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Resilience to COVID-19 and Armed Conflict Shocks: Evidence from Nigeria

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ABSTRACT

Armed conflict has been a major threat to food production and is a factor for Nigeria's perpetual status as one of the most food insecure nations globally, in spite of successive government's efforts. Also, available evidences show that COVID-19 outbreak of 2020 worsened the country's already bad food security outlook and may have weakened household resilience. In this study, we assess the effects of the interaction of these shocks, and equally provide evidences to validate studies which have reported their individual impacts on household food security and resilience. We utilize the last wave of Nigeria's LSMS-ISA data, three rounds (2, 4 and 7) of the high frequency COVID-19 National Longitudinal Phone Survey, desk-review of state-level COVID-19 containment measures, local government level COVID-19 cases, and the Armed Conflict Location and Events Data Project (ACLED), which generated one household-level data-set for the study. We predict household food security using Poisson model. Using the Cisse and Barrett approach, we estimate resilience as the conditional variance of household food security amidst shocks experienced. We find that food security and resilience worsened progressively from the pre-pandemic through the post-outbreak periods. North-west and North-east zones of the country are least resilient, while urban and male-headed households are more resilient compared to their rural and female-headed counterparts. We recommend proactive and integrated policy actions incorporating gender-responsive and region-specific strategies to boost household resilience against future shocks.

Keywords: Armed-conflicts, COVID-19, resilience, food security, Nigeria, shocks

EXECUTIVE SUMMARY

Armed conflict has been a persistent threat to food production in Nigeria, contributing significantly to the country's status as one of the most food insecure nations globally. Despite continuous governmental efforts, food security remains a critical issue. Additionally, the COVID-19 pandemic of 2020 exacerbated the already precarious food security situation and may have further undermined household resilience. This study aims to assess the combined effects of armed conflicts and the COVID-19 pandemic on household resilience. We found existing studies on individual effects of each of armed conflict and COVID-19, however, none of these studies assessed the combined effects of these shocks. We also validate findings these studies regarding the individual impacts of these shocks on household food security and resilience.

This study uses multiple data sources including the last wave (2018/19) of the LSMS-ISA, three rounds (2, 4 and 7) of the post COVID-19 outbreak's National Longitudinal Phone Survey, the Armed Conflict Location and Event Data Project (ACLED), Nigeria's local government level COVID-19 data and Desk review for state-level COVID-19 containment measures. Household food security is predicted using a weighted Poisson model using conflict attack at 10Km buffer and local-government level covid-19 incidences, the residual of which is used to estimate resilience. We used the same shocks to estimate resilience using the Cisse and Barrett's Conditional Moments-based Approach, which estimates it as the conditional variance of household food security in the presence of shocks. It is an individual-specific conditional probability of satisfying a normative minimum standard of living.We use descriptive statistics such as means, frequency counts and t-test to make some quick inferences while linear regression was used to model household resilience. We used 10Km buffer to index armed-conflicts as attack and fatalities, and compare with 5km and 20km cases in our models.

Findings indicate a progressive decline in food security and household resilience from the pre-pandemic period through the post-outbreak phases. This trend is visually corroborated by the provided time series graph, which illustrates a sharp increase in COVID-19 incidence from March to July 2020, followed by a decline and subsequent slight up-rise towards November 2020.The time series graph also reveals that while COVID-19 incidence fluctuated significantly over the study period, mortality rates remained relatively low and stable. This suggests that the pandemic's impact on food security and household resilience may be more related to secondary effects such as lockdowns and general economic disruption rather than direct mortality. Geographically, the North-West and North-East zones of Nigeria exhibit the lowest resilience levels. This finding is supported by the attack and fatality distribution map, which shows higher intensities of conflict-related incidents and fatalities in these regions The study reveals significant differences between urban and rural households, as well as those headed by males versus females, with urban and male-headed households exhibiting higher resilience. The research further demonstrates that armed conflicts

incidences and fatalities radius significantly diminish household resilience. COVID-19 incidences are found to worsen the adverse effects of armed conflicts on household resilience.

In conclusion, this study recommends that interventions should aim at enhancing the resilience of households, with more emphasis on conflict-affected North-west and North-Eastern zones. Also, gender-responsive measures should be promoted, while rural areas should also benefit from improved aids in form of infrastructure and health care facilities to ensure preparedness for future occurrences of shocks

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ACRONYMS AND ABBREVIATIONS

ACLED	Armed Conflict Location and Event Data
FCT	Federal Capital Territory
HFIAS	Household Food Insecurity Access Scale
IDP	Internally Displaced Person
IPOB	The Indegenous People of Biaffra
LSMS-ISA	[Living Standard Measurement Survey Integrated Survey in Agriculture
MASSOB	The Movement for the Emancipation of the Niger Delta
NCDC	Nigerian Centre for Disease Control
NDA	Niger Delta Avenger
NDFF	Niger Delta Freedom Fighter (NDFF)
NDGJM	Niger Delta Greenland Justice Mandate ,
OPC	Oodu People's Congress
WHO	World Health Organisation
YSDM	Yoruba Self Determination Movement

I. Introduction

The outbreak of COVID-19 which started remotely from Wuhan in China in December 2019 came as a rude shock to the entire world and soon became a global pandemic that claimed not less than 7,049,376 lives with 775,481,326 confirmed cases as of May 12th, 2024 (WHO, 2024). The pandemic never left the world the same as everyone needed to adjust to the reality of the new normal. The African continent so far recorded a total of 9,579,706 confirmed cases of COVID-19 and 175,510 deaths as of May 12th, 2024 (WHO, 2024). Literature confirms that the incidence of the pandemic in Africa worsened food insecurity, and led to skyrocketing food prices, income losses, and loss of employment (Mukiibi, 2020; Tabe-Ojong *et al.*, 2022). Nigeria as one of the developing countries in West Africa has had its heavy share of COVID-19 effects with 267,188 confirmed cases and 3,155 deaths as of May 12th, 2024 (WHO, 2024). So far, available records show that 6,013,826 persons (only 2.6% of the population; implying 26 persons per thousand population) have undergone testing in the country. The fact remains that several infection cases could have eluded official capture because testing rate is slow and the coverage of designated health centers is not as broad (Al-Mustapha *et al.*, 2021).

In Nigeria, since the advent of the pandemic, the country has witnessed increased food insecurity (Amare *et al.*, 2021), increased unemployment (Lain *et al.*, 2020), increased inflation (Andam et. al., 2020), and increased cases of armed conflicts (Columbo & Harris, 2020). Armed conflicts in Nigeria has remained a burning issue, even before the outbreak of the COVID-19 pandemic. This has come under different shades such as Boko Haram, banditry, and farmer-herder clashes.

In the face of these compounding pressures, the average Nigerian household is stressed and some of the relevant research questions include: (1) How are they coping; (2) what are the adaptation strategies deployed by the average Nigerian household to keep surviving; and (3) how do one define and measure household resilience under both the COVID-19 and insecurity shocks? According to Bowen *et al.* (2020), resilience is the ability of households to prepare for, cope with, and adapt to shocks in a way that protects their well-being and preserves them from falling or being trapped in poverty consequent upon facing the shock. Nigerian households both from the rural and urban divides have had to face and are still undergoing shocks triggered by COVID-19 and various forms of armed conflict threats across the country; it is against this backdrop that this study examines their interaction on households' resilience using food security as the outcome variable. It further seeks to analyze the differentials in effects across gender and sectors (rural-urban) as influenced by COVID-19 and armed conflict shocks, examine various containment measures and adaptation strategies deployed by households to contain the shocks, and describe the resilience of households towards COVID-19 and armed conflict shocks across gender and rural-urban divides.

Scanning through literature, we found scanty studies on the interaction between COVID-19 pandemic and armed conflicts in Nigeria (Idowu, 2020; Koehnlein & Koren, 2022; Oladunni *et al.*, 2022; Ozili, 2020; Polo, 2020), most of which focused on the effect of COVID-19 incidence on the trend or frequency of conflict attacks without looking at the effects of the shocks introduced by COVID-19 and armed conflict attacks on the households. Efforts were also made by both state and federal governments, one of which was implementation of containment measures, ranging from lock-downs, travel restrictions, market closures, among others. These efforts were although

primarily meant to reduce spread, they also have potential implications for household well-being due to reduced access to services. Interestingly, none of the identified studies have assessed the influence of containment measures in the mix. We fill these identified gaps in these study by providing answers, with empirical evidences to the following research questions:

1. How does the COVID-19 and armed conflicts interaction affect the resilience outcome of households in Nigeria?

2. How do fatalities and attack from armed-conflict at varying distance to households influence the effects of COVID-19 and armed conflict interaction on household resilience in Nigeria?

3. Does access to COVID-19 containment measures play any role in mediating the COVID-19 and armed conflicts interaction effects on household resilience?

A number of pathways could be hypothesized considering the combined effect of armed conflicts and COVID-19 shocks on households. First, with the prevalence of armed conflict shocks in some zones in Nigeria which has earlier depreciated the status of households' food security, the interruption of COVID-19 shock could rather worsen the situation. However, on the other hand, we could hypothesize that the incidence of COVID-19 pandemic could on its own restrain the activities of the Militias either of Boko Haram, Fulani herdsmen, Militancy agitations, Kidnappers or Bandits, hence reduce number of attacks and fatalities. This possible restrain of militias' activities could occur by a loss of loyalty from conflict-ridden community members who have been sympathetically cooperating with them against government authorities. It could also come through scarcity of resources or lack of mobility occasioned by the pandemic. As a result, the food security status of households could improve due to the respite in armed conflict attacks they momentarily enjoy. In addition, having adjusted to coping with conflict shocks, households' capacity to cope with the pandemic shock could be higher. Contrarily, previous conflict shocks could have weakened households' resilience and made them more vulnerable to the impact of COVID-19 shock.

The second hypothesized pathway explores the possible flow of aids and assistance programmes which could have been established towards conflict-ridden communities and Internally Displaced Persons (IDPs) camps to ameliorate the challenge of food insecurity occasioned by armed conflicts. The interruption of COVID-19 shock could introduce an imbalance in this aids and assistance programme equilibrium thereby leading to a diversion of these aids towards the pandemic epi-centres. This could invariably worsen the food insecurity status of the conflict-affected households. By and large, this study will endeavour to examine the interaction of these two shocks (COVID-19 and armed conflict) and understand whether exposure of households to a new and additional shock worsens the magnitude and impact of the previous shock or otherwise.

The paper contributes to existing literature in a number of unique ways. While several studies have looked at the effect of various shocks differently on specific outcome variables(George *et al*., 2020; Jackson *et al*., 2020; Janssens *et al*., 2021; Kafando & Sakurai, 2024; Kansiime *et al*., 2021; Kolahchi *et al*., 2021; Naseer *et al*., 2023; Ojeleke *et al*., 2024; Olarinde *et al*., 2024; Ridhwan *et al*., 2024), not many have attempted to examine the combined interaction of two different shocks on an outcome variable (food insecurity) as presented in this paper. Also, this study will be part of the few ones that have examined interaction of shocks using a panel data as against many others that have used cross-

sectional datasets (Akim *et al.*, 2024; Atilola, 2024; Ecker & Hatzenbuehler, 2022; Fadare *et al.*, 2024; Iziga & Tagagi, 2022; Olaoye *et al.*, 2024; Osabohien *et al.*, 2024). This study is the first to generate and use data on COVID-19 containment measures across all the 36 states in Nigeria and the FCT. Lastly, using Nigeria as a study area to investigate how insecurity worsens or fares with the incidence of COVID-19 pandemic can be described as a peculiar one given the place Nigeria occupies in the African continent and how representative it could be with respect to other African countries.

The rest of this paper is organized in sections 2 to 5. Section 2 explains the concept of resilience as well as provides insight into the armed conflict and COVID-19 situation in Nigeria. It also establishes the basis for the study, given some empirical evidences on the subject being investigated. In Section 3, we provide the framework for the study as guided by three frameworks. In section 4, we present an empirical framework section where the data, methodology and empirical strategy are detailed. The last section presents the results, after which conclusions and policy recommendations are drawn.

2. Background and Related Literature

Definition of Resilience

Resilience is gaining ground so fast as an emerging concept in development literature (Adelaja et. al., 2021; D'Errico & Smith, 2020). This is because of the increasing incidence of various shocks and stressors at national, regional and even global levels. Resilience has come under different shades of definitions across literature even though not without some basic similarities. This study however will adopt the definition of the Food and Agricultural Organization of the United Nations (2013) which defines resilience as "the capacity of a household, community or system to bounce back to a previous level of well-being after a shock" Some important points in the definition include the existence of some capacities or ability possessed by the recipient of the shocks or stress in question from which to draw strength to rejuvenate back into the previous status before the shock or stress. According to Bowen *et al.*, (2020), the global landscape today is fraught with interrelated and often distressing covariate shocks and stressors arising from natural disasters, climate change, economic crises, pandemics, conflicts and forced displacements. The ability to withstand these shocks and stressors by households, communities and systems becomes vital if normalcy will be maintained across communities, countries and even globally. This is where the concept of resilience comes in and proves critical.

Shades of Shocks with their Sources in Nigeria

Within the recent decades, Nigeria has had to contend with increased shocks and stressors stemming from cases of armed conflicts such as Boko Haram, Banditry, Farmer-herder clashes, militancy agitations, and secessionist threats, these aside others from climate change which manifest in the form of drought spells, unpredictable rainfall, floods and temperature rise. In addition to these was

the COVID-19 pandemic which orchestrated economic slowdown, inflation, unemployment, and poverty. As posited by Azumah (2015), Boko Haram, known to be a radical Islamic movement ravaging the North-East zone of Nigeria today is traceable to the anti-Western, anti-modern and anti-government rhetoric that has persisted since the 1950s. It started as a religious movement called Jama'atu *Ahlis Sunna Lidda'awati Wal-Jihad* (JASLWJ) in Northern Nigeria which means "people committed to the propagation of the tradition and jihad" and also known as "Boko Haram" under the leadership of Mohammed Yusuf. The appellation 'Boko Haram' is a combination of two Hausa words; 'Boko' and 'Haram' which means 'non-islamic education is forbidden'. The sect holds a puritanical view with strong contempt for western institutions, believing that it fosters the inequitable political and economic system in Nigeria (Adelaja & George, 2019a; Suleiman & Karim, 2015). According to Adelaja & George, (2019)), three different factions of Boko Haram were identified by ACLED which are 1. Wilayat Gharb Ifriqiyyah 2. Jama'atu Ahli is-Sunnah lid-Dawatai wal-Jihad and 3. Wilayat Gharb Ifriqiyyah also referred to as the 'Barnawi Faction' As time went by, this radical sect transformed into a violent and deadly group; precisely starting in 2009, after a confrontation with the Nigerian security which led to the death of their first leader. Its subsequent aggression against the Nigerian security forces then gradually grew to become a major security threat for the country today (Iacoella & Tirivayi, 2020; Suleiman & Karim, 2015). As at 2021, statistics showed that not less than 2.3 million people had been displaced and over 38,000 deaths recorded as a result of Boko Haram attacks (Adelaja & George, 2019a; Ajah *et al*., 2021; Justin George, Adelaja, & Awokuse, 2021). Also prominent among the shades of armed conflicts as earlier mentioned is banditry. Okoli & Agada (2014) posited that in recent years, banditry has been on the rise in Nigeria. They described banditry as occurrences and prevalence of armed robbery or violent crimes which could include the use of threat or force to intimidate others with the intent to rob, rape or kill. While bandits use several means to carry out their nefarious activities, kidnap for ransom seems to be the most deployed strategy among them (Okoli & Agada, 2014). According to Odutola (2020), between 2011 and 2020, not less than USD 18 Million has been paid as ransom to kidnappers in Nigeria and no fewer than 767 incidents of kidnaps have occurred within 10 states where kidnapping crime is prominent. Kidnapping is rightly described as another shade of armed robbery, only that it takes a different modality and approach as follows; i. In some situations the kidnap victim is an indirect target who is kept at hostage to enable the culprits extract ransom from their real target; ii. The kidnapping operation is usually organized rigorously and syndicated, involving actors with specialized roles. These include informants, strategists, field boys who implement the operation and their godfathers (kingpins). iii. Kidnapping takes a somewhat long process from planning to implementation along which you have abduction, hostage, negotiation, ransom making and release (Okoli & Agada, 2014). Farmer-herder conflict on the other hand is not peculiar to Nigeria only, it has been observed to evolve over the years even across other African countries such as Ghana, Mali, Burkina Faso, Chad, Senegal, Cameroon and Côte D'Ivoire (Blench *et al*., 2003; Kuusaana & Bukari, 2015; Okiti & Habib, 2017). According to George, Adelaja, Awokuse, *et al.* (2021), the tendency for farmer-herder conflict could be high in areas where pastoralism is prominent and this can be as a

result of changing climate and weather patterns affecting availability of pasture, economic downturn and increasing poverty among herdsmen, loss of access to grazing routes, weak adherence to obtainable land tenure system, poor implementation of existing land tenure laws and availability of better pasture and market in secondary grazing areas as against primary grazing areas (Adano *et al*., 2012; Butler & Gates, 2012; Eke, 2020; Gentle & Thwaites, 2016; Juan & Wegner, 2019; Lybbert *et al*., 2007). For Nigeria, the major cause of farmer-herder conflict is the changing climate and weather pattern (Nwankwo *et al*., 2020), because historically, the major tribe that dominated the pastoralist sector was the Fulani with their primary grazing area in the North (mainly the North West and East zones), however, due to climate change the available fodder in these zones kept reducing, and this necessitated increased movement of pastoralists down south. This was further exacerbated by the emergence of Boko Haram armed conflict and banditry which further pushed more pastoralists to the south (George, Adelaja, Awokuse, *et al*., 2021). Stiff competition for available resources between pastoralists and farmers is usually the cause of conflicts. Farmers also, often accuse herders of vandalizing their crop fields (Oghuvbu & Oghuvbu, 2021). There are other shocks often faced by households that are usually orchestrated by armed conflicts that are either not as pronounced as the aforementioned or are intertwined with them. Some of these are the ethnic militia, the communal militia, and the cult militia conflicts. The Indigenous Peoples of Biafra (IPOB), the Movement for the Emancipation of the Niger Delta (MASSOB) and the Niger Delta Greenland Justice Mandate (NDGJM), the Niger Delta Avenger (NDA), the Niger Delta Freedom Fighter (NDFF) are all secessionist or self-determination related. These have long existed in the Eastern zone of Nigeria, but, such a trend is gradually spreading to the South-western zone in recent times with the upspringing of groups like Oodua Peoples Congress (OPC) and the Yoruba Self-Determination Movement (YSDM). In addition to these, there also exists the Muslim militia and the Islamic State of West Africa which share a similar ideology with the Boko-Haram sect. Aside these, other armed conflict groups are referred to as Unidentified Armed Groups from Nigeria, Chad or Niger (close neighbours to Nigeria). In the foregoing, attention has been drawn to the fact that armed conflict threats loom across various zones in Nigeria; the North-East is majorly faced with Boko Haram, the North-West with the incidence of banditry while the North-Central and South-West are battling with farmers-herders' crises. The Eastern part of the country is not in any way immune to this threat as the South-South zone is rife with militancy agitations and the South-East is laden with secessionist tension. Several cases of kidnappings have also been reported across the length and breadth of the country with little or no hope of improvement. Figures 1 shows the trend of fatalities and attacks from armed conflicts in Nigeria from June 2018 and November 2020. Fatalities refer to the number of casualties or deaths recorded while by attacks we mean any strike of violence or assault directed at households by militias in the study area. As evident from the figure, fatalities are ways above the attacks as each attack could lead to several casualties or deaths, nonetheless, a positive correlation is observed between the number of attacks and fatalities recorded. However, the month of June 2020 seems to record the highest number of attacks and casualties. These have all been affecting citizens' livelihood by increasing vulnerability and the incidence of poverty, but worse

still, in the face of all these insecurity challenges, the COVID-19 pandemic struck in February, 2020. Evidences also reveals that due to insurgency and terrorism and increased presence of IDPs, there have been reduced farming activities and depletion of soil nutrient availability for agricultural crops, impacting the host communities' agricultural production and food security (Berry, 2008; Kamta *et al.*, 2020). Reduced food production, combined with reduced logistics for food down the southern part due mainly to fear of attack, kidnapping, armed robbery and other forms of insecurity which are now common across all the regions of the country has been linked to a worsening food systems and household food security in Nigeria. This is because Nigeria is a nation of mutually dependent sub-units. For example, conflict has been reported to have affected food production due to reduced farming activities in conflict-affected communities in the northern part of the country (Adelaja & George, 2019c).

3. Empirical framework

Data

The data for this study is obtained from five different sources. First is the Living Standards Measurement Study-Integrated Surveys on Agriculture (LSMS-ISA) for Nigeria (Wave 4); second is the post-COVID-19 High-Frequency National Longitudinal Phone Survey 2020; third is the Armed Conflict and Event Data (ACLED). Others are the Nigeria Centre for Disease Control (NCDC) and desk review for prevalence of COVID-19 and state-level COVID-19 containment measures, respectively. For the LSMS-ISA, data were collected in four different waves, 2018/19 being the last (fourth) round of the survey, with waves 1, 2, and 3 being conducted in 2010/11, 2012/13, and 2015/16, respectively. For each wave, households were visited twice, post-planting and post-harvest periods. Data collection for these two visits was in three folds – agriculture (for households involved in agriculture), households (all households in the study), and community (information on the socio-economic indicators of the enumeration areas where the sample households reside). The survey covers all 36 states in Nigeria, including the Federal capital territory, (Abuja). Our unit of analysis for the study is the household and data were aggregated from different levels to the household level. Household information which is the focus of this study includes household identification covering geographic area identification information, household roster, years of education, sex of household head, marital status, age of household head, household size, distance to population centre, and household's distance to market. The dependent variable of this study is food security and this was measured using the modified version of the household food insecurity access scale, comprising a set of items to which responses of 'yes' and 'no' were attached. Wave 4 food security scale has ten items but was reduced to eight for ease of comparison with the post-COVID-19 outbreak datasets, which contain eight items across-board.

The COVID-19 National Longitudinal Phone Survey 2020 is a high-frequency phone survey that used the country's latest face-to-face General Household Survey (GHS) as the sampling frame. The Survey was conducted in a total of eleven (11) rounds, (rounds 1 to 11) between 2019 and 2020. The first round serves as the baseline against which subsequent changes are compared. Although improvements were made on the survey instrument at the end of each round, common variables include knowledge regarding the spread of COVID-19, behaviour and social distancing, employment, income loss, access to basic services, credit facilities, social safety nets, coping/shocks, food security, other incomes, non-farm enterprise, and agriculture. However, only the food security indicators were filtered out of these datasets with only waves 2, 4, and 7 containing food security identified as our outcome variable of interest. Round 1 has only three items

The LSMS dataset contains information on household identification including geographic area identification information, household roster, and individual identification information, which were very useful in aggregating data to household level and in merging the dataset with the post-COVID-19 outbreak datasets. Other measures of food insecurity in the LSMS-ISA dataset are dropped due mainly to the lack of these measurement approaches in the post-outbreak dataset. Studies have adopted the use of secondary data for conflict studies recently, and ACLED is one of the most popularly used (see Adelaja & George, 2019b, 2019c; Bertoni *et al*., 2019). The Armed Conflict Location and Event Data (ACLED) is a geocoded data source that collects real-time data on the locations, dates, actors, fatalities, and types of all reported violence and events, be it political, insurgence, and others worldwide. The data for Nigeria on incidences of armed conflicts within the post-COVID data period (May 2018 to November 2020) was downloaded from the dataset and then merged with that of LSMS-ISA data using the aggregated fatality and attacks figures at a buffer of 5Km, 10Km, 15Km and 20Km to each conflict point. This approach is an improvement on Adelaja & George (2019b and 2019c) which merged ACLED with LSMS-ISA only at the LGA level and a modification to Adelaja, *et al* (2023)'s two-, ten- and twenty-kilometer attack and fatality points to the households. We adopted the use of two additional conflict measures for robustness. First is fatality (number of casualties), which measures the total number of fatalities caused by all armed conflict for households within the mentioned distance buffer points to each attack point; and second, incidents which includes all incidents of armed conflict attacks for which at least one casualty was recorded within the spatially defined area. The fourth and fifth data sources are the COVID-19 prevalence and containment measures, respectively. For the former, we accessed an LGA-level data from the Nigeria Centre for Disease Control (NCDC) in Nigeria. Data on containment measures were gathered for all 36 states (including the Federal Capital Territory) using desktop review. The NCDC data on COVID-19 also contains COVID-19 death cases at the LGA level, which the study also utilized for descriptive purposes.

From a total of 5000 households, we were able to retain a total of 4980 households for wave 4 of the LSMS-ISA dataset. For rounds two, four, and seven post-COVID-19 outbreak, we could only link 1825, 1793, and 1732 households of a total of 1950, 1881, and 1811, respectively for rounds

two, four, and seven. Our dataset is therefore structured as a panel and the unit of analysis is household, containing variables such as age, sex, marital status, distance to market, COVID-19 death, COVID-19 incidences, conflict fatalities, conflict attack, COVID-19 prevalence measures, and household food insecurity scale. Conflict attacks and fatalities represent our conflict shocks in the study and are calculated for conflict deaths occurring within 5Km, 10Km, 15Km, and 20Km attack and fatality points to households over the period from the end of the previous round/wave, to the beginning of the current. Hence, for wave 4, conflict incidence and fatalities were cases within the defined distance between 1st May 2018 and 26th February 2020. For round two post-COVID, conflict variables are calculated between 27th February 2020 and 16th June 2020, and between 17th June 2020 and 23rd August 2020, for the fourth round post-COVID outbreak. The last round (i.e. round seven) therefore covered between 24th August, 2020 and 22nd November, 2020.

Operationalising Resilience of Households to Shocks

In a bid to examine the resilience to shocks in Nigeria, the fulcrum of this study was based on the assumption that the food security outcome of resilience is a stochastic distribution using the Cisse and Barrett, 2018, or moment-based approach. More specifically, this methodology expresses the stochastic distribution of resilience as a probability of a household falling above or below a particular threshold of a resilience score. In essence, this route of analysis was adopted to proffer specific recommendations for improving the resilience level in Nigeria. Aside from the descriptive, inferential statistics (independent sample t-test) was also carried out to test if there are significant differences in resilience index across gender, sectors (rural and urban), and zones (North-central, North-east, North-west, South-east, South-south, and South-west). This paper further assumes that a household's resilience index is not just a function of shocks and/or stressors, but also of important household characteristics. Thus, characteristics of the households were used to estimate the propensity to either attain or fall below a particular resilience benchmark, expected to mediate the effects of shocks of interest.

The methodology for estimating resilience in this study is based on the Cissé and Barrett (2018) method, which directly implements the Barrett and Constas (2014) theory of development resilience. This theory defines resilience as having an acceptably high likelihood of remaining above a meaningful wellbeing threshold even in the face of shocks and stressors. The approach has been widely adopted by researchers in various contexts (Alloush, 2019; Cissé & Barrett, 2018; Knippenberg *et al*., 2019; Upton *et al*., 2016; Vaitla *et al*., 2020) and is increasingly used for impact evaluation (Cissé and Ikegami, 2016; Phadera *et al*., 2019; Premand and Stoeffler, 2020). The C&B method employs a standard ordinary least squares (OLS) regression to estimate the household-specific conditional mean of wellbeing. The residuals from this regression are then used to estimate the household-specific conditional variance. Combining these two estimated conditional moments and assuming a two-parameter distribution (such as gamma), the conditional probability of satisfying a normative wellbeing standard is then estimated estimated.

It is pertinent to state that this study uses the Household Food Insecurity Access Scale (HFIAS) as an indicator of wellbeing. We estimate food insecurity using the Poisson regression model instead of OLS, since our food security measures/scores are represented as counts of 1 to 8, where 8 indicates extreme food insecurity and 1 indicates the least food insecurity level. In adapting this method further, after the Poisson regression, we used the same explanatory variables to estimate resilience, defined as the probability of attaining a wellbeing threshold of 4 on the 8-point food insecurity scale. We then calculated the probability for each respondent and used this probability as our measure of resilience. We then "percented" this estimated probability, making the score range between 1 and 100 for ease of interpretation.

The Poisson Model is represented below:

$$\log(\mathrm{E}[Y]_{i,t} = \beta 0 + \sum_{j-1} \beta_k HFIAS^k_{i,t-1} + \gamma_1 X_{i,t} + \Omega_1 S_{1i,t} + \Omega_2 S_{2\,i,t} + \theta S_{1i,t} S_{2\,i,t} + \beta C_{i,t} + \varepsilon_{i,t} \qquad (1)$$

Where Y is the food insecurity score, X_i represents the household socio-economic characteristics, S represents shocks or stressor indicators, and HFIAS represents the food insecurity lag. For this study, COVID-19 and conflicts (represented as S1 and S2, respectively), were the two shocks captured in the model. We also included state-level COVID-19 containment measures for households indicated by C, while ε_i is the error term.

Step 2: Residuals and squared residuals are calculated from the Poisson model to estimate the conditional variance.

$$\text{Residuals} = \text{food\_insecsum} - \hat{\text{food\_insecsum}} \qquad (2)$$

$$\text{Squared residuals} = (\text{residuals})^2 \qquad (3)$$

Step 3: An OLS model is fitted to the squared residuals to estimate the conditional variance, using the same predictors as in the Poisson model.

$$\varepsilon^2 = \beta 0 + \sum_{j-1} \beta_k HFIAS^k_{i,t-1} + \gamma_1 X_{i,t} + \Omega_1 S_{1i,t} + \Omega_2 S_{2\,i,t} + \theta S_{1i,t} S_{2\,i,t} + \beta C_{i,t} + \varepsilon_{i,t} \qquad (4)$$

Step 4: We estimate the Conditional Variance using the from the OLS model.

$$\text{Conditional variance (CV)} = \beta 0 + \sum_{j-1} \beta_k HFIAS^k_{i,t-1} + \gamma_1 X_{i,t} + \Omega_1 S_{1i,t} + \Omega_2 S_{2\,i,t} + \theta S_{1i,t} S_{2\,i,t} + \beta C_{i,t} + \varepsilon_{i,t} \qquad (5)$$

Step 5: Here, we calculate the shape and rate parameters for the gamma distribution to model the resilience scores.

$$\text{Shape} = \frac{\hat{\text{food\_insecsum}}^2}{\hat{\text{conditional variance}}} \qquad (6)$$

$$\text{Rate} = \frac{\hat{\text{food\_insecsum}}}{\text{conditional variance}} \qquad (7)$$

Step 6: Resilience scores are calculated using the distribution's cumulative distribution function (CDF). This score which range from 0 to 1 is then percented so that the resilience scores of households ranged from 0 to 100 (Upton, *et al*, 2022).

$$\text{Resilience score} = P(\text{food\_insecsum} \leq \text{threshold} \mid \lambda = \hat{\text{food\_insecsum}})\text{resilience percent} = \text{resilience score} \times 100 \qquad (8)$$

$$\text{Resilience category} = \begin{cases} 0 \leq \text{resilience percent} < 25 & \text{Low} \\ 25 \leq \text{resilience percent} < 50 & \text{Moderate} \\ 50 \leq \text{resilience percent} < 75 & \text{High} \\ 75 \leq \text{resilience percent} \leq 100 & \text{Very High} \end{cases} \qquad (9)$$

3. Results and Discussions

Pattern of Armed Conflicts in Nigeria

Armed conflict in the context of our study is conceptualized as a state of open, often prolonged fighting, battle, or war, arising from disagreement or disharmony between persons, groups, or ideas, where physical force is used to resolve competing claims or interests (ACLED, 2021; Raleigh et. al. (2010). ACLED reports all cases of armed conflicts generally and our analysis of the trend between May 2018 and November 2020 which is the period of consideration within this study shows that armed conflict attacks and fatalities have not reduced, but rather assumed a marginal increase. Specifically, the highest number of attacks within this period was 158 with a total 692 fatalities associated. This figure increased to 191 and 609 attacks and fatalities, respectively in 2019. Year 2020 experienced the highest spike of 256 and 1305 for both attacks and fatalities, respectively, which is an indication of sustained rise in attack cases as the average cases was also highest for this period compared to 2019 and 2018 (May to December). Although, thissuggests an interaction with COVID-19 incidences, however, our LGA-level plot indicating interaction of armed conflicts attack and COVID-19 (Figure 4) does not show any form of interaction, indicating that neither armed conflict nor COVID-19 incidences aided the occurrence of the other. Further analysis on pattern also indicates highest prominence of armed-conflicts in the North-East and North-West, with moments of spikes of armed conflict cases in the North-central, which ranks third as shown in Figure 2.

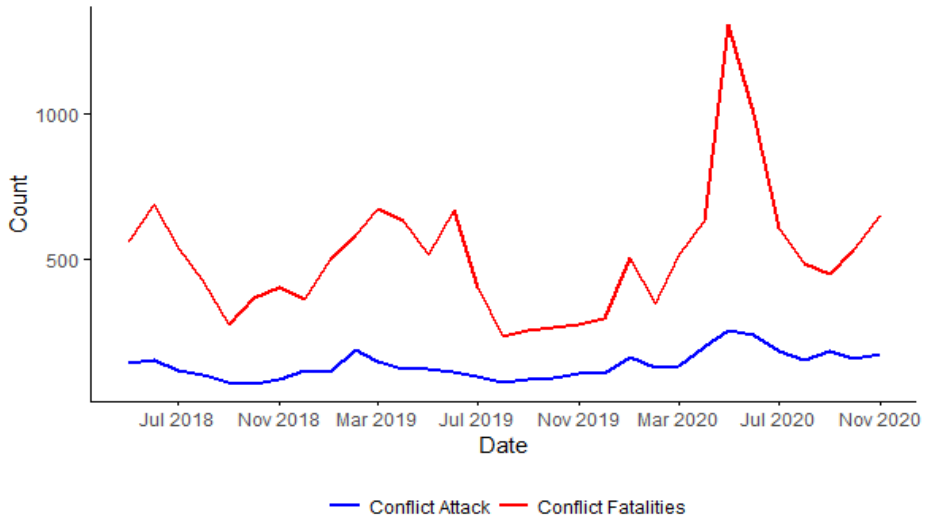

Figure 1. Armed conflicts fatalities and attacks in Nigeria from June 2018 and November, 2020

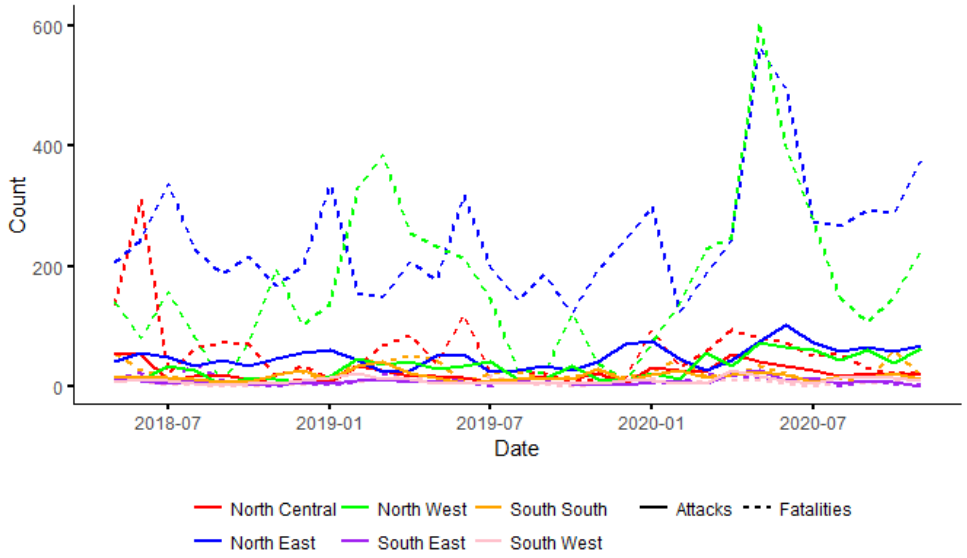

Figure 2. Attacks and fatalities from armed conflicts across Nigeria's geopolitical zones

Outbreak of COVID-19 pandemic is known to have negatively affected economies across nations in the world; how much more would it have affected Nigeria when it came to compound the already existing insecurity problem. In figure2, the COVID-19 pandemic which started in February 2020 in Nigeria reached its peak in the month of June with 13,948 infections (incidence) and 258 deaths (fatalities). This raises some curiosity and the need to investigate the extent to which citizens are affected and how they are coping with the current abnormalities in the economy. Previous

studies have examined the effect of COVID-19 on food access, food security, poverty, financial inclusion and coping strategies deployed, households' and children's school resilience to COVID-19 economic shocks as well as resilience to climate shocks (Adelaja *et al.*, 2021; Amare *et al.*, 2021; Dessy *et al.*, 2021; Ouoba & Sawadogo, 2022; Tabe-Ojong *et al.*, 2022; Turiansky *et al.*, 2021.). Although, we are interested first in determining whether there is face-level interaction between COVID-19 incidence and armed conflicts, the ripple effects generated by the concurrence of these two shocks more underlines our curiosity and is the emphasis in this study.

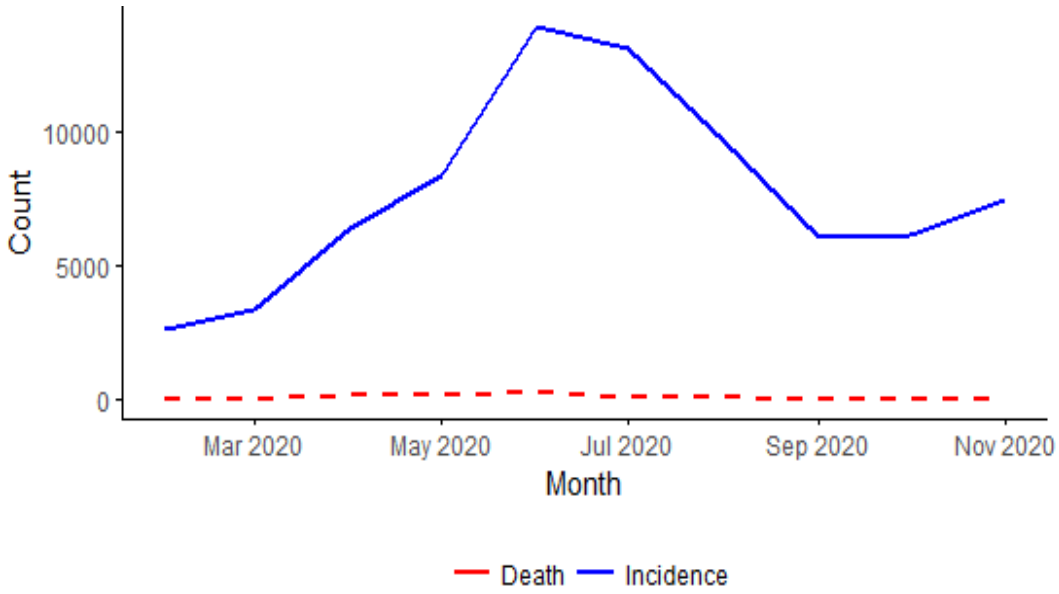

Figure 3. COVID-19 Incidences and fatalities between February 2020 and November 2020

Interaction Interaction Between Armed Conflicts and COVID-19 Shocks

While armed conflict along its different shades has been affecting household livelihoods and food security for more than a decade in Nigeria, COVID-19 pandemic likewise struck in 2020. These compounded shocks will definitely interact and impact on households in various ways. Table 1(Appendix) tracked the number of attacks and incidence of conflicts and COVID-19 respectively as well as their fatalities between May 2018 and November 2020. Both the number of attacks and incidence of conflicts and COVID-19 were found to increase simultaneously from February, while conflict attacks (256) and fatalities (1305) reached a peak in May, COVID-19 incidence (13,948) and fatalities (258) attained its peak in June 2020. After this, a gradual decrease set in. It would be noted that in Nigeria the lock down measures began to relax gradually from April 27, 2020 while a more

comprehensive ease of lock down was announced on June 30 2020. This could be responsible for this trajectory observed. The heat maps in Figures 3 and 4 likewise reveal a similar trend .

The result of our preliminary analysis (Figure 4) shows no form of interaction between COVID-19 incidences and armed-conflicts attack across all the LGAs, implying that there are no evidences that incidence of COVID-19 aided or reduced rates of armed-conflicts attacks (or vice versa) across all the LGAs in Nigeria. The results further show that armed-conflict is wide-spread across the length and breath of the country, although with higher intensity in the north, especially in the eastern and western part of the zone. This has implications for the stability of the country's food systems and hence food security of households, since about 90% of households in the north engage in crop production (Sasu, 2022; Statista, 2019), and the zone accounting for the bulk of food being produced and consumed across the country. Our preliminary analysis further shows that there are even evidently safer local government areas (from conflict) in the Northern part of the country than in the south, despite the prominence of Boko-Haram and banditry attacks in this zone. Hence, this is expected to have some dynamic implications on household food security and resilience. While direct effects are expected in most affected northern LGAs, the conflict-safe LGAs are not likely to experience so much of instability owing also to low prevalence of COVID-19. Households in the Southern zone may however experience more negative effects given the dependence on food items from the Northern part of the country which accounts for the bulk of the country's food production in both potential and actual. This hypothesis is informed by earlier findings reporting the negative effects of armed-conflicts on agricultural productivity in Nigeria (Adelaja and George, 2019, Adelaja and George, 2019b, Arias, Ibá˜nez and Zambrano, 2019,Adelaja *et al.*, 2023; Bozzoli and Brück, 2009, van der Haar and van Leeuwen, 2019).

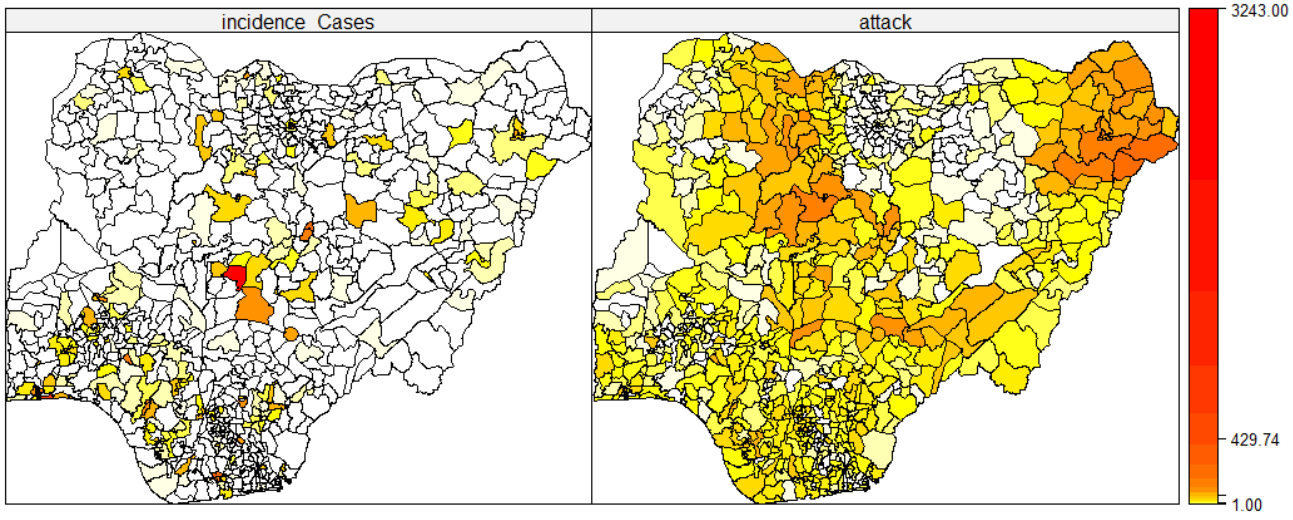

Figure 4. Heat map showing interaction of COVID-19 incidence and conflict attacks across Nigeria's Local Government Area

Household Level Descriptive Statistics

Examining the descriptive statistics (Table 1) across different periods reveals some interesting insights into the dynamics of socio-demographic factors amid the COVID-19 outbreak and armed conflict with implications for household food security. Despite the upheavals caused by these shocks, certain socioeconomic variables exhibit some measures of stability over time. For instance, the mean distances to roads (μ = 4.82 to 5.04), population centers (μ = 20.64 to 21.69), markets (μ = 63.07 to 66.24), and borders (μ = 313.96 to 315.80 units) suggest resilient infrastructural access despite the disruptions. This stability implies that communities have maintained same levels of connections to essential services and resources, mitigating the potential impacts of the crises on mobility and access to necessities. Also, the relatively maintained proportions of males (about 80 percent), literacy rates (80 percent), and household sizes (μ = 5.33 to 5.59) explain the fact that the social structures were also not significantly altered. Furthermore, the constancy in mean ages (μ = 49.76 to 50.17 years) and estimated years of formal education (μ = 17.11 to 17.75 years) underscores the resilience of human capital development efforts, which persist despite external shocks. However, these descriptive statistics also unveil areas of potential concern. For instance, while the mean distance to roads, markets, and population centers remains stable, the wide standard deviations suggest underlying disparities in accessibility that could exacerbate vulnerabilities, particularly during crises.

Table 1. Summary statistics of households in Nigeria pre- and post-outbreak of COVID-19

Variables	Period	N	Mean	SD	Min.	Max
Distance to road	1	4980	5.04	6.91	0.00	59.30
	2	1825	4.90	6.90	0.00	59.30
	3	1793	4.89	6.90	0.00	59.30
	4	1732	4.82	6.76	0.00	59.30
Distance to population centre	1	4980	21.69	20.26	0.20	155.40
	2	1825	20.76	19.64	0.20	155.40
	3	1793	20.90	20.13	0.20	155.40
	4	1732	20.64	19.78	0.20	155.40
Distance to market	1	4980	66.24	47.86	0.40	227.00
	2	1825	63.29	46.70	0.40	227.00
	3	1793	63.15	46.91	0.40	227.00
	4	1732	63.07	46.68	0.40	227.00
Male	1	4980	0.80	0.40	0.00	1.00
	2	1825	0.81	0.39	0.00	1.00
	3	1793	0.82	0.39	0.00	1.00
	4	1732	0.82	0.38	0.00	1.00
Age (Years)	1	4980	49.76	15.34	17.00	130.00
	2	1825	49.98	14.57	17.00	99.00
	3	1793	49.84	14.48	17.00	99.00
	4	1732	50.17	14.69	19.00	99.00

Variables	Period	N	Mean	SD	Min.	Max
Distance to border	1	4980	314.17	185.05	1.30	663.20
	2	1825	313.96	186.02	1.30	663.20
	3	1793	315.19	186.40	1.30	663.20
	4	1732	315.80	187.11	1.30	663.20
Household size (number)	1	4980	5.33	3.30	1.00	29.00
	2	1825	5.54	3.35	1.00	29.00
	3	1793	5.55	3.38	1.00	29.00
	4	1732	5.59	3.40	1.00	29.00
Can read	1	4980	0.73	0.45	0.00	1.00
	2	1825	0.80	0.40	0.00	1.00
	3	1793	0.80	0.40	0.00	1.00
	4	1732	0.80	0.40	0.00	1.00
Estimated years of formal education	1	4980	17.11	7.67	1.00	35.00
	2	1825	17.73	7.69	1.00	35.00
	3	1793	17.74	7.71	1.00	35.00
	4	1732	17.75	7.67	1.00	35.00

The summary statistics for conflict attacks and fatalities over the study period offer valuable insights into the social landscape in the country, with particular emphasis on the distinction between rural and urban areas amid the COVID-19 pandemic as revealed in Table 2. Period 1, spanning May 2018 to January 2020, represents a baseline of pre-pandemic conditions. During this time, the mean number of attacks at various distances (μ = 0.26 attacks within 2 km, 1.24 attacks within 5 km) and fatalities (μ = 0.60 fatalities within 2 km, 2.53 fatalities within 5 km) were relatively high, particularly in urban areas (μ = 0.72 attacks within 2 km, 3.21 attacks within 5 km). This period's statistics indicate higher conflict intensity and associated fatalities in urban regions compared to the rural areas, where the mean values were consistently lower (e.g., μ = 0.04 attacks within 2 km, 0.31 attacks within 5 km). This is an indication of higher per capital conflict attacks and fatalities for urban household owing mainly to higher population density compared to their rural counterparts.

Period 2, spanning March to April 2020 (the immediate aftermath of the COVID-19 outbreak), shows a significant reduction in conflict intensity and fatalities. The mean number of attacks within 2 km dropped to 0.15 overall, with rural areas experiencing minimal change (0.05) compared to a sharper decline in urban areas (0.30). Similar declines are observed for attacks within 5 km (0.44 overall, 0.15 rural, 0.89 urban) and fatalities (0.90 overall, 0.26 rural, 1.88 urban). These reductions suggest that the pandemic's initial disruption may have curtailed conflict activities, possibly due to movement restrictions, resource reallocation, or strategic shifts by conflict actors.

Periods 3 and 4, covering May 2020 to June 2020 and July 2020 to November 2020, respectively, indicate a mixed pattern. While the mean number of attacks and fatalities continues to decline overall, there are slight fluctuations, reflecting some measures of instability. By period 4, the mean

number of attacks within 2 km has increased slightly to 0.09 overall, with rural areas showing minimal impact (0.01) compared to urban areas (0.20). Fatalities within 5 km also decreased overall from 0.44 in period 3 to 0.44 in period 4, with urban areas (0.95) remaining more affected than rural ones (0.12). This trend highlights the disproportionate impact on urban areas, which, despite an overall reduction in conflict intensity, continue to experience higher levels of violence compared to rural regions.

Table 2. Summary statistics for conflict attacks and fatalities over the period covered by the study

Variables	Period	N	Mean	SD	Min.	Max.	Rural (Mean)	Urban (Mean)
	1	4980	0.26	1.16	0.00	25.00	0.04	0.72
	2	1825	0.15	0.67	0.00	7.00	0.05	0.30
	3	1793	0.05	0.28	0.00	4.00	0.01	0.11
Attacks at 2 Km	4	1732	0.09	0.43	0.00	8.00	0.01	0.20
	1	4980	1.24	4.31	0.00	66.00	0.31	3.21
	2	1825	0.44	1.16	0.00	7.00	0.15	0.89
	3	1793	0.17	0.56	0.00	4.00	0.05	0.35
Attacks withing 5Km	4	1732	0.33	1.46	0.00	15.00	0.05	0.76
	1	4980	3.59	8.82	0.00	81.00	1.27	8.52
	2	1825	1.10	2.27	0.00	13.00	0.37	2.23
	3	1793	0.50	1.37	0.00	14.00	0.23	0.91
Attacks at 10Km	4	1732	0.73	2.13	0.00	18.00	0.16	1.61
	1	4980	5.67	10.90	0.00	93.00	2.64	12.10
	2	1825	1.95	3.75	0.00	19.00	0.76	3.79
	3	1793	0.75	1.63	0.00	14.00	0.43	1.24
Attacks at 15Km	4	1732	1.06	2.56	0.00	21.00	0.37	2.13
	1	4980	7.96	12.80	0.00	104.00	4.36	15.59
	2	1825	2.74	4.69	0.00	20.00	1.32	4.92
	3	1793	1.02	1.77	0.00	15.00	0.65	1.60
Attacks at 20Km	4	1732	1.45	2.90	0.00	23.00	0.64	2.70
	1	4980	0.60	5.25	0.00	101.00	0.32	1.20
	2	1825	0.69	9.19	0.00	157.00	0.05	1.66
	3	1793	0.08	0.89	0.00	16.00	0.01	0.20
Fatalities at 2Km	4	1732	0.10	1.06	0.00	19.00	0.01	0.24
	1	4980	2.53	13.45	0.00	239.00	1.06	5.65
	2	1825	0.90	9.25	0.00	157.00	0.26	1.88
Fatalities within 5km	3-+	1793	0.46	3.48	0.00	38.00	0.05	1.10
	4	1732	0.44	2.61	0.00	22.00	0.12	0.95
	1	4980	6.47	23.89	0.00	270.00	3.13	13.56
Fatalities within	2	1825	1.51	9.65	0.00	157.00	0.63	2.88
10km	3	1793	0.97	4.86	0.00	38.00	0.24	2.11
	4	1732	0.98	4.31	0.00	34.00	0.25	2.13
	1	4980	9.81	29.20	0.00	336.00	5.93	18.04
Fatalities within	2	1825	2.51	11.87	0.00	157.00	1.57	3.96
15km	3	1793	1.27	5.80	0.00	74.00	0.61	2.29
	4	1732	1.30	4.77	0.00	35.00	0.48	2.58

Variables	Period	N	Mean	SD	Min.	Max.	Rural (Mean)	Urban (Mean)
Fatalities within 20km	1	4980	13.64	34.61	0.00	394.00	9.32	22.80
	2	1825	3.46	12.48	0.00	157.00	2.31	5.23
	3	1793	1.82	7.65	0.00	80.00	1.08	2.96
	4	1732	1.84	5.62	0.00	38.00	0.91	3.30

The summary statistics for COVID-19 shocks, state-level containment measures, and household food insecurity scores across different periods also reveals some interesting thoughts. During Period 2, the average number of COVID-19 deaths and incidences highlight a significant margin between rural and urban areas. Urban areas experienced significantly higher mean COVID-19 deaths (μ = 5.38) and incidences (221.72) compared to rural areas (μ = 0.38 deaths and 21.12 incidences). This urban-rural disparity persists through Periods 3 and 4 (μ = 5.41 deaths in urban areas in Period 3 and 5.23 in Period 4). This trend is consistent with findings from other regions indicating that urban areas, characterized by higher population densities and greater mobility, faced more severe COVID-19 outbreaks compared to rural regions (Stier, Berman, & Bettencourt, 2020).

Regarding food insecurity scores, there is a noticeable increase over the periods, particularly during the early months of the pandemic. The average food insecurity score in Period 4 (July to November 2020) was 4.71, a rise from 3.45 in Period 1 (May 2018 to January 2020). Interestingly, rural areas experienced a higher increase in food insecurity (from μ = 3.39 in Period 1 to 5.20 in Period 4) compared to urban areas (from μ = 3.01 in Period 1 to 2.69 in Period 4). This spike in food insecurity aligns with findings from other studies indicating that COVID-19 exacerbated food security challenges, particularly in rural areas where access to markets and food supplies was more severely disrupted (Laborde, Martin, & Vos, 2020; Torero, 2020).

State-level COVID-19 containment measures was a constant in this study. Urban areas reported slightly higher containment measures (around 14.14) compared to rural areas (μ = 12.56 to 12.59). This slight variation suggests a greater emphasis on stringent measures in urban settings, likely due to higher COVID-19 incidence rates and the need to control transmission in densely populated areas. Similar trends have been observed globally, where urban centers implemented more rigorous containment measures to manage higher infection rates (Galvani et. al., 2020; Hale et. al., 2020).

The study reveals that attacks and fatalities varied significantly across Nigeria's six geopolitical zones. During Period 1, the North West (NW) experienced the highest average number of fatalities within a 2 km radius (2.13) compared to other regions. This zone continued to have high fatalities through subsequent periods. The South West (SW) also experienced significant conflict, particularly evident in the higher mean attacks at 2 km (0.45) in Period 1 and fatalities within 5 km (1.60). These patterns are corroborated by other studies indicating persistent conflict in the NW and periodic spikes in violence in the SW due to various local grievances and insurgencies (Campbell & Page, 2018).

Table 3. Summary statistics for COVID-19 shocks, state-level containment measures and household food insecurity scores

	Pooled						By Sector	
Variables	**Period**	**N**	**Mean**	**SD**	**Min.**	**Max.**	**Rural (Mean)**	**Urban (Mean)**
COVID-19 death	1	4980	-	-	-	-	-	-
	2	1825	2.68	7.59	0.00	49.00	0.38	5.38
	3	1793	2.69	7.64	0.00	49.00	0.40	5.41
	4	1732	2.61	7.42	0.00	49.00	0.40	5.23
COVID-19_incidences	1	4980	-	-	-	-	-	-
	2	1825	113.20	354.28	1.00	2561.00	21.12	221.72
	3	1793	114.16	357.21	1.00	2561.00	21.11	223.99
	4	1732	110.05	345.73	1.00	2561.00	21.15	215.91
Food insecurity score	1	4980	3.45	3.04	0.00	8.00	3.39	3.01
	2	1825	5.08	2.73	0.00	8.00	3.48	3.05
	3	1793	4.77	2.95	0.00	8.00	4.90	2.78
	4	1732	4.71	2.99	0.00	8.00	5.20	2.69
COVID-19 containment measures	1	4980	-	-	-	-	-	-
	2	1825	13.18	2.23	10.00	19.00	12.59	14.07
	3	1793	13.20	2.24	10.00	19.00	12.57	14.14
	4	1732	13.18	2.22	10.00	19.00	12.56	14.12

Table 4. Average number of attacks and fatalities from armed conflicts across Nigeria's six geopolitical zones over the period covered

Variables	**Period**	**N**	**NC**	**NE**	**NW**	**SE**	**SS**	**SW**
Attacks at 2 Km	1	4980	0.17	0.13	0.20	0.37	0.23	0.45
	2	1825	0.13	0.05	0.29	0.25	0.05	0.09
	3	1793	0.02	0.03	0.09	0.06	0.02	0.07
	4	1732	0.05	0.05	0.23	0.10	0.06	0.04
Fatalities at 2Km	1	4980	0.29	0.25	2.13	0.24	0.42	0.27
	2	1825	0.07	0.07	3.93	0.12	0.02	0.03
	3	1793	0.00	0.08	0.34	0.03	0.03	0.04
	4	1732	0.03	0.00	0.41	0.10	0.00	0.04
Attacks at 5Km	1	4980	0.45	1.27	1.12	1.28	1.08	2.26
	2	1825	0.22	0.09	0.53	0.62	0.24	0.84
	3	1793	0.03	0.13	0.35	0.19	0.17	0.14
	4	1732	0.11	0.11	1.16	0.23	0.19	0.19
Fatalities within 5Km	1	4980	0.91	4.45	5.15	1.50	1.54	1.60
	2	1825	0.12	0.34	4.24	0.40	0.18	0.21
	3	1793	0.00	0.29	2.40	0.10	0.07	0.07
	4	1732	0.07	0.06	2.23	0.17	0.10	0.10
Attacks within 10Km	1	4980	1.30	3.89	2.42	3.41	4.06	6.55
	2	1825	0.37	0.52	0.91	1.30	0.84	2.43
	3	1793	0.10	0.72	0.68	0.63	0.45	0.39
	4	1732	0.18	0.61	1.77	0.48	0.58	0.75

Variables	Period	N	NC	NE	NW	SE	SS	SW
Fatalities within 10Km	1	4980	2.47	12.76	9.49	3.82	5.85	4.43
	2	1825	0.24	1.05	5.17	0.84	0.69	1.15
	3	1793	0.03	1.45	3.97	0.23	0.12	0.17
	4	1732	0.09	1.57	3.26	0.31	0.31	0.34
Attacks within 15Km	1	4980	2.02	5.14	3.37	5.93	6.60	11.09
	2	1825	0.63	0.66	1.23	2.24	1.40	5.03
	3	1793	0.26	0.86	0.95	0.98	0.53	0.84
	4	1732	0.38	0.77	2.25	0.77	0.95	1.26
Fatalities within 15km	1	4980	4.21	16.43	14.85	7.02	9.04	7.33
	2	1825	0.67	2.77	6.10	1.66	1.35	2.45
	3	1793	0.14	1.62	5.07	0.38	0.19	0.42
	4	1732	0.28	1.82	3.82	0.46	0.67	0.74
Attacks within 20Km	1	4980	2.80	6.45	4.36	9.18	10.36	14.81
	2	1825	0.96	0.88	1.55	3.71	2.07	6.56
	3	1793	0.42	0.93	1.23	1.39	0.67	1.36
	4	1732	0.61	0.86	2.68	1.08	1.46	2.02
Fatalities within 20km	1	4980	6.05	20.76	19.28	11.37	14.03	10.39
	2	1825	1.22	3.50	7.33	3.07	2.00	3.48
	3	1793	0.39	1.77	7.50	0.61	0.32	0.64
	4	1732	0.52	1.92	4.83	0.65	1.86	1.52

NC= North cental, NE = North east, NW = North west, SE = South east, SS = South south, SW = South west

Modelling Food Security with Conflicts and COVID-19 Shocks

The analysis demonstrates that past food insecurity significantly predicts current food insecurity. Specifically, the food insecurity lag 1 has a positive and highly significant estimate of 0.060 ($p < 0.001$) across all models (attacks at 5 km, 10 km, and 20 km). Similarly, food insecurity lag 2 and lag 3 show positive significant effects (estimates = 0.031 and 0.009, respectively), respectively, across all models. These findings align with existing literature, such as Barrett and Constas (2014), which emphasize the persistence of food insecurity over time and the importance of past conditions in shaping current food security status. The gender variable shows that being male is associated with a slight reduction in food insecurity across all our three models. This may be reflective of gender-specific access to resources, and social support systems that differ between males and females. Years of education are inversely related to food insecurity, with a highly significant estimate of -0.008 ($p < 0.001$) across all models. Education's role in enhancing food security is well-documented, as it improves income-generating opportunities and enhances decision-making capabilities Smith *et al.* (2019). Interestingly, we found no direct effect of COVID-19 incidences on food insecurity, with estimates around zero across the models. This might be due to the immediate effects of COVID-19 being more pronounced through economic and mobility restrictions rather than the virus itself. However, containment measures show a positive and significant effect ($\beta = 0.024$, $p < 0.001$), indicating that stricter containment measures are associated with higher food insecurity. This result is consistent with the findings of Barrett and Constas (2020), who explored how COVID-19

containment measures disrupted food systems and exacerbated food insecurity. The lock downs and restrictions likely disrupted supply chains, reduced income-earning opportunities, and increased food prices, thereby worsening food security.

For attacks within 5 km, the direct effect is not significant, nor is the interaction term with COVID-19 incidences. Similarly, for attacks within 10 km and 20 km, neither the direct effects nor the interaction terms are significant. This could indicate that the mere proximity to attacks does not independently worsen food insecurity but may interact with other socio-economic factors not captured in this analysis. It is also an indication that COVID-19 effects, which was obviously a stronger national emergency shock over-rode the effects of the pre-existing conditions created by conflict attacks, affecting all households, irrespective of location.The geopolitical zone dummies reveal significant differences in food insecurity across regions. The North East and South East show positive and significant estimates, indicating higher food insecurity compared to the reference zone. The South South shows a significant effect, suggesting this region faces the highest food insecurity among the zones analyzed. The results highlight the persistent nature of food insecurity and the significant impact of past food security status.

Modelling with fatality cases at 5Km, 10Km and 15Km buffer as a form of robustness check presented in Appendix 3 reveals similar result patterns with our models with armed conflict attacks at these distances.

Table 5. Poisson Regression Model explaining the combined effects of armed conflicts attack and covid-19 on food insecurity status of households

Model	Attacks at 5Km		Attacks at 10Km		Attacks at 20Km	
	Estimate	Std. error	Estimate	Std. error	Estimate	Std. error
(Intercept)	0.970***	0.053	0.963***	0.054	0.953***	0.054
Food insecurity lag 1	0.060***	0.003	0.060***	0.003	0.060***	0.003
Food insecurity lag 2	0.031***	0.003	0.031***	0.003	0.031***	0.003
Food insecurity lag 3	0.009**	0.003	0.009**	0.003	0.009**	0.003
male	-0.044*	0.023	-0.045*	0.023	-0.045*	0.023
hhsize	0.001	0.003	0.001	0.003	0.001	0.003
age_sq	-0.000**	0.000	-0.000**	0.000	-0.000**	0.000
edu_years	-0.008***	0.001	-0.008***	0.001	-0.008***	0.001
covid_incidences	0.000	0.000	0.000	0.000	0.000	0.000
attacks5km	-0.003	0.003				
dist_road2	0.000	0.001	0.000	0.001	0.001	0.001
dist_market	0.000	0.000	0.000	0.000	0.000	0.000
containment_total	0.024***	0.002	0.024***	0.002	0.024***	0.002
NC_dummy	-0.014	0.039	-0.013	0.039	-0.008	0.039
NE_dummy	0.088*	0.037	0.082*	0.037	0.086*	0.037
NW_dummy	0.015	0.04	0.013	0.04	0.017	0.04
SE_dummy	0.076*	0.033	0.075*	0.033	0.075*	0.033

Model	Attacks at 5Km		Attacks at 10Km		Attacks at 20Km	
	Estimate	Std. error	Estimate	Std. error	Estimate	Std. error
SS_dummy	0.162***	0.035	0.162***	0.035	0.164***	0.035
rural_dummy	0.01	0.023	0.018	0.023	0.021	0.023
attacks5km_covid_incidences	0.000	0.000				
attacks10km			0.000	0.002		
attacks10km_covid_incidences			0.000	0.000		
attacks20km					0.001	0.001
attacks20km_covid_incidences					0.000	0.000
Note: *** p<0.001, ** p<0.01, * p<0.05						

Resilience Status in Nigeria's Geopolitical Zones Over Four Time Periods

This results of analysis as shown in Table 6 reveals household resilience status across Nigeria's six geopolitical zones (North Central - NC, North East - NE, North West - NW, South East - SE, South South - SS, and South West - SW) and national figures at different time periods relative to the COVID-19 outbreak. The result reveals that before the COVID-19 outbreak, the majority of households nationwide were categorized as Very High (40.8%) and High (34.5%) resilience. The North Central zone exhibited the highest proportion of Very High resilience households (60.5%), while the South South had the highest percentage of Moderate resilience households (46.2%). We found that there were minimal instances of low resilience households across all zones during this period. However, two months post-outbreak, we found an observable decline in Very High resilience households and an increase in Low and Moderate resilience categories. The overall proportion of Low resilience households increased from 0.1% to 13.4%, and Moderate resilience category becoming predominant at 43.7% . The South East experienced the most significant change, with Low resilience cases worsening by increasing from 0% to 25.9%.

We found some level of stability with this pattern at the fourth month post COVID-19 outbreak, although Moderate resilience remained dominant (46.4% overall). The South East continued to have the highest percentage of Low resilience households (23.4%), while the North West showed signs of recovery in the Very High resilience category (22.7%). Seven months post-outbreak, the distribution shows a similar pattern with that of four-month point with only some observable slight fluctuations. Moderate resilience remained the most prevalent category (46.4% overall), with the North Central zone maintaining the highest proportion of Very High resilience households (22.2%). The South East still showed the highest percentage of Low resilience households (21.2%).

The result highlights that the COVID-19 outbreak significantly reduced household resilience across all zones, with the South East being notably affected, consistently showing the highest percentage of Low resilience households post-outbreak compared to other zones. The North Central zone maintained the highest percentage of Very High resilience households throughout, although with a decline. Recovery appears gradual, evident from the distribution at seven months post-outbreak differing substantially from pre-outbreak levels. The South South zone demonstrated the most stability in the Moderate resilience category across all periods.

Table 6. Resilience status of households across the four data period

Period	Resilience status	NC	NE	NW	SE	SS	SW	Overall
Pre_covid outbreak	Low	0.0	0.0	0.0	0.0	0.5	0.0	0.1
	Moderate	10.5	26.1	18.6	38.0	46.2	9.8	24.7
	High	29.0	34.1	29.3	39.5	34.8	40.7	34.5
	Very High	60.5	39.9	52.1	22.5	18.5	49.5	40.8
Two months post-outbreak	Low	2.4	17.0	10.2	25.9	14.7	9.4	13.4
	Moderate	41.4	39.4	36.4	46.3	50.2	48.5	43.7
	High	33.7	33.3	32.7	23.2	27.8	29.1	29.9
	Very High	22.6	10.3	20.7	4.6	7.3	12.9	13.1
Four months post-outbreak	Low	1.7	14.2	8.3	23.4	14.4	10.9	12.3
	Moderate	37.2	44.7	43.9	53.5	55.5	45.0	46.4
	High	41.0	34.0	25.2	18.5	25.4	33.2	29.7
	Very High	20.1	7.2	22.7	4.6	4.7	10.9	11.6
Seven month post outbreak	Low	4.2	12.8	11.1	21.2	15.5	10.2	12.5
	Moderate	39.4	44.9	35.0	54.7	52.4	52.1	46.4
	High	34.2	34.0	36.1	20.3	25.2	27.4	29.6
	Very High	22.2	8.3	17.9	3.9	6.8	10.2	11.5

NC = North central, NE = North east; NW = North west; SE = South east, SW = South west; SS = South south

Differences in Household Resilience by Sector and Sex

The analysis reveals significant variations in resilience levels across sectors and genders over the four time points of data collection. The result reveals that urban areas consistently exhibited significantly higher resilience compared to rural areas. Result for the first point (pre-COVID-19 outbreak period), urban sectors had a mean resilience score of 71.2, significantly higher than the households in the rural area's 66.7 ($t = 8.593$, $p < 0.001$). This pattern continued in subsequent waves, with urban households maintaining higher resilience despite slight fluctuations. Several recent studies corroborate these findings. Studies corroborate these findings, indicating urban-rural disparities in resource distribution and infrastructure development, which often favour urban areas (Deschênes *et al.*, 2020; UN-Habitat, 2020; World Bank, 2016). Barrett and Constas (2014) found that urban areas

tend to have higher resilience due to better infrastructure, access to services, and economic opportunities compared to rural areas. However, d'Errico *et al.* (2018) argue that urban areas can also face unique challenges, such as higher population density and greater exposure to certain risks, which can sometimes offset these advantages. This sustained rural-urban disparity in resilience suggests that rural households received less attention regarding COVID-19 related interventions compared to their urban counterparts, even as the pandemic and associated economic challenges persisted (FAO, 2021).

Our results reveals a consistent gender disparities in resilience across all waves, with male-headed households exhibiting higher resilience than their female-headed counterparts. For example, in the pre-outbreak period, male-headed households had an average of 69.81 resilience score, compared to female-headed households' 61.57 ($t = 12.549$, $p < 0.001$). This pattern continued in point 2 to 4, with male-headed households consistently showing higher resilience scores than females.This result corroborates a number of earlier findings. Smith *et al.* (2019) found that women often face greater barriers to resilience due to socio-economic disadvantages, limited access to resources, and social norms that can restrict their adaptive capacities. Enarson and Pease (2016) discussed how gender roles and expectations can impact women's ability to respond to and recover from crises. However, some other studies, such Bradshaw and Fordham (2017) suggest that in certain contexts, women can exhibit equal or even greater resilience due to strong social networks and community involvement. The consistent resilience disparity by gender further underscores the need for continuous support to female-headed households, as they bear a heavier burden during extended crises (UNDP, 2021).

Table 7. Household Resilience to COVID-19 and Armed Conflict Shocks by Sector and Sex

Groups	Wave	Category	Mean	Std. error	N	df	t_value	p-value
Sector	1	Urban Rural	71.245 66.688	0.426 0.316	1594 3385	3354.774	8.593	0.000
	2	Urban Rural	51.819 47.139	0.810 0.626	717 1107	1482.824	4.572	0.000
	3	Urban Rural	51.347 46.203	0.799 0.609	703 1089	1440.722	5.119	0.000
	4	Urban Rural	50.797 46.562	0.814 0.626	676 1056	1397.230	4.124	0.000
Sex	1	Male Female	69.805 61.567	0.278 0.595	3977 962	1467.362	12.549	0.000
	2	Male Female	50.754 41.174	0.542 1.153	1486 334	496.938	7.516	0.000
	3	Male Female	50.046 40.107	0.528 1.153	1463 328	475.181	7.837	0.000
	4	Male Female	49.935 40.356	0.539 1.188	1421 307	446.741	7.341	0.000

Explanation of household resilience using individual and combined effects of COVID-19 and armed conflicts in Nigeria

This result in Table 8 analyses the individual and combined effects of armed conflicts and COVID-19 on the resilience of households in Nigeria. Two models are presented to capture these effects, with resilience scores as the dependent variable. The first analyses the impact of conflicts measured by attacks within 10 kilometres, followed by a robustness check using fatalities within 10 kilometres.

The result reveals that the first lag of the food insecurity (Food insecurity lag1) decreases resilience by about 4.388 units, while the second lag (Food insecurity lag2) decreases resilience by approximately 2.233 units, and the third lag (Food insecurity lag3) decreases resilience by about 0.609 units. These results indicates that past food insecurity status and experience have something to with resilience, and in this case, the effect is negative. Also, as part of our control variables, we find socioeconomic characteristics of households such as gender, household size, age (square of age) and education as important predictors household resilience. Gender differences are evident, as being male increases household resilience by 3.517 units, suggesting potential gender-based advantages in resource access or decision-making. Also, we found that each additional household member decreases resilience by 0.094 units, suggestive of resource constraints in larger households. This result corroborates existing studies which reported male-headed households as being less vulnerable compared to their female counterparts, due mainly to unequal access and control over resources that in most culture in many sub-saharan African countries (Olaosebikan, *et al.* 2023; Peterman, 2011 and Quisumbing., 2006). Age squared (age_sq) also has a small but positive effect on resilience, suggesting that older household heads might leverage experience and networks to enhance resilience. Years of education (edu_years) positively influence resilience, increasing it by 0.537 units. The result highlights the role of education in equipping individuals with the skills and knowledge necessary to navigate and recover from adversities, as supported by previous studies (D'Errico, *et al.* 2021; D'ErricoUNESCO, 2014; Opiyo, 2014; Uexkull, 2020; , *et al.*, 2018).

The number of COVID-19 incidences (covid_incidences) has a positive but very small effect on resilience, reflecting adaptive behaviours or support mechanisms during the pandemic. However, the number of conflict attacks within 10 kilometers (attacks10km) negatively impacts resilience, with a coefficient of -0.013. This highlights the detrimental effect of proximate violence on household stability, consistent with findings from conflict-affected regions worldwide (Justino, 2012). Distance to the nearest road (dist_road2) and market (dist_market) both negatively affect resilience. This indicates that isolation from essential infrastructure reduces household resilience, suggesting that improving road and market access could enhance household stability and recovery capabilities (Banerjee *et al.*, 2012). Also, state-level containment measures (containment_total) significantly reduce resilience, indicating the harsh impact of restrictive measures on household well-being. This

points to the need for balanced containment strategies that mitigate the spread of diseases while minimizing economic and social disruptions (Hale *et al.*, 2020).

Zonal disparities are also evident, with significant negative effects observed for the North-East (NE_dummy), North-West (NW_dummy), South-East (SE_dummy), and South-South (SS_dummy) regions compared to the reference zone which is the South-West region. North-Central zone has the highest resilience, experiencing a significantly higher positive effects compared to the other five zones of the country. This suggests that zone-specific policies and interventions are necessary to address unique challenges and enhance resilience across different areas. This is indicative of the poverty distribution in Nigeria, with the rural households also showing lower resilience. Similar trends have been observed globally, where urban centers implemented more rigorous containment measures to manage higher infection rates (Hale et. al., 2020; Galvani et. al., 2020). Finally, the interaction term between attacks and COVID-19 incidences (attacks10km_covid_incidences) has a small but significant negative effect on resilience, highlighting the compounded stress of violence and the pandemic on household vulnerabilities. The significant negative impacts of conflicts align with existing literature on the disruptive effects of violence on food security and household resilience (Blattman & Miguel, 2010; Justino, 2012; Regnier-Davies, *et al.*, 2022)

The robustness check uses fatalities within 10 kilometers (fatal10km) as a measure of conflict impact prsents a similar result pattern. The effects of lagged food consumption scores (FCS_L1, FCS_L2, FCS_L3), gender, household size, age squared, and education years remain consistent with the previous model, reaffirming their critical roles in determining household resilience. Interestingly, the number of COVID-19 incidences (covid_incidences) continues to show a small positive effect on resilience, albeit slightly reduced (0.005). Zonal effects are similarly significant, with the North-East, North-West, South-East, and South-South zones exhibiting lower resilience compared to the reference South-western zone. Rural households continue to display lower resilience. The number of fatalities within 10 kilometers (fatal10km) shows a negative but non-significant effect on resilience, suggesting that the immediate impact of fatalities may be less influential than the overall presence of conflict. However, the interaction term between fatalities and COVID-19 incidences (fatal10km_covid_incidences) is significantly negative, indicating that combined stressors increased household vulnerabilities.

Table 8. Model explaining the combined effects of armed conflicts (attack and fatalities) and covid-19 on resilience of households in Nigeria

Model	Attack at 10Km	Std. Error	Fatality at 10Km	Attack at 10Km
(Intercept)	90.231***	0.25	90.156***	0.249
Food insecurity lag1	-4.388***	0.013	-4.391***	0.013
Food insecurity lag2	-2.233***	0.013	-2.235***	0.013
Food insecurity lag3	-0.609***	0.013	-0.610***	0.013
male	3.517***	0.103	3.512***	0.103

Model	Attack at 10Km	Std. Error	Fatality at 10Km	Attack at 10Km
hhsize	-0.094***	0.014	-0.097***	0.014
age_sq	0.001***	0.000	0.001***	0.000
edu_years	0.537***	0.005	0.537***	0.005
covid_incidences	0.007***	0.000	0.005***	0.000
attacks10km	-0.013*	0.006		
dist_road2	-0.043***	0.005	-0.041***	0.005
dist_market	-0.004***	0.001	-0.005***	0.001
containment_total	-1.672***	0.008	-1.670***	0.008
NC_dummy	0.886***	0.161	1.009***	0.162
NE_dummy	-5.609***	0.147	-5.537***	0.151
NW_dummy	-1.066***	0.165	-0.945***	0.169
SE_dummy	-5.448***	0.134	-5.397***	0.135
SS_dummy	-11.227***	0.15	-11.161***	0.151
rural_dummy	-1.338***	0.095	-1.302***	0.096
attacks10km_covid_incidences	-0.001***	0.000		
fatal10km			-0.001	0.002
fatal10km_covid_incidences			-0.001***	0.000
Note: *** p<0.001, ** p<0.01, * p<0.05				

5. Conclusion and Policy Relevance

Our findings reveal a sustained rise in conflict cases during the pandemic period, an indication of need for pro-active measures and holistic strategies addressing both immediate humanitarian needs and long-term stability in affected regions. The interplay between armed conflicts and COVID-19 shocks in Nigeria highlights the resilience and vulnerabilities within socio-demographic structures amid crises. While the pandemic initially curtailed conflict activities, urban areas continued to experience higher levels of violence, indicating the impact of population density. These findings therefore underscore the need for targeted interventions to mitigate vulnerabilities, enhance food security and strengthen household resilience, particularly in conflict-prone and relatively populated urban areas.

The COVID-19 pandemic, while having a profound impact on public health and economies globally, did not show a direct interaction with armed conflicts in Nigeria. The trend analysis between May 2018 and November 2020 showed a marginal increase in conflict attacks and fatalities, with the highest spike in 2020 (256 attacks and 1305 fatalities), indicating a sustained rise in conflict incidents. However, the LGA-level analysis revealed no evidence that the incidence of COVID-19 either aided or reduced the rates of armed conflict attacks. This suggests that the pandemic's impact

on conflict dynamics may have been indirect, potentially influencing factors such as resource allocation, restrictions on mobility, and economic stresses.

Although, we observed no direct interaction of COVID-19 incidence and armed conflict attacks, the compounded shocks from both COVID-19 and armed conflicts have significant implications for household food security and resilience. The South-west and and North-Central were the most food secure zones compared to other zones of the country. This further highlights that conflicts and COVID-19 played significant roles in the disruption of the food supply chains, with less food items allowed to transport from the Northern part of the country to the southern part. This underscores the need for deliberate and decisive actions towards taking advantages of the agricultural potentials of different agricultural/geopolitical zones of the country and tailor agricultural policies which helps unlock these potentials. The study further concludes that urban areas, particularly in the South West, continue to experience higher levels of violence and COVID-19 incidences, due to higher population densities and more stringent containment measures. Also, for the conflict-prone North-West and North-East, efforts should focus on enhancing security measures and providing humanitarian aid to stabilize food systems and support agricultural activities so as to further bring stability through a reinvigorated local production system. For urban areas facing higher COVID-19 incidences and related disruptions, policies should aim at improving healthcare infrastructure, ensuring food supply chain resilience, and implementing effective containment measures without exacerbating existing conflicts. We also found disparities in resilience status of male and female-headed households, and as such, the study confirms several positions that female-headed households are often disadvantaged compared than male headed households. Hence, the study by this result calls for tailored interventions that address the specific needs of male-headed and female-headed households differently. Gender-sensitive policies and regional-specific strategies are essential to mitigate effects of compounded shocks as well as ensuring equitable access to resources and support system. The study further shows that enhancing market accessibility and strengthening local economies can also play a vital role in improving food security and building resilience of households.

Lastly, policy makers must adopt an integrated approach to address the root causes of vulnerability and foster resilience across Nigeria's diverse communities. By prioritizing conflict-affected zones, enhancing healthcare infrastructure, and implementing gender-sensitive interventions, policy makers can mitigate the adverse impacts of shocks and promote inclusive development. Lastly, efforts should be made by the government towards unravelling the root causes of armed conflicts and policy actions directed towards addressing identified causes to achieve sustainable peace and inclusive economic prosperity.

References

Adano, W. R., Dietz, T., Witsenburg, K., & Zaal, F. (2012). Climate change, violent conflict and local institutions in Kenya's drylands. *Journal of Peace Research, 49*(1), 65–80. https://doi.org/10.1177/0022343311427344

Adelaja, A., & George, J. (2019a). Effects of conflict on agriculture: Evidence from the Boko Haram insurgency. *World Development, 117*, 184–195. https://doi.org/10.1016/j.worlddev.2019.01.010

Adelaja, A., & George, J. (2019b). Terrorism and land use in agriculture: The case of Boko Haram in Nigeria. *Land Use Policy, 88*, 104116. https://doi.org/10.1016/j.landusepol.2019.104116

Adelaja, A., George, J., Fox, L., Fuglie, K., & Jayne, T. (2021). Shocks, resilience and structural transformation in Sub-Saharan Africa. *Sustainability, 13*(24), 13620. https://doi.org/10.3390/su132413620

Ajah, B. O., Dinne, C. E., & Salami, K. K. (2021). Terrorism in contemporary Nigerian society: Conquest of Boko-haram, myth or reality. https://doi.org/10.5281/zenodo.4741879

Akim, A. M., Ayivodji, F., & Kouton, J. (2024). Food security and the COVID-19 employment shock in Nigeria: Any ex-ante mitigating effects of past remittances? *Food Policy, 122*, 102574.

Al-Mustapha, A. I., Tijani, A. A., Oyewo, M., Ibrahim, A., Elelu, N., Ogundijo, O. A., Awosanya, E., Heikinheimo, A., & Adetunji, V. O. (2021). Nigeria's race to zero COVID-19 cases: True disease burden or testing failure? *Journal of Global Health, 11*, 1–4. https://doi.org/10.7189/jogh.11.03094

Alon, T. M., Doepke, M., Olmstead-Rumsey, J., & Tertilt, M. (2020). The impact of COVID-19 on gender equality. *Labor: Supply & Demand eJournal*.

Amare, M., Abay, K. A., Tiberti, L., & Chamberlin, J. (2021). COVID-19 and food security: Panel data evidence from Nigeria. *Food Policy, 101*, 102099. https://doi.org/10.1016/j.foodpol.2021.102099

Andam, K. S., Edeh, H. O., Oboh, V. U., Pauw, K., & Thurlow, J. (2020). Impacts of COVID-19 on food systems and poverty in Nigeria. *Advances in Food Security and Sustainability, 5*, 145–173.

Azumah, J. (2015). Boko Haram in retrospect. *Islam and Christian–Muslim Relations, 26*(1), 33–52. https://doi.org/10.1080/09596410.2014.967930

Barrett, C. B., & Constas, M. A. (2014). Toward a theory of resilience for international development applications. *Proceedings of the National Academy of Sciences, 111*(40), 14625-14630.

Berdegué, J. A., & Proctor, F. J. (2015). Rethinking cities in rural transformation: The role of territories. *Development, 58*, 237-241.

Berry, L. (2008). The impacts of environmental degradation on refugee–host relationships. *African Security Review, 17*(3), 125–131. https://doi.org/10.1080/10246029.2008.9627489

Bertoni, E., Di Maio, M., Molini, V., & Nisticò, R. (2019). Education is forbidden: The effect of the Boko Haram conflict on education in North-East Nigeria. *Journal of Development Economics, 141*, 102249. https://doi.org/10.1016/j.jdeveco.2018.06.007

Blattman, C., & Miguel, E. (2010). Civil war. *Journal of Economic Literature, 48*(1), 3-57.

Blench, R., Dendo, M., Road, G., & Kingdom, U. (2003). The transformation of conflict between pastoralists and cultivators in Nigeria. In M. Moritz (Ed.), *Africa* (pp. 1-12). http://www.rogerblench.info/Conflict/Herder-farmer_conflict_in_Nigeria.pdf

Bowen, T., del Ninno, C., Andrews, C., Coll-Black, S., Gentilini, U., Johnson, K., Kawasoe, Y., Kryeziu, A., Maher, B., & Williams, A. (2020). Adaptive social protection: Building resilience to shocks. World Bank. https://doi.org/10.1596/978-1-4648-1575-1

Bradshaw, S., & Fordham, M. (2015). Double disaster: Disaster through a gender lens. In J. F. Shroder, A. E. Collins, S. Jones, B. Manyena, & J. Jayawickrama (Eds.), *Hazards and Disasters Series: Hazards, Risks, and Disasters in Society* (pp. 233-251). Academic Press. https://doi.org/10.1016/B978-0-12-396451-9.00014-7

Brück, T., d'Errico, M., & Pietrelli, R. (2016). The effects of conflict on household resilience and food security: Evidence from the 2014 South Sudan crisis. *World Development, 79*, 68-79.

Butler, C. K., & Gates, S. (2012). African range wars: Climate, conflict, and property rights. *Journal of Peace Research, 49*(1), 23–34. https://doi.org/10.1177/0022343311426166

Columbo, E., & Harris, M. (2020, May 1). Extremist groups stepping up operations during the COVID-19 outbreak in Sub-Saharan Africa. *Center for Strategic and International Studies*. https://www.csis.org/analysis/extremist-groups-stepping-operations-during-covid-19-outbreak-sub-saharan-africa

Constas, M., Frankenberger, T., & Hoddinott, J. (2014). Resilience measurement principles: Toward an agenda for measurement design. Food Security Information Network, Resilience Measurement Technical Working Group, Technical Series, 1.

d'Errico, M., & Smith, L. C. (2020). Comparison of FAO and TANGO measures of household resilience and resilience capacity. *FAO* Working Paper.

d'Errico, M., Romano, D., & Pietrelli, R. (2018). Household resilience to food insecurity: Evidence from Tanzania and Uganda. *Food Security, 10*, 1033–1054. https://doi.org/10.1007/s12571-018-0820-5

d'Errico, M., Bori, A., & Campos, A. P. d. l. O. (2021). Resilience and conflict: Evidence from Mali. *Sustainability, 13*(18), 10444. https://doi.org/10.3390/su131810444

Deschênes, S., Dumas, C., & Lambert, S. (2020). Household resources and individual strategies. *World Development, 135*, 105075. https://doi.org/10.1016/j.worlddev.2020.105075

Dessy, S., Gninafon, H., Tiberti, L., & Tiberti, M. (2021). COVID-19 and children's school resilience. https://doi.org/10.1596/1813-9450-9736

Ecker, O., & Hatzenbuehler, P. L. (2022). Food consumption–production response to agricultural policy and macroeconomic change in Nigeria. *Applied Economic Perspectives and Policy, 44*(2), 982-1002.

Eke, S. (2020). 'Nomad savage' and herder–farmer conflicts in Nigeria: The (un)making of an ancient myth. *Third World Quarterly, 41*(5), 745–763. https://doi.org/10.1080/01436597.2019.1702459

Enarson, E., & Pease, B. (Eds.). (2016). *Men, Masculinities and Disaster* (1st ed.). Routledge. https://doi.org/10.4324/9781315678122

Fadare, O., Srinivasan, C., & Zanello, G. (2024). Livestock diversification and dietary diversity in Nigeria: Is production diversity correlated with better diets? *Food Policy, 122*, 102572.

FAO, IFAD, UNICEF, WFP, and WHO. (2019). The state of food security and nutrition in the world 2019: Safeguarding against economic slowdowns and downturns. Rome, FAO. https://doi.org/10.4060/CA5162EN

Galvani, A. P., Lew, A. A., Halperin, D. T., & Yang, H. C. (2020). COVID-19: US federal projections and the faulty models supporting them. *Epidemiology & Infection, 148*, e176.

Gentle, P., & Thwaites, R. (2016). Transhumant pastoralism in the context of socioeconomic and climate change in the mountains of Nepal. *Mountain Research and Development, 36*(2), 173–182. http://www.jstor.org/stable/mounresedeve.36.2.173

George, J., Adelaja, A., & Weatherspoon, D. (2020). Armed conflicts and food insecurity: Evidence from Boko Haram's attacks. *American Journal of Agricultural Economics, 102*(1), 114-131.

George, Justin, Adelaja, A., & Awokuse, T. (2021). The agricultural impacts of armed conflicts: The case of Fulani militia. *European Review of Agricultural Economics, 48*(3), 538–572. https://econpapers.repec.org/RePEc:oup:erevae:v:48:y:2021:i:3:p:538-572.

George, Justin, Adelaja, A., Awokuse, T., & Vaughan, O. (2021). Terrorist attacks, land resource competition and violent farmer-herder conflicts. *Land Use Policy, 102*, 105241. https://doi.org/10.1016/j.landusepol.2020.105241.

George, Justine, & Adelaja, A. O. (2022). Armed conflicts, forced displacement and food security in host communities. *World Development*.

Hale, T., Webster, S., Petherick, A., Phillips, T., & Kira, B. (2020). Oxford COVID-19 Government Response Tracker. Blavatnik School of Government.

Headey, D., Heidkamp, R., Osendarp, S., Ruel, M., Scott, N., Black, R., Shekar, M., Bouis, H., Flory, A., Haddad, L., Walker, N., & Standing Together for Nutrition consortium. (2020). Impacts of COVID-19 on childhood malnutrition and nutrition-related mortality. *The Lancet, 396*(10250), 519–521. https://doi.org/10.1016/S0140-6736(20)31647-0

Iacoella, F., & Tirivayi, N. (2020). Child nutrition during conflict and displacement: Evidence from areas affected by the Boko Haram insurgency in Nigeria. *Public Health, 183*, 132–137. https://doi.org/10.1016/j.puhe.2020.03.012

Idowu, H. A. (2020). Reappraising conflict trends in Nigeria amidst the COVID-19 pandemic. *Conflict Trends, 2020*(3), 20-27.

Iziga, J. I., & Takagi, S. (2022). Food consumption–production adjustments to economic crises under credit constraints in Nigeria. *Sustainability, 14*(14), 8955.

Jackson, J. K., Weiss, M. A., Schwarzenberg, A. B., & Nelson, R. M. (2020). Global economic effects of Covid-19: In brief. *Congressional Research Service.*

Janssens, W., Pradhan, M., de Groot, R., Sidze, E., Donfouet, H. P. P., & Abajobir, A. (2021). The short-term economic effects of COVID-19 on low-income households in rural Kenya: An analysis using weekly financial household data. *World Development, 138*, 105280.

Juan, A. De, & Wegner, E. (2019). Social inequality, state-centered grievances, and protest: Evidence from South Africa. *Journal of Conflict Resolution, 63*(1), 31–58. https://doi.org/10.1177/0022002717723136

Justino, P. (2012). War and poverty. In M. R. Garfinkel & S. Skaperdas (Eds.), *The Oxford Handbook of the Economics of Peace and Conflict*. https://doi.org/10.1093/oxfordhb/9780195392777.013.0027

Kafando, W. A., & Sakurai, T. (2024). Armed conflicts and household food insecurity: Effects and mechanisms. *Agricultural Economics*.

Kamta, F. N., Schilling, J., & Scheffran, J. (2020). Insecurity, resource scarcity, and migration to camps of internally displaced persons in northeast Nigeria. *Sustainability, 12*(17), 6830. https://doi.org/10.3390/su12176830

Kansiime, M. K., Tambo, J. A., Mugambi, I., Bundi, M., Kara, A., & Owuor, C. (2021). COVID-19 implications on household income and food security in Kenya and Uganda: Findings from a rapid assessment. *World Development, 137*, 105199.

Khemani, S. (2020). An opportunity to build legitimacy and trust in public institutions in the time of COVID-19. *World Bank*.

Koehnlein, B., & Koren, O. (2022). COVID-19, state capacity, and political violence by non-state actors. *Journal of Peace Research, 59*(1), 90–104. https://doi.org/10.1177/00223433211063034

Kolahchi, Z., De Domenico, M., Uddin, L. Q., Cauda, V., Grossmann, I., Lacasa, L., Grancini, G., Mahmoudi, M., & Rezaei, N. (2021). COVID-19 and its global economic impact. In *Coronavirus Disease-COVID-19* (pp. 825-837). Cham: Springer International Publishing.

Kuusaana, E. D., & Bukari, K. N. (2015). Land conflicts between smallholders and Fulani pastoralists in Ghana: Evidence from the Asante Akim North District (AAND). *Journal of Rural Studies, 42*(2), 52–62. https://doi.org/10.1016/j.jrurstud.2015.09.009

Laborde, D., Martin, W., & Vos, R. (2020). Poverty and food insecurity could grow dramatically as COVID-19 spreads. International Food Policy Research Institute (IFPRI).

Laborde, D., Martin, W., & Vos, R. (2021). Impacts of COVID-19 on global poverty, food security, and diets: Insights from global model scenario analysis. *Agricultural Economics,* 52(3), 375–390. https://doi.org/10.1111/agec.12624

Lain, J. W., Perng, J. T. T., Vishwanath, T., Azad, M. A. K., Siwatu, G. O., Palacios-Lopez, A., Mcgee, K. R., Amankwah, A., & Contreras Gonzalez, I. M. (2020). COVID-19 from the ground up: What the crisis means for Nigerians. World Bank. https://documents.worldbank.org/en/publication/documents-

reports/documentdetail/757201593465025800/covid-19-from-the-ground-up-what-the-crisis-means-for-nigerians

Lau, L. L., Hung, N., Go, D. J., Ferma, J., Choi, M., Dodd, W., & Wei, X. (2020). Knowledge, attitudes and practices of COVID-19 among income-poor households in the Philippines: A cross-sectional study. *Journal of Global Health*, 10(1), Article 011007. https://doi.org/10.7189/jogh.10.011007

Lybbert, T. J., Barrett, C. B., McPeak, J. G., & Luseno, W. K. (2007). Bayesian herders: Updating of rainfall beliefs in response to external forecasts. *World Development*, 35(3), 480–497. https://doi.org/10.1016/j.worlddev.2006.04.004

Martine, G., & McGranahan, G. (2013). The legacy of inequality and negligence in Latin American and Caribbean cities. *Environment and Urbanization*, 25(1), 155-170.

Mukiibi, E. (2020). COVID-19 and the state of food security in Africa. *Agriculture and Human Values*, 37(3), 627–628. https://doi.org/10.1007/s10460-020-10079-9

Naseer, S., Khalid, S., Parveen, S., Abbass, K., Song, H., & Achim, M. V. (2023). COVID-19 outbreak: Impact on global economy. *Frontiers in Public Health*, 10, Article 1009393.

Nwankwo, C. F., Ayadiuno, R. U., Ali, A. N., & Madu, I. A. (2020). Farmer-herder conflict: The politics of media discourse in Nigeria. *PONTE International Scientific Researchs Journal*, 76(1). https://doi.org/10.21506/J.PONTE.2020.1.13

Odutola, A. (2020). Nigeria in 2020: SB Morgen perspective. *Nairametrics*. https://nairametrics.com/2019/12/31/nigeria-in-2020-sb-morgen-perspective/

Oghuvbu, E. A., & Oghuvbu, O. B. (2021). Farmer-herders conflict as a challenge to national unity in Nigeria. In A. M. Vasiliev, D. A. Degterev, & T. M. Shaw (Eds.), *Africa and the formation of the new system of international relations: Rethinking decolonization and foreign policy concepts* (pp. 217–226). Springer International Publishing. https://doi.org/10.1007/978-3-030-77336-6_16

Ojeleke, O., Groot, W., Bonuedi, I., & Pavlova, M. (2024). The impact of armed conflicts on the nutritional status of children: Evidence from Northern Nigeria. *The International Journal of Health Planning and Management*, 39(2), 502-529.

Okiti, O., & Habib, A. (2017). A report on the effect of the Naira devaluation on agricultural value chains in the Niger Delta. Foundation for Partnership Initiatives in the Niger Delta.

Okoli, A. C., & Agada, F. T. (2014). Kidnapping and national security in Nigeria. *Research on Humanities and Social Sciences*, 4(6), 137–146.

Oladunni, A. A., Haruna, U. A., Ijafu, L. G., & Lucero-Prisno, D. E. (2022). Will people in conflict-affected zones in Africa have access to COVID-19 vaccine? A case of Nigeria. *The International Journal of Health Planning and Management*, 37(4), 1918–1925. https://doi.org/10.1002/hpm.3474

Olaosebikan, O., Bello, A., Utoblo, O., Okoye, B., Olutegbe, N., Garner, E., Teeken, B., Bryan, E., Forsythe, L., Cole, S., Abdoulaye, T., Manyong, V., & Kulakow, P. (2023). Stressors and resilience within the cassava value chain in Nigeria: Preferred cassava variety traits and

response strategies of men and women to inform breeding. *Sustainability*, 15(10), Article 7837. https://doi.org/10.3390/su15107837

Olaoye, I. J., Edewor, S. E., Chauhan, T., & Stifel, D. (2024). Crop production diversity and the well-being of smallholder farm households: Evidence from Nigeria.

Olarinde, M. O., Osabohien, R., & Osabuohien, E. (2024). Armed conflicts and household socioeconomic status in the Lake Chad Basin: A random coefficient model approach. *Peace Economics, Peace Science and Public Policy*, 30(1), 117-136.

Opiyo, F. E., Wasonga, O. V., & Nyangito, M. M. (2014). Measuring household vulnerability to climate-induced stresses in pastoral rangelands of Kenya: Implications for resilience programming. *Pastoralism*, 4, Article 10. https://doi.org/10.1186/s13570-014-0010-9

Osabohien, R. A., Jaaffar, A. H., Ibrahim, J., Usman, O., Igharo, A. E., & Oyekanmi, A. A. (2024). Socioeconomic shocks, social protection and household food security amidst COVID-19 pandemic in Africa's largest economy. *PLOS One*, 19(1), Article e0293563.

Ouoba, Y., & Sawadogo, N. (2022). Food security, poverty and household resilience to COVID-19 in Burkina Faso: Evidence from urban small traders' households. *World Development Perspectives*, 25, Article 100387. https://doi.org/10.1016/j.wdp.2021.100387

Ozili, P. K. (2020). COVID-19 pandemic and economic crisis: The Nigerian experience and structural causes. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3567419

Polo, S. M. T. (2020). A pandemic of violence? The impact of COVID-19 on conflict. *Peace Economics, Peace Science and Public Policy*, 26.

Regnier-Davies, J., Edge, S., Yu, M. H. M., Nasr, J., Austin, N., Daley, A., & Koc, M. (2022). Towards equitable & resilient post-pandemic urban food systems: The role of community-based organizations. *Urban Governance*, 2(2), 336-346. https://doi.org/10.1016/j.ugj.2022.10.003

Ridhwan, M. M., Rezki, J. F., Suryahadi, A., Ramayandi, A., & Ismail, A. (2024). The impact of COVID-19 lockdowns on household income, consumption and expectations: Evidence from high-frequency data in Indonesia. *Bulletin of Indonesian Economic Studies*, 60(1), 67-94.

Smith, L. C., & Frankenberger, T. R. (2018). Does resilience capacity reduce the negative impact of shocks on household food security? Evidence from the 2014 floods in Northern Bangladesh. *World Development*, 102, 358-376. https://doi.org/10.1016/j.worlddev.2017.07.003

Stier, A. J., Berman, M. G., & Bettencourt, L. M. A. (2020). COVID-19 attack rate increases with city size. Mansueto Institute for Urban Innovation Research Paper No. 19. https://ssrn.com/abstract=3564464

Suleiman, M. N., & Karim, M. A. (2015). Cycle of bad governance and corruption: The rise of Boko Haram in Nigeria. *SAGE Open*, 5(1). https://doi.org/10.1177/2158244015576053

Tabe-Ojong, M. P., Gebrekidan, B. H., Nshakira-Rukundo, E., Börner, J., & Heckelei, T. (2022). COVID-19 in rural Africa: Food access disruptions, food insecurity and coping strategies

in Kenya, Namibia, and Tanzania. *Agricultural Economics*, 53(5), 719–738. https://doi.org/10.1111/agec.12709

Brück, T., d'Errico, M., & Pietrelli, R. (2019). The effects of violent conflict on household resilience and food security: Evidence from the 2014 Gaza conflict. *World Development*, 119, 203-223. https://doi.org/10.1016/j.worlddev.2018.05.008

Torero, M. (2020). Without food, there can be no exit from the pandemic. *Nature*, 580(7805), 588-589.

Turiansky, A., Lipman, E., Mamun, A., Seaton, C., Gellar, J., & Hughes, S. (2021). Financial inclusion and resilience to COVID-19 economic shocks: Evidence from Kenya, Nigeria, and Uganda.

UN Women. (2020). Gender and COVID-19: Advocacy brief.

Wilkinson, E., Le Masson, V., & Norton, A. L. (2015). Gender and resilience.

World Bank. (2017). Gender-based violence: An analysis of the implications for the Nigeria for Women Project.

World Health Organization. (2023). WHO Coronavirus (COVID-19) dashboard | WHO coronavirus (COVID-19) dashboard with vaccination data. https://covid19.who.int/

Supplementary Materials

Table A1. Armed-conflict and COVID-19 statistics from May, 2018 to November, 2020

Date	Conflicts		COVID-19	
Date	Attack	Fatalities	Incidence	Fatalities
2018-05	145	565	0	0
2018-06	156	692	0	0
2018-07	122	543	0	0
2018-08	103	427	0	0
2018-09	82	280	0	0
2018-10	77	368	0	0
2018-11	90	403	0	0
2018-12	119	365	0	0
2019-01	118	501	0	0
2019-02	191	583	0	0
2019-03	153	675	0	0
2019-04	126	632	0	0
2019-05	124	516	0	0
2019-06	118	669	0	0
2019-07	98	405	0	0
2019-08	78	239	0	0
2019-09	89	256	0	0
2019-10	94	268	0	0
2019-11	111	277	0	0
2019-12	110	297	0	0
2020-01	166	506	0	0
2020-02	129	351	2671	34
2020-03	134	517	3346	68
2020-04	200	632	6405	163
2020-05	256	1305	8379	210
2020-06	242	1000	13948	258
2020-07	186	609	13125	160
2020-08	157	485	9706	92
2020-09	189	453	6080	61
2020-10	162	533	6170	75
2020-11	178	655	7459	63

Table A2. Summary statistics for COVID-19 shocks, containment measures and food insecurity scores

Variables	Period	NC	NE	NW	SE	SS	SW
COVID-19 death	1	-	-	-	-	-	-
	2	5.77	2.50	1.07	0.47	1.34	4.69
	3	5.78	2.44	1.07	0.45	1.31	4.71
	4	5.13	2.45	1.07	0.47	1.20	4.73
COVID-19_incidences	1	-	-	-	-	-	-
	2	271.81	58.82	45.24	26.12	25.61	235.00
	3	271.38	57.61	44.29	25.64	25.20	235.40
	4	239.50	58.00	44.14	26.20	22.95	235.46
Food insecurity score	1	2.16	2.86	2.81	4.88	4.76	3.29
	2	5.19	5.17	4.71	5.31	5.04	5.05
	3	4.64	5.09	4.85	4.98	4.73	4.33
	4	4.56	5.03	4.71	4.99	4.73	4.25
COVID-19 containment measures	1	-		-	-	-	-
	2	12.47	11.99	12.36	12.71	12.97	16.14
	3	12.46	11.99	12.35	12.71	13.07	16.17
	4	12.43	12.00	12.36	12.70	13.09	16.13

NC= North cental, NE = North east, NW = North west, SE = South east, SS = South south, SW = South west.

Table A3. Poisson Regression Model explaining the combined effects of armed conflicts fatality and covid-19 on food insecurity status of households

Model	Fatality at 5Km		Fatality at 10Km		Fatality at 20Km	
	Estimates	Std. Error	Estimates	Std. Error	Estimates	Std. Error
(Intercept)	0.967***	0.053	0.969***	0.053	0.971***	0.053
FCS_L1	0.060***	0.003	0.060***	0.003	0.060***	0.003
FCS_L2	0.031***	0.003	0.031***	0.003	0.031***	0.003
FCS_L3	0.009**	0.003	0.009**	0.003	0.009**	0.003
male	-0.045*	0.023	-0.044	0.023	-0.044*	0.023
hhsize	0.001	0.003	0.001	0.003	0.001	0.003
age_sq	-0.000**	0.000	-0.000**	0.000	-0.000**	0.000
edu_years	-0.008***	0.001	-0.008***	0.001	-0.008***	0.001
covid_incidences	0.000	0.000	0.000	0.000	0.000	0.000
fatal5km	-0.001	0.001				
dist_road2	0.000	0.001	0.000	0.001	0.000	0.001
dist_market	0.000	0.000	0.000	0.000	0.000	0.000
containment_total	0.024***	0.002	0.023***	0.002	0.023***	0.002
NC_dummy	-0.012	0.039	-0.015	0.039	-0.012	0.039
NE_dummy	0.089*	0.037	0.083*	0.037	0.086*	0.037
NW_dummy	0.02	0.04	0.013	0.04	0.016	0.04
SE_dummy	0.077*	0.033	0.074*	0.033	0.076*	0.033
SS_dummy	0.163***	0.035	0.160***	0.035	0.162***	0.035
rural_dummy	0.011	0.023	0.016	0.023	0.014	0.023
fatal5km_covid_incidences	0.000	0.000				
fatal10km			0.000	0.001		
fatal10km_covid_incidences			0.000	0.000		
fatal20km					0.000	0.000
fatal20km_covid_incidences					0.000	0.000
*** p<0.001, ** p<0.01, * p<0.05						

Table A4. Resilience Status in Nigeria's Geopolitical Zones Over Four Time Periods

Zone	Mean	Sd	Max	Min	n
NC	76.864	14.994	96.439	35.830	845
NE	66.757	18.035	94.501	26.370	826
NW	73.477	16.710	95.615	31.741	843
SE	60.961	16.226	94.782	25.517	823
SS	56.045	17.950	92.582	20.991	816
SW	74.295	14.487	96.093	34.751	826
NC	57.377	19.536	93.792	15.457	299
NE	47.991	21.955	87.857	8.805	315
NW	54.410	21.602	89.441	11.806	294
SE	39.805	19.498	85.577	10.001	328
SS	45.830	19.751	88.511	7.992	245
SW	48.931	20.545	87.950	13.384	343
NC	58.008	18.542	91.554	17.057	294
NE	46.703	20.219	86.864	8.832	319
NW	53.540	21.858	88.848	13.103	278
SE	39.125	18.660	87.236	8.827	325
SS	42.916	18.326	88.511	7.273	236
SW	49.212	20.364	87.883	8.832	340
NC	57.477	19.690	93.792	13.641	288
NE	47.326	20.171	86.325	8.112	315
NW	53.667	21.841	87.885	8.885	280
SE	39.371	18.371	85.113	11.215	311
SS	44.072	19.370	92.695	6.526	206
SW	47.281	19.911	87.556	11.969	332

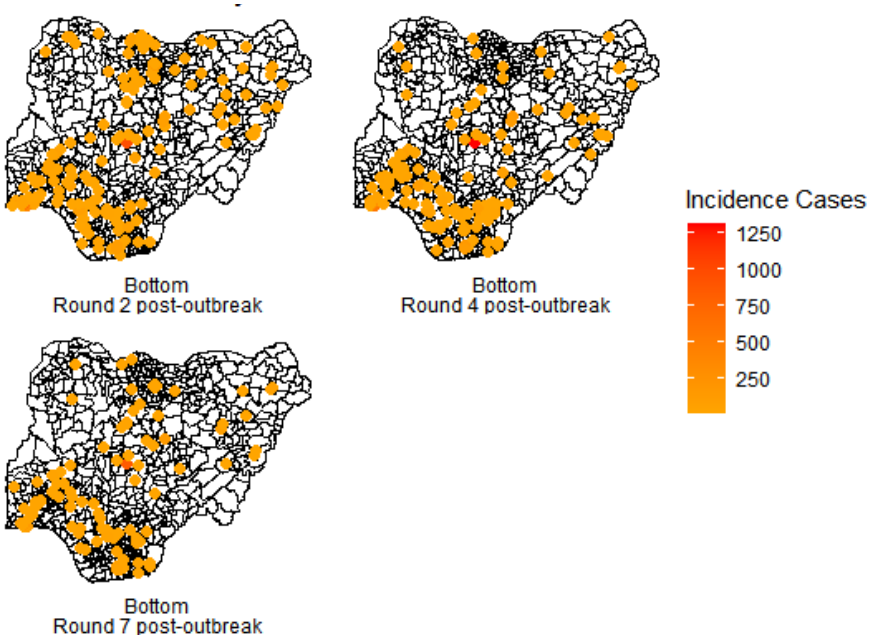

Figure A1. Incidences of COVID-19 by LGA across the study periods

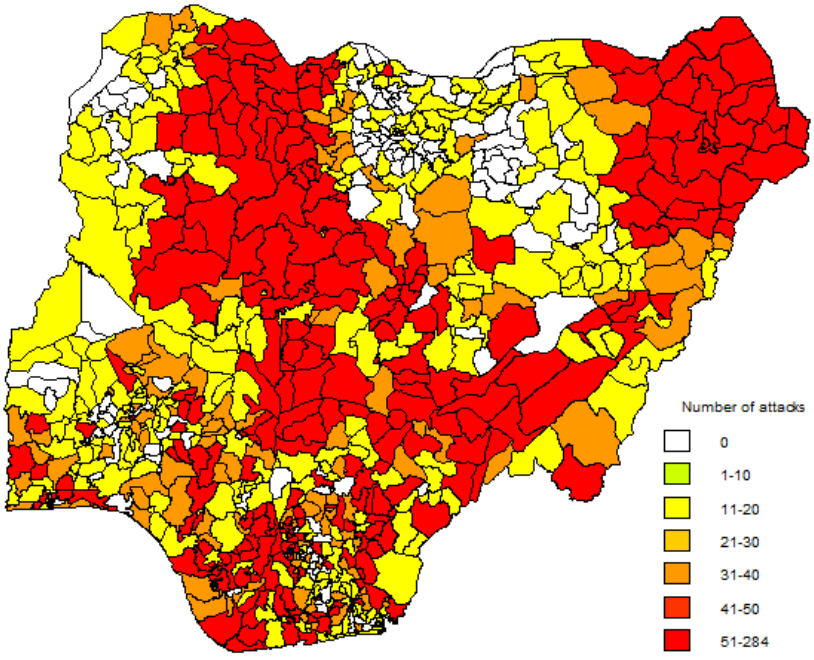

Figure A2. Overall armed conflict attacks within the study period

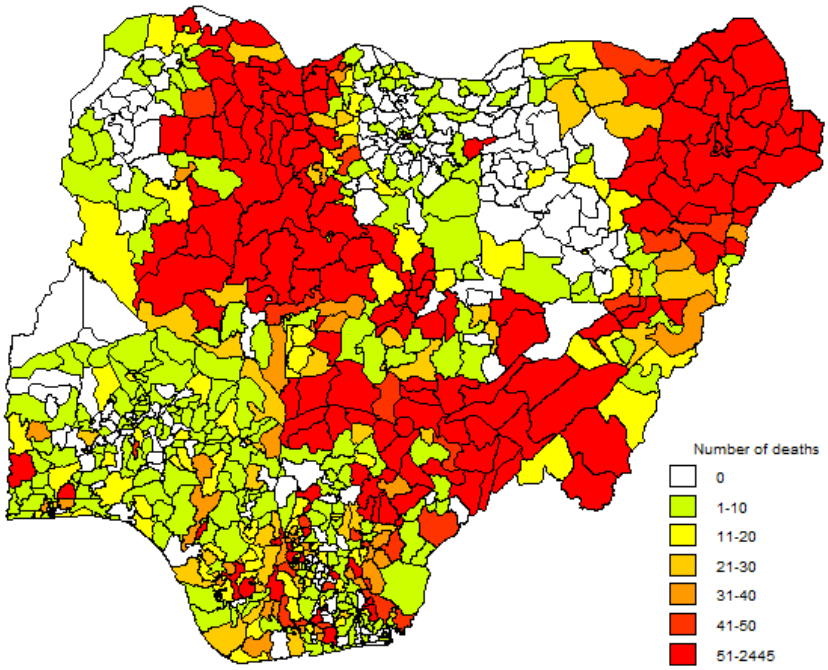

Figure A3. Overall armed conflict fatalities within the study period