ARDL test are crude oil, domestic food supply, and real effective exchange. However, since no economic phenomenon operates separately, the study controlled for food import, gross domestic product, and government expenditure. Aside from the use of heteroskedasticity in ensuring the robustness of the study's result, other post-estimation diagnostics were deployed to assess the reliability of the results which are discussed as follows. In statistics, R-square is a measure that shows the total explanatory power exhibited by the combined regressors in a series on the regressand.

Due to the kitchen sink problem that makes the R-square monotonic in nature and increases as more variables are added to the regressors, it often becomes inefficient to use the R-square to measure the explanatory power exerted by the independent variables, the Adjusted R-square was introduced which is efficient in controlling additional power introduced in the model by new regressors added to the model as confirmed see (Dekowski et al. 2023). Surprisingly, the tests registered an R-square of 0.992 with an Adjusted R-square of 0.991 for both Model 1 and Model 2 according to Table 4.8. Based on the discourse above, the study dwelled on the Adjusted R-Square in examining the total explanatory power of the regressors. In conclusion, the independent variables accounted for 0.99 variation in the dependent variable, this signifies that the model is fit for examining the intended effect. The Model 1 recorded a regression error of 0.0714 meanwhile Model 2 recorded an estimation error of 0.071, since this is less than 1, we conclude the Models are accurate. F-statistics is a measure used to assess the significance of an entire model. This is rejected at the alpha value of less than 0.05 on the null hypothesis of the model is not significant. Models 1 and 2 showed prob(F-stat) values of 0.000*** and 0.000*** respectively. Per this result, the study rejects the null hypothesis and concludes that the model is significant.

Table 4. 8: ARDL result for FIF and determinants of food inflation.

Variable	Long Run		Short Run	
	Model 1	**Model 2**	**Model 1**	**Model 2**
C	2.944	1.490	10.482	6.552
	(0.000***)	(0.000***)	(0.000***)	(0.000***)
FIF(-1)			0.956	0.956
			(0.000***)	(0.000***)
CO	0.253		0.011	
	(0.015**)		(0.002**)	
DFS	-1.195		-0.052	
	(0.001***)		(0.001***)	
EXR	-1.042		-0.046	
	(0.000***)		(0.000***)	
CO_SQ		0.001		0.006
		(0.027**)		(0.007**)
DFS_SQ		-0.008		-0.003
		(0.001***)		(0.002**)
EXR_SQ		-0.005		-0.002
		(0.000***)		(0.000***)
GDP	-0.167	-0.172	-0.007	-0.007
	(0.561)	(0.549)	(0.565)	(0.551)
FI	-3.574	-3.556	-0.157	-0.156
	(0.000***)	(0.000***)	(0.000***)	(0.000)
GE	0.003	3.920	0.001	1.721
	(0.352)	(0.270)	(0.356)	(0.273)
ECM			-0.044	-0.044
			(0.000***)	(0.000***)
R-Square			0.992	0.992
Adj R-squared			0.991	0.991
S.E of regression			0.0714	0.0718
Prob(F-stat)			0.000***	0.000***

Source: E-views estimate (2023). **Note *,** ** and *** denote significance at 10%, 5% and 1%. Figures in parenthesis are probabilities whilst those without are coefficients.

4.11 Discussion of Results

This section of the study interprets the result ascertained from the various empirical tests.

4.11.1: Objective One: Causes of food inflation in Ghana

According to the causality test, the study concludes that there is a unidirectional causality from the real effective exchange rate to food inflation in Ghana as described earlier. This conclusion means that any variation in the Ghanaian cedi exerts a significant impact on food prices in the country. This impact can be either positive or negative on food inflation. Again, the causal effect of the real exchange rate on food cost in Ghana means that a unit appreciation or a unit loss or gain of value to the major trading currencies affects the general price of food commodities in Ghana. The ascertained result means that changes in food commodities prices in Ghana significantly depends on the performance of the Ghanaian cedi to other world trading currencies. Also, the recorded result translates that a gain in the value of the Ghanaian cedi to the Chinese Yuan can trigger variation in the prices of food commodities imported from China such as perfume rice among others.

Furthermore, an increase or depreciation in the real effective exchange rate (i.e., a decrease in the value of the domestic currency relative to a basket of foreign currencies) leads to an increase in food inflation in Ghana. This indicates that when the country's currency weakens against other currencies, the cost of importing food and other goods rises, leading to higher food prices domestically. On the other hand, the absence of causality from food inflation to real exchange rate meant that changes in food inflation do not seem to have a notable effect on the real effective exchange rate. This suggests that food inflation is not a significant driver of currency movements or exchange rate

fluctuations in Ghana, at least in the time frame and data used for the analysis. It's important to note that causality tests do not necessarily imply a direct cause-and-effect relationship between variables; rather, they indicate a statistical association or influence in a particular direction. Other factors and economic conditions might also be contributing to food inflation and currency movements in Ghana, which the causality test might not have considered.

This finding coincides with the result of Bane (2018) who discovered that food commodities price hikes are caused by variations in the real effective exchange rate. Again, the finding that real effective exchange rate granger causes food inflation is conventional because the same result was ascertained by Osei (2014) in the investigation that dwelled on secondary data in assessing the factors that cause food inflation in Ghana for the period preceding 2014. Moreso, the inquiry of Bawa et al. (2016), Nguyen (2015), and Makun (2021) on the factors that influence food prices in Eswatini, India, and South Africa concluded that movement in the real effective exchange of the various country's currencies to other major trading currencies triggers considerable hike in food prices. Additionally, the study of the causality between real exchange rate and food inflation unveiled that there exists a unidirectional causality from real exchange rate to food inflation. The similarity in the result of previous studies to that recorded by the current study is attributed to the dormancy of the currency of the sampled countries to that of major trading currencies like that of the United State dollar, Great Britain pounds, and the German euro.

On the causality between trade openness and food inflation in Ghana, the test found no causality between the two. This result suggests that based on the analysis conducted,

there is no evidence to support the idea that changes in trade openness have a significant impact on food inflation in Ghana. Again, the finding means that the level of openness or liberalization of trade through lessening cross-border restrictions in Ghana does not appear to be a driving factor influencing the inflation rate of food products in the country. This result confirms the finding of Aimola et al. (2021) whose study of the determinants of food inflation in Nigeria concluded that trade openness does not significantly impact inflation in Nigeria. Notwithstanding, the authors found the opposite result when the study was replicated in Ghana (Aimola et al. 2021). The consistency of the result of Aimola et al (2021) could be possible as a result of the bilateral relationship between Nigeria and Ghana again, both studies used the same ARDL technique as employed in the present study. The divergence in the findings from that of Aimola et al. (2021) in Ghana could be attributed to different datasets and periods characterized by different economic conditions.

The causality test showed an absence of causality between money supply and food inflation rate in Ghana. This finding implies that changes in the money supply in the economy do not have a significant impact on the rate of food inflation in the country. In practical terms, this result has several potential interpretations and implications. That is monetary policy pursued by the central bank and policymakers in Ghana may need reassessment of the monetary policy tools and strategies. If changes in the money supply do not influence food inflation, focusing solely on monetary measures to control food inflation may not be effective. Policymakers might need to explore other tools and policies to address food price instability. Per theory, the absence of causality between money supply and food inflation rate in Ghana, as indicated by the causality test

contradicts the predictions of the Monetarist inflation theory, which is based on the Quantity Theory of Money. The Quantity Theory of Money, as postulated by Friedman (1960) and later expanded upon by Friedman and Schwartz (1963), suggests that fluctuations in the overall price level in an economy are primarily driven by changes in the money supply when other factors such as the velocity of money and nominal income remain constant.

In the context of the Monetarist inflation theory and the Quantity Theory of Money, if the money supply in an economy increases, and the velocity of money (the speed at which money circulates in the economy) and nominal income (total income without adjusting for inflation) remain constant, then it should lead to a proportional increase in the overall price level, including food prices (food inflation). However, since the causality test shows no significant relationship between money supply and food inflation in Ghana, it suggests that the assumption made by the Monetarist inflation theory does not hold for the Ghanaian perspective. There may be several potential reasons for this discrepancy which include but are not limited to variations in macroeconomic variables, inherent spatial influences in the economy as well as specific economic and monetary policies pursued by the Ghanaian government that has the potential for altering the expected effect.

Again, the no evidence of causality found by the study is inconsistent with the assertion of the structural inflation theory. This is true because the structuralists argue that investment expenditure and money supply expansion are immediate causes of inflation, meaning they play a direct role in driving inflationary pressures in the short term. However, the absence of causality between government expenditure and food inflation in Ghana indicates that these immediate factors might not have a strong direct impact on

food price inflation within the country. The finding of no causality between money supply and food inflation in Ghana contradicts the argument put forward by Bane (2018), Osei (2014), Adom et al. (2015), and Unsal (2015) who unanimously concluded that money supply impact the price of food commodities significantly. Again, the account of previous studies see Nguyen (2015), Mohammed (2016) documented that food inflation is influenced by the variation in money supply in an economy. Moreover, Agyei (2018) and Doudo (2022) provided sufficient evidence in their study that the causes of inflation in Ghana is dominated by money supply which is consistent with the present finding.

Similarly, government expenditure on the other side, showed no causality on food inflation in Ghana. It means that changes in the level of government spending in the economy do not have a significant impact on the rate of food inflation in the country. In practical terms, this result carries several possible interpretations and implications. The discovery shows that there is limited fiscal policy influence on food inflation which translates that government expenditure, as a fiscal policy tool, might not be effective in directly controlling or influencing food prices in Ghana. In other words, increasing or decreasing government spending on its own does not seem to have a substantial effect on the inflation rate of food products. Similar to the absence of causality between money supply and food inflation, this result indicates that other factors are likely more dominant drivers of food inflation in Ghana. The no causality could also mean that the increase in government spending does not predominantly focus on the food production sector of the economy. From a theoretical perspective, the result deviates from the prepositions of the structural theory of inflation as advanced by (Myrdal & Straiten, 1968; Riti and Kumah, 2015; Bassey, 2019).

The structuralists argue that investment expenditure and money supply expansion are immediate causes of inflation, meaning they play a direct role in driving inflationary pressures in the short term. However, the absence of causality between government expenditure and food inflation in Ghana indicates that these immediate factors might not have a strong direct impact on food price inflation within the country. Also, the finding that government expenditure does not Granger cause food inflation in Ghana challenges the notion put forth by the structural inflation theory that investment expenditure is a direct driver of inflation in developing countries. It highlights the need to explore a broader set of structural factors that influence inflation in Ghana and other developing nations.

This result is non-conventional as it opposes the literature see Bane (2018), and Unsal (2015) who provided evidence that food inflation is significantly impacted by variation in government expenditure. Again, the result is incongruent with the study of Mohammed et al. (2016) who unveiled that food inflation hikes in Algeria are predominantly caused by the level of expenditure incurred by the government. The inconsistency in the finding could possibly be a result of the different economic terrain and spatial effect of the two countries.

Food export like that of government expenditure had no causality with food inflation in Ghana. It signifies that changes in the level of food exports from the country do not have a significant impact on the rate of food inflation within Ghana. In practical terms, this result carries several possible explanations. The finding suggests that the quantity of food exported from Ghana does not directly affect the domestic prices of food products within

the country. Even if food exports increase or decrease, it does not lead to substantial changes in the inflation rate of food items available for local consumption.

Overall, the result indicating no causality between food exports and food inflation in Ghana suggests that changes in food export levels are not directly linked to changes in domestic food inflation. The plausible reason leading to this result is that the country engages in the export of fewer or no staple food products unlike other countries like the People's republic of China. Also, this result is intuitional because Ghana since the 1990s mostly exported mineral resources like aluminium, gold, bauxite, manganese, and non-staple food products such as Cocoa. The finding of no absence of causality between food export and food inflation in Ghana deviated from the account of Qayyum and Sultana (2018) who unearthed that food prices in Pakistan are predominantly fuelled by food export.

Likewise, food import does not granger cause food inflation in Ghana. This result, though surprising, means that changes in the level of food imports into the country do not significantly predict or lead to changes in the rate of food inflation within Ghana. In other words, fluctuations in the quantity of food imported into the country do not have a substantial impact on the inflation rate of food products available in the domestic market. The finding implies Ghana may have multiple sources of food, and the country's reliance on imported food items may not be substantial enough to exert a significant influence on domestic food prices. The availability of locally produced food and other factors could dampen the direct impact of food imports on inflation. This result is found surprising and deviates from the expectation of the study because Ghana has been a predominantly import dependent country over the last decade for food items such as frozen chicken,

parboiled rice, and cooking oil just to mention but few. The plausible reasons for this result could be attributed to the fact that the government subsidizes the cost of importing food items or the country imports food commodities from a cheaper source.

Again, another possible reason for the result of no causality between food import and food inflation in Ghana is that imported food is consumed by the elite class making it less possible for importers to shift their total cost of importation to the final consumer. The finding contravenes the result of Makun (2021) whose study unveiled that food import cost significantly drives up food inflation in Fiji. Again, the absence of causality of food import on food inflation in Ghana refutes the argument as put forward by Qayyum and Sultana (2018) in their empirical enquiry that unveiled that food importation is a significant contributor to food inflation in Pakistan. The divergence in the findings is as a result of myriad spatial factors that prevail in these economies. For instance, fiscal policies pursued by the central government of Pakistan may be significantly different from those set by the Ghanaian government regarding food import.

In a similar vein, gross domestic product was found not to granger cause food inflation in Ghana. This finding means that there is no evidence of a cause-and-effect relationship between the country's Gross Domestic Product (GDP) and food inflation. In other words, changes in Ghana's GDP do not lead to changes in food inflation, and changes in food inflation do not cause fluctuations in GDP. The growth in the gross domestic product means the economy is expanding whilst decreases in GDP shows that the economy is contracting in terms of progress. Therefore, the absence of causality connotes that as the economy expands or contracts it does not trigger any effect whatsoever on the level of prices of food commodities in Ghana. The possible reason for the recorded result could

be that as the Ghanaian economy grows, indigenous do not increase their consumption or engage in activities that fuel food inflation in the country. This result contradicts the evidence of Makun (2021) who unearthed that gross domestic product granger causes food inflation in Fiji. Again, Aimola et al. (2021) found that changes in the gross domestic product, possibly GDP growth cause food inflation in Nigeria. Also, the absence of causality registered by GDP debunks the finding of Qayyum and Sultana (2018) whose study on the determinants of food inflation in Pakistan revealed that GDP significantly influences food inflation.

Conversely, the crude oil price was found to granger cause food inflation in Ghana meanwhile food inflation did not granger cause crude oil price. This shows the presence of unidirectional causality between crude oil and food inflation in Ghana. The study's result means that changes in crude oil prices can be used to predict future changes in food inflation in Ghana. This suggests that fluctuations in crude oil prices have an impact on food inflation in the country. The unidirectional causality indicates that the causality between the two variables is one-way. In this context, crude oil price is found to granger cause food inflation in Ghana, but the reverse is not true. Changes in food inflation do not provide information that can help predict future changes in crude oil prices.

The result is intuitional since Ghana is a fossil fuel importer therefore, a change in the price of crude oil on the world market would have an impact on the level of production and production cost in the economy by manufacturing firms and consequently translates into food prices. Also, the result meets the expectation of the study since most of the industries and food value chain dealers depend on fuel in their operations such as transport operators and warehouse dealers for cooling and heating food items. This

finding supports the results of Mndzebele (2021); Bane (2018), and Mohammed et al. (2016) who provided evidence that food inflation in the Kingdom of Eswatini, Ethiopia and Algeria is significantly influenced by changes in the price of crude oil. Also, Davidson et al. (2016) and Adom et al. (2015) empirically proved that food inflation is fueled by variations in crude oil prices.

Additionally, the domestic food supply was found by the causality test to cause food inflation in Ghana. Nonetheless, there was no evidence of causality from food inflation to the domestic food supply in Ghana. This implies the existence of unidirectional causality between domestic food supply and food inflation. The result shows that in Ghana domestic food supply provide information that helps predict future changes in food inflation, but food inflation does not provide information about future changes in domestic food supply. The ascertained result implies that fluctuations in the availability of domestically produced food can influence the overall inflation rate in Ghana. Interpretation is that when the domestic food supply is limited due to factors such as adverse weather conditions, low agricultural productivity, or supply chain disruptions, it can lead to significant changes in food prices in the market, resulting in food inflation. This result has implications for food security in emerging economies like that of Ghana which depends largely on stable and sufficient domestic food supply to meet the needs of its population. Unidirectional causality from domestic food supply to food inflation underscores the significance of maintaining a resilient and efficient agricultural sector that can meet domestic demand consistently.

4.11.2 Objective two: Effect of the identified factors on food inflation in Ghana

This session of the discussion is based on the three variables that were found through the causality test to cause food inflation in Ghana. Real effective Exchange Rate (EXR), recorded a coefficient of -1.042 and probability of 0.000*** in the long run and a coefficient of -0.046 with a p-value of 0.000*** in the short run. This shows that there is a significant inverse association between the real effective exchange rate and food inflation in Ghana. The negative effect of the real exchange rate on food inflation in Ghana suggests that an increase in the exchange rate of the Ghanaian cedi relative to other currencies leads to a decrease in the rate of food inflation in the country. In other words, when the cedi appreciates against other currencies, it tends to have a moderating effect on food price inflation. The observed finding could be triggered by several factors, for example, Ghana, like many other countries, relies on importing certain food items to meet its domestic demand such as frozen Chicken, and perfumed rice among others.

When the cedi appreciates, it means that each unit of the local currency has become stronger compared to foreign currencies as a result, the cost of importing food items may decrease. Since imported food products make up a significant portion of the country's food supply, a decrease in their cost due to a stronger cedi can contribute to lower food prices. Again, an appreciating exchange rate can also lower the cost of imported inputs and raw materials used in domestic food production. For instance, agricultural machinery or fertilizers that are imported can become cheaper in local currency terms, potentially leading to increased productivity and reduced production costs for local farmers. These cost savings can be passed on to consumers in the form of lower food prices in both the short and long run. Also, the recorded finding could be a result of price competitiveness

since a stronger cedi can make domestically produced food relatively more competitive compared to imported alternatives. Consumers may opt for locally produced food items, and producers may adjust their prices to remain competitive in the market. This competitive pressure could lead to a moderation in food price inflation. Moreover, a stronger cedi may positively impact Ghana's trade balance, particularly if the country relies heavily on food imports.

A better trade balance can lead to an increased supply of foreign exchange reserves, potentially stabilizing the currency and further impacting food prices. It is imperative to note that the magnitude of the adverse effect of real effective exchange on food prices is more intense in the long run than in the short run. In the context of theoretical prepositions, the observed result is line with the admonition of the Keynesian inflation theory which states that inflation in an economy is driven when aggregate demand outstrips aggregate supply in that appreciation in the cedi would lead to lower import cost which can have a dampening effect on food prices as imported goods may become cheaper for consumers driving an increase in aggregate demand which if not commensurate with requisite supply would result in inflation as postulated by the Keynesian framework (Defina, 1991). Again, the observed result aligns with the prepositions of the Keynesian theory because strengthening of the cedi leads to reduced cost of production emanating from lower input cost for food production materials used in domestic production. This can enhance supply by reducing production expenses for farmers and food producers, potentially mitigating upward pressure on food prices. The ascertained result is unconventional since it is consistent with the account of Davidson et

al. (2016) who found that an increase in the real effective exchange rate leads to higher prices of food commodities.

Moreover, the result opposes the argument as put forward by Bane (2018), Osei (2014), and Nguyen (2015) who unanimously found that a rise in the real effective exchange rate triggers a sore in the price of food items. Moreso, the result that a rise in exchange rate among currencies leads to hikes in the price of food items as put forward by Mohammed et al. (2016), Qayyum and Sultana (2018), and Makun (2021) in Algeria, Pakistan, and Fiji respectively is opposed by the present negative finding.

Domestic Food Supply (DFS) registered a coefficient of -0.052 at a p-value of 0.001*** and a coefficient of -1.195 with a probability of 0.001*** for short and long respectively. This indicates a statistically significant negative relationship between domestic food supply and food inflation in Ghana in both the long and short run. The observed result meant that a unit rise in the quantity of a basket of food supplied in the economy would lead to a remarkable decline in the price of a basket of food commodities. The result indicates a strong correlation between domestic food supply and food inflation in Ghana as a rise leads to a marginal fall in price whilst a decline leads to a rise in food price in both the short and the long term. This finding connotes that in the interim period measures put in place to boost domestic food production contribute significantly to a reduction in prices of food commodities. Again, in the long-run sustained food production measures lead to a marginal reduction in food items in Ghana. The result is intuitional and meets the expectation of the study since enhancing the production capacities through the supply of farm implement such as weedicides, snap sack sprayer, moto-blow, combine harvesters, and improved and diseases resistant seedlings would

lessen pressures on farmers and expand their scope of production leading to high agricultural output.

Again, supporting farmers through agricultural credit would enable them to hire more laborers and acquire other necessary farm wares which would lead to higher yields. Furthermore, granting agricultural credit to farmers can lure and propel more youth and peasant farmers to engage in commercial farming which involves irrigational farming to produce crops all year round to make supply variety of crops. The aggregate effect of these interventions is an increase in food supply leading to a decline in prices of food commodities with ceteris paribus in both the interim period and the long run. Concerning theory, the result is consistent with the assertions of the Keynesian inflation theory which assert that inflation in an economy is primarily caused by rising aggregate demand for food over the corresponding supply for food or services as postulated (DeFina, 1991). The inverse relationship between domestic food supply and food inflation in Ghana supports the Keynesian theory because an increase in the supply of food items to outstrip aggregate demand would mean excess supply leading to decline in food prices. On the other hand, a decline in local food supply with aggregate demand remaining constant would lead to disequilibrium with more money chasing fewer goods with the resultant effect of inflation as championed by the Keynesian framework. The result confirms the reality experienced by the Ghanaian economy when the central government initiated its flagship policy of planting for food and jobs that led to a significant increase in the production of staple food crops with the net effect of a marginal decline in food items until the inception of the novel covid-19 which altered the narrative. The finding of the study supports the account of Bane (2018) whose empirical investigation on the

relationship between domestic food supply and food inflation in Ethiopia registered a negative relationship. Again, the inverse association between domestic food supply and food inflation affirms the result of Davidson et al (2016) who documented a negative relationship between the variables of domestic food supply and food prices.

On the contrary, the result refutes the finding of Nguyen (2015) and Osei (2015) who unanimously concluded in their studies that domestic food supply has a positive relationship with food inflation in India and Ghana respectively. Contrastingly, Makun (2021) documented that there is no significant relationship whatsoever between domestic food supply and food inflation as argued by previous studies. The consistency in the findings of this result with the previous account can be attributed to the use of the same estimation technique thus the ARDL whilst the discrepancies are attributed to the different settings, periods, datasets, and sources as some of these studies relied on data collected by national statistical agencies meanwhile others dwelled on primary data with high human interference.

Crude oil as the third driver of food inflation in Ghana as recorded by the study registered a coefficient of 0.11, p-value of 0.002** and coefficient of 0.253 and associated p-value of 0.015** for the short and long run accordingly. This implies a statistically significant positive relationship between crude oil prices and food inflation in both the short and the long run. The observed result signifies that a rise in crude oil prices on the world market leads to hikes in food prices in Ghana. Economically, the price of crude oil significantly impacts the prices of myriad items and services due to the commodity's crucial role it plays in keeping economies running. The effect of a crude oil price increase is felt in Ghana because the country is a heavy fossil fuel consumer therefore, an increase in the

price of the product on the world market triggers changes in the price of several items including food items in Ghana. For instance, in the transport industry, crude oil is a significant component of transportation and distribution costs within the food supply chain. When crude oil prices increase, the cost of transporting food from farms to markets and eventually to consumers also rises. These increased costs are often passed on to consumers, leading to higher food prices. Agriculture is an energy-intensive sector, relying on machinery, fertilizers, and other inputs that may be oil-dependent.

When crude oil prices are high, production costs for farmers and food processors can increase, leading to higher prices for food products. Global market dynamics turn to affect many emerging economies, Ghana, like many other countries, may rely on imported food items and processed goods. High crude oil prices can result in increased transportation costs for imported goods, leading to higher food prices in the domestic market. Inflation expectations can be a cause of inflation when consumers and producers expect higher crude oil prices to persist in the future, they may anticipate higher costs across the board, including food prices. This can lead to a self-fulfilling prophecy where inflation expectations drive actual inflation. This finding satisfies the expectation of the structural inflation theory which posits that inflation is primarily caused by the structure of a country's economy thus the systems and framework and how they interact as proposed by (Myrdal & Straiten, 1968; Riti & Kumah, 2015; Bassey, 2019).

This result reflects the structuralist theory in that when the country is not self-sufficient by operating its refinery to process crude oil for domestic consumption then any price hike in crude oil price on the international market would increase food prices in the country. The finding supports the account of Bane (2018), Mndzebele (2021), and Adom

et al. (2015) who unanimously concluded in their studies that an increase in crude oil prices significantly increases food commodity prices. Again, the evidence put forward by Davidson (2016) and Makun (2018) that crude oil has a positive relationship with food inflation is confirmed by the result of the present study. The consistency of the result with previous studies can partly be attributed to the use of the same econometric model in the estimation as well as the heavily dependent on fossil fuel by studied countries.

The control variable gross domestic product showed a negative statistically insignificant relationship with food inflation in both the short and long run in all models. This result is logical since the causality test revealed that gross domestic product does not correlate with or cause food inflation in Ghana. Food import, on the other hand, showed a negative statistically significant relationship with food inflation in Ghana in both the short run and long run. The recorded finding means that a rise in the quantum of food imported would drive food inflation in Ghana. This result, though logical, is anchored on the fact that the importation of food may be associated with several taxes which are pushed to the final consumer leading to a high cost of food in Ghana. This phenomenon is what the Ghanaian economy is experiencing with the rising cost of rice and frozen products which are predominantly. Government expenditure has a positive relation however statistically insignificant relationship with food inflation in Ghana. This means that a unit rise in government spending does not lead to any effect on the cost of food commodities in Ghana.

The observed finding may be a result of government expenditure geared toward improving infrastructure with little or no investment in the production sector. This account debunks the findings by Bane (2018) who discovered that rise in government

spending increases food commodity prices in Ethiopia as supported by the result of Unsal (2015) who also documented that there is a positive significant relationship between government expenditure and food inflation. Again, the study by Mohammed et al. (2016) in Algeria further proved that there is a positive significant relationship between government expenditure and food inflation. The discrepancy in the findings may be a result of different economic policies pursued by the various countries and which industry they set as a priority to benefit a chunk of government investment.

4.11.3 Non-linear effect of the determinants of food inflation on food inflation in Ghana

To assess the third objective, the study sought to answer the above research question through an exponential estimation in Model 2 with the result discussed as fellows. The lag value of the regressand had a positive statistically significant association with present values of food inflation in Ghana. This result means that the past inflationary figures do predict future inflationary pressures. This finding is economically reasonable because rational consumers would expect inflation in future periods if there is fierce inflation pressure today. Moreso, the ascertained result connotes that exponential records of inflation in previous years would trigger the current period inflation. The exponential constant also demonstrated a positive relationship with food inflation indicating that in the absence of the sampled determinants or when the determinant assumes zero values inflation would remain a positive value.

The exponent of crude oil recorded a coefficient of 0.001 with a p-value of 0.027** in the long run whilst short-run values stood at 0.006 for coefficient and 0.007** for p-value. The recorded result implies a positive statistically significant relationship between non-linear movement in crude oil prices and food inflation in Ghana. An exponential rise in

the price of crude oil on the international market leads to a 0.001 increment in food commodity prices in the long run whilst the magnitude of increment in the short run would be 0.006. It is worth noting that a linear increase in crude oil prices inflicts a higher magnitude of a positive impact on food commodity prices than it appears in the non-linear increase in crude oil prices in the Ghanaian narrative. The observed movement in food inflation as a result of a double increment in crude oil prices is more intense in the short run than in the long run. This result is logical and means that policies pursued by the central government and other policymakers play a mitigating role in restoring the economy from crude oil price shocks in the long run in Ghana. The findings connote that the government of Ghana is efficient in its economic policies in restoring distortions emanating from non-linear increases in crude oil prices. This result supports the moderate speed of adjustment rate recorded by the ECM in bringing the variation in the series back to equilibrium. The lesser impact of non-linear increment in crude oil prices on food inflation in Ghana is attributed to possible government interventions initiated to absorb the undesirable exponential rise in oil prices.

Comparatively, exponential increase in domestic food supply recorded a coefficient of -0.008 and p-value of 0.001*** for the long run meanwhile the short run estimate revealed -0.003, 0.002** as coefficient and p-value respectively. This implies a statistically significant inverse relationship of the domestic food supply with food inflation in Ghana for both the short-run and long-run periods. A non-linear rise in the domestic food supply would cause a significant reduction in the price of food commodities. The observed results indicate that the inverse effect of an exponential increase in the domestic food supply is lesser than the effect resulting from a linear increase in the domestic food

supply on food inflation in Ghana. The ascertained finding means that when a country doubles its food production capacities by providing easy access to credit for farmers, providing farm wares such as weedicides, improved seedlings reduce the cost of farming and increase output leading to a significant decline in food prices in Ghana. Moreover, if these initiatives are complemented with storage facilities through the provision of silos among others, harvested farm produce can be stored for a longer period and supplied at affordable prices in the long run. This result as observed in the Ghanaian narrative is not surprising since the Ghanaian government initiated an agricultural policy dubbed planting for food and jobs which has made available enough staple food crops since 2017.

The result deviates from the expectation of the structuralist inflation theory as advanced by Myrdal and Straiten (1968) which posits that an increase in inflation in an economy is caused by systems and structures within an economy (Bassey, 2019). The study's result contends the structuralist theory because when the country institute measures to double its food production, it reduces food inflation. Also, the negative association between the exponential rise in domestic food supply and food inflation in Ghana agrees with the expectation of the Keynesian inflation theory Defina (1991) and McKnight et al. (2020) in that a double increase in the food supply would outweigh demand for food leading to a marginal decline in food inflation. The negative findings correspond with the studies of Osei (2014) and Nguyen (2015) who discovered an inverse relationship between domestic food supply and food inflation in Ghana and India respectively. Contrastingly, the inverse relationship disagrees with the finding ascertained by Davidson et al. (2016) who documented that there is a positive relationship between domestic food supply and food inflation.

The non-linear exchange rate registered a coefficient of -0.002 and p-value of 0.000*** for the short run whilst the long run coefficient and p-value are -0.005 and 0.000*** respectively. This signifies a negative association between non-linear exchange rates and food inflation for both runs in Ghana. The finding means that an exponential increase in exchange rate leads to a 0.002 reduction in food inflation in Ghana during both the short run and long run. A decreasing food inflation rate can have positive implications for the economy and consumers in Ghana. It implies that as the local currency strengthens against major trading currencies, the country becomes competitive in terms of international trade, and the cost of imported food items decreases, making them more affordable for consumers. This can contribute to overall price stability and improve the purchasing power of consumers. Again, the finding means that when the Ghanaian currency gains value against other foreign currencies imported farm implement becomes cheaper leading to an overall reduction in the cost of farming which translates to a significant reduction in farm produce.

Moreover, the recorded result aligns with the structuralist inflation because if systems and structures are in place, Ghana can produce or manufacture more for export making the cedi gain value against major trading currencies leading to lower cost of importation of raw materials and manufactured goods. It is worth noting that the effect does not only prevail in the short run but is also carried to the long run. The negative association between a non-linear rise in the exchange rate and food commodity prices deviates from the account of Bane (2018) who discovered in Ethiopia that a rise in exchange rate leads to an increase in food inflation. Again, the positive account as provided by Osei (2014) contradicts the negative result as recorded by the present study. Also, the findings of

Nguyen (2015) and Mohammed et al. (2016) that exchange rate exert a significant positive effect on food inflation is opposed by the present study's negative result. The discrepancy in the findings could be attributed to different estimation techniques used by the various studies, different dataset periods as well as the setting for the study.

The Error Correction Model (ECM) which serves as the indicator of the rate at which distortions in the series are restored to normal depicted a negative coefficient of -0.44 and was significant at 0.000*** in both models which meets its underlying assumption of being statistically significant and negative with a coefficient of between -1 and 0. This stands to reason that disruptions in food commodity prices are restored to normal within one year at a moderate speed of 44%.

4.12 Conclusion

It is imperative to acknowledge that the magnitude of the non-linear effect of the variable exchange rate, domestic food supply, and crude oil prices is lesser than the linear effect of the same factors on food inflation in Ghana. Again, in the long-run the extent of the effect of the aforementioned factors on food inflation is more intense than in the short run for the linear model whilst there was a mixed level of effect of the variables in the short run and long run for the exponential model.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter of the study presents the summary of the results and findings ascertained from the various statistical tests conducted to assess the objectives of the study. The chapter also makes conclusions based on the findings recorded by the study. Finally, it presents recommendations based on the findings of the study. Chapter 5 serves as the heart of an academic research paper, as it provides the reader with a comprehensive understanding of the research findings and their broader context within the academic discourse. It is where the researcher demonstrates their ability to draw valid and meaningful conclusions, and contribute to the body of knowledge in their field.

5.2 Summary of the Study

Inflation which refers to the persistent increase in the general prices of goods and services over a period of time has received close attention recently due to the phenomenon's demeaning effect on the progress of an economy. The incessant increase in the price of goods and services are experienced in both developing and developed economies however, the impact of the variable is adversely felt in developing countries of which Ghana is of no exception. There are a myriad of factors that can cause inflation in every economy depending on the level of growth and the ability of an economy to absorb economic shocks. A factor that can drive inflation in a developed economy like that of western nations may not be necessary to drive inflation in an emerging economy like Ghana nevertheless, factors that can drive inflation in Ghana may not necessarily drive inflation in the United State of America and vice versa. Some factors that can cause high

inflation in the long-term in Ghana may not affect inflation in the long-term in another country. This shows that studies on drivers of inflation should be taken in country perspectives.

Existing studies on drivers of inflation have mostly concentrated on drivers of inflation in general with drivers of food inflation seemingly missing in the inflation literature and scarce in the Ghanaian narrative, this necessitate and incite research. Therefore, this study sought to explore this gap by specifically examining one, investigate the drivers of food inflation in Ghana; two, to examine the association between the determinant of food inflation and food inflation in Ghana and three, to examine the exponential effect of the determinant of inflation on food inflation in Ghana. The study reviewed existing literature on the concept of inflation to form the background of the study and to know the extent the concept has been explored, the monetarist inflation theory, the Keynesian inflation theory and the structural inflation theory that underpins the concepts were reviewed. The study employed secondary time series data extracted from the WDI section of the world bank database for the period 2000 to 2021. Data analysis techniques employed were bound testing to cointegration and the ARDL technique through ECM approach. The results recorded from the statistical tests are summarized based on the objectives below.

5.2.1 Causes of food inflation in Ghana.

Through the Toda and Yamamoto granger causality test, the study found three of the sampled variables as determinants of food inflation in Ghana. These variables are crude oil prices with p-value of 0.037**, domestic food supply with p-value of 0.005**8 and exchange rate with p-value of 0.01788. The remaining variables were considered as non-

determinant of food inflation in Ghana due to insignificant probabilities. The finding that crude oil prices and exchange rate are determinants of food inflation in Ghana is consistent with literature however, the discovery that domestic food supply causes food inflation in Ghana is unconventional. It was found that distortions in food inflation in the short run are restored back to equilibrium at a significant rate with 44% speed of adjustment.

5.2.2 Relationship between determinants of food inflation and food inflation.

The ARDL estimation through the ECM test revealed that one year lag of food inflation has a positive relationship with current price of food. Again, the study found that crude oil price has statistically significant relationship with food inflation in Ghana at a coefficient of 0.253 and p-value of 0.015** in the long run however, the short run coefficient and p-values were 0.011 and 0.002** respectively. Also, exchange rate had a statistically significant inverse relationship with food inflation in Ghana at a coefficient of -1.042 and p-value of 0.001*** in the long-run, the short run estimate showed an inverse relationship between exchange rate and food inflation at a p-value of 0.000** associated with a coefficient of -0.046.

5.2.3 Exponential effect of determinant of food inflation on food inflation in Ghana.

The ARDL estimation unveiled that an exponential movement in crude oil price has a statistically significant positive effect on food inflation in Ghana in both the short and the long-run. The extent of effect was 0.001 in the long-run and 0.006 in the short run. Exponential rise in exchange rate on the other hand, recorded a significant negative impact on food inflation in Ghana at a magnitude of -0.005 and p-value of 0.000*** in the long-run whilst the short run estimate showed a p-value of 0.002** against a

coefficient of 0.002. Again, a double increase in domestic food supply has a statistically significant adverse impact of -0.008 on food inflation in Ghana in the long-run whilst in the short run the magnitude of effect was -0.003 at a p-value of 0.002**.

5.3 Conclusion of the study

The findings of the study and the interpretations give rise to the following conclusions.

5.3.1 Determinants of food inflation in Ghana.

It is concluded based on the causality test that the main determinants of food inflation in Ghana are crude oil price, real exchange rate and domestic food supply. Thus, changes in the level of food supply in the local economy, volatility in the value of the Ghanaian currency to other international currencies would affect food inflation in Ghana. Again, any changes in the price of crude oil on the world market would impact food prices in Ghana.

5.3.2 Relationship between the determinant of food inflation and food inflation in Ghana.

The inverse relationship between the real exchange rate and food inflation in Ghana underscores the significance of currency stability in influencing food prices. When the Ghanaian cedi appreciates against other currencies, it contributes to a reduction in food price inflation, particularly for imported food items. This highlights the critical role of exchange rate management in mitigating inflationary pressures in the country's food market. Boosting local food production through provision of support services to farmers can cause an increase in food production and reduction in food prices, underscoring the significance of agriculture tailored policies. Continuously heavily dependent on crude oil would hurt the Ghanaian economy through food prices.

5.3.3 Exponential effect of determinant of food inflation on food inflation.

In light of the above findings, the Monetarist inflation theory, which emphasizes the role of money supply in inflation, may find support in the negative relationship between non-linear exchange rates and food inflation. A stronger domestic currency, driven by structural improvements and increased food supply, aligns with Monetarist principles by reducing inflationary pressures. On the other hand, the Keynesian inflation theory, emphasizing demand and supply imbalances, is corroborated by the inverse association between domestic food supply and food inflation. Increased food production, as seen in Ghana's policies, can mitigate demand-supply gaps, aligning with Keynesian principles to reduce inflation. The Structuralist inflation theory, which looks at underlying systems and structures, finds partial support in the positive link between non-linear crude oil price increases and food inflation. However, the study's results also challenge this theory, suggesting that policy interventions can counteract structural inflationary pressures. Additionally, it is concluded that there is no marginal difference between linear and exponential increase in determinant of food inflation on food inflation.

5.4 Recommendations of the study

The mixed results recorded from the various statistical tests and its appropriate interpretations necessitate the following recommendations.

Based on the causality found between exchange rate, crude oil prices, domestic food supply and food inflation, it is recommended that the government of Ghana should diversify its energy source to renew energy and also include nuclear energy in its energy mix to minimize the impact of crude oil price on food items. Again, the government can use import substitution to strengthen the currency in minimizing its adverse impact when

the cedi devalues. Agricultural incentives should be increased to increase food production to further slow food inflation in Ghana.

Given the negative relationship between non-linear exchange rates and food inflation, policymakers should ensure that monetary policies support a stable and strong domestic currency. This can be achieved by closely monitoring and managing money supply to prevent excessive currency depreciation, which can help reduce inflationary pressures.

To further strengthen the inverse relationship between domestic food supply and food inflation, government policies should continue to invest in the agricultural sector. This includes providing farmers with access to credit, modern farming technologies, and infrastructure for storage and distribution. Encouraging sustainable agricultural practices can lead to increased food production and price stability.

Given the positive link between non-linear increases in crude oil prices and food inflation, businesses and industries in Ghana should explore alternative and renewable energy sources such as installation of solar panels for solar energy. This diversification can reduce their dependence on volatile crude oil prices and mitigate the impact of energy-related inflation on food prices. In light of the findings related to domestic food supply, businesses involved in food production and distribution should focus on optimizing their supply chains. This includes investing in efficient logistics and storage facilities to ensure a consistent and affordable supply of food commodities. Collaboration with the government's initiatives like "Planting for Food and Jobs" can further enhance the supply chain and reduce food prices for consumers.

5.4.1 Recommendation for further studies

The study implores academia to explore the causes of food inflation in the anglophone countries in West Africa and the Economic Community of West African State at large. Again, to validate the result of the study, future studies should use different data analysis techniques to explore the variables taken into consideration in the study.

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Appendix 1

Vector Autoregressive Estimate

	TO	MS	GE	GDP	FIF	FI	FE	EXR	DFS	CO
TO(-1)	1.895429	-0.0308	-1.65E+08	-0.31356	0.036375	-0.0589	0.443229	0.001141	-0.01535	-0.87219
	(0.06270)	(0.15343)	(3.3E+08)	(0.17416)	(0.14985)	(0.14312)	(0.30952)	(0.28463)	(0.10797)	(0.86432)
	[30.2322]	[-0.20072]	[-0.50678]	[-1.80039]	[0.24275]	[-0.41152]	[1.43197]	[0.00401]	[-0.14215]	[-1.00911]
TO(-2)	-0.8931	0.091884	1.43E+08	0.348523	-0.00643	0.030018	-0.56589	-0.0167	0.047417	0.978490
	(0.06475)	(0.15846)	(3.4E+08)	(0.17988)	(0.15476)	(0.14781)	(0.31968)	(0.29397)	(0.11152)	(0.89269)
	[-13.7924]	[0.57985]	[0.42518]	[1.93756]	[-0.04155]	[0.20308]	[-1.77018]	[-0.05682]	[0.42521]	[1.09612]
MS(-1)	0.035666	1.756612	1.21E+08	-0.01323	-0.00147	0.053814	0.076985	-0.00789	-0.02137	0.151503
	(0.02947)	(0.07211)	(1.5E+08)	(0.08186)	(0.07043)	(0.06727)	(0.14548)	(0.13378)	(0.05075)	(0.40624)
	[1.21035]	[24.3592]	[0.78692]	[-0.16159]	[-0.02088]	[0.80002]	[0.52918]	[-0.05894]	[-0.42114]	[0.37294]
MS(-2)	-0.04114	-0.78907	-1.33E+08	0.014662	-0.00317	-0.04007	-0.06681	-0.0006	0.026811	-0.1861
	(0.02845)	(0.06963)	(1.5E+08)	(0.07904)	(0.06801)	(0.06495)	(0.14048)	(0.12918)	(0.04900)	(0.39228)
	[-1.44589]	[-11.3316]	[-0.89843]	[0.18550]	[-0.04666]	[-0.61682]	[-0.47555]	[-0.00463]	[0.54712]	[-0.47442]

GE(-1)	-2.58E-12	-1.23E-12	1.900494	1.01E-11	-1.65E-11	9.03E-12	-4.49E-11	6.43E-12	-4.07E-12	1.05E-11
	(1.0E-11)	(2.5E-11)	(0.05212)	(2.8E-11)	(2.4E-11)	(2.3E-11)	(4.9E-11)	(4.5E-11)	(1.7E-11)	(1.4E-10)
	[-0.25755]	[-0.05027]	[36.4671]	[0.36302]	[-0.68786]	[0.39520]	[-0.90795]	[0.14132]	[-0.23577]	[0.07641]
GE(-2)	2.67E-12	-2.29E-12	-0.94154	5.11E-13	2.44E-11	6.06E-13	6.17E-11	-3.43E-11	1.21E-11	-1.00E-11
	(1.0E-11)	(2.5E-11)	(0.05414)	(2.9E-11)	(2.5E-11)	(2.4E-11)	(5.1E-11)	(4.7E-11)	(1.8E-11)	(1.4E-10)
	[0.25644]	[-0.09012]	[-17.3903]	[0.01767]	[0.98179]	[0.02554]	[1.20048]	[-0.72621]	[0.67476]	[-0.06981]
GDP(-1)	0.025607	-0.02016	-1.36E+08	1.760427	0.088059	0.025628	0.158610	-0.2166	0.049811	0.059819
	(0.03110)	(0.07612)	(1.6E+08)	(0.08640)	(0.07434)	(0.07100)	(0.15356)	(0.14121)	(0.05357)	(0.42880)
	[0.82326]	[-0.26489]	[-0.84131]	[20.3743]	[1.18453]	[0.36095]	[1.03289]	[-1.53394]	[0.92989]	[0.13950]
GDP(-2)	-0.02584	0.025274	1.69E+08	-0.76673	-0.09192	-0.0339	-0.17619	0.236898	-0.05446	-0.06985
	(0.03123)	(0.07644)	(1.6E+08)	(0.08677)	(0.07465)	(0.07130)	(0.15420)	(0.14180)	(0.05379)	(0.43060)
	[-0.82734]	[0.33065]	[1.04175]	[-8.83677]	[-1.23134]	[-0.47541]	[-1.14257]	[1.67068]	[-1.01246]	[-0.16222]
FIF(-1)	-0.01464	-0.06127	2.53E+08	0.113867	1.775374	-0.02231	-0.24926	0.252066	-0.05994	0.536983
	(0.03417)	(0.08363)	(1.8E+08)	(0.09493)	(0.08168)	(0.07801)	(0.16871)	(0.15514)	(0.05885)	(0.47111)
	[-0.42828]	[-0.73266]	[1.42497]	[1.19949]	[21.7368]	[-0.28593]	[-1.47745]	[1.62476]	[-1.01846]	[1.13982]
FIF(-2)	0.012070	0.075947	-2.70E+08	-0.11695	-0.78733	0.017826	0.248575	-0.27887	0.071525	-0.55718
	(0.04106)	(0.10048)	(2.1E+08)	(0.11406)	(0.09814)	(0.09373)	(0.20271)	(0.18641)	(0.07071)	(0.56606)
	[0.29397]	[0.75582]	[-1.26221]	[-1.02527]	[-8.02274]	[0.19019]	[1.22625]	[-1.49601]	[1.01149]	[-0.98431]
FI(-1)	0.012866	-0.05659	1.25E+08	0.061668	0.017332	1.768033	-0.07291	0.156653	-0.02304	0.563531

	(0.02989)	(0.07316)	(1.6E+08)	(0.08304)	(0.07145)	(0.06824)	(0.14759)	(0.13572)	(0.05148)	(0.41212)
	[0.43038]	[-0.77347]	[0.80227]	[0.74260]	[0.24258]	[25.9090]	[-0.49398]	[1.15427]	[-0.44752]	[1.36738]
FI(-2)	-0.01189	0.085824	-1.43E+08	-0.06074	-0.00843	-0.8023	0.034716	-0.16322	0.024552	-0.50749
	(0.02956)	(0.07234)	(1.5E+08)	(0.08212)	(0.07065)	(0.06748)	(0.14594)	(0.13420)	(0.05091)	(0.40752)
	[-0.40233]	[1.18639]	[-0.93089]	[-0.73966]	[-0.11926]	[-11.8898]	[0.23788]	[-1.21627]	[0.48229]	[-1.24530]
FE(-1)	0.007390	0.006703	19528925	0.024140	-0.00029	0.016736	1.791893	-0.03121	0.008302	0.158594
	(0.01234)	(0.03021)	(6.4E+07)	(0.03429)	(0.02950)	(0.02818)	(0.06094)	(0.05604)	(0.02126)	(0.17017)
	[0.59873]	[0.22191]	[0.30403]	[0.70402]	[-0.00965]	[0.59398]	[29.4048]	[-0.55695]	[0.39055]	[0.93199]
FE(-2)	-0.01014	-0.00677	-2E+07	-0.02281	0.000304	-0.01434	-0.81452	0.025577	-0.00472	-0.22175
	(0.01218)	(0.02981)	(6.3E+07)	(0.03384)	(0.02911)	(0.02780)	(0.06013)	(0.05530)	(0.02098)	(0.16792)
	[-0.83245]	[-0.22705]	[-0.32123]	[-0.67415]	[0.01043]	[-0.51562]	[-13.5448]	[0.46252]	[-0.22486]	[-1.32056]
EXR(-1)	0.036242	-0.02092	-3.8E+07	0.004010	0.089604	-0.01228	0.050398	1.738260	0.016928	0.270486
	(0.02159)	(0.05283)	(1.1E+08)	(0.05997)	(0.05160)	(0.04928)	(0.10658)	(0.09800)	(0.03718)	(0.29760)
	[1.67886]	[-0.39607]	[-0.34179]	[0.06688]	[1.73668]	[-0.24918]	[0.47289]	[17.7368]	[0.45534]	[0.90888]
EXR(-2)	-0.03772	0.020835	40394272	-0.0022	-0.09556	0.020343	-0.06397	-0.75492	-0.01456	-0.2963
	(0.02151)	(0.05264)	(1.1E+08)	(0.05975)	(0.05141)	(0.04910)	(0.10619)	(0.09765)	(0.03704)	(0.29653)
	[-1.75364]	[0.39583]	[0.36089]	[-0.03689]	[-1.85890]	[0.41431]	[-0.60241]	[-7.73097]	[-0.39310]	[-0.99923]
DFS(-1)	0.058409	-0.03938	-3.6E+07	-0.04925	0.024380	-0.00529	0.216062	0.002962	1.837414	0.597103

	(0.03720)	(0.09103)	(1.9E+08)	(0.10333)	(0.08891)	(0.08491)	(0.18365)	(0.16888)	(0.06406)	(0.51282)
	[1.57019]	[-0.43255]	[-0.18596]	[-0.47664]	[0.27422]	[-0.06234]	[1.17651]	[0.01754]	[28.6817]	[1.16435]
DFS(-2)	-0.06416	0.000553	68702854	0.040649	-0.06452	0.026772	-0.1701	0.020000	-0.86181	-0.65858
	(0.03740)	(0.09152)	(1.9E+08)	(0.10389)	(0.08939)	(0.08537)	(0.18464)	(0.16979)	(0.06441)	(0.51560)
	[-1.71555]	[0.00604]	[0.35301]	[0.39126]	[-0.72174]	[0.31359]	[-0.92122]	[0.11779]	[-13.3803]	[-1.27732]
CO(-1)	-0.01024	0.000264	30087195	0.020482	-0.02366	0.006078	-0.03031	0.031759	-0.0089	1.792676
	(0.00644)	(0.01575)	(3.3E+07)	(0.01788)	(0.01538)	(0.01469)	(0.03178)	(0.02922)	(0.01108)	(0.08874)
	[-1.59123]	[0.01679]	[0.89826]	[1.14548]	[-1.53779]	[0.41369]	[-0.95393]	[1.08684]	[-0.80308]	[20.2025]
CO(-2)	0.009461	-0.0031	-3.3E+07	-0.02341	0.027556	-0.00282	0.035975	-0.04172	0.010096	-0.84114
	(0.00658)	(0.01611)	(3.4E+07)	(0.01829)	(0.01574)	(0.01503)	(0.03250)	(0.02989)	(0.01134)	(0.09076)
	[1.43703]	[-0.19247]	[-0.96339]	[-1.27997]	[1.75116]	[-0.18734]	[1.10680]	[-1.39591]	[0.89043]	[-9.26733]
C	0.847110	0.176684	-5.98E+08	-1.06505	1.710049	-1.22777	5.363330	2.406525	-0.5794	9.932286
	(0.48520)	(1.18737)	(2.5E+09)	(1.34784)	(1.15966)	(1.10756)	(2.39539)	(2.20272)	(0.83559)	(6.68896)
	[1.74590]	[0.14880]	[-0.23689]	[-0.79020]	[1.47462]	[-1.10853]	[2.23902]	[1.09252]	[-0.69340]	[1.48488]
FIF(-3)	-0.00508	-0.02176	24375033	-0.0028	-0.00373	0.024629	0.002888	0.012824	-0.01458	-0.13896
	(0.01604)	(0.03926)	(8.3E+07)	(0.04457)	(0.03835)	(0.03663)	(0.07921)	(0.07284)	(0.02763)	(0.22120)
	[-0.31688]	[-0.55420]	[0.29194]	[-0.06287]	[-0.09736]	[0.67245]	[0.03645]	[0.17606]	[-0.52748]	[-0.62821]

R-squared	0.999963	0.998631	0.999993	0.999999	0.999785	0.997518	0.999401	0.999761	0.999982	0.999439
Adj. R-squared	0.999959	0.998470	0.999992	0.999998	0.999760	0.997227	0.999331	0.999733	0.999980	0.999373
Sum sq. resids	0.377926	2.263297	1.02E+19	2.916360	2.158868	1.969269	9.211306	7.789068	1.120872	71.82642
S.E. equation	0.045949	0.112446	2.39E+08	0.127642	0.109821	0.104888	0.226848	0.208601	0.079132	0.633455
F-statistic	232862.7	6217.632	1137855.	5842708.	39614.65	3425.374	14225.53	35643.07	467137.5	15187.76
Log likelihood	345.5677	165.6848	-4151.34	140.2067	170.4323	179.6704	24.62212	41.47701	236.3078	-181.787
Akaike AIC	-3.21958	-1.4297	41.52572	-1.17619	-1.47694	-1.56886	-0.02609	-0.1938	-2.13242	2.027730
Schwarz SC	-2.85802	-1.06814	41.88728	-0.81463	-1.11538	-1.2073	0.335465	0.167755	-1.77086	2.389286
Mean dependent	59.77396	27.39254	8.84E+10	113.2984	15.13652	16.28508	29.87798	89.98598	85.55831	70.16087
S.D. dependent	7.185047	2.875073	8.26E+10	99.97609	7.083629	1.991656	8.769869	12.76293	17.52558	25.30340

Determinant resid covariance (dof adj.)	0.212865
Determinant resid covariance	0.066784
Log likelihood	-2580.09
Akaike information criterion	27.86154
Schwarz criterion	31.47710
Number of coefficients	220

Source: E-views (2023).

Appendix 2: Toda and Yamamoto Causality Test

Dependent variable: TO

Excluded	Chi-sq	df	Prob.
MS	5.289321	2	0.0710
GE	0.066838	2	0.9671
GDP	0.686439	2	0.7095
FIF	0.262835	2	0.8769
FI	0.228082	2	0.8922
FE	4.191646	2	0.1230
EXR	3.649797	2	0.1612
DFS	3.820123	2	0.1481
CO	4.339735	2	0.1142
All		16	---

Dependent variable: MS

Excluded	Chi-sq	df	Prob.
TO	12.71961	2	0.0017
GE	0.430795	2	0.8062
GDP	1.313713	2	0.5185
FIF	0.577977	2	0.7490
FI	12.68902	2	0.0018

FE	0.052360	2	0.9742
EXR	0.157095	2	0.9245
DFS	9.588063	2	0.0083
CO	2.659632	2	0.2645
All		16	---

Dependent variable: GE

Excluded	Chi-sq	df	Prob.
TO	0.799954	2	0.6703
MS	1.501460	2	0.4720
GDP	12.26793	2	0.0022
FIF	2.058817	2	0.3572
FI	1.891263	2	0.3884
FE	0.118007	2	0.9427
EXR	0.169256	2	0.9189
DFS	1.536425	2	0.4638
CO	1.232986	2	0.5398
All	30.80638	18	0.0303

Dependent variable: GDP

Excluded	Chi-sq	df	Prob.
TO	5.148011	2	0.0762
MS	0.066490	2	0.9673
GE	3.194842	2	0.2024
FIF	1.497494	2	0.4730
FI	0.551874	2	0.7589
FE	0.536684	2	0.7646
EXR	0.114951	2	0.9441
DFS	0.571544	2	0.7514
CO	3.027148	2	0.2201
All		16	---

Dependent variable: FI

Excluded	Chi-sq	df	Prob.
TO	3.893465	2	0.1427
MS	2.632170	2	0.2682
GE	3.900159	2	0.1423
GDP	3.885744	2	0.1433
FIF	0.123614	2	0.9401
FE	0.722361	2	0.6969
EXR	3.515449	2	0.1724
DFS	3.346143	2	0.1877

CO	4.487277	2	0.1061
All		16	---

Dependent variable: FE

Excluded	Chi-sq	df	Prob.
TO	12.57165	2	0.0019
MS	0.435765	2	0.8042
GE	2.992815	2	0.2239
GDP	4.592013	2	0.1007
FIF	2.340986	2	0.3102
FI	4.644864	2	0.0980
EXR	2.384523	2	0.3035
DFS	4.523081	2	0.1042
CO	3.070192	2	0.2154
All		16	---

Dependent variable: EXR

Excluded	Chi-sq	df	Prob.

TO	0.244733	2	0.8848
MS	0.257039	2	0.8794
GE	7.660585	2	0.0217
GDP	7.865849	2	0.0196
FIF	2.641271	2	0.2670
FI	1.674264	2	0.4330
FE	0.861124	2	0.6501
DFS	0.962965	2	0.6179
CO	9.742829	2	0.0077
All		16	---

Dependent variable: DFS

Excluded	Chi-sq	df	Prob.
TO	7.086141	2	0.0289
MS	1.241878	2	0.5374
GE	4.417737	2	0.1098
GDP	2.875629	2	0.2374
FIF	1.068249	2	0.5862
FI	0.300036	2	0.8607
FE	1.943228	2	0.3785
EXR	0.664020	2	0.7175
CO	1.373854	2	0.5031

All		16	---

Dependent variable: CO

Excluded	Chi-sq	df	Prob.
TO	1.773126	2	0.4121
MS	0.833284	2	0.6593
GE	0.006359	2	0.9968
GDP	0.168958	2	0.9190
FIF	1.340422	2	0.5116
FI	2.737683	2	0.2544
FE	11.43835	2	0.0033
EXR	1.931472	2	0.3807
DFS	2.166815	2	0.3384
All		16	---

Source: E-views Estimate (2023).