EFFECT OF INSECURITY ON AGRICULTURAL PRODUCTIVITY IN NIGERIA

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ABSTRACT

Food security, agricultural productivity, and foreign and domestic investment in Nigeria have all been affected by the rising level of insecurity in the country and climate change. This study used the autoregressive distributed lag model to analyse data from 1981 to 2021 to investigate the effects of insecurity on agricultural productivity in Nigeria. The study's empirical results show that increased levels of insecurity negatively impacted inflation rates and foreign direct investment, affecting agricultural productivity both in the short and long run. Further, both the unemployment rate and insecurity have shown negative short- and long-run effects on agricultural output; with the short-run negative effects linked to government subsidy programmes intended to lessen the consequences of the increasing prevalence of insecurity in Nigeria. The study findings also suggest that population expansion and gross fixed capital formation have negative short- and long-term effects on agricultural productivity, which reduces agricultural output. The study indicates that government expenditure on healthcare, education, and agriculture can positively impact agricultural production over the long term, ultimately increasing food productivity in Nigeria. As a result, the study suggests that governments provide favourable conditions for both domestic and foreign investors. This can generate jobs for the populace and eventually deter insecurity while also promoting agricultural output in Nigeria.

Keywords: Insecurity, Agricultural output, Bounds test to co-integration, Security spending, Banditry, Agricultural spending

JEL classification: C1, E2, H5, O47

1. Introduction

Nigeria confronts a substantial challenge characterized by a profound impact on food security, agricultural productivity, and economic investment, attributable to the concurrent escalation of insecurity and the pervasive repercussions stemming from climate change. The impact of climate change in Nigeria is becoming pronounced as a continuous contest for resource control between farmers and headers remains famous. This has resulted in a clash between headers and farmers in Nigeria. Agriculture is a major source of livelihood for the teeming population of Nigeria and consequently has been affected by this crisis. The imperative provision of sustenance through agricultural activities, encompassing both cultivated crops and animal husbandry, is indispensable for the preservation of human existence (Steensland, 2022). Food insecurity is defined as uncertainty about the source of your next meal. However, as food insecurity increases, millions of Nigerians are malnourished and poor and the income of the populace diminishes. As a result of hardship and hunger, a tendency for a high crime rate due to able bodies diverting energy to negativities, harming potential investment increases. Subsequently, bridging this gap necessitates the assurance of security for both domestic and foreign investment.

Nigeria is food insecure with high food inflation because the country does not produce enough food for its teeming population. Many farmers in the North East and the South West have been forced to abandon their farms and homes and seek refuge in camps for displaced persons due to constant attacks by armed bandits and kidnappers. In addition, climate change resulting in floods, drought, and variation in rainfall has also contributed massively to low agricultural production and food insecurity in Nigeria. The cumulative effect of these factors is soaring inflation, rising unemployment, and a reduction in domestic and foreign investment in Nigeria. The clash between headers and farmers as a result of competition for water and grazing lands has led to the displacement of many farmers from their farmlands.

A review of the potential effects of insecurity — especially armed banditry and farmers and herders' crisis — on agriculture productivity demonstrates clear negative results (Uduji et al., 2024). An entire nation's capital stock is lowered as a result of these security threats, which hurt both domestic and foreign investment in the agricultural sector. More so, the increased spending on security measures by the government diverts funds for infrastructural developments that have the potential to reduce unemployment through spending on agriculture, education, and healthcare, which can drive long-term economic growth. The effects of these socioeconomic issues include widespread poverty and an undernourished populace, inequality in income distribution, extreme unemployment, poor agricultural output, and a high inflation rate (Naha, 2024).

The relationship between agricultural productivity and insecurity is a crucial research gap that needs to be thoroughly investigated. Although it is generally accepted that insecurity harms economic growth, few thorough studies have explicitly shown how insecurity and agricultural productivity are directly interwoven, particularly in the context of the Nigerian economy. By carefully examining the fundamental factors that determine agricultural output and how insecurity affects it, this study seeks to fill this gap. Finding the complex effects of insecurity on Nigeria's agricultural productivity is the primary objective of the current study. The study applies the autoregressive distributed lag model to unravel the intricate relationship between insecurity and agricultural productivity in Nigeria using time series data spanning the period 1981 to 2021. The outcome of the study is expected to provide valuable insight that can influence the formulation of policies and strategic interventions, aimed at ultimately promoting sustainable agricultural growth and improved food security in Nigeria.

Following this introduction is the review of the theoretical and empirical literature on the relationship between insecurity and agricultural productivity in Nigeria in section 2. Section 3 provides the data sources and formulation of the empirical model. Section 4 discusses the results and findings of the study. The conclusion and policy recommendations are presented in Section 5.

2. Conceptual and Theoretical Framework

National security in modern times has expanded to include social, economic, cultural, political, environmental, and even technical factors. This has become essential because many academics and researchers believe that security must be viewed holistically for a country to be truly secure. "Security is defined as the pursuit of freedom from harm and the capacity of a nation and community to preserve distinct identities and their operational integrity against what they perceive as hostile forces of change" (Stone, 2009; Nkwatoh and Nathaniel, 2018). Security threats can come in different forms, however, Nwagbala & Ejike, 2022; and Black et al., 2023) they can be divided into two broad areas: traditional and non-traditional threats. Traditional security threats such as terrorism, nuclear proliferation, and energy security have been known for centuries. The traditional school of thought believes security to be the pursuit of freedom from danger as well as the capacity of nations and societies to preserve their unique identities and structural integrity in the face of forces of change that they perceive as hostile. Today, while these traditional threats remain on the table, they are joined by a set of “non-traditional” security threats, ranging from the effects of climate change to racial and economic inequality, food insecurity, and migration. The liberal school of thought believes that the government should focus on improving individual economic prosperity over crime prevention because economic uncertainty is the root cause of insecurity.

Whatever the viewpoint, it is generally conceived that security is crucial for national stability, long-term productivity, and economic growth. The failure of any government starts from the ungovernable environment, which is propelled by poverty, social inequality, starvation, and hunger, degenerating into insecurity that will have a long-term effect on agricultural productivity and other worsened situations. Thus, this study's conceptual definition of insecurity is a decline in agricultural growth and productivity brought on by historical, ethnic-regional, civic, social, economic, or political elements that fuel ongoing conflicts and lead to the systematic destruction of people's lives and property.

2.1 Theoretical framework

Although numerous studies have explored the socioeconomic effects of insecurity on productivity using a variety of theoretical methodologies, the theoretical background of this study is based on the relative deprivation theory covered below: Insecurity is caused by a sense of general economic and social deprivation, inferred by Gurr's (1970) relative deprivation hypothesis. The premise that deprivation is likely to result in violence is supported by three theories, each of which focuses on a different aspect of poverty. The idea of frustration and aggression is the first and holds that frustration leads to aggressive behaviour (Gøtzsche-Astrup, Van den Bos, & Hogg, 2020). The expectation paradigm, which asserts that when an expected outcome is not realized, violence will ensue, is the second (Goldstone, 2015). Third, according to the reactance theory, the removal of behavioural freedom, which elicits reactance, may result in violence (Rosenberg and Siegel, 2018). These three concepts highlight the possibility that different levels of poverty may contribute to various forms of insecurity in Nigeria. Nigeria, like many developing nations, experiences unusually poor material conditions as well as issues with governance and the economy. The political system is rife with incompetent, dishonest, and terrible leadership and the country has continued issues with poverty, inflation, unemployment, access to social services and education, and deteriorating infrastructure and services (Evans and Kelikume 2019; Kurfi, 2023). As a result of poverty and environments that are permissive to violence, there is a great deal of anger and mistrust among the populace, which expresses resistance to and disregard for societal norms. The people are therefore open to political, cultural, and other manipulations that might easily incite them to violence. The huge socioeconomic disparities also lead to conflict, particularly when the outlook for economic growth is bleak.

2.2 Empirical review

The effects of insecurity on agricultural productivity have been studied theoretically and empirically. An example is the study by Okafor, Okonkwo, and Chinenye (2023) who examined the effects of insecurity on the consumption pattern of households. The study concluded based on its findings

that insecurity altered the feeding pattern of respondents in terms of being unable to have a balanced diet as well as a change of desired diet options as a result of a hike in prices. Similarly, Amana, Aigbedion, and Zubair (2020) examined the impact of government security spending on economic growth in Nigeria through the application of the classical econometric model (OLS). Their finding shows that government security expenditure has a significant impact on economic growth in Nigeria. In an attempt to proffer a solution to the security challenges in Nigeria, Yusuf & Mohd (2023) investigated the impact of insecurity on the Nigerian economy from 1980 to 2019; an ARDL methodology was used for the estimated periods. The empirical findings demonstrated that the high unemployment rate, domestic capital formation, foreign direct investment, and government spending on education and security were negatively affected by the growing level of insecurity and consequently retarded growth in the long and short run. In line with this, Okoro (2018) and Muhammed et al., (2023) investigated the herdsmen/farmers conflict and its effects on socio-economic development in Nigeria. The results show that conflicts have resulted in loss of lives, displacement, distrust, destruction of properties, etc. The study concluded that the herdsmen/farmers conflict has created food insecurity, distrust, and unemployment. Mathias (2021) also examined the implications of the crisis for food production in Nigeria. The result suggests that for an enabling environment for food security, peace, and sustainable development, there is a need for the Nigerian government to come up with a proper-orientation programme that will breed good social interaction, irrespective of religious or ethnic background. Similarly, Ikezue and Ezeah (2017) and Ekanem (2022) examined the recurrent conflicts among migrant Fulani herdsmen and indigenous communities in Southern Nigeria and Southern Taraba respectively. The findings show that the inability of the Nigerian state to equitably distribute and allocate land resources for cattle routes and grazing is at the core of the conflict. Similarly, Khan et al. (2021) studied the links between renewable energy, fossil energy, terrorism, economic growth, and trade openness in Pakistan. The findings suggest that terrorism has a negative influence on Pakistan's economic growth and trade.

Theoretical explanations of the mechanisms through which insecurity impedes economic progress are provided by Richards (2018) and Geloso and

Salter (2020). Costs incurred directly and indirectly can be used to categorize these channels. According to Richards (2018), the destruction of physical capital, including the destruction of public infrastructure and the loss of human capital, is the most evident and immediate threat posed by civil war (of which terrorism can be viewed as a subset). Due to a lack of security, this destruction increases transaction costs; at the same time, the efficiency of governmental institutions is put in danger. Chuku, Dominic, and Ima-Abasi (2019) adopted the ARDL and structural vector auto-regressive (SVAR) technique to examine the growth and fiscal consequences of terrorism in Nigeria using different measures of terror incidence, government expenditure, and economic activity. The empirical results indicate that terrorism leads to the reallocation of economic activity away from private investment spending to government counter-terrorism spending thereby impacting growth negatively. The study used inflation-unadjusted GDP to represent growth and left out the revenue side of fiscal policy. Despite covering a substantial amount of material, the examined studies have some gaps.

The potential level of resource dependency and the general effect on agricultural productivity in Nigeria have not been widely considered in the literature. Also there is lack of focus on Nigeria in understanding whether agricultural output is sustainable under the peculiar conditions that the country faces, particularly in terms of the weak institutional and security capabilities to protect their citizens and assets from acts of insurgency, which could have severe consequences for the development process. Furthermore, most of the existing empirical studies are sub-regional, use classical regression models, and are unable to uncover country-specific idiosyncrasies in the economy–terrorism relationship, particularly concerning agricultural output. This study attempts to fill these identified gaps by interpreting the country-specific characteristics of the agricultural productivity-terrorism relationship in Nigeria.

3. Data and Methodology

The macroeconomic variables on which data were collected include agricultural output (*AGOT*) as the dependent variable, and the independent

variables including government spending on health (*HETH*), government spending on education (*EDUS*), government spending on agriculture (*GEXA*), total population (*POPL*), gross fixed capital formation (*GCFF*), insecurity (*INS*), unemployment rate (*UNEP*), inflation rate (*INFR*), and foreign direct investment (*FDDI*). Data on *AGOT*, *HETH*, *EDUS*, *GEXA*, and *POPL* were obtained from the Central Bank of Nigeria (CBN), whereas, *GCFF*, *INFR*, and *FDDI* were obtained from the National Bureau of Statistics (NBS) and data on *UNEP* was obtained from the World Development Indicators (WDI). Data on *AGOT*, *HETH*, *EDUS*, *GEXA*, *POPL*, and *FDDI* were obtained in their nominal forms and were log-transformed to enable their variance and percentage-based interpretations, whereas, *GCFF*, *UNEP*, and *INFR* were retained in their rate form. The dummy variable "insecurity" (*INS*) was integrated into the model to effectively capture and account for the substantial variations in insecurity levels over time. A value of "0" was assigned to the period from 1980 to 2008, during which low insecurity prevailed due to factors such as the farmers-herders crisis linked to climate change and resource disputes, and a value of "1" to the subsequent period from 2009 to 2021, characterized by the emergence and diversification of insurgency, including the prominence of Boko Haram and the proliferation of various forms of insecurity in Nigeria. The omission of important variables in a study constitutes significant bias in an econometrics analysis of this nature. To avoid variable omission bias, the study modeled AGOT as a function of the above-stated independent variables. The functional form of the model adopted was anchored on Gurr (1970), Mathias (2021), and Ekanem (2022) to capture the objectives of the study, based on the theoretical and empirical reviews and is stated below:

$$AGOT = f\ (HETH\ , EDUS\ , GEXA\ , POPL\ , GCFF\ , INS\ , UNEP, INFR\ , FDDI\ )$$

The multivariate ARDL model, in an error correction form (ECM), was designed and specified as follows:

$$\Delta LnAGOTt = \beta_0 + \beta_1 LnHETHt_{-1} + \beta_2 LnEDUSt_{-1} + \beta_3 LnGEXAt_{-1} +$$

$$\beta_4 LnPOPLt_{-1} + \beta_5 GCFFt_{-1} + \beta_6 INSt_{-1} + \beta_7 UNEPt_{-1} + \beta 8 INFR +$$

$$\beta 9\, LnFDDI + \sum_{i=0}^{q} \Psi 1^{\Delta} LnAGOT_{t-1} + \sum_{i=0}^{q} \Psi\, 2^{\Delta} LnHETHt_{-i} +$$

$$\sum_{i=0}^{q}\Psi_3\Delta LnEDUSt_{-i} + \sum_{i=0}^{q}\Psi_4\Delta LnGEXAt_{-i} + \sum_{i=0}^{q}\Psi_5\Delta LnPOPLt_{-i} +$$

$$\sum_{i=0}^{q}\Psi_6\Delta GCFFt_{-i} + \sum_{i=0}^{q}\Psi_7\Delta INSt_{-i} + \sum_{i=0}^{q}\Psi_8\Delta UNEPt_{-i} +$$

$$\sum_{i=0}^{q}\Psi_9\Delta INFRt_{-i} + \sum_{i=0}^{q}\Psi_{10}\Delta FDDIt_{-i} + ECTt_{-1} + \mu_t$$

where all variables remain as already defined, and Δ denotes the first differences of the respective variables; 1 is the lag length selections accorded to each variable; *t* = time trend consisting of years from 1981 to 2021; β0 = intercept; β1, β2, β3, β4, β5, and β6, β7, β8, β9, and β10, are the coefficients of the long-run impact of the explanatory variables to be estimated; Psi Ψ 1, Ψ 2, Ψ 3, Ψ 4, Ψ 5, Ψ 6, Ψ7, Ψ 8, Ψ 9, and Ψ 10 are the coefficients of the short-run impact related to the model's convergence to long-run equilibrium.

In contrast, ECT is the speed of adjustment parameter that transmits the pace of convergence or how swiftly the variables are returned from disequilibrium in the short-run to long-run equilibrium. The variables are expected to interfere or correlate with one or more of the endogenous variables in the model.

3.1 Estimation procedure

To carry out this investigation, the ARDL model is utilized. The choice of the ARDL model is to enable the study to capture a significant number of lags in the data generation process. Application of the ARDL approach regardless of whether the underlying variables are I (0), I (1), or a combination of both but not I (2) helps avoid the pre-testing challenges associated with conventional co-integration analysis, which calls for the classification of variables into I (0) and I(1). Endogeneity is less problematic in the ARDL technique since it is free of residual correlation and each of the underlying variables stands as a single equation. When there are several co-integrating vectors, this approach's main benefit is that it can identify the co-integrating vectors. It is also worth noting that in the ARDL procedure, the dependent variable is intimated to be an I(1) variable (Pesaran & Shin, 2001). Moreover, Pesaran & Shin (2001) indicated that the short and long-run parameters estimated using the ARDL

methodology are reliable and efficient for small sample analyses that can be related to what the study encompassed.

4. Results and Discussion of the Findings

To analyze the effect of insecurity on the agricultural output in Nigeria, model estimation was carried out using annual time series data covering the period 1981 to 2021. The summary of the descriptive statistics of relevant variables of the study is reported in Table 1.

Table 1: Descriptive Analysis of Variables

	Mean	Median	Maxi	Mini.	Sta.Dev	Skewn	Kurto	JB.Pro	Obs
AGOT	8512.154	2020.000	41130.00	17.05000	11183.39	1.37	4.00	0.07	41
HETH	82.72463	16.64000	521.6100	0.030000	123.2044	1.75	5.73	0.055	41
EDUS	148.2078	57.96000	646.7500	0.160000	193.8384	1.23	3.33	0.08	41
GEXA	20.69415	7.540000	76.60000	0.010000	24.37998	0.91	2.52	0.046	41
POPL	131.9390	125.3900	211.4000	75.44000	40.37238	0.38	1.96	0.24	41
GCFF	35.65488	33.00000	89.39000	14.17000	18.95568	1.08	3.92	1.61	41
INS	0.317073	0.000000	1.000000	0.000000	0.471117	0.78	1.61	0.23	41
UNEP	10.24854	9.000000	33.30000	1.800000	8.481150	0.95	3.05	0.052	41
INFR	18.49405	12.21700	72.83600	0.000000	16.92678	1.81	5.21	0.06	41
FDDI	2597.122	1870.000	8840.000	189.2000	2521.508	1.11	3.12	0.13	41

The results in Table 1 indicate that the Jarque–Bera likelihood values of *AGOT*, *HETH*, *EDUS*, *POPL*, *GCFF*, *INS*, *UNEP*, *INFR*, and *FDDI* are larger than the 5% significance level indicating that these variables are normally distributed. The Jarque-Bera probability value of *GEXA* demonstrates a distinct lack of normality in the residual as evidenced by a significant Jarqure-Bera probability value of less than 0.05%. The non-normality of the residual may be because this variable is significantly prone to insecurity and other economic instabilities, which would have caused an outlier, leading to residual non-normality. However, except for *INFR*, *GCFF*, and *UNEP*, which are in percentage form, the Jarque-Bera probability of the nominal values of *HETH*, *EDUS*, *GEXA*, *POPL*, *INS*, *UNEP*, and *FDDI* are estimated to be normally distributed. Furthermore, the normality of the data distribution is not required for use in the ARDL cointegration technique used in this study (Chima and

Yusuf, 2023a). Accordingly, the reportable estimated results within the study are considered relatively efficient.

Since most macroeconomic variables exhibit multi-collinearity, correlation analysis was required to examine the extent and severity of this multi-collinearity. Table 2 shows the correlation analysis result of the model.

Table 2: The Pearson Correlation Analysis

	HETH	*EDUS*	*GEXA*	*POPL*	*GCFF*	*INS*	*UNEP*	*INFR*	*FDDI*
HETH	1.00								
EDUS	0.41	1.00							
GEXA	0.63	0.65	1.00						
POPL	0.68	0.59	0.57	1.00					
GCFF	-0.57	-0.61	-0.64	-0.61	1.00				
INS	0.66	0.39	0.70	0.54	-0.61	1.00			
UNEP	0.55	0.55	0.54	0.55	-0.62	0.63	1.00		
INFR	-0.26	-0.25	-0.29	-0.23	0.15	-0.18	-0.30	1.00	
FDDI	0.49	0.68	0.64	0.67	-0.53	0.56	0.61	-0.21	1.00

From the result, there is no serious problem of multi-collinearity or linear dependency among the explanatory variables of the estimation model as their correlation coefficient values are within the threshold of ± 80% (Chima and Yusuf, 2023b). The maximum correlation between any paired regressors was found to be 69%, which is less than the generally acceptable threshold of 80%. Even though the ARDL bounds testing approach does not depend on prior knowledge about the order of integration of the series under investigation, it is, however, essential to test for the stationarity status of all variables to ensure that none of the variables under review are I (2) to ensure reliable results. The result is shown below:

Unit Root Test

Table 3: Summary of Unit Root Test

Variables	ADF		PP Test			Bai-Perron Test			
	Level	1st Diff	Level	1st Diff	Remrk	Break Date	Level	1st	Rmk
LnAGOT	-2.1792[n]	-4.0004[a]	-2.1792[n]	-4.0531[a]	I (1)	2016[a]	-2.422 [n]	-4.219[a]	I (1)
LnHETH	-2.7093[c]	-2.4322[n]	-1.3958[n]	-20.0759[b]	I (0)	2014[n]	-5.071[c]	-11.163[n]	I(0)
LnEDUS	-2.9636[b]	-5.2481[a]	-1.4869[n]	-10.4935[a]	I (1)	2009[a]	-3.764[b]	-5.019[a]	I (0)
LnGEXA	-3.7988[a]	-6.5852[a]	-1.8422[n]	-9.0439[a]	I (0)	2015[a]	-5.231[a]	-7.413[b]	I (0)
LnPOPL	0.5975[n]	-2.7937[c]	0.5383[n]	-10.6197[a]	I (1)	2011[n]	-4.638[n]	-6.023[n]	I (1)
GCFF	-3.5979[b]	-4.4217[a]	-3.6629[a]	-4.3029[a]	I (1)	2013[b]	-6.226[b]	-7.271[b]	I (0)
INS	-0.6498[n]	-6.2450[a]	-0.6498[n]	-6.2450[a]	I (1)	2008[n]	-8.314[n]	-9. 553[n]	I (1)
UNEP	0.2475[n]	-5.0551[a]	0.0566[n]	-5.0551[a]	I (1)	2016[n]	-4.738[n]	-4.866[n]	I (1)
INFR	-2.8882[c]	-2.9153[c]	-2.7934[c]	-9.0446[a]	I (0)	1994[c]	-2.962[c]	-3.713[c]	I (1)
LnFDDI	-2.5533[n]	-10.5430[a]	-2.4350[n]	-10.3782[a]	I (1)	1999[n]	-5.140[n]	-5.824[n]	I (0)

Notes: a, b, and c denote the rejection of the null hypothesis at 1%, 5%, and 10% significance levels, respectively, while n denotes Not Significant

The study implemented two stability tests of Augmented Dickey-Fuller (1981) and Phillips-Perron (1988), and a structural break test of Bai-Perron (1998). It can be correctly inferred from the results in Table 3 that none of the study variables are integrated into order two. The explanatory variables were detected to be either level or first difference stationary while the dependent variable achieved stationarity only after first differencing. The combination of I (1) and I (0) variables is a prerequisite theory to justify the pertinence of an ARDL approach to test for co-integration. Furthermore, structural breaks represent the structural changes that appear in the individual time series. We tested the overall structural break after estimating the regression using E-views 12 statistical package, which captured 2016, 2014, 2009, 2015, 2011, 2013, 2008, 2016, 1994, and 1999 respective structural breaks. These break dates represent years of political instability, economic shocks, and insurgent activities in the country caused by a series of events, including military insurrections, religious crises, farmers-headers crises, and climate change effects in Nigeria. These events collectively disrupted the overall economy and political institutions, and more especially, increased general price levels.

ARDL Bounds Test for Co-integration

An ARDL bounds test method checks for the combined significance of lagged-level variables included within the model and uses the F-test to determine whether a long-run nexus exists between the variables under consideration. Therefore, choosing the appropriate lag length is crucial for the relationship between the F-test findings. Annual observations are used for the study, and a sample size of 41 with 9 parameters is utilized. Due to the wide range of observations and the requirement to include degrees of freedom, a perfect lag length of 1, 2 was selected, and it was required on the variable quantity and the regressors' use in the Akaike Information Criterion (AIC) analysis. The most effective of the calculated models, the lag structure (1, 2, 2, 2, 1, 2, 1, 2, 2, 0), was used to measure Eq. (1) in the investigation. Table 4 presents the findings from the ARDL bounds testing method and, consequently, the estimated F-test. A significant long-term relationship between insecurity and agricultural productivity in Nigeria—expressed specifically in Eq. (1)—exists, as the table shows, with the calculated F-statistic value of 4.772390 being larger than the upper bound critical value of 3.97 at the 1% significance level. As a result, any short-term deviation from the equilibrium in these variables' interactions can be restored over time as they move into the long run.

Table 4: ARDL Bounds Test for Co-integration

Model	*F*-statistics	*K*	Critical values			Decision
			%	Lower Bound I (0)	Upper Bound I (1)	
LnAGOT = F (LnHETH, LnEDUS, LnGEXA, LnPOPL, GCFF, INS, LnUNEP, INF, LnFDDI)	4.772390	9	1%	2.65	3.97	Reject H_0 and accept H_A. Co-integration exists
			2.5%	2.37	3.6	
			5%	2.14	3.3	
			10%	1.88	2.99	

Long-Run Effect of Insecurity on Agricultural Output/Production in Nigeria

The conditional ARDL long-run approach was computed using Equation 1 in the study to validate the long-term fiscal impact of insecurity on agricultural output in Nigeria. Table 5 presents the long-run expected model results.

Table 5: Estimated ARDL Long-run coefficients Dependent variable: LnAGOT

Regressors	Coefficient	Std. Error	t-statistics	P-value
LnHETH	0.625234	0.158556	3.943291	0.0015
LnEDUS	0.022617	0.136126	0.166144	0.8704
LnGEXA	0.082969	0.077110	1.075977	0.3001
Ln POPL	-0.950798	1.158505	-0.820711	0.4256
GCFF	-0.013550	0.007205	-1.880637	0.0810
INS	-0.422402	0.197173	-2.142290	0.0502
UNEP	-0.022966	0.009244	-2.484360	0.0262
INFR	-0.019773	0.003848	-5.138544	0.0002
LnFDDI	-0.156616	0.055301	-2.832045	0.0133
C	1.146593	0.129652	8.843628	0.0000

The estimated long-run coefficient of government expenditure on health (LnHETH) demonstrates a statistically significant positive relationship with agricultural output at a one percent probability level. The findings indicate that a one percent increase in health spending is associated with a 0.62% increase in agricultural output, holding all other factors constant. These results suggest that improved access to quality healthcare services can positively influence healthy lifestyles, consequently contributing to higher levels of farming activity. Importantly, these findings are consistent with the theoretical expectations based on the human capital growth model and are supported by existing literature (Apata, 2021).

The estimated coefficient of government expenditure on education (LnEDUS) revealed a positive relationship with long-term agricultural output, although the relationship was not statistically significant. This suggests that education enhances knowledge of agricultural practices, potentially influencing productivity levels over time.

The long-run agricultural output and the projected coefficient outcome of government spending on agriculture (LnGEXA) exhibited a positive but non-significant link. The non-significant result is that theories have shown that government-scarce resources can be influenced by diverted security spending on education, health, and agriculture. From the results, it may be inferred that an increase in government spending on agriculture will result in a long-run

increase in agricultural output of approximately 8%. In other words, government spending on critical agricultural programs such as capital agricultural projects, improved seedlings, and extension services, if other things remain unchanged, will generate an increase in food production. The result is in tandem with Adesoye et al. (2018) whose findings show that government agricultural spending has a direct impact on agricultural productivity in Nigeria.

The estimated coefficient of population (LnPOPL) exhibited a negative relationship with the value of long-run agricultural production. The negative coefficient of the variable, though confirmed a priori expectations, has shown that a rising population triggers competition for land and other resources leading to crises that reduce the production of crops and animals for feeding, thereby inducing poverty and hunger. The estimated long-run coefficient of gross fixed capital formation (GCFF) indicated a negative non-significant relationship with agricultural output. Low domestic capital formation is a deceased investment in agriculture and agricultural activities. It exposes that domestic private investors have little or no investment in agriculture which is yet to be seen as lucrative, affecting agricultural output in Nigeria.

The long-run agricultural output and the projected coefficient result of insecurity (INS) unveiled a negative significant relationship at a 5% probability level. The result from Table 5 implies that a unit increase in the level of insecurity, ceteris paribus yielded about a 0.42% decrease in long-run agricultural output. Through the erosion of human and material capital, insecurity has a direct negative impact on agricultural production. Bandits and farmers-headers crises have chased farmers away from their farmlands, leading to food shortage, starvation, and hunger. The result is in accord with Yusuf and Mohd (2023) who affirmed that rising levels of insecurity and anti-national activities pose a significant challenge to national rules and regulations, human rights and, in particular, have a significant negative impact on the economy, affecting price, output, employment, trade balance, poverty, inequality, defence, expenditure, government budget patterns, and several others in Nigeria.

The estimated long-run coefficient of unemployment (UNEP) was rightly signed and is evidence of a negative effect on agricultural production that was statistically significant at a five percent probability level. From Table 5, a

percentage increase in the unemployment rate, holding other explanatory variables constant, propelled a decrease of approximately 0.022% in long-run agricultural production. High levels of youth unemployment as a result of modern Nigerian youths not finding agriculture lucrative and not getting involved in farming activities, negatively affects food productivity in Nigeria. The outcome meets the a priori expectation and is in line with the study's theoretical predictions as well as previous findings by Evans and Kelikume (2019), Nkwatoh & Nathaniel (2018), and Brodeur (2018).

Table 5 also shows that the long-run coefficient of inflation rate (INFR) had a considerable negative effect on agricultural production at the 1% level. The overall price level of agricultural output decreases by one unit, which is a result of food production in the long run. Nigeria's high inflation rate occasioned by low agricultural production is worsening the level of food insecurity in Nigeria by reducing living standards and increasing malnutrition. The result is in tandem with the a priori expectation indicating that a small decrease in the overall level of pricing of goods and services will reduce crises which will spur long-term productivity. The result is in accord with Nguyen-Anh et al. (2022) and Ogunpaimo, Oyetunde-Usman & Surajudeen (2021), who confirmed a decline in the standard of living results from declining purchasing power as a result of income erosion brought on by price increases in Vietnam and Nigeria respectively.

The estimated coefficient of foreign direct investment (LnFDDI) in Table 5 indicated a significant negative relationship with long-run agricultural productivity at approximately a one percent probability level. Accordingly, a percentage decrease in foreign direct investment, keeping other variables unchanged, generated a decrease of about 0.15% in long-run agricultural output. Foreign direct investment coming into Nigeria has not found agriculture important, rather foreign investors are interested in the petroleum, and mining sectors, thereby making a relatively significant contribution to agricultural output in Nigeria. The result is in concord with previous studies by Edeme and Nkalu (2019), Nguyen-Anh et al. (2022) and Yusuf and Mohd (2023), who reported a significant negative impact of FDI on the insecurity and growth of Nigeria and Vietnam.

Short-Run Result

To anticipate the short-run dynamics associated with the long-run link after estimating the long-run coefficients, the ARDL model used the lagged values of all the variables in Eq. (1) (a linear combination denoted by the error correction term (ECT)). Displayed in Table 6 are the short-run results of the model estimating the fiscal effect of insecurity on agricultural output in Nigeria.

Table 6: Error correction Representation for the Selected ARDL Model

Error correction representation for the selected ARDL model ARDL (1, 2, 2, 2, 1, 2, 1, 2, 2, 0)	Regressors	Coefficient	Std.Error	t-statistics	P-value
	D(LnHETH)	0.349643	0.053535	6.531167	0.0000
	D (LnHETH (-1))	-0.156825	0.031251	-5.018313	0.0002
	D (LnEDUS)	0.171094	0.030309	5.644929	0.0001
	D (LnEDUS (-1))	-0.170262	0.042010	-4.052921	0.0012
	D(LnGEXA)	0.018334	0.022627	0.810268	0.4313
	D (LnGEXA (-1))	-0.073737	0.025205	-2.925456	0.0111
	D(LnPOPL)	-16.699622	4.565317	-3.657933	0.0026
	D(GCFF)	-0.013746	0.002615	-5.256984	0.0001
	D (GCFF (-1))	0.007722	0.002616	2.951082	0.0105
	D(INS)	-0.108347	0.076626	1.413974	0.1792
	D(UNEP)	-0.004814	0.004002	1.202675	0.2490
	D (UNEP (-1))	-0.013334	0.004148	3.214377	0.0062
	D(INFR)	-0.009110	0.001172	-7.773923	0.0000
	D (INFR (-1))	-0.007450	0.001676	-4.443904	0.0006
	D(LnFDDI)	-0.083268	0.020891	-3.985838	0.0014
	Cointeq (-1)	-0.584838	0.057330	-10.201232	0.0000***

Cointeq = LnAGOT2 -(0.6252*LnHETH + 0.0226* LnEDUS + 0.0830* LnGEXA – 0.9508* LnPOPL - 0.0136* GCFF -0.4224* INS – 0.0230* UNEP – 0.0198* INFR -0.1566* LnFDDI)

According to the results in Table 6, the expected measurement of adjustment speed, the lagged error term coefficient (Coint. Eq (-1)), is negative and highly significant at the one percent level. The error correction term's coefficient is -0.584838, which means that in the current year, almost 58 percent of the deviations from the long-run productivity level in agriculture brought on by shocks of insecurity from past years will have returned to long-run equilibrium. The substantial negative sign, significant and less than one, further affirms the existence of a long-run relationship between the predictors of agricultural output in Nigeria.

The findings in Table 6 also indicate that the current level of public health spending D(HETH) is in agreement with the long-run effect of agricultural productivity at the one percent probability level. Consequently, the coefficient of the one-year lag of government health spending D (HETH (-1)), on the other hand, confirmed a negative and significant relationship with a probability level of about 1 percent. As a result, a decrease in health spending from the previous year led roughly to a 0.15 percent drop in agricultural productivity. This is a result of a substantial reduction in health spending due to reallocation to other sectors.

The estimated coefficient of the current level of government expenditure on education D(LnEDUS) in line with the long-run results indicated a significant positive impact on the present rate of agricultural productivity and was significant at the one percent probability level. Thus, a unit increase in the current year stimulates an approximate increase of 0.17% in the agricultural output at the current level. However, the coefficient of the one-year lag, D (LnEDUS (-1)) showed a negative significant effect on agricultural productivity at the one percent probability level. Accordingly, a percentage increase in government education spending in the previous year caused a 0.17% reduction in agricultural productivity. As a result, the reduction in government spending on education is discouraged by some other economic challenges in Nigeria which affected education expenditures that would have improved the better and modern agricultural practices that would expand food productivity in Nigeria.

The coefficient result of government expenditure on agriculture D(LnGEXA) in tandem with the long-run results indicated a positive non-significant relationship with the current rate of agricultural output. However,

the one-year lag of government agricultural spending D(LnGEXA (-1)) contrary to the long-run agricultural output exhibited a negative significant link with the long-run agricultural productivity at the one percent probability level. The result consequently indicated that a percentage decrease in government expenditure on agriculture in the previous year produced around a 0.07% decrease in agricultural productivity at the previous year's level. The reduction in agricultural expenditure is affected by enormous national economic problems distorting the agricultural budget for food security in Nigeria.

The estimated coefficient of the population D(LnPOPL) affirmed with the long-run results portrayed a significant negative impact on the existing rate of agricultural output. They indicated that a one percent increase in population growth generated about a 16.6% reduction in the current agricultural output level. The estimated coefficient of gross fixed capital formation D(GCFF) in agreement with the long-run result indicated a significant negative relationship on agricultural output at the one percent probability level. In comparison, the one-year lag coefficient D (GCFF (-1)) showed a significant positive impact on the existing rate of agricultural production at the one percent probability level. A percentage increase in the current level of domestic capital investment prompted a decrease of approximately 0.01% while a unit increase in the one-year lag value of the variable increased the current rate of agricultural output by about 1%.

According to Table 6, the coefficient value of insecurity D (INS) in conformity with the long-run result indicated no significant negative impact on agricultural productivity. The non-significant of the variable could be a result of corruption in the non-judicious usage of security spending to boost agricultural productivity in Nigeria. The estimated coefficient result of unemployment D (UNEP) was in line with the long-run result' thus, indicating a negative non-significant relationship with the agricultural output. However, the estimated coefficient result of the one-year lag D (UNEP (-1)) also confirmed a negative significant link with long-term agricultural productivity. Thus, a percentage increase in the current and previous year promoted a negative impact on the current rate of agricultural output by about 1% in both cases.

Based on the results in Table 6, the coefficient value on the current rate of inflation D (INFR) and the one-period lag D (INFR (-1)) in agreement with the

long-run result produced significant negative impacts on the current rate of agricultural production at the one percent probability level in both cases. A percentage increase in the current and previous rate of inflation decreased the current rate of agricultural output by about 1% percent in both cases.

The estimated coefficient result from foreign direct investment inflow D (FDDI) confirmed with the long-run result indicated a significant negative relationship with the agriculture output. A percentage increase in the current rate of foreign direct investment prompted an approximately 0.15% reduction in agriculture productivity in Nigeria.

4.1 Post-estimation diagnostics tests

Different econometric diagnostic tests, including serial correlation, heteroscedasticity, functional form, and stability tests, were used to validate the study's findings. The tests' outcomes are shown in Table 7.

Table 7: ARDL Model Diagnostics Test Indicators

Test	Null hypothesis	F-statistics	P-value
Breusch Godfrey LM Test	No Serial Auto-Correlation	1.509804	0.2601
Jarque- Bera	Normally Distributed		
Breusch-Pagan-Godfrey	No Heteroscedasticity	0.412638	0.9727
Ramsey RESET	No Misspecification	0.646099	0.4360

The model's residuals are normally distributed, according to the diagnostics tests, and there is no solid proof of multi-collinearity, serial correlation, heteroscedasticity, or model misspecification error. The model has the aforementioned desirable traits of OLS models and was described correctly. The estimated model parameters are within the 5% critical value, accepting the null hypothesis that all coefficients and the ECM are dynamically stable, and the estimated findings are accurate and sufficient for forecasting and policymaking, according to the results of the CUSUM and CUSUM of squares tests (Figs. 1 and 2).

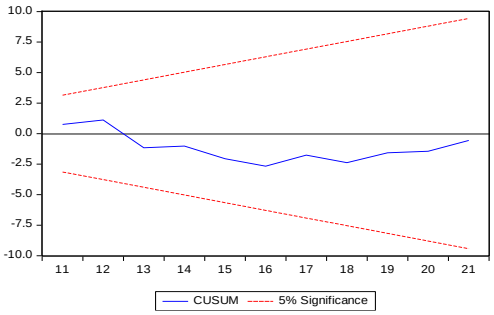

Figure 1.

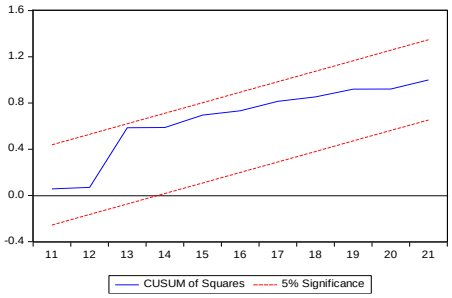

Figure 2.

5. Conclusion and Policy Implications

Food security, agricultural productivity, and foreign and domestic investment in Nigeria are all suffering from the effects of rising levels of insecurity and climate change. For many years now, the herders-farmers crisis, banditry, and all kinds of insecurity have been witnessed, caused by competition for resources. As a result, farmers have been displaced, and farmlands abandoned, resulting in a shortage of food production. This study uses the autoregressive distributed lag model to analyse data from 1981 to 2021 to investigate the effects of insecurity on agricultural productivity in Nigeria. The study's empirical results show that increased levels of insecurity negatively impact inflation rates and foreign direct investment, affecting agricultural productivity in the short and long runs. Further, both the unemployment rate and insecurity have shown negative short- and long-run effects on agricultural output; with the short-run negative effects linked to government subsidy programmes intended to lessen the consequences of increasing insecurity prevalence in Nigeria. The study findings also suggest that population expansion and gross fixed capital formation have negative short- and long-term effects on agricultural productivity, which reduces agricultural output. The study indicates that government expenditure on healthcare, education, and agriculture can positively impact agricultural production over the long term, ultimately increasing food productivity in Nigeria. As a result, the study suggests that government provides favourable conditions for both domestic and foreign investors. This can generate jobs for the populace and eventually deter insecurity while also promoting agricultural output in Nigeria.

5.1 Policy Implications

The study findings have policy implications for more government spending on health, education, and agriculture sectoral services to improve the quality of life of the citizens and minimize insecurity. (which is capable of distorting the whole economic system and thus), and improve agricultural productivity. This would provide adequate nutrition, ensure sound health, and reduce impoverishment in the growing population. The provision of a safe and secure environment for human capital development, and improved access to social and economic services are starting points to inclusiveness, productivity, and poverty reduction which are enablers to reduce insecurity. Nigeria's agriculture sector has recently been bedevilled by armed banditry, terrorism, and the farmers-herders crises that have ravaged farmlands and agricultural produce throwing millions of Nigerians into abject poverty, starvation, and hunger. Unless serious actions are taken by the government against the rising insecurity, food productivity will continue to deteriorate as output declines due to the rising population of unemployed youths who do not find agricultural practices in the country attractive. Therefore, the study suggests that policymakers should institute policies that will increase agricultural output by providing a conducive enabling environment capable of improving security and making agricultural practices attractive to provide job opportunities for the teeming population.

Notwithstanding that the current study provides remarkable insights into the impacts of insecurity on Nigerian agricultural output, it is susceptible to significant limitations, mostly related to data availability and the econometric technique. Future research could look into the effects of insecurity on agricultural output in West Africa using panel data analysis.

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