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ANALYSIS OF FOOD INSECURITY AND HUNGER ON NIGERIA'S POVERTY LEVEL

Food insecurity is lack of access to an adequate supply of affordable and wholesome food for a population. As a results of years of food decline, the number of individuals who experience poverty and consequently hunger have begun to rise on continual basis This study focuses on the food insecurity, hunger and poverty in Nigeria. The indicator of poverty is poverty rate while the indicators of food insecurity and hunger were food production index, prevalence of food inadequacy and number of the undernourished. The study employed autoregressive distributed lag (ARDL) model using time series data from 1990-2021. The study showed that food production index had negative impact on poverty level ($p=.0008$; $t=-3.859645$; coef. at -0.133758) and that undernourishment had significant negative impact on extreme poverty level ($p=.0001$; $t=-4.861845$). The study also found that the direction of causality between food production, hunger, and extreme poverty level showed that both food production and hunger granger caused extreme poverty ($t=-4.152609$, $t=-2.250300$ & $t=5.317666 > t=2.0000$). The study suggested that in order to increase affordability, a distribution system for increased food production must be put in place to improve malnourishment.

Key words: Food insecurity, Hunger, Poverty, Undernourishment, Nigeria.

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Нигериядағы кедейлік деңгейіне азық-түлік қауіпсіздігі мен аштықтың әсерін талдау

Азық-түлік қауіпсіздігінің болмауы-халықтың арзан және пайдалы азық-түліктің жеткілікті қорына қолжетімділігінің болмауы. Азық-түлік өндірісінің көпжылдық қысқаруының нәтижесінде кедейлікке, демек, аштыққа ұшыраған адамдардың саны үнемі өсе бастады. Бұл зерттеу – Нигериядағы азық-түлік қауіпсіздігіне, аштық пен кедейлікке бағытталған. Кедейлік көрсеткіші кедейлік деңгейі, ал азық-түлік қауіпсіздігі мен аштық көрсеткіштері азық-түлік өндірісінің индексі, азық-түлік тапшылығының таралуы және тамақтанбағандар саны болды. Зерттеу 1990-2021 жылдар аралығындағы уақыт қатарының деректерін пайдалана отырып, авторегрессиялық үлестірілген кідіріс (ARDL) үлгісін пайдаланды. Зерттеу көрсеткендей, азық-түлік өндірісінің индексі кедейлік деңгейіне теріс әсер етті ($p=.0008$; $t=-3,859645$; coef. $-0,133758$ деңгейінде) және дұрыс тамақтанбау өте кедейлік деңгейіне айтарлықтай теріс әсер етті ($p=.0001$; $t=-4,861845$). Зерттеу сонымен қатар азық-түлік өндірісі, аштық және өте кедейлік деңгейі арасындағы себеп-салдарлық байланыстың бағыты азық-түлік өндірісі де, Грейнджердің аштығы да өте кедейлікті тудырғанын көрсетті ($t=-4,152609$, $t=-2,250300$ және $t=5,317666 > t=2,0000$). Зерттеу қол жетімділікті арттыру үшін дұрыс тамақтанбауды бақылау мақсатында азық-түлік өндірісін ұлғайту үшін тарату жүйесін енгізу қажет деген болжам жасады.

Түйін сөздер: Азық-түлік қауіпсіздігі, аштық, кедейлік, дұрыс тамақтанбау, Нигерия.

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Анализ влияния отсутствия продовольственной безопасности и голода на уровень бедности в Нигерии

Отсутствие продовольственной безопасности – это отсутствие доступа населения к достаточному запасу недорогих и полезных продуктов питания. В результате многолетнего сокращения производства продовольствия число людей, испытывающих бедность и, следовательно, голод, начало постоянно расти. В этом исследовании основное внимание уделяется отсутствию

продовольственной безопасности, голоду и бедности в Нигерии. Показателем бедности является уровень бедности, в то время как показателями отсутствия продовольственной безопасности и голода были индекс производства продовольствия, распространенность нехватки продовольствия и число недоедающих. В исследовании использовалась модель авторегрессионного распределенного запаздывания (ARDL) с использованием данных временных рядов за период с 1990 по 2021 год. Исследование показало, что индекс производства продуктов питания оказал негативное влияние на уровень бедности ($p=.0008$; $t=-3,859645$; coef. на уровне $-0,133758$) и что недоедание оказало значительное негативное влияние на уровень крайней бедности ($p=.0001$; $t=-4,861845$). Исследование также показало, что направление причинно-следственной связи между производством продуктов питания, голодом и уровнем крайней бедности показало, что как производство продуктов питания, так и голод Грейнджера вызвали крайнюю бедность ($t=-4,152609$, $t=-2,250300$ и $t=5,317666 > t=2,0000$). В исследовании было высказано предположение, что для повышения доступности необходимо внедрить систему распределения для увеличения производства продуктов питания с целью борьбы с недоеданием.

Ключевые слова: отсутствие продовольственной безопасности, Голод, Бедность, недоедание, Нигерия.

JEL Classification Codes: Q01, Q18, P46

Introduction

Food insecurity is lack of access to an adequate supply of affordable and wholesome. Fighting hunger, which is a basic human need, is one of the century's biggest challenges (Ojo & Adebayo, 2012). As a results of years of food decline, the number of individuals who experience poverty and consequently hunger have begun to rise on continual basis (FAO, 2019). Due to problem of regular access to food, insufficient variety of foods with proper nutritional contents, and adequate food for the entire population. Two billion people still have experience from moderate to severe food shortages. Of the two billion people facing food insecurity, 820 million are going hungry (FAO, 2019). Many are unable to achieve their basic nutritional needs, especially in poor nations (Oyinloye et al., 2018). Numerous academics have investigated the elements that contribute to food security as well as their direct and indirect effects (Berhanu and Wolde, 2019; Martin-Shields and Stojetz, 2019; Musemwa et al., 2015). Conflict, climate change, and economic growth are three major causes of food insecurity that have been compared by Missethorn (2005) among others. These factors frequently coexist and have an impact on one another, as many researchers have noted. It is nearly impossible to assess just one factor that influences food insecurity, hence it is crucial to take confounding causes into consideration.

Although hunger is not a certain result of food poverty, it is a possibility. Insufficient dietary energy intake results in the unpleasant or painful bodily sense of hunger. When a person does not regularly consume enough calories (dietary energy) to live

an ordinary, active, and healthy life, the condition progresses into chronicity. In Nigeria, hunger is among the warning signs of poverty because it is the first indicator of poverty (Saches, 2011). Food insecurity and poverty are inextricably linked. Hunger and poverty coexist; they cannot be separated from one another. Hunger is a symptom of a severe lack of a basic necessity, such as food (Sachs, 2011).

When someone is living in poverty, they are unable to afford basic essentials like food, clothing, and shelter. An individual or group can also be in a state of poverty if they lack the resources or necessities for a minimal level of living. Hunger and poverty in Nigeria are getting worse as a result of food insecurity. The escalating wave of insecurity in Nigeria has exacerbated the situation extremely worse. The tensions, struggles, and open hostilities between a variety of interests in Nigeria, especially farmers-herder's crisis worsens the dire condition of food insecurity in the country. The country's severe food insecurity situation is made worse by the farmers-herders dispute in particular. Therefore, it is crucial to look into how hunger, food insecurity, and unemployment are related.

Nigeria is categorized as one of the nations with an astonishing speed of food insecurity and is placed 103rd among the food-secure nations of the globe by the Global Hunger Index (GHI, 2022). In the same way, the nation's poverty rate is rising such that an increasing percentage of the population is suffering from extreme hunger. Understanding the underlying dimension of the rising instances of hunger and poverty is crucial as they continue to grow in number. Related studies have looked into the problems of hunger, food insecurity, and destitution. The studies which investigated the causes of food insecurity and the nexus between food insecurity and poverty

in Nigeria include Otaha (2013), Emmanuel, Otu, & Odey (2017), Matemilola & Elegbede (2017), Abdulmalik (2020), Kralovec (2020), Akanni et al (2020), and Otekunrin, Sawicka, & Pszczółkowski (2021), however, little or no study have been able to link hunger, food insecurity, and poverty in Nigeria. Therefore, the main objective of this study is to analyze the impact of food insecurity and hunger on poverty in Nigeria. From the foregoing, the following research questions were postulated: what are the patterns of food insecurity, hunger, and poverty in Nigeria?, what kind of impact does food insecurity and poverty have on hunger level in Nigeria? what relationship exists between food insecurity, hunger and poverty in Nigeria?

Section two and three presented the literature review and research methods. Results and analysis were shown in section four, while section five concluded the study.

Literature Review

Conceptual Clarifications

Food Insecurity, Hunger, and Poverty

The concept of food insecurity can be viewed from various perspectives. First off, food insecurity can be defined as a lack of access to safe, nutrient-dense food that is mostly the result of poverty (Kleinman, et al. 2010). According to World Bank (2001), Food availability, accessibility, and affordability are the three pillars of food security. As a result, food insecurity implies that food is unavailable due to either inaccessibility or expense. According to Otaha (2013), food insecurity is the inability to obtain a diet that is nutrient-dense. According to the food and agriculture organization, poor dietary intake of foods that are physiologically adequate causes food insecurity because the body's psychological need for food falls under the purview of nutrition and health (FAO, 2010).

Adeoti (1989) identified persistent inadequate nutrition as a result of chronic food insecurity due to a lack of resources to produce and procure food long before this idea was developed by food and agricultural organizations. When the demand and supply sides are out of balance, a state of food insecurity is said to have ended (FAO, 2010). Food insecurity occurs when no one can ever afford to eat healthfully and adequately to maintain an active lifestyle.

Global Hunger Index Classifications of Hunger

The Global Huger Index classifies hunger into five levels. The classification is presented in the table below. Each level of classification has threshold value for its measurement.

Level	Value
Alarming	35.0-49.9
Extremely Alarming	≥ 50.0
Low	9.9
Moderate	10.0-19.9
Serious	20.0-34.9

Source: Global Hunger Index, 2022.

The amount of hunger is divided into five categories in the table above: extremely worrisome, alarming, serious, moderate, and low.

The value thresholds are also displayed. The threshold for extremely alarming hunger is greater than or equal to 50, the threshold for alarming poverty is between 35 and 49.9, the threshold for serious hunger is between 20 and 34.9, the threshold for moderate hunger is between 10 and 19.9, and the threshold for low hunger is 9.9 or less.

Theoretical Review

Food Availability Decline Theory

According to this idea, the fall in food production, the supply of food, and the food distribution are the main causes of famine. The production and distribution of food is seen as the primary contributor to famines and hunger. This idea, however, was unable to explain why some members of the population—such as agricultural laborers—were more vulnerable to famines than others.

Failure of Exchange Entitlement Theory

According to Amartya Sen, the theory stresses that the causal relationship/mechanism for instigating hunger includes many variables in addition to the decrease in food accessibility, such as an agricultural laborer's incapability to transfer his primary entitled attitude, i.e. workers for rice, when his job growth became irregular or entirely erased.

Empirical Review

Existing studies spanned from causes and prevalence of food insecurity, hunger, and poverty in Nigeria which has been the subject of a number of insightful empirical research.

For instance, Addulmalik (2020) investigated the causes of food insecurity in Nigeria and its effects on the country's efforts to reduce poverty. The Variance Decomposition Device and the Moment Generating Functions were employed with the Vector Auto Regression Model. According to the study, per capita income and domestic food production both influence the level of food insecurity. Accord-

ing to the report, Nigeria should be self-sufficient in food and strictly regulate food imports in order to reduce poverty.

The effects of violence, economic growth, and climate science on food safety in Nigeria were specifically examined by Kralovec (2020). The effects of many factors that put Nigeria's food security at risk were examined. The study sought to examine these elements to see how they relate to the idea of food security whether and how much they have an impact on food insecurity in Nigeria. The study employed a combination of methodologies. Numerous sources that provide metrics of the economy, conflict, food security, and climate change were searched for quantitative data. NGOs in Nigeria were interviewed and qualitative information were reported. Cautious research indicates that all three causes of food insecurity might contribute to it, which aids in explaining why malnutrition exists in Nigeria. Within case of Nigeria, this report closes by confirming the findings of earlier studies.

In 2020, Akanni et al examined the prevalence of food insecurity among government employees working for the Oyo State Secretariat. Ninety-two randomly chosen respondents were given a really well questionnaire, and the results were used as primary information. Descriptive statistics, a food security measure, and linear regression were used to evaluate the data. According to the results of the linear regression, there is a substantial correlation between the amount of food insecurity and a few chosen socioeconomic indicators, including monthly pay and educational attainment. Spending money saved for other projects on food and eating only once a day are the main coping mechanisms used by respondents to deal with food insecurity. It was determined that responders with supporting employment had access to food. It is advised that salary and benefits be raised as this will boost employees' workplace productivity.

Otekunrin, et al (2021) used cross-sectional records from 211 farming homes through a multi-stage sampling approach to estimate food shortages among agricultural households in rural Oyo State, Nigeria. The Household Food Insecurity Access Scale (HFIAS) module was employed in assessing food insecurity status of farming households, and the ordered logit model (OLM) was used to analyze factors influencing food insecurity among farming households. The results revealed that 12.8% of the farming households were food secure while 87.2% had varying levels of food insecurity. The OLM results showed that substantial differences in food insecurity among farming households were associ-

ated with age, household head's years of education, gender, farm size, experience, non-farm income, food spending, and access to extension services. According to the results, efforts should focus on strengthening families' education-related effective interventions in order to improve their knowledge of nutrition, which can improve their situation with regard to food security. Additionally, there should be provision of rural infrastructural facilities such as piped water, rural electrification, and healthcare service that promote healthy living and enhance households' agricultural productivity.

The pre-existing ideas that were examined for this study centered on a single variable that was unrelated to the others. From the aforementioned, the current study aims to integrate and reconcile the linkages between food insecurity, hunger, and poverty in Nigeria in order to close the empirical gap that has been established. Data from the World Development Indicators (WDI) covering the years 1992–2016 were utilized by Aderounmu et al (2021) to evaluate the main factors affecting Nigeria's poverty level and its consequences for government initiatives. According to the Autoregressive Distributed Lag (ARDL) model's findings, unemployed actually makes people poorer in the near term while inflationary increment does the opposite. According to the report, the government should implement sufficient policies and create favorable conditions to promote increased business activity in the nation.

Materials and Methods

This paper used secondary time-series data on food production and hunger level which were sourced from the Food and Agriculture Organization (FAO). Data on poverty rate was sourced from World Bank Development Indicators (WDI), covering periods of 1990 to 2021. These were were classified along the four dimension of food security – availability, access, utilization and stability. Therefore, the four dimensions of food security measure the food security and its constituent, hunger. Thus, food availability is proxy with food production index (FPI), access to food is proxy by prevalence of food inadequacy (PFI), utilization is proxy by number of people undernourished (NPU).

The model for the study was specified as:

$$PPR = f(PFI, NPU, PFI) \quad (1)$$

The general econometrics model that described the functional relationship between the variables is specified as:

$$\begin{aligned} \text{EXTP}_t = & \beta_{10} + \beta_{11} \text{FPI}_t + \beta_{12P} \text{PFI}_t + \\ & + \beta_{13} \text{LNPU}_t + \mu_{t1} \end{aligned} \quad (2)$$

The ARDL model is explicitly specified as follows taking the log of the variables:

$$\begin{aligned} \text{EXTP}_t = & \beta_{20} + \beta_{21} \text{FPI}_t + \beta_{22} \text{LPFI}_t + \\ & + \beta_{23} \text{LNPU}_t + \beta_{25} \text{LPPR}_{t-1} + \beta_{26} \text{FPI}_{t-1} + \\ & + \beta_{27} + \beta_{28} \text{LNPU}_{t-1} + \mu_{t2} \end{aligned} \quad (3)$$

where: EXTP =Extreme Poverty Level, FPI = Food Production Index, LPFI = Log of Prevalence of Food Inadequacy, and LNPU = Log of Number of People Undernourished. β_0 = Intercept, β_{11} to β_{29} = Coefficient of the independent variables, and μ_{ts} = Error terms.

The a-priori expectation of the behavior of the variables in terms of their parameters to be estimated as: $\beta_1 > 0$: There is a positive relationship between hunger and poverty rate. $\beta_2 > 0$: There is a positive relationship hunger and food production.

The technique of autoregressive distributive lag model (ARDL) was used to analyze impact of food insecurity and hunger on poverty level in Nigeria. There are some excellent qualities to the ARDL model method.

Results and Discussion

This section presented the patterns of food insecurity, hunger, and poverty in Nigeria, impact the food insecurity and poverty have on hunger level in Nigeria and the relationship between food insecurity, hunger and poverty in Nigeria.

The Patterns of Food Insecurity and Hunger in Nigeria

Prior data analysis, we explore the trends of food insecurity and hunger in Nigeria. We presented food production and inadequacy as well as prevalence of undernourishment and the number of people undernourished. These were presented in Figures 1 and 2 respectively.

Figure 1 above contained trends of average value of food production. From Figure 1, the prevalence of food inadequacy has been falling, steadily, from 1990. However, this fall, the prevalence of food inadequacy showed a stagnant movement from 2006 till date. This stagnation in the trend signals a non-changing situation in level of food inadequacy in Nigeria. A further look at average value of food showed that food production increased substantially from 1990 and reached the peak in 2004. This, comparatively, coincided with period of falls in prevalence of food inadequacy. Therefore, the fall in food inadequacy is, during this period, adduced to increase in food production.

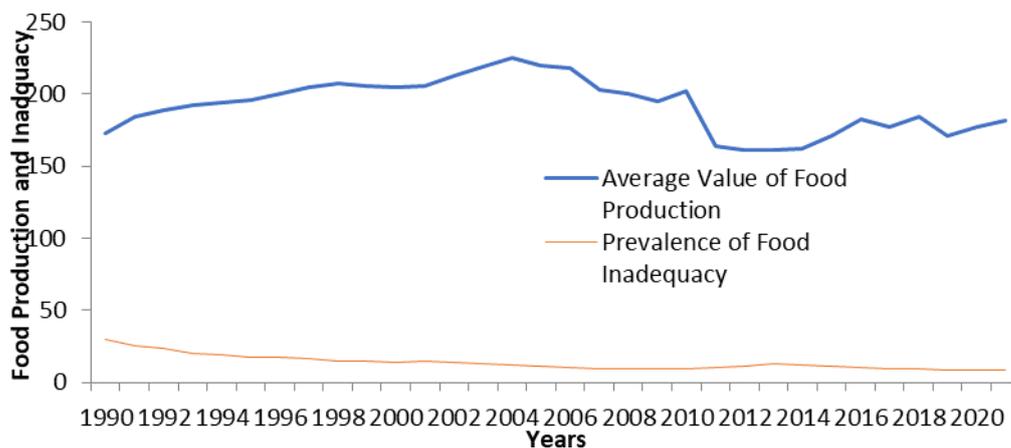


Figure 1 – Food Production and Inadequacy between 1990 and 2021 in Nigeria
Source: FAO, 2022.

The periods of declining or unstable food production also saw the prevalence of inadequate nutrition. The time period demonstrated that the impact of a decline in

food generation is countered by unrelated factors, such as food importation, to maintain the incidence of insufficient foods in Nigeria from 2004 to 2021.

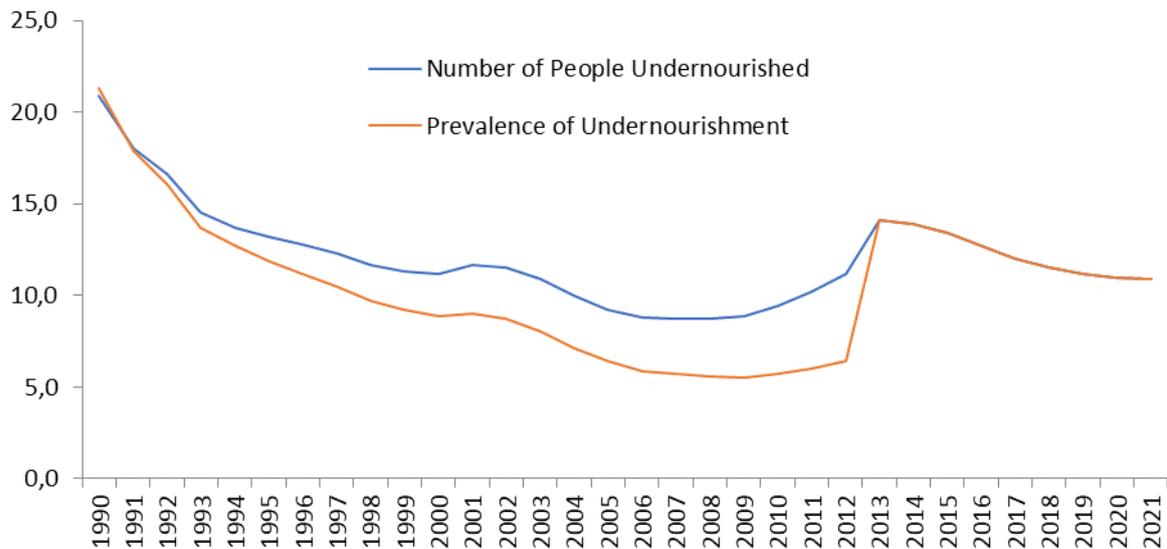


Figure 2 – Number of Undernourished and Prevalence of Undernourishment between 1990 and 2021 in Nigeria
Source: FAO, 2022.

Figure 2 showed the trends of number of people undernourished and prevalence of undernourishment in Nigeria from 1990 to 2021. The two variables move together and signals co-movement in the two variables. Therefore, rise and fall in number of people undernourished is followed by rise and fall in prevalence of undernourishment. The period between 1990 and 2000 witnessed fall in number of people undernourished and prevalence of undernourishment in Nigeria. At this period, also, comparatively, food production increased and prevalence of food inadequacy fell. The logic is that fall in food inadequacy ushered in decrease in undernourished people and its prevalence. The period between 2000 and 2003 saw a slight increase in both number of people undernourished and prevalence of undernourishment. A cross-comparison with food production equally show fall in food production during this period. Following this is the period of fall in number of people undernourished and prevalence of undernourishment from 2004 to 2007. Sadly, the trends saw upward movements from 2008 and reached peak in 2014. Coincidentally, food production and food inadequacy also fell and rise during this period. It is also interesting that number of people undernourished and prevalence of undernourishment fell between 2015 and 2020,

over the same period when food production and food inadequacy rose and fell.

Analysis of the Impact of Food Security and Hunger on Poverty in Nigeria

In a bid to examine the impacts of food security and hunger on poverty level in Nigeria, ARDL, as stipulated in the estimation technique sub-section, is employed. To achieve the goal of the study, the summary of the unit root test conducted is presented in this sub-section. The F-Bound test and Error Correction Mechanism were also presented in this chapter.

Unit Root Test

Table1 showed the summary of stationary test (ADF). The test employed is the Augmented Dickey-Fuller Test. As shown in the table, all variables were integrated at order 0 or order 1. Specifically, LPFI, LNPU, FPI were integrated at order 1 I(1).

Only EXTP is integrated at level, that is, at order 0. It is observed from the table that the absolute values of ADFs are greater than the absolute values of the variables at critical levels of 5%. Subsequently, all the probability values of the variables are all less than 5% critical level. The results above are in line with conditions set by ARDL; all variables should integrate at a level, or at mixed levels and dependent variable must be integrated at level. Also, no variable should integrate at order 2.

Table 1 – Augmented Dickey-Fuller Unit Root

Variables	1% level	5% level	10% level	ADF	P-value	Order
LPFI	-4.416345	-3.622033	-3.248592	-4.631171	0.0063	I(1)
LNPU	-4.416345	-3.622033	-3.248592	-4.645279	0.0062	I(1)
EXTP	-4.309824	-3.574244	-3.221728	-7.103337	0.0000	I(0)
FPI	-4.323979	-3.580622	-3.225334	-4.143421	0.0150	I(1)

Source: Author's computation using EViews 12.

Table 2 – F-Bound Test

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	9.913624	10%	2.37	3.2
k	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66

Source: Authors' Computation

The above tables show the F-Bound test. The test tests for long run cointegration between dependent and independent variables. From the table, F-statistic indicates 9.913624, with the lower bound at 5% significant level at 2.79, and upper bound at 5% significant level at 3.67, the F-stat is greater than upper bound. Therefore, the

hypothesis that there is no level relationship is rejected in favour of the alternative hypothesis. Hence, there is level relationship and cointegration between the variables.

Since long run relationship exist between variables, and then the level relationship is shown in table 3.

Table 3 – Long run Analysis of Food Insecurity and Hunger

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FPI)	-1.340369	0.322778	-4.152609	0.0004
D(LNPU)	-249.1219	110.7061	-2.250300	0.0348
LPFI	32.81827	6.171556	5.317666	0.0000
C	-19.11956	14.56340	-1.312850	0.2028

Source: Authors' Computation

The food production index (FPI), log of the number of undernourished (LNPU), and log of the prevalence of food inadequacy (LPFI) all significantly correlate with extreme poverty, as indicated in the table above (EXTP). FPI specifically has a detrimental effect on EXTP. In this sense, the FPI and EXTP move counter-clockwise; a drop in the FPI causes an increase in the EXTP. Additionally,

extreme poverty has a favorable long-term connection with hunger as assessed by NPU. Lastly, there is a positive correlation between extreme poverty and the prevalence of food inadequacy (PFI) (EXTP).

Short Run ARDL Estimate

The short run estimates presented below contained the impact of independent variables on dependent variable in the short run.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FPI,2)	-0.133758	0.034656	-3.859645	0.0008
D(LNPU,2)	-44.23564	9.098529	-4.861845	0.0001
D(LPFI)	68.51033	10.65895	6.427491	0.0000
CointEq(-1)*	-0.212331	0.027742	-7.653790	0.0000
R-squared	0.728129	Mean dependent var		-0.249563
Adjusted R-squared	0.696759	S.D. dependent var		2.682538
S.E. of regression	1.477201	Akaike info criterion		3.741741
Sum squared resid	56.73522	Schwarz criterion		3.928568
Log likelihood	-52.12612	Hannan-Quinn criter.		3.801509
Durbin-Watson stat	1.738180			

Source: Authors' Computation

The table above presents ADDL short run estimates. In the short run, all independent variables significantly impacted extreme poverty level. To start with, food production index in the last two periods had negative impact on poverty level in the current period ($p=.0008$; $t=-3.859645$; coef. at -0.133758). Also in the short run, undernourishment had significant negative impact on extreme poverty level ($p=.0001$; $t=-4.861845$; and coeff. -44.23564). From the table also, the coefficient of determination (R-squared) stood at 0.728129; meaning about 73% of the variations in extreme poverty were accounted for by variations in food production and undernourishment. The adjusted coefficient of determination (Adjusted R-squared) was about 70%. Overall, this means the model fitted and explained the relationship between the variables.

From the table, three information criteria were presented; the AIC, SC, and HQC with 3.741741, 3.928568, and 3.80159 respectively. From this, AIC had the smallest absolute value, and reason for its adoption as information criterion for the ARDL short run estimation. Further, the D-W coefficient showed insignificance, then there was a possibility of autocorrelation of the error terms. Last, the speed of adjustment is shown by the ECM given by -0.212331 . This ECM is also significant with $p=.0000$. This means, the variations in the previous period is corrected at the present period at adjustment speed of about 21%.

Autocorrelation LM Test

To finally put this to rest the tendency for the presence of autocorrelation of the error terms, Breusch-Godfrey test of autocorrelation was conducted and the result presented below.

Breusch-Godfrey Serial Correlation LM Test:

Null hypothesis: No serial correlation at up to 2 lags

F-statistic	1.030007	Prob. F(2,20)	0.3752
Obs*R-squared	2.801467	Prob. Chi-Square(2)	0.2464

Source: Authors' Computation

The null hypothesis states that no serial correlation existed among the error terms. The probability of Chi-Square indicated that the null hypothesis cannot be rejected ($p.2464 > .05$). Hence, the estimate does not suffer from problem of autocorrelation of the error terms.

Relationships between Hunger, Poverty, and Food Insecurity in Nigeria

Granger Causality Test of ARDL Estimate

From the ARDL estimate, all independent variables have significant impacts on extreme poverty level. The significance of t-values of the indepen-

dent variables or otherwise determined the Granger causality between dependent variables. The prevalence of food inadequacy (PFI) and number of people undernourished (NPU) represented food insecurity and hunger level respectively. Therefore, Causality Wald Test is conducted to check causalities between prevalence of food inadequacy (PFI), number of people undernourished (NPU), and poverty level.

Causality between Poverty, Prevalence of Food Inadequacy (PFI) and Number of People Undernourished (NPU)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FPI)	-1.340369	0.322778	-4.152609	0.0004
D(LNPU)	-249.1219	110.7061	-2.250300	0.0348
LPFI	32.81827	6.171556	5.317666	0.0000
C	-19.11956	14.56340	-1.312850	0.2028

Source: Authors' computation

In the above table, the null hypothesis states that variables (FPI, LNPU, and LPFI) caused extreme poverty. The results contained in the table ($t=-4.152609$, $t=-2.250300$ & $t=5.317666 > t=2.0000$) showed that both food insecurity and hunger Granger caused poverty because t-values are greater than critical value t-values at 2. Therefore, null hypothesis is rejected in favour of alternative hypothesis. Hence, food insecurity and hunger have causal relationship with poverty and Granger-caused it. Individually, food production index, the number of undernourished and the prevalence of food inadequacy have significant negative effects on poverty which implies that food production index, number of undernourished and the prevalence of food inadequacy worsen poverty level in Nigeria.

Conclusion

The results made it quite evident that Nigeria's extreme poverty level was negatively impacted by food production. Additionally, there was detrimental influence of hunger on extreme poverty. These results agreed with that of Akanni et al (2020). As a result, extreme poverty in Nigeria is impacted by both the degree of food production and undernourishment. The ramifications are twofold: first, food

production had implications on food access and affordability, and second, hunger levels have an effect on severe poverty levels through undernutrition. Therefore, in both short run and long run, food production had negative significant impacts on extreme poverty level. In this wise, when food production increased, extreme poverty reduces. Conversely, hunger level have positive relationship with extreme poverty level in the long run. Finally, the direction of causality between food production, hunger, and extreme poverty level showed that both food production and hunger caused extreme poverty.

Poverty levels will decrease as food production rises. This cannot be said about the degree of hunger because rising hunger levels eventually cause more people to live in poverty, even when there are short-term benefits. Finally, the extreme poverty rate in Nigeria was a result of both food production (food insecurity) and hunger.

We recommended policies that will lead to increase in food production should be put in place. and the development should correspond to the pattern in population increase. This will guarantee that because it is evident that availability of food via agricultural production does not ensure an increase in nutrient quality in a drive to improve affordability necessary for improvement in nourishment.

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