Asymmetric Impact of Insecurity on Agricultural Productivity in Nigeria

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ASYMMETRIC IMPACT OF INSECURITY ON AGRICULTURAL PRODUCTIVITY IN NIGERIA

Abstract

This paper investigates the asymmetric impact of insecurity on agricultural productivity in Nigeria. It used non-linear autoregressive distributed Lag model to capture the effect of insecurity proxied by terrorism index and crime rate on agricultural productivity proxied agriculture share of gross domestic product. Quarterly time series data were sourced from Central Bank of Nigeria, Institute for Economic and Peace and World Development Indicators for the period 2009Q1 to 2022Q4. Major findings revealed significant long and short run asymmetric impact of terrorism on agricultural productivity, as increase and decrease in terrorism and crime rate in Nigeria cause disproportionate change in agricultural productivity. The paper concludes that insecurity is a major determinant of agricultural productivity in Nigeria and recommends in favor of the need to re-invest in the security sector especially in the rural communities of Nigeria where the impact of insurgencies and other forms of terrorism are prevalent. This will help reduce the effect of terrorism on agricultural productivity in food producing communities, in addition to helping communities affected by terrorism to revive their interests in agriculture.

Keyword: Agricultural productivity, insecurity, terrorism, crime rate, NARDL.

1. Introduction

In 2023, the federal government of Nigeria declared a state of emergency on food and nutrition security and hence, one of the priorities of the Federal Ministry of Agriculture and Rural Development (FMARD) is to make Nigeria food secure. One of the means by which the Nigerian government seeks to achieve this tall objective is by increasing agricultural productivity in the country (FMARD, 2016). Being endowed with vast human and agro-ecological advantages, Nigeria is believed to possess the capabilities of achieving this stride. However, experiences in the immediate past have proven that similar efforts in reviving the agricultural sector and boosting food productivity in Nigeria have failed to achieve desired results due to resource utilization gap (Illesanmi & Odefadehan, 2022), as only an approximated 32 million out of the 94 million hectares of land are cultivated annually. This forms a mere 34% of the total productive capacity of Nigerian agro-ecosystem (Fadare et al., 2019).

One of the major culprits of poor agricultural productivity in Nigeria is the macro-scale insecurity in the country with tribal conflicts, insurgency and banditry as major drivers. Evidence suggests that in the last five years, an approximated 77,000 people were lost to tribal conflict and 2.6 million people of the farming community were displaced due mainly to conflict between Fulani herdsman and local farmers in the North-West and North-Central parts of the country. In the North-eastern part of the country, the Boko Haram insurgency has not only consumed an estimated 32 thousand

people, mostly from the agrarian communities in Bornu State but has also neutralized the 420,000 tons wheat production capacity of the state which is 30% of annual national consumption (Illesanmi & Odefadehan, 2022; Usman, 2018).

The rise in kidnaping of farmers forms another major insecurity-related threat to agricultural productivity in Nigeria through underutilization of human and financial resources in food production. The fear of being attacked or kidnapped, high ransom, and the high seasonal levy imposed by bandits on local farming communities to allow them have access to their farm lands have seriously depleted the availability of labor supply for farm activities and of consequence, low agricultural productivity and output in Nigeria (Ibrahim et al. 2024; Olagunju et al., 2020).

Poor agricultural productivity in Nigeria as a result of rising insecurity has set a thick cloud around the smooth growth of the Nigerian economy. Hence, agriculture in general and food sub-sector in particular are meant to pay dearly by the burden of insecurity in the country. Rising food price inflation which has perennially become the driver of overall inflation in Nigeria (Verter 2019) is believed to be a strong consequence of low agricultural production due to rising insecurity. Prices of important staple food items and vegetables have seen a rise of between 124% to 254% between the year 2020 and 2022. Also, because Nigeria has lost the capacity to meet the huge domestic consumers food demand and hence, feed itself, the county relies heavily on food importation. This has caused a one-dimensional increase in the country's food import bill by about 140% (Illesanmi & Odefadehan, 2022).

The increasing level of distress on how agricultural insecurity affects food production and utilization have resulted in many empirical researches who have tried to investigate the nature of the relationship between insecurity and agricultural productivity in the Nigerian context. For example, Adebiyi and Oladele 2015; Adebisi and Okotie 2017, Louis and Hiikyaa 2018, Musa and Muhammed 2020, Mmaobika et al. 2022, Babajide and Badru 2022 and Illesanmi and Odefadehan 2022 have all showed that insecurity has strong negative impact on agricultural productivity in Nigeria. While most studies have found a strong connection between rising insecurity and agricultural sector performance, only a handful of studies in our investigation such as Louis and Hiikyaa (2018) have revealed a weak relationship between insecurity and agricultural productivity in Nigeria. Hence, in view of emerging data, indicators and techniques of analysis, there is need to further the investigation in this area in order to determine whether previous findings can stand the test of time.

Another major lacuna found in the reviewed literature is that while most of the studies took the broadest perspective to measuring insecurity with little or no effort in determining the impact of different forms of insecurity on agricultural productivity, some of these studies have measured insecurity in terms of national insecurity (Louis & Hiikyaa, 2018; Illesanmi & Odefadehan, 2022), public insecurity (Mmaobika et al., 2022) and security spending (Musa & Muhammed, 2020). A blind spot remains with respect to measuring the impact of human insecurity on agricultural productivity in the Nigerian context.

This study contributes by bridging the gap while focusing mainly on indicators of human insecurity as they affect agricultural productivity in Nigeria to answer the question: to what extent do terrorism and crime rates affect agricultural productivity in Nigeria? Following this introduction, the next section accounts for conceptual, theoretical and empirical literature reviews. While section three discusses methodology of analysis, section four presents and discusses empirical findings. Finally, section five concludes the paper with policy implications of findings.

2. Literature Review

The empirical relationship between insecurity and agricultural productivity has received considerable attention. Researchers are however inconclusive on the extent to which insecurity in Nigeria affect agricultural productivity. Mmaobika et al. (2022) investigated the impact of public security on agricultural productivity and transport in Nigeria using the explorative method of qualitative data collection during the period 1999 to 2020. The major findings from the study suggest that public security is a gradual by major dissatisfaction of the part of public security officers which affect the quality of services they rendered. The findings further revealed that human and drug trafficking, large-scale use of narcotics, banditry, kidnapping and terrorism are among the leading forms of public insecurity in Nigeria which have negatively impacted agricultural productivity and transportation in Nigeria. The authors concluded in favor of grater reimbursement of public officers for effective service delivery as a way of ensuring better security and improvement in agricultural productivity and transport.

In a recent study, Babajide and Badru (2022) investigated the effects of insecurity on agricultural productivity in Nigeria. Relying on a thematic approach to literature review while adopting agricultural output as dependent variable and insurgency, famers-herders crisis, communal conflict, religious crisis and banditry as explanatory variables, the study found insecurity to significantly impact negatively on agricultural productivity in Nigeria. Further findings revealed

that political and leadership factors contribute to rising insecurity in Nigeria which further impact negatively on agricultural productivity. The study concluded in favor of strategic investment in the security sector and mechanization of the agricultural sector as a way of integrating idle youths into the employment sector. This is predicted on the potential of the agricultural sector in creating employment for the gullible and vulnerable citizens.

Illesanmi and Odefadehan (2022) examined the effects of insecurity on agricultural productivity and food loss in Nigeria during the 2011 and 2020. The authors relied on time series data soured from the World Bank Metadata and the error correction mechanism (ECM) as method of data analysis. Considering the dependent variable to be agriculture share of the gross domestic product as proxy or agriculture productivity while aggregate government expenditure on security, unemployment, crime and poverty rates as explanatory variables, the authors found that while crime and unemployment rates had negative impact on agricultural productivity during the period investigated, aggregate government expenditure on security had a positive impact on agriculture productivity. Moreover, poverty rate was found to have no significant impact on agricultural productivity. the authors conceded that there is a there is an overall negative impact on insecurity on agricultural productivity Nigeria.

Musa and Muhammed (2020) analyzed the impact of government security spending on economic growth in Nigeria using the cointegration and error correction mechanism. Annual time series data were sourced from World development indicators are Tradeconomics for the period 1986-2020. While considering real GDP and dependent variable, government security capital and recurrent expenditures, terrorism index and corruption perception index were considered as the explanatory variables. The findings of the study revealed a positive and significant impact of government security spending on economic performance in Nigeria while corruption and terrorism indexes were found to negatively impact economic performance during the period considered. Further findings revealed a bi-directional association between government security spending and economic performance in Nigeria. The authors concluded in favor of a greater reimbursement of both capital and recurrent security spending in Nigeria while closely monitoring the trajectories of corruption and terrorism in the country.

Louis and Hiikyaa (2018) examined the dynamic relationship between insecurity and economic activities in Nigeria using quarterly time series data for the period 2009 and 2016 while employing the vector autoregressive technique of data analysis. Considering growth rate of GDP and growth

rate of capital formation as dependent variables while unemployment rate, global terrorism index and growth rate of military expenditure as explanatory variables, the study found economic growth and investment to respond passively to rising insecurity and a reduction in unemployment rate in the short term. Further findings revealed that increase in government military expenditure only results to economic expansion in the long run. The study therefore concluded that insecurity constitute no more than a threat to economic activities with no significant negative impact on the Nigerian economy, hence, more efforts and resources should be allocated to creating employment opportunities in the county as against increasing government military spending in Nigeria.

Adebisi and Okotie (2017) examined the impact of Boko Haram insurgency on food loss in Nigeria using secondary tie series data and descriptive technique of data analysis and the t-test approach during the 2009 and 2016 period. The findings from this study show that the value added of agriculture to Nigeria's GDP was relatively higher during periods before the insurgency compare to the period during the insurgency, indicating that the Boko Haram insurgency has contributed greatly in disrupting agricultural output in Nigeria during the past years. The authors concluded in favor of an affirmative action by the government that will incentivize and encourage farmers to boost their investment and commitment in improving national agricultural productivity.

Adebiyi and Oladele (2015) determined the relationship between insecurity and economic performance proxied by agricultural productivity in Nigeria during the period 1970 to 2014 using annual time series data sourced from the Central Bank of Nigeria. Utilizing the vector autoregression and error correction mechanisms, the study revealed a negative and significant relationship between insecurity and agricultural productivity in Nigeria. Further finding from the impulse responses suggest a negative, however diminishing impact of past insecurity shocks on present insecurity index. The study therefore concluded that the rise in insecurity in Nigeria has led to a decline in agricultural productivity and overall performance of the Nigerian economy.

Another important study by Adewale (2011) analyzed the crowding-out impact of insecurity on agricultural sector in Nigeria employed the time series data during the period 1900 and 2009. Relying on the experimental research design and error correction mechanism to analyze the data which were sourced from the CBN and World Bank databases, findings revealed a negative association between insecurity and agricultural output in Nigeria during the period investigated. The author concluded in favor of a reintroduction of re-orientation programmes on a nations scale that will enlighten the people on the critical need of eradicating the menace of insecurity in their

communities as a way of enhancing productivity not only of the agricultural sector but that of all sectors of the economy.

3. Methodology

The main objective of this study is to investigate the impact of terrorism and crime rates on agricultural productivity in Nigeria for the period 2009Q1 to 2022Q4. This choice of this period is justified to the extent that in addition to data availability for all variables of interest, it focuses on the period in which insecurity crisis was on a sharp increase as a result of rise insurgency in Nigeria following the Boko Haram crisis in the North-East, Niger-Delta militancy, banditry and Kidnapping in the North-West and farmers-herders clashes in the North-Central parts of the country. Intuitively all these insecurity situations have a direct link to reduced agricultural productivity in Nigeria. In order to guarantee robustness, validity and reliability of results, the study employs Nonlinear Autoregressive Distributed Lag (NARDL) estimation technique introduced by Shin and Greenwood-Nimmo (2014) which has the ability to capture asymmetric relationships, dynamic effects, and robustness to model misspecification.

In line with its objectives, the model employed by this study is anchored on the propositions of the agricultural productivity gap theory as in Gollin (2013) and an adaptation of that of Eneji (2019) model. The parameterized model in presented in equation 1.

$$AGDP_t = \beta_0 + \beta_1 TI_t + \beta_2 CR_t + \beta_3 POV_t + \beta_4 UNMP_t + \mu_t \qquad 1$$

Where: AGDP is agriculture gross domestic product, TI is terrorism index, CR is crime rate POV is poverty rate and UNMP is unemployment rate. β_0 is Constant parameter, $B_1 \ldots \beta_4$ are parameters of the explanatory variables and μ is error term.

Equation 1 is re-parameterizing this model in an asymmetric NARDL form inspired by Shin and Greenwood-Nimmo (2014) in equation 2.

$$\begin{aligned}\Delta lnAGDP_t = {} & \alpha_0 + \alpha_1 lnAGDP_{t-1} + \alpha_2 ln\mathrm{TI}_t^{+ve}{}_{t-1} + \alpha_3 ln\mathrm{TI}_t^{-ve}{}_{t-1} + \\ & \alpha_4 ln\mathrm{POV}_t^{+ve}{}_{t-1} + \alpha_5 ln\mathrm{POV}_t^{-ve}{}_{t-1} + \alpha_6 ln\mathrm{UNMP}_t^{+ve}{}_{t-1} + \alpha_7 ln\mathrm{UNMP}_t^{-ve}{}_{t-1} + \\ & \alpha_8 ln\mathrm{CR}_t^{+ve}{}_{t-1} + \alpha_9 ln\mathrm{CR}_t^{-ve}{}_{t-1} + \sum_{i=1}^{p} \beta_1 \Delta lnAGDP_{t-i} + \sum_{j=0}^{p} \beta_2 \Delta ln\mathrm{TI}_t^{+ve}{}_{t-i} + \\ & \sum_{j=0}^{p} \beta_3 \Delta ln\mathrm{TI}_t^{-ve}{}_{t-i} + \sum_{j=0}^{p} \beta_4 \Delta lnnPOV_t^{+ve}{}_{t-i} + \sum_{j=0}^{p} \beta_5 \Delta ln\mathrm{POV}_t^{-ve}{}_{t-i} + \\ & + \sum_{j=0}^{p} \beta_6 \Delta ln\mathrm{UNMP}_t^{+ve}{}_{t-i} + \sum_{j=0}^{p} \beta_7 \Delta ln\mathrm{UNMP}_t^{-ve}{}_{t-i} + \sum_{j=0}^{p} \beta_8 \Delta ln\mathrm{CR}_t^{+ve}{}_{t-i} + \\ & \sum_{j=0}^{p} \beta_9 \Delta ln\mathrm{CR}_t^{-ve}{}_{t-i} + ECT_{t-1} + \varepsilon_t \qquad 2\end{aligned}$$

In equation 2, the positive coefficients (α_1 to α_9) indicate the effect of a positive change (increase) in the explanatory variables on the dependent variable. Conversely, the negative coefficients represent the effect of a negative change (decrease) in the respective explanatory variables. These coefficients capture the long-run relationship between the variables and the dependent variable, which are estimated.

Data for this paper are generated from different sources. Data on agriculture share of GDP is generated from Central Bank of Nigeria (CBN) statistical Bulletin, data on terrorism index and crime rate are generated from Institute for Economic and Peace (IEP), data for poverty rate is generated from Nigeria Bureau of Statistics (NBS) and finally, data for unemployment rate is generated from World Development Indicators (WDI). The sources and expected behaviors of variables are further explained in table 1.

Table 1
Summary of Data, Measurement, Source and Expected Sign

Variable	Measurement	Source	Expected Sign
AGDP	% of GDP	CBN	+
TI	Nigeria Terrorism Index	IEP	-
CR	Militarization Index	IEP	-
POV	Estimated value	NBS	-
UNMP	% of labor force	WDI	-

Source: Authors' Tabulation

4. Results and Discussion

This section discusses results elicited from the investigation of how agricultural productivity is affected by indicators of insecurity in Nigeria.

Table 2
Summary Statistics

Statistic	AGDP	TI	CR	PSTAB	UNEMP
Mean	22.30	3.74	1.83	0.22	4.57
Median	21.88	3.72	1.79	0.23	4.36
Maximum	26.74	4.08	2.05	0.24	5.99
Minimum	19.99	3.51	1.62	0.19	3.70
Std. Dev.	1.80	0.16	0.15	0.01	0.84
Skewness	0.93	0.54	0.07	-0.41	0.52
Kurtosis	3.25	2.83	1.59	1.80	1.78
Jarque-Bera	8.24	2.80	4.63	4.97	6.04
Probability	0.01	0.24	0.29	0.08	0.14
Sum	1249.00	209.71	102.52	12.72	256.02
Sum Sq. Dev.	178.71	1.44	1.28	0.01	39.25

Observations	56	56	56	56	56

***Source**: Extract from E-views 9 Output, 2024*

Table 2 describes the properties of the data for the estimation period. It is observed that agriculture gross domestic product (AGDP) range between 19.99 and 26.75 with a mean growth rate of 22.30 billion Naira and a standard deviation of 1.80. Because the mean is farther from the maximum, AGDP is positively skewed. The mean of Nigeria's terrorism index (TI) is 3.74 with a range between 3.51 and 4.08 score and a standard deviation of 0.16. TI is also positively skewed. It is further observed that crime rate (CR) ranges between 2.05 and 1.62 with an average point of 1.83 and a standard deviation of 0.15 and a positive skewness. Moreover, political stability (PSTAB) is also observed with a mean rate of 0.22 and ranging between 019 and 0.24. it is however negatively skewed with a standard deviation of 0.01. Finally, unemployment rate (UNEMP) is observed to range between 3.70 and 5.99 with an average of 4.57 and a standard deviation of 0.84. UNEMP is also observed to be positively skewed. The highest maximum and lowest minimum values of the variables are AGDP (26.74) and PSTAB, (0.19). The maximum and minimum values for each measure suggest that their performances vary substantially. The Jarque- Bera statistics test of normality suggest that variables AGDP and PSTAB are not normally distributed at 5% significance level. Finally, the kurtosis statistic shows that TI, CR, PSTAB and UNEMP are platykurtic in nature while AGDP is leptokurtic.

Table 3

Unit Root Tests without Structural Break

Panel A: Augmented Dickey-Fuller (ADF)					
	LEVEL		FIRST DIFFERENCE		
Variable	**Constant**	**Trend and constant**	**Constant**	**Trend and constant**	**I(d)**
LAGDP	2.3224	2.1165	7.2667***	8.1083	I(1)
	(0.1687)	(0.5253)	(0.0000)	(0.0000)	
LTI	2.6036*	2.6190	4.8807	4.9595	I(0)
	(0.0984)	(0.2738)	(0.0002)	(0.0010)	
LCR	1.5188	2.4364	7.2227***	7.1650	I(1)
	(0.5167)	(0.3575)	(0.0000)	(0.0000)	
LPSTAB	1.4424	1.0015	7.2131***	7.3184	I(1)
	(0.5549)	(0.9352)	(0.0000)	(0.0000)	
LUNEMP	0.1166	2.3150	7.8810***	7.8569	I(1)
	(0.9421)	(0.4189)	(0.0000)	(0.0000)	
Panel B: Kwiatkowski-Phillips-Schmidt-Shin (KPSS)					
LAGDP	0.6373	0.2494	0.2523**	0.1534	I(1)
	(0.4630)	(0.1460)	(0.4630)	(0.1460)	

LTI	0.1056**	0.0955	0.0827	0.0528	I(0)
	(0.4630)	(0.1460)	(0.4630)	(0.1460)	
LCR	0.6426	0.1017	0.0763**	0.0637	I(1)
	(0.4630)	(0.1460)	(0.4630)	(0.1460)	
LPSTAB	0.4100**	0.2080	0.2288	0.0901	I(0)
	(0.4630)	(0.1460)	(0.4630)	(0.1460)	
LUNEMP	0.8407	0.1856	0.1823**	0.1290	I(1)
	(0.4630)	(0.1460)	(0.4630)	(0.1460)	

***Source**: Extract from E-views 9 Output, 2024*

NB: ***, ** and * indicate significance at 1%, 5% and 10% respectively.

Table 3 presents unit root stationarity test of the variables employed in this study, using the conventional tests without structural breaks. It shows in panels A and B, ADF and KPSS unit root results at level I(0) and first difference I(1) for all the variables in the two categories of equations (that is, equations that include intercept or intercept & trend). The results therefore are mixed order of integration. LTI under ADF unit root test is stationary at level I(0) while LAGDP, LCR, LPSTAB and LUNEMP are stationary at first difference I(1). The ADF results are not significantly different from that of KPSS with the only difference that LPSTAB is stationary at level for the KPSS test.

Table 5

Bound Cointegration Test

NARDL Bound Test			
F-Statistic	I(0)	I(1)	**Significance**
4.152***	2.12	3.23	10%
	2.45	3.61	5%
	3.14	4.43	1%

***Source**: Extract from E-views 9 Output, 2024*

NB: ***, ** and * indicate significance at 1%, 5% and 10% respectively.

From result in table 5, it is established that the F-statistic derived from the bound test is 7.61 which is the value obtained from the Pesaran table at 5% level of significance. Comparing this to the critical value, it is observed that the F-statistic is greater than the critical values at upper bound (4.15). This informs the rejection of the null hypothesis at 5% level of significance and the conclusion that variables are cointegrated. In other words, there is a long run cointegrating relationship among the variables employed. existence of cointegration necessitates the interest in the error correction components of the models.

Table 6

NARDL Estimation

Panel A: Long Run				
Variable	**Coefficient**	**t-Statistic**	**Prob.**	**Wald Test**
C	2.2904***	0.147417	0.0000	Ho: No asymmetry
LTI_POS	-0.7776***	0.135699	0.0000	21.0360 (0.0401)
LTI_NEG	0.6502***	0.202006	0.0027	
LCR_POS	-0.2015*	0.115431	0.0890	
LCR_NEG	-0.3816**	0.194105	0.0568	
LPSTAB	0.5231	0.383092	0.1803	
LUNEMP	0.5853***	0.097661	0.0000	
Panel B: Short Run				
@TREND(-1))	0.0996	0.0970	0.3110	
@TREND(-2))	0.0996	0.0970	0.3110	
D(LTI_POS)	-0.7405***	0.1419	0.0000	
D(LTI_NEG)	0.3822***	0.1307	0.0059	
D(LCR_POS)	-0.3496***	0.0886	0.0003	
D(LCR_NEG)	-0.2243**	0.1135	0.0557	
D(LPSTAB)	-0.0806	0.3996	0.8411	
D(PSTAB(-1))	0.0000	0.4720	1.0000	
D(PSTAB(-2))	-0.3127	0.3672	0.4000	
D(LUNEMP)	0.7084***	0.0973	0.0000	
ECT(-1)	-0.5878***	0.1236	0.0000	

***Source**: Extract from E-views 9 Output, 2024*

NB: ***, ** and * indicate significance at 1%, 5% and 10% respectively.

The results in table 6 are generated through Schwarz Criterion (SIC) model selection and automatically select lag length (0, 3, 1, 0, 3, 1). The significant probability value of the Wald test result of decomposed positive and negative effects of explanatory variables on the dependent variable, hence, showing an asymmetric long run impact of insecurity on agricultural productivity in Nigeria. The results show agricultural gross domestic product (AGDP) responds negatively to positive shock in Nigeria's terrorism index (TI) and positively to negative shock in TI. This clearly indicates an asymmetric effect of terrorism index on agricultural productivity in Nigeria. By implication, a percentage increase in Nigeria's terrorism index has reduced agricultural output in Nigeria by 78% in the long run, on average, all things being equal, at 1% level of statistical significance during the period investigated. Conversely, a percentage decrease in Nigeria's terrorism index has increased long run agricultural output in Nigeria by 65%, on average, all things been equal. at 1% level of statistical significance.

The result also reveals an asymmetric long run impact of crime rate on agricultural productivity in Nigeria during the period investigated, as AGDP is found to have responded negatively to both

positive as well as negative shocks in CR. Specifically, a percentage increase in Nigeria's crime rate has in the long run, reduced agricultural output in Nigeria by 20%, on average, all things being equal, at 10% level of statistical significance. On the other hand, a percentage decrease in Nigeria's crime rate has in the long run, reduced agricultural output in Nigeria by 38%, on average, all things being equal, at 10% level of statistical significance. As for the control variables of this study, unemployment is also revealed to be a strong predictor of long run agricultural productivity in Nigeria, as a percentage change in UNEMP is found to have a positively impact on AGDP by 58%, on average, all things been equal. at 1% level of statistical significance, during the period investigated.

From panel B of table 4, the dynamic relationship between economic growth and the predictor variables employed are summarized. Similar to what obtains in the long run, the outcome of the short run model also shows an asymmetric effect of the primary explanatory variables Nigeria's terrorism index and crime rate on agricultural productivity in Nigeria, during the period investigated as AGDP responded significantly to short run positive and negative shocks in TI and CR. Specifically, a percentage increase in Nigeria's terrorism index has reduced agricultural output in Nigeria by 74% in the short run, on average, all things being equal, at 1% level of statistical significance during the period investigated. Conversely, a percentage decrease in Nigeria's terrorism index has increased short run agricultural output in Nigeria by 38%, on average, all things being equal at 1% level of statistical significance. Moreover, agricultural output responded negatively to both positive and negative shocks in short run crime rate by 34% and 22% respectively, on average, all things being equal. While positive shock in CR is statistically significant at 1% level, negative CR shock is found to be significant at 10% level of significance.

Moreover, unemployment is also shown to have a significant short run impact on agricultural output, as a percentage change in UNEMP increased agricultural productivity by 71%, on average, all things being equal at 1% level of statistical significance, during the period investigated. The error correction coefficient (ECT) parameter is -0.59 which indicates that 59% errors generated in one period is corrected in the next period. This highly significant and negative ECT coefficient also supports evidence that there is a stable long-run relationship between the dependent variable and the independent variables.

Table 7
Post Estimation Diagnostics

Post Estimation Test (Robustness Check)			
Panel A: Primary Diagnostics			
Diagnostic Test	**F-statistic**	Df	**Prob.**
R^2	0.7631	-	
Adj R^2	0.7517	-	
DW	2.1476	-	
F-Stat	84.8506***	-	0.0000
Panel B: Secondary Diagnostics			
Linearity (RESET)	0.8034	1, 14	0.3852
Serial Correlation	0.5375	2,13	0.5966
Heteroscedasticity	0.3756	13,15	0.9581
JB-Normality	2.0726	-	0.3547

***Source**: Extract from E-views 9 Output, 2024*

NB: ***, ** and * indicate significance at 1%, 5% and 10% respectively.

In table 7, summary of primary and secondary diagnostics is reported. From panel A, the adjusted R^2 revealed that 75 percent of the variation in economic growth is jointly explained by explanatory variables employed in the regression model which indicates the goodness of fit of the regression model. The Durbin Watson statistic suggests the absence of first-order serial correlation in the regression model. Moreover, the F-statistic indicates that the model is adequately specified.

On panel B, further estimation tests of reliability of the regression model revealed that there is absence of specification error, second-order serial correlation and heteroscedasticity, with normally distributed residuals.

4.1 Discussion of Findings

A major finding of this study is the existence of a long run cointegrating relationship between insecurity and agricultural productivity, as the cointegrating vector in the agriculture gross domestic product was found to be very strong at 5% level of statistical significance. This finding justifies a major assumption of the theoretical framework of this study. The labor productivity gap theory assumes a direct relationship between resource committed in terms of human and capital and agricultural output. Hence, in a regime of high insecurity, lower agricultural productivity is expected as more productive resources flow out of the agricultural sector (Gollin, 2013). This finding also supports that of Adebiyi and Oladele (2015) and Illesanmi and Odefadehan (2022) who also found a cointegrating relationship between security and agricultural output in Nigeria.

Another major finding of this study is the existence of significant long and short run asymmetric impact of terrorism on agricultural productivity, as increase and decrease in terrorism in Nigeria

causes a disproportionate change in agricultural productivity. While rise in terrorism rate causes decrease agricultural productivity, increase in the agricultural productivity is relatively slower in case of fall in terrorism. Hence, re-investment in land and labor to reflect significantly on agricultural productivity is expectedly slower as shown by the finding of this study. The finding supports the finding by Adebisi and Okotie (2017) that value added of agriculture to Nigeria's GDP was relatively higher during periods before the Boko Haram insurgency compare to the period during the insurgency. Moreover, significant negative impact of insurgency on agricultural output in this study confirms the finding by Mmaobika et al. (2022) of a negative relationship between terrorism and agricultural output. This however, contradicts the finding by Louis and Hiikyaa (2018) of a weak impact of terrorism on agricultural productivity.

Finding further revealed the existence of significant asymmetric impact of crime rate on agricultural productivity both in the long and short run. In this case increase and decrease in terrorism in Nigeria causes a disproportionate decrease in agricultural productivity. The decreasing impact increase crime rate on agricultural productivity is well understood as justified by the previous empirical evidences in Musa and Muhammed (2020) and Illesanmi and Odefadehan (2022) who in their different studies found unemployment, crime rate and corruption and poverty rates as major predictors of fall in agricultural productivity. However, the decreasing impact decrease in crime rate on agricultural productivity in Nigeria as fond in this study is not well documented in known preceding empirical evidences but could be explained by the argument of the urban-industrial impact theory previously reviewed in this study. This theory argued that agricultural productivity is witnessed more in those regions with higher urban and industrial development than in regions with comparatively lower urban and industrial development (Omorogbe et al., 2014). Hence, urban-bias policy of reducing urban crimes rate fails to reflect its impact positively on agricultural output which is accounted for mostly by the rural dwellers. The negative impact of crime rate on agricultural productivity is however contradicted by the finding of Muhammad and Lawong (2016) whose result showed a significant positive impact of insecurity on macroeconomic performance in Nigeria both in the long run and short run and their conclusion that insecurity has greater impact on the external sector than the internal sector of the Nigerian economy.

5. Conclusion and Recommendations

The study investigated the impact of insecurity on agricultural productivity in Nigeria. Asymmetric effects of some key indicators of insecurity including terrorism index and crime rate on agricultural productivity were empirically examined. Based on the empirical findings, this study concludes that insecurity is a major vector in determining agricultural output in Nigeria. As significant variation in agricultural output in Nigeria is due to level of security in the country, future increase in agricultural productivity will be impacted by a reduced level of insecurity and vice versa. Also, in comparison with other indicators of insecurity, terrorism and crime rates exert more impact on agricultural productivity in Nigeria.

The implications of this study are as follows: There is need for a strategical re-investment in the security sector especially in the rural communities of Nigeria where the impact of insurgencies and other forms of terrorism are prevalent. This will help reduce the effect of terrorism on agricultural productivity in food producing communities, in addition to helping communities affected by terrorism to develop interest in agricultural activities again. This could be achieved through a proper and effective synergy among federal, state and local governments investment not only in logistics but intelligence gathering and working towards sustainable peace of local communities.

It is important to invest in policies and programmes that will protect farmers interests in a sustainable way against common crimes, harassments and anti-competitive market practices. This could be achieved through adequate funding towards training and re-training of security personnel in best global preventive intelligence gathering and security practices. This is predicated on the argument that boosting farmers' confidence and securing their financial stability, is capable of making the efforts of government against crime and terrorism more impactful on agricultural productivity.