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## IMPACT OF BANDITRY ON AGRICULTURAL OUTPUT IN NIGERIA

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**Abstract.** This study aims to examine the impact of banditry on Nigeria's agricultural output with an emphasis on herdsmen attacks between 2014 and 2020. The study employs a quantitative research method, with the source of data being a secondary source. The proxies used for the independent variable are the total number of deaths resulting from pastoralists' attacks, the total number injured by pastoralists, and the total number of internally displaced persons, while the agricultural output percentage of GDP was used to proxy the dependent variable. The data was collected from the Central Bank of Nigeria (CBN) Statistical Bulletin, 2020, the Global Terrorism Database, 2020, and the Internal Displacement Monitoring Center Database, 2022. The data was analysed using Auto-regressive Distribution Lag (ARDL). The results of the study show that as the number of deaths from herdsmen attacks increases the agricultural output decreases, while the number of injured from herdsmen attacks has no significant effect on the agricultural output. Furthermore, the results reveal that as persons become displaced internally, agricultural output rises. The study recommends that the government should provide more securities aid to the farming communities, provide adequate healthcare for these communities, and also help the internally displaced farmers and others to settle quickly to their new environment and provide them with adequate tools to engage effectively in agricultural activities.

**Key words:** agricultural output, herdsmen attacks, banditry, farmers, Nigeria.

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## ВЛИЯНИЕ БАНДИТИЗМА НА ВЫПУСК СЕЛЬСКОХОЗЯЙСТВЕННОЙ ПРОДУКЦИИ В НИГЕРИИ

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**Аннотация.** Данная статья имеет целью изучить влияние бандитизма на выпуск сельскохозяйственной продукции в Нигерии с учетом нападений на пастухов в 2014–2020 годах. Исследование использует количественные методы исследования, при этом источником данных являются вторичные источники информации. Эрзац-переменными, использовавшимися для исследования, стали общее количество смертей в результате нападений на сельскохозяйственных рабочих, общее количество раненых, общее количество перемещенных лиц внутри страны. Доля сельскохозяйственной продукции в ВВП была использована как заменитель для зависимой переменной. Источниками информации послужили Статистический бюллетень Центрального банка Нигерии за 2020 г., База данных по глобальному терроризму за 2020 г. и База Центра мониторинга

внутреннего перемещения за 2020 год. Данные были проанализированы с помощью модели авторегрессии и распределенного лага. Результаты исследования показывают, что, когда количество смертей пастухов от нападений увеличивается, сельскохозяйственное производство уменьшается, в то время как количество раненных при нападениях на пастухов не имеет значительного влияния на сельскохозяйственное производство. Более того, результаты расчетов показывают, что, поскольку люди перемещаются внутри страны, сельскохозяйственное производство растет. В статье даются рекомендации, согласно которым необходимо, чтобы государство обеспечивало большую безопасность сельским работникам, предоставляло соответствующую медицинскую помощь в сельские регионы, а также помогало фермерам, перемещенным внутри страны, и прочим лицам с целью более быстрого устройства на новом месте проживания и их обеспечения соответствующим инструментарием, позволяющим эффективно заниматься сельскохозяйственным производством.

**Ключевые слова:** выпуск сельскохозяйственной продукции, нападения на пастухов, бандитизм, фермеры, Нигерия.

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## Introduction

The largest part of the Nigerian agricultural output is produced in the rural areas of the country dominated by the less educated smallholder farmers. This is because very few less-educated citizens can gainfully be employed in the industrial sector of the country. Also, due to the increase in the level of unemployment in the country, some fresh graduates have resorted to agriculture as a means of survival. Due to this new trend, the agricultural sector in the country has experienced an increase in the number of citizens engaging in its activities, due to this the agricultural output contributed almost 30% of the total gross domestic product of the country as of the third quarter of 2021 [Annual Abstract Report, 2021]. According to Towobola, Luqman, Kolade, Ogunwale, and Olakojo [2014], before the unearthing of crude oil, agriculture was the central sector of the Nigerian economy, responsible for rural employment, food and fiber sufficiency, and export earnings. However, despite the increase in the number of persons joining the agricultural sector the sector has barely experienced an increase in the level of its input annually. Even though the sector's performance has not reached predicted levels, it has so far managed to support the socio-economic development of rural areas. This is especially true in the northern region of the country, where many people farm to feed themselves and sell their products for profit and the ability to continue their activities. Yet, the failure of the sector to grow is a major problem for the growth of the economy.

This problem can be attributed to several factors, namely lack of adequate agricultural tools, poor educational background for the local farmers, government neglect of the sector, and several others [Onogwu et al., 2017]. A major challenge in recent times is the high level of insurgency in the country, most of which is committed in the rural part of the country where most of the farmers are based and also carry out their agricultural activities. Ezema [2013] concludes that the occurrence of insurgency has disrupted the country's agricultural and social activity, particularly in the north. Insurgency in the country started barely a decade and a half ago when the Boko Haram insurgence started its operation in the northeastern part of the country. Ever since, the insurgency has become a household term in the country spreading from the northeastern region to the whole north and even to the middle-belt and western parts of the country, being carried out in different forms ranging from kidnapping, suicide attacks, armed robbery, killings, and such other forms. According to the study by Jare and Bunu [2021], the insurgency has contributed to the deaths of over 27,000 people, an unaccounted number of injured persons, and over 3.2 million persons being internally displaced. Most of the affected people are farmers who are entirely focused on farming activities. The activities of insurgents have forced eight hundred thousand (800,000) children of the farming communities out of their homes in the affected zone [Sam, 2015]. These violent attacks on farmers are indications of the escalation of conflicts between pastoralists and farmers into generalized rural banditry

[Ibrahim, 2014]. Consequently, the agricultural output of the country has not experienced any significant growth despite the increase in the number of persons engaging in agricultural activities.

The agricultural sector is a major part of any economy, the increase in its level of output has an extending effect on the growth level of the economy since this will increase the gross domestic product of the economy. However, the rate of killings, injuries, and the internal displacement of persons caused by banditry has reduced the level of output of the agricultural sector and extended the gross domestic product of the country. The federal government in an attempt to curb the rate of insurgency has increased budgetary provisions for security purposes in its annual budget deployed security personnel to areas affected by insurgency and areas that can be potentially affected while encouraging more citizens to divert to agriculture.

On the part of the sub-national governments, laws have been enacted by state houses of assembly, especially in the middle belt and southern regions where most attacks have occurred, outlawing open grazing by pastoralists. Despite these efforts by the government, banditry has not decreased, and consequently, production in the agricultural sector is constantly falling. This study aims to examine the resultant effect of banditry on agricultural output in Nigeria. Several authors have studied the effects of the insurgency on the agricultural sector, focusing on different parts of the country. This study, however, will focus solely on the impact of pastoral attacks on the country's total agricultural output, filling a gap in research on this sector of the economy. The study explores the effect of banditry on agricultural output in Nigeria.

## **Literature review**

### ***Conceptual review***

In Nigeria, banditry has been explicitly described as a kind of terrorism. According to Ochojila [2022], the activities of the Yan Bindiga (Hausa word for gunmen) group, Yan Ta'adda (Hausa word for terrorists) group, and other similar groups in Nigeria are declared to be terrorism and illegal in any part of Nigeria, according to the Nigerian government. As a result,

any act by any sect that endangers the lives and property of Nigerians is considered banditry by law. Terrorism, according to Eke [2013], is defined as actions aimed at harming certain individuals to instill fear in others by attacking civilians, facilities, or systems on which civilians rely. Terrorism can be defined as a form of violence by which people are targeted to subdue a supposed foe by instilling fear, discouragement, and political tension in the people being attacked [Schmid et al., 2005].

In recent years, this act of banditry is being carried out by groups of organized pastoralists who, under the pretence of grazing their herds, have used such gaps to attack and kill locals, as well as destroy crops. In the words of Masari, "most of the individuals implicated in this banditry are Fulani, whether it is acceptable or not, but that is the truth. I'm not claiming all of them are Fulani, but the bulk of them are, and they live in the forest and raise cattle as their main source of income" [Masari, 2021]. These attacks have resulted in countless lives being lost, countless people injured, and millions of people displaced across several states in the country's agricultural belt, also known as the food basket of the nation, as well as the business and commercial states of the southwestern region. The economic toll of banditry on farmers extends to using their capital and meager life savings for payment of ransom when kidnapped by the bandits; many times they are not able to service loans obtained from financial institutions and several government interventions [How Niger State ... , 2021].

Agriculture is the practice of cultivating land, growing animals, and rearing them to produce food for humans, animals, and raw materials for industries. Crop production, livestock, forestry, and fisheries, as well as the processing and marketing of these agricultural goods, are all included [Mabuza et al., 2008]. Agriculture was critical in spurring Nigeria's economic growth and development in the early 1950s and 1960s. It employed millions of Nigerians, with agriculture accounting for more than seventy percent (70%) of the labour force, the most of who were from rural areas [Abayomi, 2006]. Agriculture contributed more than 70% of the country's export revenues during the same period [Annual Report ... , 2007]. Despite the modest agricultural holdings and poor institutions, agriculture was the main determinant of economic growth in Nigeria.

Agricultural input to GDP outweighed that of other industries. According to African Continental Free Trade Area [African Continental ... , 2020], Nigerians engaged in agricultural activities are about 36%, which offers sustenance for one-third (1/3) of Nigerian citizens who earn a low income, hence, the agricultural sector remains the highest employer of labour in Nigeria. While the Northern part of the country can guarantee the production of cereals such as sorghum, maize, millet, groundnut, cowpea, and cotton, the Middle Belt and the South can guarantee the production of tubers such as cassava, yam, cocoyam, and [Abdullahi, 2003]. Aside from cereals, the country is also interested in cattle, fishery, forestry, and wildlife production. Nigeria, according to Ukpong and Iniodu [1995], is endowed with enormous natural resources, multiple perennial supplies of water, and a favorable tropical climate. Rainfall is normally sufficient and squarely distributed over the country. About 75.30 percent of the 98.321 million hectares of land accessible in Nigeria can be classified as arable land, 10 percent as forest reserves, and the other 14.70 percent is thought to be permanent pastures, built-up areas, and uncultivable waste [Adebisi et al., 2017]. Agriculture has continuously been an important sector and the foundation of the Nigerian economy [Igboeli, 2000]. Agriculture was the pillar of the Nigerian economy from 1930 to 1965, both before and after freedom. Agriculture employed 70 percent to 80 percent of the country's workforce and generated 60 percent of GDP and foreign exchange profits [Ugwu et al., 2012].

### *Theoretical review*

The theoretical framework underpinning this study is Durkheim and Merton's theory of anomie. According to the hypothesis, anomie is caused by the collapse of social structures as a result of rapid societal change when people are not certain which cause of action is wrong or right [Durkheim, 1897]. In most cases, the social system regulates endless human desires. These urges are no longer regulated if the social order collapses. As a result, valid behavior regulation and norms lose their function, leading to aberrant behaviour in one form or another. While Merton [1957] opined that anomie is an intrinsic component of society, he also claimed that it is caused by the disintegration

of the social order. When a society's culture assigns precise aims to the majority of its members, yet the social structures do not provide the lawful means to fulfill these goals, anomie occurs. As a result, anomie is caused by a misalignment of aims and means. As a result, social pressure causes deviant behaviour or action (an activity that is regarded illegitimate by the local society), as people are expected to realize prescribed goals yet lack the resources to do so. A person's proclivity for anomie is determined by their place in society, which is defined by age, sex, race, religion, and other factors. Anomie can manifest itself on many systemic levels (i.e., in various subsystems to which an individual belongs) and to diverse degrees [Dunman, 2003].

### *Empirical review*

The effect of Boko Haram insurgency on crop production in Hawul Local Government Area, Borno State, Nigeria was studied by Anjikwi, Bashir, Pilngwa, and Adamu [2021]. The method employed was multistage random sampling. The descriptive and inferential statistics-paired *t*-tests were utilized to estimate the data. The influence of insurgency on-farm operation, farm inputs, and crop yield before and after the war was investigated using percentages and means, whereas the effect of insurgency on-farm operation, farm inputs, and crop yield were investigated using the paired *t*-test technique. As a result of the dramatically increased cost of the farm operation and input consumption during the insurgency, the study found that farmers in the study region had low yields. Furthermore, during the period after the incident, the yield of kilograms per acre decreased dramatically.

Maina and Agofure [2021] assessed the impact of the Boko Haram insurgency on the nutritional condition of two villages in Yobe State, Nigeria. The study used a simple random sample approach to perform a descriptive cross-sectional study with 391 respondents. A questionnaire was employed to gather data from respondents, while anthropometrical measurements of height and weight were taken using the proper tools. Analysis was given in the form of descriptive frequency, tables, and graphs. The results of the study reveal that Boko Haram insurgency continues to pose major hurdles to farming operations, resulting in

higher food costs and lower nutritional conditions among impacted communities.

The impact of insurgency on agricultural value chains in Nigeria's northeast was investigated by Aigbedion, Anyanwu, and Anefu-Apochi [2019]. The study employed structured questionnaires and focus group talks as key data collecting methods. The research region included all of Nigeria's the northeastern states, including Adamawa, Bauchi, Borno, Gombe, Taraba, and the Yobe states and LGAs. The questionnaires were distributed to 400 respondents (sample size) from northeastern Nigeria's designated local government areas. Tables, charts, graphs, and basic percentages were used in the study's descriptive analysis. Insurgency harms agricultural value chains in Nigeria's the northeastern states. The survey also indicated that the availability of agricultural inputs and goods in the region has decreased.

Ojo, Usman, Mohammed, Ojo, and Oseghale [2018] examined the impact of the insurgency on the production of food crops by farmers in Nigeria's Borno and Gombe states. The study's data was gathered from primary sources via a questionnaire sent to 240 randomly chosen food crop growers. The effect of insurgency on food crop production in the research region was investigated using the ordinary least square regression model. The regression analysis revealed that farm size ( $p < 0.01$ ), fertilizer ( $p < 0.01$ ), farming experience ( $p < 0.05$ ), degree of education ( $p < 0.10$ ), and the farmer's age ( $p < 0.01$ ) all contributed to improved production. In the studied area, insurgency ( $p < 0.01$ ) was inversely connected to production.

Adewuyi and Michael [2020] conducted a study on the impact of the insurgency on food crop production in Borno State, Nigeria's Chibok Local Government Area. Data for this study was gathered from 80 farmers in the study region who were chosen at random. The data were analyzed using simple descriptive statistics. As a result of increased insurgent activities, the study found that the area's rural farmers' production capacities have declined significantly.

Babagana et al. [2018] conducted research in Gujba Local Government Area of Yobe State, Nigeria, in November and December 2018 to analyze the effects of the Boko Haram insurgency on agriculture. The study focused on

six towns: Buni Yadi, Gujba, Goniri, Katarko, Mutai, and Wagir. These towns were the Local Government's agricultural mainstays. The study looked at the effects of the insurgency on farming when citizens returned to these communities after nearly two years of exile in other areas due to militant activity (2016–2017). A descriptive survey design using mixed methodologies was utilized with 394 respondents. The instruments for collecting data were closed-ended questionnaires and structured interview procedures. The results showed that the Boko Haram insurgency had taken a toll on all regular human activities in the area, including farming, at first (2012–2016), to the point that agricultural and animal production almost came to a halt, and several farmers fled and became refugee for two years (2014–2016).

Usman and Bawa [2019] examined the impact of the insurgency on cowpea production in the Potiskum Local Government Area of Yobe State, Nigeria, which was investigated in this research work. 120 cowpea farmers were randomly sampled using structured answer questionnaires in this quantitative study. Descriptive and inferential statistics were employed to estimate the data. The study found that insurgency existed in the study region, with fatalities, crop losses, and the destruction of schools, telecommunications masts, mosques, churches, markets, and homes.

Sidney, Hayatudeen, and Kwajafa [2017] investigated the impact of sect activities on peasant farmers' productivity in a few localities in Adamawa State. A total of 330 questionnaires were distributed to the study's target group. The study included both descriptive and inferential analysis. To assess the productivity of local farmers in the research region, the logit model was utilized. The main findings revealed that peasant farmers' production has decreased, and local farmers' income has decreased in the afflicted areas. The bulk of the farmers in the impacted areas are women farmers who are unable to obtain financing. Fear of the unknown prevented the government from supplying agricultural input subsidies.

Adebisi et al. [2017] evaluated Boko Haram's insurgency in the Nigerian economic environment's agriculture sector. The secondary data were analyzed using descriptive statistics and *t*-tests before and throughout the insurgency

between 1994 and 2013, using a time-series analysis research technique. The data revealed that the agricultural value contributed to GDP was high before the Boko Haram disturbance and has decreased throughout the insurgency era.

Jelilov, Ayinde, Tetik, Celik, & Olali [2018] examined the influence of terrorism on agribusiness in Borno State is investigated in this research. As a result, the influence of insurgency-related activities on agriculture in Borno State is investigated in this study. The Ordinary Least Squares approach is used in this study. The results show that both correlations are negative, demonstrating a statistically significant detrimental effect of terrorism on farming in Borno State.

Madu [2019] investigated the impact of the Boko Haram insurgency on the livelihood of farmers in Borno State's Chibok Local Government Area. A multi-stage sample method was utilized to pick 120 people from six villages out of the 11 that made up the local government area for this study. The farmers' information was gathered using a standardized questionnaire. The field data were examined using descriptive statistics (frequency, mean, and percentage). *T*-test analysis was also utilized to compare means and establish the insurgency's major impact on the study area's farmers. The findings revealed that the Boko Haram insurgency has had a detrimental influence on farmers' livelihoods. As a result of the insurgency, farmers' farm sizes, production, revenue, and non-farm activities have shrunk.

Aluko, Osikabor, Adejumo, and Sumade [2016] examined the effect of Boko Haram on accessible ways of moving merchandise from the problem zone to the Bodija markets in Ibadan, Oyo State, Nigeria was explored in this study. To assess the hypotheses, all data were provided and inferential statistics were employed. The reported effect of the Boko-Haram insurgency on the means of accessing cowpea among merchants was substantially related to age, tribe, education, marketing experience, and ways of accessing cowpea from the insurgency zone to market. The insurgency, the research determined, hurt the ways of transporting cowpea from the problematic zone to the Bodija market.

## Methodology

The data used for this study will be drawn from secondary sources in a time series format, ranging from 2014 to 2020 which was sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin, 2020, Global Terrorism Database 2020 [Information ... , 2020], and Internal Displacement Monitoring Center Database, 2022 [Global Internal ... , 2022]. The data was extracted in a quarterly format from the first quarter of 2014 to the first quarter of 2020. The agricultural output percentage of GDP is used as the measurement for agricultural output. While the number of deaths resulting from pastoralists attacks, the number of injuries resulting from pastoralists attacks, and the number of internally displaced persons was used as the measurement for banditry. The model of the study is specified as indicated below.

$$\text{Mathematically, } AOP = f(\text{NMD}, \text{NMI}, \text{IDP}). \quad (1)$$

$$\text{Statistically, } AGO_t = \beta_0 + \beta_1 \text{NMD}_t + \beta_2 \text{NMI}_t + \beta_3 \text{IDP}_t + \mu_t. \quad (2)$$

Where: AOP = Agricultural Output; NMD = Number of Deaths; NMI = Number of Injured; IDP = Internal Displaced Persons;  $\beta_0$  = Constant;  $\beta_1, \beta_2, \beta_3$  = Regression coefficients;  $\mu$  = Error Term; At time *t*, the variables were defined.

The ARDL specification for the model is stated below:

$$\ln LAOP_t = \alpha_0 + \sum_{i=1} \alpha_1 \ln LAOP_{t-i} + \sum_{i=0} \alpha_2 \ln LNMD_t + \sum_{i=0} \alpha_3 \ln LNMI_t + \sum_{i=4} \alpha_4 \ln LIDP_t + \varepsilon_t.$$

The study uses Auto regressive distribution lag (ARDL) estimation techniques to analyse the data. The summary statistics, correlation matrix, and stationarity test will be estimated as a form of pre-estimation while the serial correlation test, normality test, and multicollinearity test will be conducted as a form of post-estimation. The ARDL will be used to determine the individual effect of each of the regressors on the dependent variable. The summary statistics will present the results of basic measures of central tendencies and dispersion. The correlation matrix will provide the pairwise association between the variables. The serial correlation test, normality

test, and multicollinearity test are used to determine the distribution of the series and the goodness fit of the model.

Table 1 presents the summary statistics of the variables. From the table, the average of AOP, NMI, NMD, and IDP is 5993991, 68.06667, 14.77333, and 2069620 respectively, the standard deviation which captures discrepancy indicates that AOP, NMI, NMD, and IDP have a standard deviation coefficient of 1710342, 55.07638, 17.10147, and 424395.4 respectively; hence AOP has the highest discrepancy while NMD has the lowest discrepancy. The skewness captures the shape of a distribution. The skewness shows that AOP, NMI, and NMD are positively skewed with a skewness coefficient of 0.538240, 0.733933, and 2.284808 respectively, indicating that AOP, NMI, and NMD are tailed to the right. While IDP is negatively skewed with a skewness coefficient of -0.256999 indicates that IDP is tailed to the right. The kurtosis measures the sharpness of the peak of a distribution, all the variables are platykurtic with each variable's kurtosis coefficient being lesser than 3 except NMD with a kurtosis coefficient of 8.616711 greater than 3. The Jarque-Bera probability indicates that AOP, NMI, and IDP are all normally distributed with a probability value greater than 0.05, however, NMD does not follow a normal distribution with a probability value less than 0.05.

The nature of the association between the variables is measured using the correlation matrix, the result is presented in Table 2. AOP and NMI

are strongly and negatively associated, while AOP and NMD shared a weak and negative association, AOP and IDP are found to be positively and strongly associated. NMI shared a moderate and positive correlation with NMD. NMI and IDP are associated in a weak and positive form, while NMD and IDP shared a negative and weak association.

The stationarity test presented in Table 3 shows that NMI, NMD, and IDP are all stationary at levels, while AOP is stationary at first difference. Due to this mixture of integration order, the study proceeds to employ Auto-Regressive Distribution Lag (ARDL) for the estimation technique.

The ARDL bound test is estimated to capture the existence of a long-run relationship between the dependent variable (AOP) and the independent variables (NMI, NMD, & IDP). The result from Table 4 suggested the existence of a long-run relationship between the variables. The value of the *F*-statistics 6.952843 is greater than the coefficients of the 1% significance level, which indicates that there is a long-run relationship in the model at the 1% significance level.

Table 5 presents the long-run relationship between AOP and NMI, NMD, and IDP. NMI is found to exert a positive and insignificant effect on AOP with 0.168603, this indicates that a unit increase in NMI will cause an insignificant increase of 0.168063 on AOP. NMD on the other hand exerts a negative and significant effect on AOP with -0.228296, this indicates that a unit increase in NMD will cause AOP to decrease by

Table 1. Empirical analysis and results. Summary statistics

	AOP	NMI	NMD	IDP
Mean	5993991.	68.06667	14.77333	2069620.
Median	5849998.	66.33333	9.000000	2025500.
Std. Dev.	1710342.	55.07638	17.10147	424395.4
Skewness	0.538240	0.733933	2.284808	-0.256999
Kurtosis	2.585775	2.842376	8.616711	2.724721
Jarque-Bera	1.385827	2.270285	54.61336	0.354139
Probability	0.500117	0.321376	0.000000	0.837722

Note. Source: authors' computation.

Table 2. Correlation matrix

	LAOP	LNMI	LNMD	LIDP
LAOP	1			
LNMI	-0.70	1		
LNMD	-0.33	0.63	1	
LIDP	0.7	-0.39	-0.21	1

Note. Source: authors' computation.

0.228296 in the long run. IDP exerts a significant positive effect of 0.276910 on AOP, which suggests that a unit in IDP will cause an AOP to increase by 0.276910 in the long-run.

The short-run effect of the regressors on the dependent variable is captured in Table 6. The CoinEq(-1) coefficient indicates that there is a short-run relationship in the model, and the relationship is statistically significant. AOP at lag 1 exerts a positive and significant effect on AOP at present, which indicates that a unit increase in AOP at lag 1 will cause an AOP at present to increase in the short run. In the short-run NMI is found to have a positive and significant effect on AOP, which indicates that an increase in NMI will cause AOP to increase. NMD exerts a negative and significant increase on AOP, which

implies that an increase in NMD will cause AOP to decrease. IDP is found to have a positive and significant effect on AOP in the short-run; this indicates that an increase in IDP will cause AOP to increase. The adjusted R-squared coefficient indicates that 60.24% of the changes in AOP are caused by the selected explanatory variables; the Durbin-Watson stat indicates that there is an absence of autocorrelation in the model.

Table 7 presents the diagnostic tests conducted to test the fitness of the model. The table indicates that the residuals are not serially correlated, the model is homoscedastic, the residuals follow a normal distribution, and each of the independent variables is independent of each other. Hence, the explanatory variables are fit and can satisfyingly be regressed on the dependent variable.

Table 3. Stationary test

UNIT ROOT TEST RESULTS TABLE (PP)				
Null Hypothesis: the variable has a unit root				
At Level	LAOP	LNMI	LNMD	LIDP
<i>t</i> -Statistic	-2.4927	-3.1288	-3.6705	-2.8874
<b>Prob.</b>	<b>0.1295</b>	<b>0.0390</b>	<b>0.0124</b>	<b>0.0616</b>
	no	**	**	*
At First Difference	<i>d</i> (LAOP)	<i>d</i> (LNMI)	<i>d</i> (LNMD)	<i>d</i> (LIDP)
<i>t</i> -Statistic	-6.3082	-10.3112	-6.6004	-2.9139
<b>Prob.</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.0591</b>
	***	***	***	*

Note. Source: authors' computation. \* – significant at the 10%; \*\* – significant at the 5%; \*\*\* – significant at the 1%; no – not significant. Lag Length based on AIC. Probability based on MacKinnon [1996] one-sided *p*-values.

Table 4. ARDL bound test

<i>F</i> -Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	<i>I</i> (0)	<i>I</i> (1)
			Asymptotic: <i>n</i> = 1000	
<i>F</i> -statistic	6.952843	10%	2.37	3.2
<i>K</i>	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66

Note. Source: authors' computation.

Table 5. ARDL long-run relationship

Variable	Coefficient	Std. Error	<i>t</i> -Statistic	Prob.
LNMI	0.168603	0.100148	1.683547	0.1308
LNMD	-0.228296	0.094757	-2.409291	0.0426
LIDP	1.021133	0.117300	8.705325	0.0000
C	0.276910	0.785390	0.352576	0.7335
EC = LAOP – (0.1686*LNMI – 0.2283*LNMD + 1.0211*LIDP + 0.2769)				

Note. Source: authors' computation.



### Findings and implications

The findings indicate that the number of injured exerts a positive and insignificant effect on agricultural output in Nigeria. Due to its insignificance, it does not affect agricultural output during the period under study. The number of deaths is discovered to have a negative and significant effect on agricultural output, this implies that as the number of deaths resulting from pastoralists attacks increases agricultural output decreases, this suggests that farmers are mostly the causalities of the pastoralist attacks and hence, a decrease in the output of agricultural produce of Nigeria. Internally displaced persons caused by crisis are found to exert a positive effect on agricultural output in Nigeria. This implies that as the number of internally displaced persons increases, agricultural production increases. This outcome could be caused by two reasons. First, farmers who are displaced from their homes continue farming activities where they currently

sojourned and hence contribute significantly to the agricultural output in Nigeria. Second, citizens who are not farmers before they were displaced might resort to farming as a source of income where they reside and therefore contributes to agricultural output in Nigeria.

### Conclusion and policy recommendations

The study examined the impact of banditry on agricultural output in Nigeria. The study specifically measured the effect of the number of injured and deaths resulting from attacks by pastoralists and the number of internally displaced persons resulting from the crisis and violence. The study discovered that the number of injured has no significant effect on agricultural output during the period under study. However, the number of deaths is found to exert a negative impact on agricultural output in Nigeria. An internally displaced person is found to have a positive impact on agricultural output in Nigeria. The study

Table 6. ARDL short-run relationship

Variable	Coefficient	Std. Error	t-Statistic	Prob.
<i>D</i> (LAOP(-1))	1.133766	0.234488	4.835074	0.0013
<i>D</i> (LNMI)	0.108434	0.044061	2.460985	0.0393
<i>D</i> (LNMI(-1))	-0.063368	0.032467	-1.951780	0.0868
<i>D</i> (LNMD)	-0.123863	0.035087	-3.530165	0.0077
<i>D</i> (LNMD(-1))	0.094095	0.028207	3.335920	0.0103
<i>D</i> (LIDP)	2.375745	0.879077	2.702546	0.0270
<i>D</i> (LIDP(-1))	-1.494038	0.681240	-2.193114	0.0596
CointEq(-1)	-0.077725	0.010762	-7.221241	0.0001
R-squared	0.602364	Mean dependent var		0.013981
Adjusted R-squared	0.545410	S.D. dependent var		0.105936
S.E. of regression	0.041652	Akaike info criterion		-3.229774
Sum squared resid	0.020818	Schwarz criterion		-2.831481
Log likelihood	40.29774	Hannan-Quinn criter.		-3.152023
Durbin-Watson stat	1.881011			

Note. Source: authors' computation.

Table 7. Diagnostic tests

Breusch-Godfrey Serial Correlation LM Test	
<i>F</i> -statistic	2.190437
<i>p</i> -values	0.0955
Heteroskedasticity Test: Breusch-Pagan-Godfrey	
<i>F</i> -statistic	0.918717
<i>p</i> -values	0.4062
Jarque-Bera Test for Normality of Residual	
Jarque-Bera	2.943446
<i>p</i> -values	0.229530
Multicollinearity Test	
Centred VIF (mean)	1.562514

Note. Source: authors' computation.

recommends that the Nigerian government, both the federal and sub-nationals, should revamp the security architecture of the country, especially in the agricultural value chain and the farming communities, in order to stem the tide of violence, banditry, kidnapping and terrorism. They should provide adequate healthcare for already affected communities, and also help displaced farmers and others to settle quickly to their new environment and provide them with adequate tools to engage effectively in agricultural activities.

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