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Examining the Impact of Commercial Banks' Credit, Government Expenditure, Insecurity, Inflation, and Interest Rate on Food Security in Nigeria: Evidence from Food Production Dynamics

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ABSTRACT

This study examines the impact of commercial banks' credit to agriculture, government expenditure on agriculture, insecurity, inflation, and interest rate on food security in Nigeria through food production dynamics. Annual time-series data covering 1981- 2024 were obtained from the World Bank and Central Bank of Nigeria Statistical Bulletin. Food security is proxied by the Food Production Index. The study employs the Autoregressive Distributed Lag (ARDL) bounds-testing approach to investigate the short- and long-run relationships among the variables, complemented by Wald tests and VAR Granger causality-Block Exogeneity Wald tests to examine dynamic interactions and predictive relationships. The bounds test confirms the existence of a long-run relationship among the variables. The long-run estimates show that commercial banks' credit to agriculture and government expenditure on agriculture have positive and statistically significant impacts on food security, while insecurity has a negative and statistically significant impact. Inflation and interest rate have negative but statistically insignificant long-run impacts. In the short run, commercial banks' credit and government expenditure positively influence food security, although government expenditure is significant only at the 10% level, while insecurity and interest rate show significant negative effects. Inflation remains negative but statistically insignificant. The error-correction coefficient is negative and significant, indicating that approximately 30.7% of short-run disequilibrium is corrected annually. The Granger causality results further indicate that interest rate predicts food security, while insecurity predicts inflation and interest rate. The study concludes that sustainability in Nigeria's food-production capacity require simultaneous attention to agricultural financing, productive public expenditure, rural security, and a supportive macroeconomic environment. It recommends expanding affordable and well-targeted agricultural credit, improving the efficiency and composition of government agricultural expenditure, strengthening security in farming and food-supply, and using targeted financing mechanisms to reduce the adverse effects of high borrowing costs. Coordinated agricultural, fiscal, monetary, and security policies are therefore essential for strengthening food availability and improving food-security outcomes in Nigeria.

1.0 Introduction

Food security is a major issue that affects national stability and people's health. It is defined as the availability, access and use of adequate, safe and nutritious food to support all people's food systems for an active and healthy lifestyle (Obed et al., 2025). In other words, food security is the ability of every person in a country or geographical area to have access, physically and economically, to sufficient food to meet the dietary needs at all times, including access to food and money to purchase it, knowledge of how to make the most of available food resources, and stability

in access over time. (Gibson, 2012; Bassey & Ndu, 2025). In 2025, an estimated 25.8 percent of the global population 2.1 billion people were moderately or severely food insecure, down from 27.1 percent in 2024 and 28.7 percent in 2020. That is the equivalent of nearly 86 million fewer people in 2025 compared to 2024, and 135 million fewer compared to 2020. However, the observed decrease was not enough to reach pre-pandemic levels. Of the 2.1 billion people facing moderate or severe food insecurity in 2025, more than one-third were severely food insecure 778.6 million people, or 9.5 percent of the global population. Compared to 2024, this is nearly 25 million fewer people facing severe food insecurity [Food and Agricultural Organization (FAO 2026)].

In Nigeria, approximately 87 million of Nigeria's 220 million people (39.5%) remained living below the poverty line due to the country's lack of technological know-how which could contribute to its vast resources to enhance the welfare of its citizens (Adeola et al., 2022). In addition to weak governance, corruption and mismanagement of public funds, there is also a growing threat to the security of local farmers, businesses and potential investors due to rising insecurity, conflict and inflation (Yusuf & Muhd, 2023). One of the simplest impacts has been the situation of food shortage and worsening food insecurity, which is expected to affect approximately 26.5 million Nigerians in 2024, against 18.6 million in the preceding last quarter of 2023 (Wudil et al., 2022). Some 2.2 million people have been displaced in the conflict in North-East Nigeria, while an additional 4.4 million are food insecure in Yobe, Adamawa and Borno States, with Borno alone hosting some 3 million food insecure people (Ofuani-Sokolo & Okunrobo, 2023). WFP has turned its attention to responding to the needs of 1.1 million vulnerable people per month in northern Nigeria, including Displaced Persons in Host Communities and IDP camps (International Organization for Migration, 2017). Over the years the Federal government has increasingly declared food insecurity, food pricing and food sustainability emergencies as part of its efforts to reduce malnutrition among vulnerable children (Akpoghelie et al., 2024), for instance, in 2023, the government declared matters related to food availability and affordability under the National Security Council (Wudil et al., 2022). The Food and Agriculture Organization recently reported on the trends of food and nutrition insecurity in Nigeria, with 30.6 million Nigerians out of 227 million expected to be severely food and nutrition insecure in 26 states and the Federal Capital Territory, a slight improvement from 33.1 million Nigerians a year before (FAO 2025a). However, access to data continues to be affected by data access constraints (DACs), a fact noted by stakeholders. There is insecurity, rising prices (inflation), economic challenges, political uncertainty and violence in the Northern part of Nigeria, which are identified as critical factors contributing to food insecurity in Nigeria (FAO, 2025b) and requires investigation to prevent it getting worse or exacerbate the poverty situation.

The consensus on government spending on agriculture is less clear. In the last ten years, several financing programmes have been introduced in Nigeria to boost agricultural production, the Anchor Borrowers' Programme, the Commercial Agriculture Credit Scheme and the Agricultural Credit Guarantee Scheme Fund (ACGSF) among others have collectively provided over N1 trillion to the agricultural sector (CBN, 2023; Etuk, 2025). These programmes have evolved out of a longer history of government intervention since 1972, such as the National Accelerated Food Production Project (NAFPP), the National Cereals Research Institute (NCRI) (1974), the Agricultural Cooperative Government Scheme for Small Farmers (ACGSF) (1978), the Abakaliki Rice Project (1978), the Green Rice Project (1986), the Agricultural Development Project (1987), the Nigeria Agricultural Cooperative Bank (1988), the National Special Food Security Programme, the National Fadama Development Project (Fadama I–III) (Blench and Ingawa, 2003 was designed to

raise the incomes of Fadama users by empowering communities to direct their own development), and more recently the Anchor Borrowers' Programme (2016), the multinational New Rice for Africa initiative (2000), the Ibom Rice Project (2001), and the Anchor Borrowers' Programme (2016) (Ayinde et al. 2018). The government capital expenditure also went up, from a budget of ₦3.486 billion in 1990 to ₦705.80 billion in 2020, CBN (2020) reported, though it dipped to a low of ₦348.75 billion in 2015, probably because of the shift in government's focus on electioneering activities. Similarly, credit guaranteed under the ACGSF increased steadily from ₦1,861,097.10 in 2005 to ₦5,850,923.35 in 2010, and double the amount in 2015 to ₦9,459,018.28, but reduced drastically to ₦3,037,457.20 by 2020, largely due to the change of government in 2015, and the drop in federal revenue following the oil price glut and the increased spending on defence as a result of the deteriorating security situation (Anthony & Tijjani, 2022; Perron, 1997)

Commercial banks credit enables farmers to purchase yield-enhancing inputs such as improved seeds, fertilizers, and machinery, which raises productivity and food availability (Osabohien et al 2020; Ogbanna et al 2022). Access to credit also improves household dietary diversity and calorie consumption per capita. Commercial bank lending may be more effective than government schemes because of its direct credit channeling and institutional efficiency, whereas fiscal allocations and guarantee schemes suffer bureaucratic delays and implementation gaps (Aigbovo & Edohen 2025). Perhaps the most direct and disruptive threat to Nigeria's food-production system is insecurity. Weak extension services, poor mechanization and post-harvest losses at more than 30% of the annual production result in low transformation potential of agricultural credit, and Nigeria remains an import dependent nation despite its huge resources, these effects are worsened by insecurity, which has disrupted agricultural activities, especially in the food producing regions like the North East and North-West (Akpoghelie et al., 2024).

Even though conflict and fight have been a fact of life worldwide for the longest time, they have continued to negatively affect all aspects of food security of the affected populations, affecting more than half of the world's 815 million people suffering undernourishment in countries affected by conflict and violence and fragility (Shemyakina, 2022; Bezabih & Belay, 2025). Again, Conflict affects food security in various interconnected ways both in terms of food supply and food demand, by destroying agricultural infrastructure, reducing food production and market access (Ibrahim & Bavorova, 2024; Shemyakina, 2022), and affecting food security directly through disruption of markets, supply chains, livestock deaths, burning of fields and damage to infrastructure (Bezabih & Belay, 2025). Losses in crop production are largely due to land abandonment, loss of productive assets and uncertainty caused by violence (Kafando & Sakurai, 2024), insecurity also disrupts access to rural roads, increase in transportation costs, and reluctance to participate in markets, these effects are most likely to impact poor households (Edewor & Ogbe, 2026). There is also a clear cross-country quantitative correlation showing that exposure to violent conflict results in significant reduction in the Food Consumption Score, which is 16.13% in sub-Saharan Africa with significant negative impact on household food consumption due to reduced dietary diversity (Kafando & Sakurai, 2024), and can be far larger when conflict overlaps with natural shocks (Muriuki & Hudson, 2023). In Nigeria, the food-insecurity situation has further deteriorated caused by the increasing insurgency, banditry and abductions which has consistently taken its toll on food availability and access by affecting household livelihoods, agricultural investment and productivity through herder–farmer conflict, displacement and market disruption (Abaji et al. 2025 Olanrewaju & Balana, 2023).

Food inflation persisted through 2025, driving up the cost of foods needed for a healthy diet. On the assumption that healthy-diet food prices tracked the broader trend in food inflation, the global average Cost of a Healthy Diet (CoHD) is estimated to have risen to 4.28 PPP dollars in 2025, up from 3.44 PPP dollars in 2021 and 2.94 PPP dollars in 2017. This CoHD estimate, in turn, makes it possible to calculate the number of people priced out of a healthy diet. Using 2021 as the base year for healthy-diet food prices, an estimated 2.97 billion people were unable to afford a healthy diet that year, representing 37.4 percent of the global population. Notably, this figure appears to have declined globally since peaking at 3.13 billion in 2020, falling to roughly 2.69 billion people or 32.7 percent of the world's population by 2025 (FAO et al., 2026). The association between inflation and food security is also as consequential but more controversial. Food and income shocks from food and financial crises are estimated to have historically contributed to increased world hunger, and a sharp rise in hunger and poverty in low-income countries, such as Nigeria, is attributed to the combined effect of the food-price and income shocks experienced during the food and financial crises (Achoja & Okeke, 2019; FAO, 2009).

The major contributions of this study are as follows: First, the literature that addresses the determinants of food security based on food-production dynamics in Nigeria is still limited, especially when the effects of the commercial banks' credit, government expenditure, insecurity, inflation and interest rate is combined. This study differs from the earlier work, which mainly focuses on the effect of the agricultural determinants or macroeconomic determinants on food production in Nigeria, by considering the financial, fiscal, security, and macroeconomic determinants together in one analytical model to gain a more comprehensive view of the food-production determinants in Nigeria. Second, the study is important because it explicitly considers the dynamic causal linkages between food production and its determinants, rather than estimating individual effects, it investigates the direction of the predictive relationship between the variables of food production, credit, government expenditure, insecurity, inflation, and interest rate, thus providing new insight into the interconnected mechanisms by which financial, macroeconomic, and security conditions influence food production in Nigeria. Third, the use of a relatively long time series for Nigeria allows for country-level analysis that enhances the empirical evidence base for understanding the structure and macroeconomic drivers of food security problems, which should prove useful to policy makers in developing coordinated policies that span agricultural finance, public expenditure, macroeconomic stability and insecurity reduction. This study was aimed at investigating how these factors influence food security in Nigeria, with a view to proposing solutions to food insecurity. Data used covered 1981–2024 period. However, the specific objectives of the study are to: (i) evaluate the impact of commercial banks credits to agriculture on food security in Nigeria (ii) determine the impact of government expenditure to agriculture on food security in Nigeria (iii) examine the impact of insecurity on food security in Nigeria (iv) assess the influence of inflation on food security in Nigeria and (v) investigate the impact of interest rate on food security in Nigeria. Furthermore, the study was organized in five sections; introduction, literature review, methodology, data analysis and, conclusion and policy recommendations.

2. Literature Review

This section reviews the conceptual, theoretical, and empirical literature relevant to the relationship among commercial banks' credit to agriculture, government expenditure on agriculture, insecurity, inflation rate, interest rate, and food security in Nigeria.

2.1 Conceptual Review

Food security is conventionally defined along four dimensions established at the World Food Summit: availability, access, utilization, and stability. Availability concerns the physical presence of sufficient food through domestic production, stocks, and imports; access concerns households' economic and physical ability to obtain food; utilization relates to the body's ability to use food through an adequate diet, water, sanitation, and health care; and stability requires that the other three dimensions hold consistently over time (FAO, 1996). In this study, food security is seen in terms of food-availability, which is measured with food-production dynamics.

Commercial banks credit given to agriculture is the credit facilities given by commercial or deposit money banks to agricultural producers and agro-related businesses for the purpose of financing agricultural production, processing, storage and marketing activities. (CBN 2023)

Government expenditure on agriculture covers government spending on agricultural research program, agriculture extension service program, irrigation, rural road construction program, input support program, agricultural storage program, livestock, fisheries other than agriculture or rural development program. It is composed of capital and recurrent expenses (FAO 2015)

Insecurity is when people, families and property are at risk of violence, conflict, terrorism, banditry and kidnapping, or other criminal activity, according to Institute for Economics & Peace (2024). In the agricultural context, insecurity refers to violent activity that impedes access to land, prevents farmers from producing and makes it more expensive for them to get their farm produce to market.

The rate of inflation is the percentage increase of the general price level of a group of commodities and services during a period of time. It is generally measured by the Consumer Price Index. In this study, inflation captures the rate at which the prices of food, agricultural inputs, transportation and other goods and services increase in Nigeria (IMF 2024)

Interest rate is the ratio stating how much money has to be paid back or how much money that can be earned for the loan, based on the amount of money and the amount of time that it is borrowed. The interest rate used in this study is the lending rate or other relevant market rate for agricultural loans from commercial banks (CBN 2024).

2.2 Theoretical Review

This study is based on four theoretical strands that complement each other and that each relate to one block of explanatory variables in the model, namely, the financial intermediation theory (commercial banks' credit and interest rate), the Keynesian theory on public expenditure (government spending), the entitlement approach and conflict economics (insecurity), and the quantity theory of money (inflation). The study does not assume a single, overarching theory, and considers food production as a result of the interaction of the financial, fiscal, security and monetary conditions, as in its multivariate empirical approach.

2.2.1 Financial Intermediation Theory

The treatment of credit by commercial banks is based on the financial intermediation theory as developed by Gurley and Shaw (1955) and expanded by McKinnon (1973) and Shaw (1973). The theory states that banks and other deposit-taking institutions are intermediaries that act as a facilitator in pooling the surplus funds of savers and provide them to deficit units like farmers and agribusinesses which do not have adequate funds to invest. Financial intermediaries mitigate the liquidity constraint and the working-capital constraint of agriculture by turning short maturity

deposits into loans of longer maturity, Theory predicts that this effect is not homogenous across agricultural subsectors, and indeed recent Nigerian evidence confirms this Fagbemi et al., (2025) and Oko (2024), and Anofe et al. (2024) indicates that the effect is not found in all subsectors, a feature that theory does not make any prediction about. A direct effect, suggested by McKinnon (1973) and Shaw (1973) is that policy-induced credit-market distortions, like interest-rate ceilings or credit rationing or artificially high borrowing costs, reduce lending to credit-dependent sectors like agriculture, and thus lower output. But this effect is what makes it legitimate to include interest rate with the credit variable, instead of treating it as an entirely different, unrelated pure monetary phenomenon credit multiplies the resources to invest in agriculture, and the interest rate limits how much credit the farmers will be able to profitably get.

2.2.2 Keynesian Theory of Public Expenditure

The function of government spending is based on the Keynesian theory of public spending (Keynes, 1936) which suggests that government spending works as a fiscal instrument capable of boosting aggregate output via the multiplier effect. Private investment is not only crowded out by government investment in agricultural infrastructure, but is also directly expanded by government expenditure on agricultural research, extension, and input subsidies. This is the conventional theory explanation for food security modelling in Nigeria where government agricultural expenditure is considered a positive determinant of food security. The multiplier logic of the theory makes an easy sense of the lagged effects of the theory that are generally documented empirically: Public investment in infrastructure, research, and irrigation takes a time to be implemented and to become an effective source for increasing productive capacity; Dada et al. (2023) documented that the fiscal effect shows up after an eight-period lag. This is because the transmission of fiscal expenditure is different from the more direct, working-capital channel of financial intermediation theory in which commercial credit transmits its effects.

2.2.3 Entitlement Approach and Conflict Economics

Insecurity is incorporated into the work using Sen's 1981 entitlement approach, and Collier and Hoeffler's (2004) conflict-economics approach. Food insecurity is only viewed as a problem of access when a household's production-based, labor-based or trade-based entitlement to food is reduced through conflict, displacement or market disruption in the face of nominally sufficient national food supply, even if the overall food supply is sufficient, Sen (1981). The conflict-economics approach of Collier and Hoeffler (2004) reinforces this by identifying one of the mechanisms by which this erosion takes place: violent conflict depletes both physical and human capital, induces land abandonment, and disrupts factor and product markets, all with direct implications for agricultural production. Reading these two strands together, it seems likely that insecurity is a separate structural driver of food production, which should have a negative coefficient on the insecurity term, and not simply a macroeconomic shock or disturbance that is captured in the error term. According to this theoretical positioning, insecurity does not only represent an independent negative shock; it also functions as a moderator over the effectiveness of financial and fiscal interventions, a finding that is in line with the entitlement approach's focus on access conditions shaping the food security impacts of resources.

2.2.4 Quantity Theory of Money and Monetarism

The treatment of inflation is based on the quantity theory of money and its monetarist restatement (Fisher, 1911; Friedman, 1968) which holds that when the money supply grows at a higher rate

than output, the general price level will also rise at a higher rate. When the labor sector applies this, the real farm income is lost, inflation raises the nominal cost of inputs like fertilizer, fuel and machines, which is likely to reduce investment, and at the same time it reduces real income of net-buyer households, making food less affordable, justifying the expected negative coefficient on inflation. In the Nigerian context, however, the theory's pure monetary transmission mechanism is supported by the results of Sakanko et al. 2025, which indicates that insecurity plays an important role in driving food-price inflation, implying that inflation is partly driven by cost-push factors other than monetary factors. It does not constitute a rejection of the quantity theory, but rather highlights that the coefficient of inflation should be taken with the qualification that it is a function of insecurity, and suggests that the empirical coefficient should be tested for a directional causal link between insecure and monetary factors and inflation instead of assuming this causal connection is money causally driving insecurity.

Therefore, the above four theories are not competing but complementary explanations of different transmission channels that are at work simultaneously on Nigeria's food production. The monetary-cost channel, the financial-repression channel, the fiscal-infrastructure channel, and the access-and-disruption channel are explained by financial intermediation theory and its corollary, conflict economics, and the entitlement approach.

2.3 Empirical Review

2.3.1 Commercial Banks' Credit and Food Security

The time-series evidence from Nigeria is consistently positive, in the long run, between commercial bank credit and food security or agricultural output, however, the magnitude is dependent on lag structure and the commercial bank credit measure used. Osabohien et al. (2018), based on the ARDL bounds testing approach, revealed that commercial bank credit and the Agricultural Credit Guarantee Scheme Fund (ACGSF) improved food security, whereas population growth reduced food security and urged the need to closely monitor the rates of agricultural loans for commercial banks. In the same vein, in the same time frame (1981-2020), using ARDL methodology, Anthony and Tijjani (2022) obtained a similar finding for the food security proxy variable; commercial bank credit, ACGSF, government expenditure on agriculture and interest rate together and significantly determined food security. A similar study conducted by Shaibu et al. (2022) revealed that commercial bank loans and ACGSF disbursements were positive and significant to food security, whereas the opposite would be true for the lending rate and exchange rate. Oyewale and Alliu (2018) had noted that bank credit was one of the key factors influencing agriculture productivity for the period (1981-2016) and its impact was significantly influenced by the productive use of funds, accessibility and borrowing cost. This relationship is also supported by more recent literature: Fagbemi et al. (2025) concluded that agricultural bank loans and ACGSF both were positive and significant on agricultural productivity both in the long run (1991–2023) and short run (2000–2023); Gana et al. (2024) and Oko (2024) found agricultural financing significant and positive on agricultural output in the short and long run respectively. The impact of commercial bank credit was however different across the agricultural subsectors as revealed by Anofe et al. (2024) while Nnamocha and Charles (2015) earlier showed that the relationship between credit and output was rather weak in the shortrun compared to the longrun. All this literature corroborates the prior belief that the coefficient for commercial banks' credit (CBAC) would be positive, yet issues the warning that quantity of credit is not enough without the necessary conditions of affordability, timeliness, targeting, infrastructure and security.

2.3.2 Government Expenditure and Food Security

Government agricultural spending is among the most consistently studied fiscal drivers of food security in Nigeria, though findings diverge on the timing of its effect. Anderu and Efuntade (2020), applying ARDL and bounds cointegration to 1981–2018 data, found both short- and long-run positive effects of government spending on agricultural output growth. Udeaja (2014), using a vector error-correction framework, identified government expenditure and agricultural credit as key determinants of agricultural output, concluding that coordinated fiscal and monetary policy is necessary for food security. Osuji (2020), applying ARDL bounds testing to 1995–2015 data, found a long-run relationship among food security, government expenditure, inflation, interest rate, exchange rate, net exports, and money supply, with government expenditure significant in both the short and long run. Dada et al. (2023), using finite distributed-lag models, found that government agricultural expenditure explains variation in food security only with a considerable lag their preferred specification used an eight-period lag implying the fiscal effect is distributed over several years rather than contemporaneous. Shaibu et al. (2025), using Dynamic OLS on FAO-disaggregated expenditure categories (1960–2020), found that spending on agriculture, transportation, and health raised output and per-capita food expenditure, while education spending showed a negative coefficient, suggesting the effect depends on whether spending is agriculture-specific. Nwosu (2024) likewise emphasized the joint importance of commercial bank credit and government agricultural expenditure for output and food security. Governance quality moderates this relationship: a 2020 study in the Journal of Economics and Allied Research found that the interaction between government expenditure and corruption weakened the effectiveness of public agricultural spending, indicating that composition and implementation matter as much as nominal spending size. This body of evidence supports a positive expected coefficient on government expenditure (GEA), with the effect likely more robust in the long run given the infrastructure-dependent, lagged nature of fiscal transmission.

2.3.3 Insecurity and Food Security

Insecurity remains comparatively under-represented in aggregate macro time-series models of Nigerian food security, with the strongest quantitative evidence instead coming from household-survey, panel, and conflict-event microdata. Adelaja and George (2019) linked Boko Haram attacks to reduced agricultural investment and food security in affected households, while George et al. (2021), using Nigeria General Household Survey panel data, found that conflict fatalities significantly reduced household food security and dietary diversity. Regional evidence corroborates the mechanism: Jelilov et al. (2018) showed that insurgency-driven land abandonment, market closures, and disrupted trade depressed food production in Borno State, and Kah (2017) documented similar destruction of crops, displacement, and disrupted cross-border trade across the wider Lake Chad Basin. At the national time-series level, Chima (2023), using ARDL on 1981–2021 data, found that insecurity significantly affected agricultural productivity, and Gana et al. (2024), using a nonlinear ARDL model, found significant short- and long-run asymmetric effects of terrorism and crime meaning increases and decreases in insecurity do not affect production by the same magnitude. Subnational survey evidence reinforces this: Tanko et al. (2024), surveying 355 respondents in Sokoto East, found insecurity reduced food production through farm displacement, restricted land access, and input disruption; Ewubare et al. (2024) linked insecurity to farmland abandonment and disrupted supply chains; and Thomas and Turk (2023), in IMF study, identified insecurity-related disruption as a key constraint on Nigeria's food supply. Onyele et al. (2025) add an important moderating finding: commercial bank credit,

government agricultural expenditure, microfinance, and ACGSF funds improved agricultural labour productivity, but insecurity weakened the positive effect of agricultural finance evidence that financial and fiscal interventions may underperform in an insecure production environment. Adding further relevance, Sakanko et al. (2025) found that insecurity is itself a significant driver of food-price inflation in Nigeria, suggesting insecurity and inflation may be jointly endogenous rather than independently determined a relationship this study's Granger causality framework is well positioned to test. The general absence of insecurity from aggregate ARDL-based food-security models in sharp contrast to its prominence in the conflict-microdata literature is itself central to the gap this study addresses.

2.3.4 Inflation and Food Security

Evidence on the inflation–food security relationship in Nigeria is more mixed than for credit or government expenditure. Osuji (2020) found that inflation significantly influenced food security in both the short and long run, particularly relevant where food security is understood to include affordability and access rather than availability alone. Ezebilo et al. (2023), using a nonlinear ARDL model (1980–2021), found that monetary policy responses to food inflation operate asymmetrically, with tightening measures reducing food inflation only with a lag. By contrast, several ARDL-based agricultural-financing studies including Anthony and Tijjani (2022) report a negative but frequently statistically insignificant relationship between inflation and food security once credit and fiscal variables are controlled for, suggesting inflation's effect on production may operate more through exchange-rate and input-cost channels than as an independently significant determinant. Sakanko et al. (2025) add a further layer: insecurity, alongside oil-price and crop-production shocks, was found to be a significant driver of food-price inflation implying that inflation may partly transmit insecurity's effect on food security rather than operate as a fully independent channel. This pattern a theoretically expected negative sign that is often empirically weak once other financial and fiscal variables are controlled for is consistent with treating inflation as a control variable in the present study's a priori expectations.

2.3.5 Interest Rate and Food Security

Interest rate is rarely modeled as a variable of primary interest in isolation; it typically appears alongside credit and fiscal variables, consistent with the financial-intermediation and financial-repression logic underpinning this study. Osabohien et al. (2018) recommended closer monitoring of commercial banks' lending rates, implicitly treating interest rate as a moderator of the credit food security relationship. Shaibu et al. (2022) found lending interest rate had an inverse effect on food security, implying higher borrowing costs reduce agricultural investment and weaken production capacity. Anthony and Tijjani (2022) found interest rate had a significant influence on food security within their combined ARDL model, consistent with the expectation that higher borrowing costs constrain agricultural investment, while Nnamocha and Charles (2015) similarly found the cost of credit acted as a drag on the positive contribution of bank lending to output. Udeaja (2014) also identified lending rate as an important monetary-policy variable shaping agricultural-sector performance. This literature supports a negative expected coefficient on interest rate (INTR), while also indicating consistent with the financial-repression logic of McKinnon (1973) and Shaw (1973) that its effect may interact with the credit variable rather than operate entirely independently of it.

2.4 Literature Gap

Three patterns emerge from this review. First, commercial banks' credit and government expenditure on agriculture are the most extensively studied determinants, generally positive in the long run, though short-run significance and appropriate lag structure vary across studies. Second, inflation and interest rate are typically treated as secondary or control variables rather than variables of central theoretical interest, and their estimated effects are less consistently signed or significant, often mediated by exchange-rate and monetary-policy channels not always explicitly modeled. Third and most consequential for this study insecurity is almost never incorporated into the same aggregate time-series model as the financial and fiscal variables: the insecurity literature is dominated by household-survey, panel, and regional case-study designs, while the credit-expenditure-inflation-interest-rate literature, including the closest comparator Anthony and Tijjani (2022), relies on national annual time series that omit insecurity altogether. This is the gap the present study addresses. To the best of my knowledge no study jointly estimates commercial banks' credit, government expenditure, insecurity, inflation, and interest rate within a single ARDL bounds-testing framework for Nigeria's food production dynamics, nor examines the directional Granger-causal linkages among these five variables via a Block Exogeneity Wald framework. By extending the series to 2024, the study also captures Nigeria's post-2023 macroeconomic realignment fuel subsidy removal and exchange-rate unification and the intensification of farmer herder conflict and banditry in food-producing regions, neither reflected in the 1981–2020 or 1981–2022 samples used by the closest prior studies. In doing so, the study integrates the financial-intermediation, Keynesian, and entitlement-based strands of the literature into a single empirical model of Nigeria's food-production dynamics.

3. Data and Methodology

3.1. Data

The study uses annual time-series data covering 1981–2024. Food security, proxied by the Food Production Index, which is the dependent variable and captures the food production dynamics dimension of food security in Nigeria. The explanatory variables are commercial banks' credit to agriculture, government expenditure on agriculture, inflation rate, insecurity, and interest rate. The Food Production Index is sourced from World Bank; macroeconomic and insecurity indicators are sourced from the World Bank and commercial banks' contribution to agriculture and government expenditure on agriculture are sourced from the CBN Statistical Bulletin as listed in the table. For the study therefore, all financial, fiscal, macroeconomic and security-related determinants have been brought together to investigate their influence on the food security dimension in Nigeria.

3.2 Model Specification and Variables Measurement

This study used the model of Anthony, and Tijjani, (2022) with little modification who used the ARDL model approach in the study of the short run and long run effect of commercial banks credit on the growth of agricultural sector. Their model was given as:

$$FOS = f(CBA, GEA, INFR, INS, INTR) \quad (1)$$

Given the above equation (1) it is further expressed in econometric form as shown below:

$$LFOS_t = \varphi_0 + \varphi_1 LCBA_t + \varphi_2 LGEA_t + \varphi_3 INFR_t = \varphi_4 INS_t + \varphi_5 INTR_t + \mu_t \quad (2)$$

A priori commercial banks' credit and government spending on agriculture are expected to have positive effects on food production and food security ($\varphi_1, \varphi_2 > 0$) because they may alleviate financing constraints, facilitate agricultural investment, infrastructure and productive capacity. Inflation is broadly thought to have a negative effect ($\varphi_3 < 0$) as lasting inflationary pressures may lead to production costs increase and reduce food affordability. Insecurity is also likely to negatively affect food production and food security ($\varphi_4 < 0$) due to disruption of farm operations, displacement, limited access to land for farming, and food supply chain disruptions. Interest rate is mainly negatively associated with the expected value of interest ($\varphi_5 < 0$) since increased borrowing costs could limit agricultural investment and access to finance.

Table 1: Variables and Their Measurement

Label	Measurement	Source
FOS	Food Production Index (2014–2016 = 100)	World Bank
GEA	Billions of Naira (₦)	CBN Bulletin
CBAC	Billions of Naira (₦)	CBN Bulletin
INFR	Annual inflation rate (%)	World Bank
INS	Insecurity index (%)	World Bank
INTR	Real Interest rate (%)	World Bank

Source: Author's Compilation 2026.

In order to minimize scale differences and to make the elasticity interpretation easier, the Food Production Index, the credit balance of the commercial banks at the agriculture sector, and the expenditure of the government at the agriculture sector are expressed in natural logarithms as in the transformed series in the empirical results. Inflation, insecurity and interest rate remain as reported.

3.2. Techniques of Analysis

Autoregressive Distributed Lag (ARDL)

The ARDL approach by Pesaran et al. (2001) is suitable for the current study for the following reasons: it allows regressors to be integrated at various degrees I(0) and I(1) with no integration of I(2); it is well suited to relatively small samples; it allows simultaneous estimation of short- and long-run dynamics; and it offers a flexible and statistically efficient framework for time-series analysis. Hence, the unrestricted ARDL model of this study is specified as follows:

$$\Delta LFOS_t = \gamma_0 + \sum_{i=1}^{p} \gamma_{1i}\, \Delta LFOS_{t-i} + \sum_{i=0}^{q^1} \gamma_{2i}\, \Delta LCBA_{t-i} + \sum_{i=0}^{q^2} \gamma_{3i}\, \Delta LGEA_{t-i} + \sum_{i=0}^{q^3} \gamma_{4i}\, \Delta INFR_{t-i} + \sum_{i=0}^{q^4} \gamma_{5i}\, \Delta INS_{t-i} + \sum_{i=0}^{q^5} \gamma_{6i}\, \Delta INTR_{t-i} + \phi_1 LFOS_{t-1} + \phi_2 LCBA_{t-1} + \phi_3 LGEA_{t-1} + \phi_4 INFR_{t-1} + \phi_5 INS_{t-1} + \phi_6 INTR_{t-1} + \mu_t \quad (3)$$

Where Δ is the first-difference operator; p and q denote the lag lengths of the dependent and explanatory variables; φ_0 is the intercept; φ terms capture short-run dynamics; γ terms capture the long-run relationship; and μ_t is the disturbance term. Once cointegration is established, the model can be represented in an error-correction form as:

$$\Delta LFOS_t = \psi_0 + \sum_{i=1}^{p} \psi_{1i}\, \Delta LFOS_{t-i} + \sum_{i=0}^{q^1} \psi_{2i}\, \Delta LCBA_{t-i} + \sum_{i=0}^{q^2} \psi_{3i}\, \Delta LGEA_{t-i} + \sum_{i=0}^{q^3} \psi_{4i}\, \Delta INFR_{t-i} + \sum_{i=0}^{q^4} \psi_{5i}\, \Delta INS_{t-i} + \sum_{i=0}^{q^5} \psi_{6i}\, \Delta INTR_{t-i} + \gamma_1 ECT_{t-1} + \varepsilon_t \quad (4)$$

where ECT_{t-1} is the error-correction term and γ measures the speed at which short-run disequilibrium is corrected toward the long-run equilibrium path. A negative and statistically significant coefficient on the ECT supports convergence to long-run equilibrium.

4. Analysis and Discussion

4.1. Summary Statistics

Table 2 shows descriptive statistics and the correlation matrix for the variables for the period 1981-2024. The mean values are 4.140847 for LFOS, 4.470898 for LGEA, 1.306479 for LCBA, 19.40136 for INFR, 10.24595 for INS, and 0.719926 for INTR. The high standard deviation and range of LCBA, inflation and interest rate suggest that there was significant variation in agricultural financing and macroeconomic conditions over the study period. INTR is strongly negatively skewed while LGEA, INFR, LGEA and LFOS are skewed to the left and LCBA is skewed to the right. The Jarque–Bera probabilities indicate that LFOS, LGEA and LCBA are not deviant of normality at 5%, whereas inflation, insecurity and interest rate are deviant from normality at 5%. As can be seen, the results of the correlation analysis indicate strong positive relationships between food production and commercial banks credit to agriculture (0.883084) and government expenditure on agriculture (0.975542), and inflation has displayed a weak negative correlation with food security (-0.178768). There is a weak positive correlation between INS and LFOS (0.101424), and between INTR and LFOS (0.436543). The time-series analysis is used to assess the dynamic relationships between variables: These pairwise correlations are only descriptive, not causal.

Table 2: Descriptive Statistics and Correlation Matrix Result

	LFOS	LGEA	LCBA	INFR	INS	INTR
Mean	4.140847	4.470898	1.306479	19.40136	10.24595	0.719926
Median	4.235193	4.057218	2.363372	13.12650	11.20551	3.666917
Maximum	4.791607	7.721064	4.473803	72.83550	13.43081	18.18000
Minimum	3.148882	1.774952	-4.360664	5.388008	2.961284	-65.85715
Std. Dev.	0.502171	1.622416	2.984042	16.23182	2.758745	13.84328
Skewness	-0.566384	0.367835	-0.745109	1.795631	-1.210106	-2.808480
Kurtosis	2.196368	2.051586	2.133397	5.275433	3.535640	13.72106
Jarque-Bera	3.536478	2.641282	5.448203	33.13706	11.26462	268.5676
Probability	0.170633	0.266964	0.065605	0.000000	0.003580	0.000000
Observation	44	44	44	44	44	44

Variables	LFOS	LCBA	LGEA	INFR	INS	INTR
LFOS	1					
LCBA	0.883084	1				
LGEA	0.975542	0.815311	1			
INFR	-0.178768	-0.214396	-0.210368	1		
INS	0.101424	0.453310	0.036758	-0.294251	1	
INTR	0.436543	0.431588	0.445028	-0.489602	0.122747	1

Note: This table reports descriptive statistics and correlations for the variables over the period 1981–2024, including the mean, standard deviation, minimum, and maximum values. The statistics provide an overview of the scale, dispersion, and distributional properties of the variables prior to econometric analysis. Source**:** Author's Computation (2026) using E-views 13.

4.2. Stationarity and Chow Breakpoint Tests

The order of integration of the series was first checked by applying both Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests as shown in Table 3 before the estimation of the ARDL model. The results showed mixed order of integration, both tests place the variables at level, I(0) in the stationary set, and the variables at I(1) in the stationary set. None of the variables has order of integration equal to 2, which suggests that the combination of I(0) and I(1) variables is suitable for analysis in the ARDL framework.

Table 3. Unit Root Test Results

Variables	Lags	ADF - Unit-root		Phillips Perron Unit-root		Remarks
		At-Level	At-First Difference	At-Level	At-First Difference	
LFOS	1	0.0276**	----	0.0225**	----	I(0)
LCBA	1	0.8350	0.0001***	0.7410	0.0000***	I(1)
LGEA	1	0.3271	0.0000***	0.3867	0.0000***	I(1)
INFR	1	0.0070***	----	0.0234**	----	I(0)
INS	1	0.5648	0.0000***	0.5470	0.0000***	I(1)
INTR	1	0.0000***	----	0.0000***	----	I(0)

This table reports Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root test results. The null hypothesis is the presence of a unit root. (*), (**) and (***) denote significance level at 10, 5 percent, and 1 percent levels, respectively. I(0) and I(1) denote stationarity at levels and first differences. Source**:** Author's Computation (2026) using E-views 13.0

The Chow breakpoint test is also reported in Table 4. All the reported p-values are greater than 5%, which means that the null hypothesis of no structural break cannot be rejected at the given breakpoint. Therefore, the test suggests that there is no statistical evidence to include a breakpoint dummy in the estimated model. Why the year 2008 was selected as the structural break year was because the year was attributed to the global financial crisis, which resulted in the overall economic turmoil, which in turn impacted all the sectors of the economy, including the food sector.

Table 4. Chow breakpoint test

F-statistic	0.603018	Prob. F(6,32)	0.7258
Log likelihood ratio	4.713200	Prob. Chi-Square(6)	0.5811
Wald Statistic	3.618105	Prob. Chi-Square(6)	0.7282

This table reports the Chow breakpoint test for structural stability. The null hypothesis is that there is no structural break at the specified breakpoint. Rejection of the null indicates a significant structural change in the relationship among the variables. Source: Author's Computation (2026) using E-views 13,

4.3. ARDL Results

4.3.1. ARDL Bounds Test

Table 5 shows the result of ARDL bounds test cointegration relationship among food security, commercial banks credit to agriculture, government expenditure on agriculture, inflation, insecurity, and interest rate. The computed F-statistic value 8.9198 is greater than the upper bound critical values at the 10%, 5%, and 1% significance levels. The null hypothesis of no long run relationship is thus rejected and there is evidence of cointegration between the variables. This result suggests that in the long run, the production of food and the chosen financial, fiscal,

macroeconomic and insecurity indicators are correlated, but in the short run, they can deviate from each other. Hence, cointegration allows the estimation of the long-run coefficients, as well as the error-correction model. E-Views 13 has picked ARDL (1,1,0,0,0,1) as its preferred specification. The long- and short-term estimates corresponding are given in Table 6.

Table 5: ARDL Bounds Test

Test-statistics	Value	Significance	Critical Value Bounds	
			L-Bounds (0)	Upper Bounds (1)
F-statistics	8.9198	10%	2.276	3.297
K	5	5%	2.694	3.829
N	43	1%	3.060	4.150

This table reports the ARDL bounds test for cointegration. The null hypothesis is no long-run relationship among the variables. The reported F-statistic is compared to the critical bounds of Pesaran et al. (2001). Rejection of the null indicates the existence of a long-run equilibrium relationship. Source: Author's Computation (2026) using E-views 13

4.3.2. Long-Run and Short-Run ARDL Results

Table 6 presents the long-run ARDL estimates which reveal that commercial banks' credit to agriculture has a positive and statistically significant relationship with food security. Specifically, a 1% rise in the agricultural credit is found to be related to the increase in food security by 0.184% at 1% level of significance (p=0.0001). This means that better access to bank finance helps food production and thus enhances food security. The long run impact of government expenditure on agriculture on food security is also positive and significant (p = 0.0029). The results further showed that insecurity had negative long-run effect (-0.034718; p = 0.0177), which means that it has a negative effect on the extent of food security as it affects food production The other variables, however ,are statistically insignificant over the long run; inflation has a coefficient of -0.003123 with a p value of 0.1659, which is negative but not precise over the long run, interest rate is also negative in the long run (-0.005131), statistically insignificant at the conventional level (p = 0.1899).

In the short-run results, commercial banks credit to agriculture has a positive and significant coefficient of 0.056675 (p = 0.0062) and the government expenditure on agriculture is positive significant at 10% level of significance 0.021599 (p = 0.0776). Inflation remains negative but insignificant (-0.000960; p = 0.1754). The short-run negative and significant effect of insecurity on food security is (-0.010672; p = 0.0403), suggesting the potential of fast disruption of food production due to insecurity shocks. Interest rate is also negative and very significant (-0.002461; p < 0.001) indicating that higher interest rates may reduce food security in the short term.

The coefficient of the lagged dependent variable is negative and significant, whereas the error-correction term CONITEQ (−1) is found to be -0.307386, which is highly significant (p < 0.001) which shows that there is a convergence towards their long run equilibrium: about 30.7% of the short run food security disequilibrium is eliminated after one year. The Wald test results also show that the impacts of LCBA, INS, and INTR are statistically significant, while the effect of inflation is not statistically significant. Thus, the findings indicate that agricultural credit and government investment are positive influences and insecurity and interest rates are negative influences on the dynamics of food production.

Table 6: Long-run and Short-Run ARDL Results

ARDL Long-run Form

Variables	Coefficient	Std. Error	t-Statistic	Prob.
LCBA (-1)	0.184379***	0.041522	4.440496	0.0001
LGEA	0.070266***	0.022060	3.185241	0.0029
INFR	-0.003123	0.002209	-1.413533	0.1659
INS	-0.034718***	0.013981	-2.483117	0.0177
INTR	-0.005131	0.003842	-1.335347	0.1899
C	3.770955***	0.114126	33.04198	0.0000

ARDL Short-run Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LCBA (-1)	0.056675***	0.019413	2.919474	0.0062
LGEA	0.021599*	0.011870	1.819607	0.0776
INFR	-0.000960	0.000694	-1.384023	0.1754
INS	-0.010672**	0.005005	-2.132181	0.0403
INTR	-0.002461***	0.000478	-5.144983	0.0000
CONITEQ*	-0.307386***	0.035865	-8.570738	0.0000

Wald Test

Variables	F-statistic	Prob.	Chi-square	Prob.
LCBA(-1)	10.69450***	0.0025	10.69450	0.0011
LGEA	3.310971*	0.0776	3.310971	0.0688
INFR	1.915521	0.1754	1.915521	0.1664
INS	4.546195**	0.0403	4.546195	0.0330
INTR	4.872716**	0.0341	4.872716	0.0273

Long-run ARDL: This table presents long-run coefficient estimates from the ARDL model. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Coefficients can be interpreted as long-run elasticities. Short run: This table reports short-run dynamic coefficients from the ARDL Error Correction Model (ECM). The Error Correction Term (ECT) captures the speed of adjustment toward long-run equilibrium following a shock. A negative and statistically significant ECT confirms model stability and convergence. Wald Test: This table reports Wald Test statistics for short and long-run causality. ***Source:*** Author's Computation (2026) using E-views 13

4.3.3. Diagnostic Tests

The post-estimation diagnostic and stability tests are reported in Table 7. The Breusch-Pagan-Godfrey test p value is 0.9908, which cannot reject the null hypothesis that the residuals are homoscedastic. The p-value for the Breusch–Godfrey serial correlation LM test is 0.5026, which is just above the 5% significance level and so provides no evidence of serial correlation at the 5% level. The Jarque–Bera normality test (p = 0.7056) suggests that the residuals are normally distributed and the Ramsey RESET test (p = 0.3149) does not suggest functional-form misspecification. Furthermore, the CUSUM and CUSUM of Squares graphs do not cross the critical boundaries of 5%, indicating stability of the estimated parameters over the sample period.

Table 7: Post Estimation Test Result

Test	F-Statistics	P-value	Outcome
Heteroskedasticity Test: Breusch-Pagan-Godfrey	0.697993	0.9908	Homoscedastic
Correlation LM Test: Breusch-Godfrey Serial	4.040925	0.5026	No serial correlation
Normality Test Jarque-Bera	---	0.7056	Normally distributed
Ramsey Reset Test	0.784443	0.3149	Stable

This reports diagnostic test statistics for serial correlation, heteroskedasticity, normality, and functional form. The null hypotheses correspond to no serial correlation, homoskedasticity, normal residuals, and correct functional form. Failure to reject the null indicates that the model is well specified. Source: Author's Computation (2026) E-views 13.

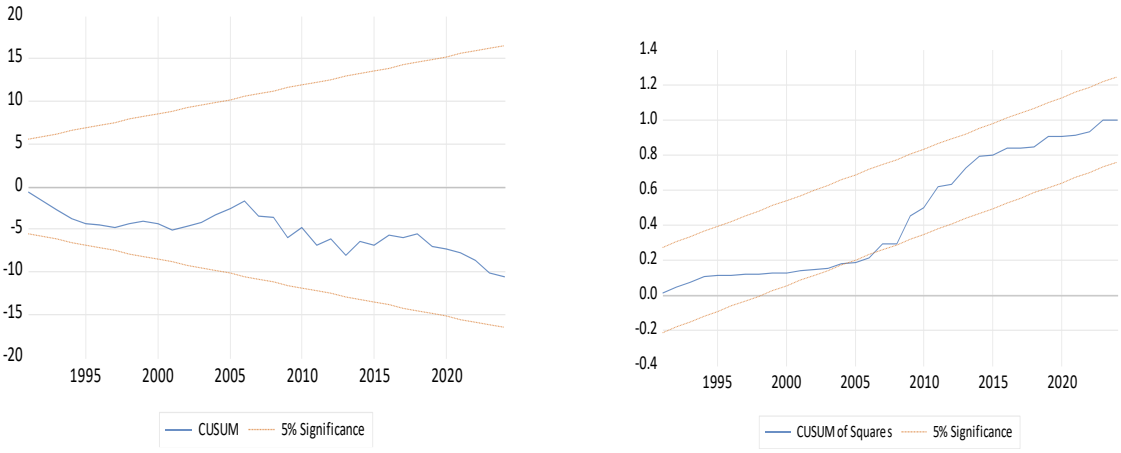


Figure 1. CUSUM and CUSUMQ model stability at 5% significance level

4.4. VAR Granger Causality (Block Exogeneity Wald Tests)

The Granger causality tests have showed a number of causal links between the variables concerning the production of food and the various types of financial, fiscal, macroeconomic and insecurity variables. Of importance, interest rate Granger-caused food security ($p = 0.0252$), meaning that past values of interest rates contain useful information for predicting food security. food security, in turn, Granger-causes government expenditure on agriculture ($p = 0.0003$), indicating a feedback channel that may see changes in agricultural output, the results indicate that the government spending Granger-causes inflation ($p = 0.0469$), whereas insecurity Granger-cause inflation ($p = 0.0001$), suggesting that insecurity lead to inflation given that they affect production, distribution, transportation, and the functioning of the market. The credit of agriculture of commercial banks Granger-causes insecurity ($p < 0.001$), and the government expenditure marginally Granger-causes insecurity at 10% ($p = 0.0807$) and insecurity Granger-causes interest rate ($p = 0.0004$).

Table 8. VAR Granger Causality Test-Block Exogeneity Wald Tests

Direction	χ^2	p-value	Decision
INTR → LFOS	7.3652	0.0252	Significant at 5%
LFOS → LGEA	16.2079	0.0003	Significant at 1%
INFR → LGEA	6.1193	0.0469	Significant at 5%
INS → INFR	19.2488	0.0001	Significant at 1%
LCBA → INS	32.4648	0.0000	Significant at 1%
LGEA → INS	5.0337	0.0807	Significant at 10%
LGEA → INTR	5.9787	0.0503	significant at 10%
INS → INTR	15.5844	0.0004	Significant at 1%

The remaining pairwise relationships are statistically insignificant at conventional levels. In particular, there is no evidence of direct Granger causality between commercial banks' credit to agriculture and food production in either direction within the VAR specification. The joint block-exogeneity result further shows that the five excluded variables jointly fail to Granger-cause food production at the 5% level ($p = 0.1143$), although this does not contradict the ARDL findings because the two approaches answer different questions: ARDL evaluates conditional short- and long-run associations within the specified cointegrating relationship, whereas the Granger test assesses incremental predictive content from lagged variables in the VAR system.

4.5. Discussion

The empirical evidence gives a coherent picture of the dynamics of food production in Nigeria. First, in both the short and long run commercial banks' credit to agriculture becomes a strong positive influence on food production this is in consistent with the findings of (Onyele,et al 2025; Anthony & Tijjani, 2022; Osabohien et al., 2018; Nwosu, 2024). More recent evidence also confirms that commercial-bank credit has a positive and statistically significant long-run effect on crop production in Nigeria Anofe et al. (2024). The result suggests that, relaxing credit constraint could help facilitate the purchase of inputs, machines, technology, storage facilities, and working capital which would enhance the productive capacity of agriculture.

Secondly, Government spending on agriculture has a positive impact on food production, it has an important long run impact and a non-negligible but positive short run impact, it also agrees with the findings of Nwosu (2024) and Efanga et al. (2024) can take time to have an impact on agricultural production, particularly in terms of irrigation, rural infrastructure, research and extension, input support, storage and market access. Thus, the relative effectiveness of agricultural spending should be judged by the amount of such spending, but also by its composition, quality of implementation, timeliness, and effectiveness in crowding in private investment.

Third, insecurity has a long-term impact on food production, both in the short and the long run, the negative and statistically significant impact of insecurity on food production is consistent with Tanko et al. (2024), who found that insecurity reduced agricultural productivity through farmer displacement, farm abandonment and reductions in cultivated area. Similarly, Gana et al (2024) reported that insecurity had adverse short- and long-run effects on agricultural output in Nigeria. The finding also agrees with more recent evidence that insecurity weakens the productivity-enhancing effect of agricultural finance (Onyele et al., 2025) Security shock may impact farmers access to land, deter investment, impact planting and harvesting cycle, increase the cost of transport and transactions and decrease the transport of foodstuffs from producers to markets.

The negative but statistically insignificant effect of inflation is consistent with Anthony and Tijjani (2022) and Efanga et al. (2024) who found that inflation have a negative but statistically insignificant influence on agricultural output or food security in Nigeria. This result suggests that inflation may not independently determine physical food production once other relevant economic factors are controlled for. Nevertheless, inflation can still affect food security indirectly by increasing the prices of fertilizer, seeds, fuel, transportation and other agricultural inputs. The Granger-causality result showing that insecurity predicts inflation agrees with the findings of Gana (2024), who reported that increases in insecurity raised food prices in Nigeria. It is also consistent with Ojo and Oladipupo (2025), who identified insecurity as an important driver of inflation through its effects on food supply, transportation costs and agricultural production. Thus, insecurity may affect the food system through both a direct production channel and an indirect price channel.

The negative and statistically significant short-run effect of interest rate is consistent with Udeaja (2014) and Oyewale and Alliu (2018), who found that higher lending rates constrained agricultural-sector performance in Nigeria. The short-run effect may arise because higher interest rates immediately increase the cost of financing farm inputs, labour and working capital. However, the insignificant long-run coefficient may indicate that farmers and agribusinesses gradually adjust by relying on informal credit, cooperative finance, retained earnings or subsidized agricultural lending programs. The finding that interest rate Granger-causes food production further confirms the importance of monetary and credit-market conditions in agricultural decision-making. This result is consistent with Udeaja (2014), who identified lending rates and commercial-bank credit as important monetary-policy variables influencing agricultural-sector performance in Nigeria. It also supports the argument that changes in financing costs can affect farmers' input decisions, investment behaviour and production levels.

5. Conclusions and Policy Recommendations

5.1. Conclusions

Despite Nigeria's progress, food security remains a significant development and policy problem, especially due to the hazardous, cyclical state of its agricultural production, elevated food prices, food insecurity and limited access to productive finance. In this light, this study reviewed the effect of commercial banks credit to agriculture, government spending on agriculture, insecurity, inflation and interest rate on food security in Nigeria; food production dynamics was used as the empirical proxy for food availability dimension of food security. The study covered the period of 1981 to 2024, the analysis methodology that employs was the Autoregressive Distributed Lag (ARDL), Wald test, and VAR Granger causality (Block Exogeneity Wald test). The order of integration of the variables was found mixed from the unit root results, some variables are stationary at level and others are stationary after the first difference, which is in favour of adopting the ARDL method. The ARDL bounds test also supported the existence of a long-run relationship among the variables involved in the food production, commercial banks' credit to agriculture, government expenditure on agriculture, inflation, insecurity, and interest rate. The long run results show that there is statistically significant positive effect of commercial banks' credit to agriculture on food security. Meaning that more formal credit availability leads to greater investment in agriculture, productive activities and thus enhances the food security. Likewise, agricultural investment by government has a positive and significant impact in the long run, indicating that continued public investment in agriculture helps to build the productive capacity and food security needed for the sector.

In contrast, insecurity has a negative and statistically significant impact in the long run on food security. This discovery is an established fact that insecurity is one of the greatest threats to food security in Nigeria as it hampers agricultural activities, farm access, food investment and food distribution system. Both inflation and interest rate have a negative long-term coefficient but neither are significant at the conventional level. The positive and statistically significant effect of commercial banks' credit on food security has remained in the short term. A positive effect of government spending on agriculture is also present, despite less in the short term. Insecurity is negatively and significantly impacting food production, thus demonstrating that insecurity related shocks can have immediate impacts on food security. The short-run effect of interest rate is also negative and statistically significant, suggesting that as interest rate rises, agricultural production can be reduced due to farmers and agribusinesses' limited access to credit. There is a negative but non-statistically significant correlation between inflation and food security.

The error-correction term is statistically significantly negative, thus confirming that deviations from long-run equilibrium are corrected over time. In particular, of the short-run deviations from equilibrium in food production, about 30.7% are corrected over a period of one year, which would represent a fairly substantial speed of adjustment to long-run equilibrium. The Wald test additionally confirms the significant dynamic effects for commercial banks' credit to agriculture, insecurity, and the interest rate, but not for inflation. The VAR Granger causality-Block Exogeneity Wald test also provides valuable information on the direction of the relationships between the variables. Interest, interest rate Granger-causing food security, which means that changes in interest rates have information that is useful for predicting changes in food security. If food output is the case for food production, the Granger-causality test indicates that governmental spending on agriculture may occur after the developments of agricultural output. Insecurity also Granger-causes inflation and interest rate, underscoring all the larger macroeconomic impacts of security disruptions. Therefore, the results show that there is a mutual interaction between the various factors affecting food security in Nigeria, namely agricultural finance, public expenditure, security factors, and macro-economic factors. Hence, it can be concluded that agricultural measures are not sufficient to achieve sustainable improvements in food security. To boost food production and food availability, good agricultural financing, productive public expenditure, better security and a conducive macroeconomic climate should be in operation at the same time.

5.2. Policy Recommendations

From the empirical results of this study, the following recommendations are made: (i) There is need to improve the efficiency and effectiveness of access to commercial banks' credit for agriculture, by establishing policies to boost food security and should target easing the financial constraints on farmers and agricultural enterprises, especially commercial banks, as their credit has a positive and statistically significant impact on food security in both the short and long run. (ii) Make government spending in agricultural sector more focus and effective, the government spending should focus on developing agricultural infrastructure, irrigation, rural roads, agricultural research and development, extension agencies, storage and processing centres, and market access, also special focus should be on minimizing leakages and that budget allocations are released and put in place as scheduled. (iii) Government should ensure that agricultural and rural security are key pillars of food-security policy, therefore, security must be addressed and it should be directed towards safeguarding farming communities, guaranteeing agricultural land and enhancing the security of transportation networks and food chains. (iv) Government should provide a financing environment conducive to agricultural production, by taken into account for monetary and

financial policies, Interest-rate policy has to balance the broader macroeconomic goals, (v) Government should address inflation with coordinated monetary and fiscal policies on food systems and macroeconomics. (vi) Finally, food-security policy should not be made without considering other policies, there is a need for policies by the Federal Government, Central Bank of Nigeria, state governments, commercial banks and relevant agricultural and security institutions to be coordinated to enhance agricultural financing, increase productive public investment, safeguard farming communities and create macroeconomic conditions that support agricultural production.

5.3. Suggestions for Future Studies

Food security is a multidimensional aspect which refers to food availability, food access, food use and food security stability. This study deals with the dynamics of food production as a representation of the availability dimension of food security as a proxy indicator for food security. Therefore, the conclusions must be seen mainly in the light of food availability and agricultural production and not as a full picture of food security. Other measures of food security, such as undernutrition, food energy supply, food affordability, household-level food security indicators and others, can reflect other aspects of food security. Opposite measures of food security could then be used in future studies to test the strength and statistical significance of the relationships found in this study. Furthermore, use of annual aggregate data does not reflect any interregional, interstate or antiagricultural differences among agricultural producers. Future research can help analyse the effect of agricultural credit access, public spending, insecurity, and macroeconomic factors on various farmer groups and agricultural enterprises using geo-political zones, state, Household, or Farm level data. Last but not least, further conditions affecting the production of food and food security, such as agricultural research and development, technological innovation, climate variability, agricultural labour, human capital, agricultural infrastructure, movements in exchange rates, or the quality of institutions, could be added. Other advanced empirical models such as the nonlinear model, asymmetric ARDL model, and structural model may also give additional evidence on the differential impact of financial, fiscal, security and macro-economic variables across the period.

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