Journal of African Economies, 2022, Vol. 00, number 0, 1–34
doi: 10.1093/jae/ejac015
Advance Access Publication Date:
Articles

OXFORD

The Boko Haram Conflict and Food Insecurity: Does Resilience Capacity Matter?

George Abuchi Agwu[a,b,c,*]

[a]University of Pau and Pays de l'Adour, TREE, E2S, UPPA, France, [b]Alex Ekwueme Federal University Ndufu-Alike Ikwo, Nigeria, [c] Centre for the Study of the Economies of Africa (CSEA), Abuja-Nigeria

*Corresponding author: george78ng@yahoo.com

Abstract

Drawing from a robust identification strategy and household panel data collected before and after households were exposed to the Boko Haram conflict, this paper addresses the question of whether resilience capacity is an important factor in mitigating household risks of food insecurity due to conflict shocks. Using the non-parametric difference-in-differences framework, the paper identifies that the shocks negatively affect food security, but resilience capacity attenuates the effects. While resilience actively protects households from the adverse stressors, the paper observes that the pillars of resilience were also significantly decimated by the conflict, thereby weakening households' long-run capacity to withstand future shocks. The results are prescriptively unchanged after adjusting the operating spatial distance of exposure or switching the measure of conflict exposure to conflict intensity represented as battle fatalities. These estimates align well with the various hypotheses of the resilience approach to sustainable development. It is, therefore, recommended that conflict intervention programs incorporate rebuilding resilience, which might help restore households' ability to overcome future shocks.

Keywords: Boko Haram, conflict, food security, resilience, Nigeria
JEL classification: D12, I30, I32

1. Introduction

As the frequency of natural disasters and civil conflicts spikes globally, rapid response systems, the likes of early warning systems facilitating rapid intervention, assume prominence (Smith & Frankenberger, 2018). While such interventions alleviate crises, they seldom address the underlying vulnerability. Occasionally, the short-term interventions generate serial dependence of individuals and households on aid and handouts (Alinovi *et al*., 2008; Bene *et al*., 2016). Some of these concerns motivate the recent calls for the resilience approach to development, whereby building resilience capacity becomes a primary concern

© The Author(s) 2022. Published by Oxford University Press on behalf of the Centre for the Study of African Economies, all rights reserved. For Permissions, please email: journals.permissions@oup.com.

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

of development planning and emergency interventions (Tendall *et al.*, 2015). The resilience approach prioritises the mobilisation of resources through integrative livelihood strategies, human capital combination, social protection, nutritional health and other private and public goods, which in times of shock protect households from extreme consequences (Bene *et al.*, 2016). In the political economy of most developing countries, the penetration of social protection is abysmal despite the prevalence of economic shocks from natural and man-made sources. Such settings provide an ideal environment to explore the interactions among vulnerability, resilience and economic shocks. Exploiting this setting in the case of Nigeria, this paper uses a unique identification strategy based on three rounds of panel data to test the role of resilience capacity in mitigating shocks arising from a deadly conflict. The evidence from this paper might be useful for general development policies, particularly those related to emergency interventions.

From theoretical perspectives, resilience protects households from loss of economic welfare and facilitates recovery from experienced shocks (Alinovi *et al.*, 2008; Bene *et al.*, 2016). Accordingly, development agencies such as the World Bank (WB), the Food and Agricultural Organization (FAO) and the World Food Program (WFP) devote substantial resources to encouraging the build-up of household resilience, and to facilitate empirical assessment of the importance of the concept, the agencies commission works for streamlining its measurement. This incentive has motivated more vigorous assessment of the theoretical links between resilience and food security in particular, with most of the studies adopting the harmonised framework. In the meantime, the frame of analysis is predominantly cross sectional, whereas it might be more appropriate to identify the role of resilience in dynamic settings where the dynamics of shocks, welfare and the intervention of resilience may be exploited (Smith & Davies, 1995). In the particular case of shocks relating to violent conflicts, the difficulty of obtaining before and after longitudinal data with which to investigate the role of resilience confines most of the studies to cross-sectional analysis. The present study is distinguished from most of the previous studies in this respect because of the adoption of the setup of D'Souza & Jolliffe (2013) and the replacement of its self-reported shocks with objective conflict shocks.

Therefore, this paper uses the shocks originating from the battles of Boko Haram (BH), one of the leading violent terror groups in the world, to test the role of resilience capacity in shock mitigation. Most of the studies linking conflict and food security only investigate the short-term consequences and assume direct cause and effect relationship between conflict shocks and food security. This study extends this literature by investigating resilience capacity as an intervention factor and as a potential channel of extending the immediate consequences of the conflict. The study casts resilience as an absorber of the food shocks generated by the BH conflict, which are expected to threaten household food security. By identifying that resilience cushions the effects of the conflict through its various pillars, the paper aligns with the growing literature on a resilience-based approach to managing development.

The remainder of the paper is organised as follows: Section 2 discusses the related literature and background of the study. Section 3 provides an overview of the data and descriptive statistics. Section 4 estimates the basic short-run relationships among the key variables. Section 5 extends the analysis to the long-run through the effects of the conflict exposure on dimensions of resilience capacity. Section 6 reports some robustness checks. Lastly, Section 7 concludes with policy recommendations.

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

2. Literature and background of the study

2.1 The conflict and its effects on channels of food supply

Violent conflicts such as the BH insurgency are usually disruptive of established institutions, including the food systems (Dercon, 2002). The BH particularly targets important economic activities such as farming and related non-farm business activities, and previous studies have acknowledged that this aspect constitutes one of the most important channel of its economic impact, particularly by limiting the ability of households to access food and other livelihood resources (Adelaja & George, 2019; Falode, 2016). In contrast to other types shock, 'food wars' are usually part of civil conflicts, whereby channels of food supply are targeted by actors in the conflict. Consistent with this, the food system may be a means to the end for the BH, as a result of which the food system is central to violent exchanges between the BH and the Nigerian state (Bertoni *et al.*, 2018; Messer & Cohen, 2007). The first violence claimed by the insurgents in the country was a series of attacks against military formations in Bauchi state on the 29th of July 2009 after their first leader, Mohammed Yusuf, was killed by the Nigerian security forces (Adesoji, 2010). Subsequently, BH metamorphosed into a terror group involved in violent confrontations with the state. Millions of people have been displaced from their homes and thousands killed in the course of the war (Adelaja & George, 2019). The group employs diverse tactics in the struggle against the state, one of which is the widely condemned kidnapping of about 300 high school girls in 2014 (Iyekekpolo, 2016). Of most concern for this study is the targeting of agricultural production through the kidnapping of farmers and the destruction of farm infrastructure such as irrigation and storage facilities. Additionally, the BH targets and destroys markets, roads, bridges and other factors that constitute the enabling environment for the production and distribution of foods (Campbell, 2019). These have raised the concerns of stakeholders about possible long-term damages to economic welfare, and food security in particular (FAO, 2015). The conflict intensified around 2013 following a more spirited drive of the state to recapture annexed territories and eradicate the insurgency (Onapajo, 2017). Instead, the BH attacks grew more clandestine and concentrated in less-governed spaces such as farmlands and local markets.

The BH became a much more formidable threat on account of this covert strategy; it became the world's most deadly terrorist group in terms of the counts of casualties, and direct confrontation with state forces was eschewed in favor of targeted and mostly suicide attacks (Omeni, 2018). Consequently, the sabotaging of economic activities through raids on agricultural farms and general disruption of essential economic activities was escalated within few soft target areas (Campbell & Harwood, 2018). Figure 1 clearly demonstrates this transition, where suicide fatalities rose sharply from 2014. One can therefore imagine the extent of disruption in the food system given that the transition focused attacks on agrarian hot spots (Onapajo, 2017). Cases of infrastructure and personal asset damages reportedly also depicted a similar trend (Hoek, 2017). This scenario illustrates potential mechanisms that might drive the expected negative consequences of the conflict on food security, namely, through limitation of food production and distribution (D'Souza & Jolliffe, 2013; Kimenyi *et al.*, 2014).

2.2 Food security and resilience capacity

According to Spedding (1988), the household is a central unit of the food system and subject to destabilisation by economic shocks, idiosyncratic and general. Under normal circum-

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

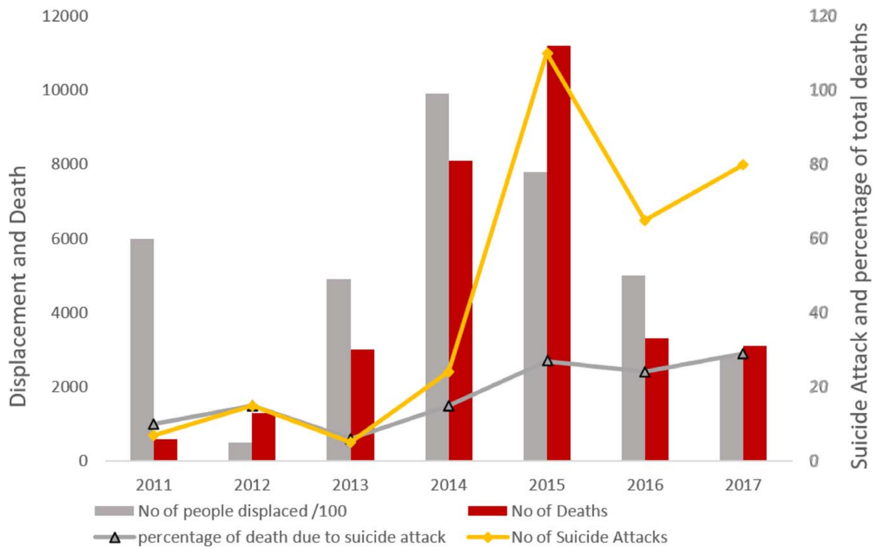

Figure 1: Trends of BH Attacks and Casualties

stances, the household maintains its members' economic welfare by aligning its components with the immediate social and economic environments. Similarly, while facing economic shocks, the household remains central to austerity-coping decisions including deciding income-generating activities, allocating food and non-food expenditures and choosing risk management strategies, which makes it a suitable nucleus of resilience analysis (Cherchye *et al.*, 2007). The concept and measurement of resilience has tremendously transformed driven mainly by the evolution of the construct and the diversity of disciplines in which the construct is appropriated. The FAO of the United Nations defined resilience as 'the capacity of a household to bounce back to a previous level of food security after a shock' and pioneered the Resilience Index Measurement and Analysis (RIMA) approach, which is widely applied in the field of food security analysis (Alinovi *et al.*, 2008).

RIMA denotes resilience as a latent proxy index, which may be directly or indirectly measured (Alinovi *et al.*, 2009). Under the framework, the latent proxy is usually estimated by reducing a large number of theoretical variables to a single resilience index derived from known pillars measured at the first of the two-stage estimation procedure. The direct measurement approach mostly uses structural models such as the MIMIC (Multiple Indicators Multiple Causes) and aims at describing households that may be more/less likely to resist shock at a particular point in time. On the other hand, the indirect approach focuses on the theoretical determinants of resilience to draw inference for policies or predict the dynamic path of resilience. However, Ciani & Romano (2014) pioneered a method of resilience capacity measurement that may be applied to predict the consequences of shocks on food security in dynamic settings, and which acts as a bridge between the direct and indirect RIMA measures. This method has been tested by d'Errico *et al.* (2018) and Kozlowska *et al.* (2015) and is adopted for the present study. The Technical Working Group on Resilience Measurement (TWGRM), a group of expert stakeholders, provides the recommendations guiding the selection of variables for the estimation (d'Errico *et al.*, 2018).

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

The resilience capacity measured under this approach incorporates the idea that households respond to economic shocks by drawing down on accumulated resources and utilising available capacities to develop optimal coping strategies (FAO, 2016). Shocks such as violent conflicts may specifically target pillars of resilience including public infrastructure and income generation assets, which might then extend the duration of the consequences of the initial shocks. Therefore, in addition to the short-term analysis of the effects of the conflict on food security, the study considers the potential long-term impact through its effects on the resilience resources that should mitigate future shocks.

2.3 Relating the conflict, food security and resilience capacity

The prevailing state of conflict and humanitarian crisis in north-east Nigeria is attributed to the BH insurgency, which is rooted in a complex combination of institutional failures, extreme religiosity and welfare limitations (Iyekekpolo, 2016). Apparently, the general state of economic welfare including food security has dipped since the inception of the crisis. The FAO reports that about 3.7 million individuals would become food insecure in the region by 2018, and the WFP estimates that out of the 14.8 million people exposed to the crisis, about 8 million have become food insecure (Baliki *et al.*, 2018). These reports indicate that agricultural productivity has declined in the region, but most importantly the functioning of local agricultural markets has been hampered. This implies that food scarcity and rising food prices might be prevalent. As a result, food provisioning strategies such as relying on less preferred foods, skipping meals and so forth have risen among the exposed households who are desperately attempting to survive the conflict (Marc *et al.*, 2015).

Pioneering studies of this conflict detected negative effects on food supply due to substantial loss of agricultural production (see Adelaja & George, 2019), leading to widespread food insecurity (George *et al.*, 2020). However, beyond the immediate food systems, essential resources supporting household food security and general welfare resilience have also been affected. Hoek (2017) reports direct disruption of the functioning of local markets by the conflict due to actual attacks and threats of attacks, while Bertoni *et al.* (2018) reports substantial decrease in human capital accumulation from the destruction of schooling infrastructures and threats to life. Similarly, Chukwuma & Ekhator-Mobayode (2019) document substantial decrease in the production and consumption of health services. Theoretically, the erosion of resilience capacities as reported here would potentially leave affected households stuck in poor economic welfare and food insecurity long after the conflict might have been eliminated. For example, inadequate supply of health services could increase the frequencies of illnesses and draw down on household food consumption budget, and this would likely be the case in this particular conflict given that cases of epidemics are already being reported in the exposed communities (Adamu *et al.*, 2021). Therefore, policy makers might be interested in understanding the immediate and the long-term implications of the conflict on food security and related outcomes. Using similar shocks, previous studies have demonstrated the importance of resilience capacity for the household's long-term survival (D'Souza & Jolliffe, 2013; Smith & Davies, 1995).

This paper stands out from the previous studies on this conflict through its investigation of the role of resilience in the context of violent conflict that compromises food security and resilience capacity simultaneously. In other contexts, while previous studies document negative effects of shocks on food security, they also demonstrate that resilience capacity

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

intervenes by wholly or partially absorbing the food supply shocks thereby alleviating the adverse welfare consequences of the shocks for households. After the 2014 catastrophic floods in Bangladesh, Smith & Davies (1995) demonstrate the role of resilience in ensuring household food security recovery, particularly the pillars of asset holdings, and access to basic services (ABS) and social safety nets (SSN). Bruck *et al.* (2019) demonstrate similar pattern of resilience mediation in the case of the Israel-Palestine conflict in the Gaza strip. The study identifies SSN and ABS as important dimensions of resilience, which attenuated the welfare-reducing effects of the conflict. The same mechanism operates also in the case of idiosyncratic shocks as self-reported by the households. For this case, Bruck *et al.* (2019) identify the cushioning effects of resilience capacity, particularly the adaptive capacity (AC).

3. Data

3.1 Conflict in the neighborhood of households

Overall, the empirical strategy relies on the difference-in-differences (DiD) estimator to identify the effects of exposure to the conflict on the relevant outcomes. Resultantly, this section adapts the estimation data to the DiD estimation set-up including the main assumption of parallel trend. To create the required treatment and control groups, the relevant households are classified as exposed and non-exposed based on their proximity to the BH conflict battles. Under this type of classification, the parallel trend assumption may be violated due to certain time-varying economic conditions that predispose locations to conflicts, such as poverty (Abadie, 2006; Blattman & Miguel, 2010; Pinstrup-Andersen & Shimokawa, 2008). To mitigate this, the dynamic spatial extension of the conflict is closely monitored and used to pick out the locations to be included in each of the exposed and control groups. This mitigation requires that each of the designated treatment and control group experiences exposure to the conflict, but during different data collection rounds. This maneuver potentially mitigates endogenous selection into conflict exposure because economic conditions in exposed locations are likely to be comparable, irrespective of time of exposure. Hence, the identification relies on variation in the timing of exposure and on successive data collection rounds. The data selection process is as described below:

The post harvest visits of the first three waves of the Nigerian Living Standard Measurement Survey (LSMS) collected by the WB and Nigeria's national bureau of statistics are used in the study[1] . The nationally representative LSMS panel contains comprehensive information on household socio-demographic characteristics and consumption, including a dedicated module for food security. The periods covered by the three waves are between February 2011 and April 2011 (hereafter: baseline), between February 2013 and April 2013 (hereafter: period 1) and between February 2016 and April 2016 (hereafter: period 2).[2] The survey data is accompanied by location longitudes and latitudes, which might be used to merge the data with other geo-referenced data sources such as the armed conflicts location and events database (ACLED) (Raleigh *et al.*, 2010). Using string search within the ACLED

1 The visits are chosen because they contain the most comprehensive modules of agricultural production, being an important aspect of household consumption.

2 Although the data collection spans more than one month, distinguishing which households were interviewed in which month is not possible. Hence, mention of period in the entire paper refers 'as a snapshot' to data collection within a specific data collection round of the LSMS.

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

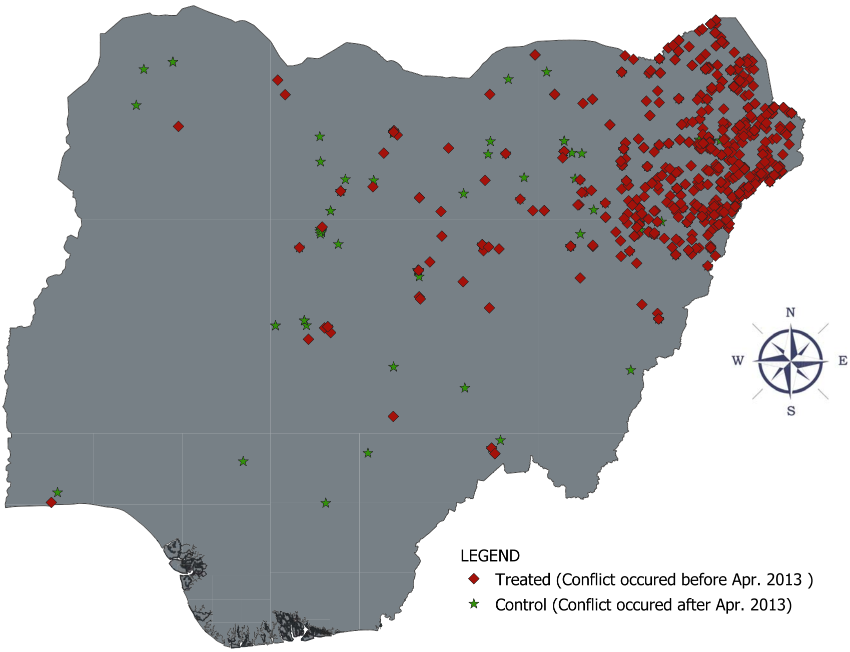

Figure 2: Conflict-Defined Treatment and Control Geographical Locations

database, conflict event data involving the BH in Nigeria are selected and spatially merged with the LSMS households. This allows spatial proximity analysis determining the spatial distance in kilometers (km) of a household's location from dated conflict events.

In partitioning the households into exposed and non-exposed households, the former must live within a distance close to any BH battle involving at least one fatality. However, the distance should be such that not all the households are considered exposed at a given period. Two buffers of radii, 5 and 7 km, are created around each conflict event based on distance bands already established for this conflict (see Bertoni *et al.*, 2018).[3] Only the households residing within any of these buffers are included in the estimation sample. Restricting the main estimations to baseline and period one only, the dichotomy of exposed and control groups is determined by time of exposure as follows: the households that are exposed to events occurring during the time interval between baseline and period one are designated as exposed group, while those exposed to events occurring between periods one and two fall into the control group.[4] Under this restriction, the control group is strictly exposed between periods one and two, whereas the exposed group is allowed to include certain

3 Buffers above 7 km do not provide room to separate the exposed and control groups, because then nearly all the relevant data points fall within the buffer at any given event-date combination.

4 Note that households in this second group will be exposed in the future but remain unexposed as of the time of the estimations.

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

Table 1: Summary Statistics for the Control Variables at Baseline by Household Exposure Status

	Pooled sample			Treatment 7 km			Control 7 km			
Variable	obs	Mean	sd	obs	Mean	sd	obs	Mean	sd	*t*-test
Urban	1,500	0.17	0.37	1,062	0.17	0.35	438	0.22	0.42	-0.06
Age of HH head	1,500	47.68	15.25	1,062	49.98	15.53	438	46.89	14.45	3.09*
HH head is wage worker	1,500	0.41	0.28	1,062	0.53	0.27	438	0.48	0.32	0.06
HH is agricultural worker	1,500	0.68	0.14	1,062	0.72	0.14	438	0.68	0.15	0.04
Household size	1,500	6.58	3.37	1,062	6.30	3.04	438	7.34	4.04	-1.05
Female HH head	1,500	0.07	0.25	1,062	0.08	0.27	438	0.04	0.19	0.04
HH head is literate	1,500	0.51	0.50	1,062	0.52	0.50	438	0.49	0.50	0.03
Ratio of children	1,500	0.36	0.23	1,062	0.35	0.23	438	0.38	0.22	-0.02
HH head marital status										
Never married	1,500	0.02	0.15	1,062	0.02	0.14	438	0.03	0.18	-0.01
Monogamous marriage	1,500	0.61	0.49	1,062	0.63	0.48	438	0.57	0.50	0.06
Polygamous marriage	1,500	0.28	0.45	1,062	0.27	0.43	438	0.35	0.48	-0.08*

Notes: Treatment group comprises households exposed to conflicts occurring before September 2012. The control group comprises households exposed to conflicts occurring after September 2012. The date is chosen because treatment period survey commenced in September 2012. The *t*-test column refers to mean differences between the treatment and control groups. $^{***}P < 0.01$, $^{**}P < 0.05$, $^{*}P < 0.1$.

households exposed consecutively in the two periods. Finally, households never exposed to any conflict were eliminated. The geographical distribution of the samples is shown in Figure 2.

3.2 Description of main non-conflict variables

3.2.1 Food security and controls

Three main food security measures are considered in this paper: the coping strategy index (CSI), the food consumption score (FCS) and the share of food consumption expenditure in total household expenditure per capita. While the CSI captures the behavioral and food utilisation aspect of food insecurity (Maxwell, 1996; Maxwell *et al.*, 1999), the share of food expenditure captures access to food through household purchasing ability, and the FCS captures food availability through the diversity of household nutritional intake (Lovon & Mathiassen, 2014). Except for FCS, which is conversely distributed, higher values of the measures indicate higher food insecurity. Having utilised other household heterogeneities in the computation of household resilience capacity, the control variables are selected to reflect mainly the structural characteristics of the households, including age, gender, schooling, occupation of household head and size as well as proportion of children in the household. Table 1 summarises the baseline control variables for all the estimations and compares them across exposure status. The household heads in the exposed group are slightly younger and are more likely to be in a polygamous marriage; otherwise, the control variables are balanced across the exposure status divide. This being in line with the objective of the data selection strategy reveals that the households are quite comparable in the absence of the conflict exposure and lends credence to the identification strategy.

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

The relevant food security measures are computed as follows:

$$FS_{it} = \sum_{i=1}^{n} f_{it} * w,$$

where i indexes household and t takes the values of 0 or 1 for the periods before and after the commencement of the BH insurgency, respectively. FS_{it} stands for both CSI and FCS. For the CSI, f_{it} represents frequency of coping strategy based on the number of days in the past seven days that such strategies were used and w represents weights based on the severity of the strategy (Maxwell *et al.*, 1999; WFP, 2008). For the FCS, f_{it} represents the number of standard food classes that the household consumed during the past 7 days and w weights based on the micro-nutrient contents of the food classes (WFP, 2008).[5] The food ratio is calculated as the weekly per capita household food expenditure divided by the total weekly expenditure per capita.

3.2.2 Computing resilience capacity

As discussed in Section 2.2, the method adopted to measure the resilience capacity index (RCI) in this study is based on the approach developed by Ciani & Romano (2014). Under this approach which embraces the framework of TWGRM, the resilience to food insecurity of a given household at a given time is assumed to depend primarily on the pillars of AC, access to asset (Asset), ABS and SSN, which are indices computed at the first of a two-stage factor analysis strategy using variables reported at the household level (see Table A1). At the second stage, the index is calculated as specified below using the already defined index notations:

$$RCI_{it} = f(AC_{it}, Assets_{it}, ABS_{it}, SSN_{it}), \tag{1}$$

where as before i and t index household and time, respectively. Bene *et al.* (2016) provide useful guidelines, which the study followed in the selection of suitable variables from the LSMS. In practical terms, since the variables measure similar tendencies, the first stage variables are retained if they score up to 60% factor uniqueness. The retained variables used in the second stage are the ones displayed in Figure 3. Table A2 presents the summary statistics resilience variables at the first stage, Table A3 displays the corresponding factor loadings and Table 2 compares the household indices across conflict exposure status and over time.

3.3 Attrition from the sample

Overall, the attrition in the Nigerian sample of the LSMS is known to be low, at about 4% for the data collected during the period of estimations in this paper (see Osabohien, 2018). However, the sample was further restricted for the analysis, eliminating four out of six political regions of Nigeria where the BH conflict does not exist. In particular, the North-

5 The food classes include staples, pulses, vegetables, fruits, animal products, sugar, diaries, fats and oil, and the micro-nutrients weights obtained from the West African food composition table (Barbara *et al.*, 2012).

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

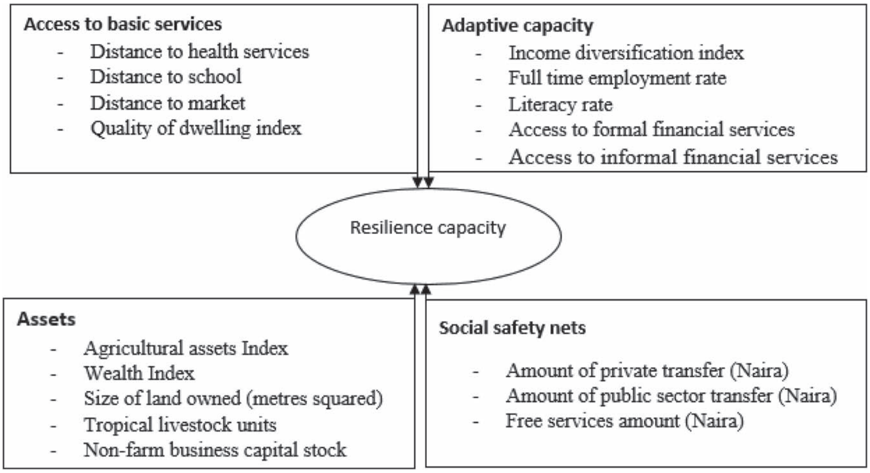

Figure 3: Indicators of Resilience Capacity and Pillars

East and North-West regions epicentre of the Boko Harm are retained, whereas the South-East, South-West, South-South and North-Central regions were eliminated. This technically reduced the sample from 5000 to 1589 households, of which 1511 was interviewed in the two consecutive waves (2010–2016) and further 11 households were dropped due to missing values thereby resulting to an attrition rate of 5.6%. In general, under normal residential relocation of households, the LSMS team traces and re-interviews such households in their new locations, but this was not the case for these 78 households suggesting that it was due to the conflict. Although this attrition rate is considerably low, this section conducts falsification test to confirm that attrition does not bias the estimates. Defined as missing households during the estimation period one, attrition is estimated as a function of the conflict exposure using the equation specified below:

$$Attrition_{ic1} = \alpha + X'_{i0}\delta + \theta_c + \epsilon_i, \quad (2)$$

where $Attrition_{ic1}$ is the attrition dummy variable, X_{i0} is a vector of household characteristics at baseline including measures of resilience capacity and θ_c denotes a vector of community dummy variables based on the survey enumeration areas. Reassuringly, as shown in Table A4, attrition is related to neither conflict exposure, nor the control variables. Nevertheless, the levels of resilience is weakly correlated with attrition: the coefficients of ABS and AC are negative and marginally significant at the 10% level. If households of low resilience capacity in their baseline conditions disintegrate or relocate upon exposure to the conflict, this might introduce a downward bias to the moderating effects of resilience capacity, and this should be kept in mind when interpreting the estimated role of resilience.

4. Estimation of the direct effects

4.1 The conflict and food (in)security: direct relationship

In the meantime, this section ignores the potential linkage between food security and resilience capacity and investigates the basic relationships between the BH shocks and food

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

insecurity. In particular, the section estimates the average effects of the conflict without accounting for the mediation of resilience capacity. The extension of these analyses in Section 4.4 explores the heterogeneous effects according to level of resilience capacity, and this sheds some lights on the theoretical roles of resilience capacity. In general, the identification is based on the DiD estimator where the main outcomes are continuous variables FS_{it} denoting the various measures of food (in)security. The treatment variable $Conflict_i$ assumes two forms: when denoted as a dummy variable, $Conflict_i$ equals 1 if as at 2012/2013 period the household resides within any of the buffer zones earlier described, but as a continuous variable $Conflict_i$ equals the conflict intensity conventionally represented by the fatalities arising from the conflict. The non-parametric DID estimator α estimates the impact of exposure to the conflict on food security as specified in equation 3 below:

$$\alpha_{DID} = E[FS_{i1} - FS_{i0}|Conflict = 1] - E[FS_{i1} - FS_{i0}|Conflict = 0]. \tag{3}$$

If households were randomly exposed to the conflict, the exposure effect would simply be the difference in food security between the exposed and control households, which is not the case in the present study. However, given that exposure is eventually realised for all households in the sample in monitored time intervals, an empirical approximation of this difference may be obtained by monitoring the trends of food security across the defined groups, through for instance the DID framework. The non-parametric DID framework assumes that except for the conflict exposure, the treatment and control groups would have followed similar trends. Then, controlling for time-invariant household characteristics, the differences in food (in)security between the exposed and non-exposed households in the presence of group-based exposure are considered unbiased estimates of the average treatment effects of the conflict on the outcomes.[7] The tests of mean differences by exposure status in Table 2 provide the bivariate approximation of these differences. In nearly all the cases, the outcome levels are significantly different between the pre-exposure (PRE) and post-exposure ($POST$) periods, suggesting the occurrence of trend discontinuities that likely arose from exposure to the conflict. Nevertheless, these may only be considered associative since the trend may be conflated with other fixed time-varying household characteristics. Hence, the multivariate extensions include all the available controls to narrow the sources of the remaining differences to the conflict exposure.

4.2 Econometric specifications

Drawing from the preceding discussions, this section estimates two multivariate econometric approximations of the DID model: The first regression is estimated for the levels of the outcomes in the post conflict period ($POST = 1$), conditioning on the baseline ($POST = 0$) levels of the control variables and the baseline levels of the outcome variables as a capture for the effects of differences in initial levels of the outcomes. The second regression incorporates some dynamics by allowing the period ($POST$) to vary from 0 to 1. The specifications are

7 A replica of this strategy is also applied to test whether the conflict links with future vulnerability by decimating household endowments of resilience.

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

Table 2: Summary Statistics of the Food Security and Resilience Capacity Outcomes by Time and Treatment Status

	Pooled sample			Treatment			Control			*t*-test of
Variable	obs	Mean	sd	obs	Mean	sd	obs	Mean	sd	means
PRE										
CSI	1,500	1.80	5.55	1,062	2.15	6.32	438	1.90	2.64	0.26
Food ratio	1,500	0.77	0.17	1,062	0.78	0.17	438	0.75	0.17	0.03
FCS	1,500	53.06	21.88	1,062	52.71	22.99	438	54.50	18.16	-1.79*
RCI	1,500	0.23	0.15	1,062	0.22	0.15	438	0.24	0.15	-0.02
ABS	1,500	0.20	0.05	1,062	0.20	0.05	438	0.21	0.05	-0.01
AC	1,500	0.20	0.05	1,062	0.21	0.05	438	0.20	0.05	-0.01
SSN	1,500	0.34	0.18	1,062	0.33	0.17	438	0.37	0.18	-0.01*
Asset	1,500	0.83	0.12	1,062	0.83	0.12	438	0.82	0.13	0.01*
POST										
CSI	1,500	3.88	8.41	1,062	4.67	9.46	438	1.78	4.70	2.89***
Food ratio	1,500	0.80	0.22	1,062	0.83	0.23	438	0.73	0.13	0.10***
FCS	1,500	53.35	23.46	1,062	52.54	23.25	438	57.10	23.38	-4.56***
RCI	1,500	0.21	0.14	1,062	0.20	0.13	438	0.27	0.17	-0.07**
ABS	1,500	0.19	0.05	1,062	0.18	0.05	438	0.19	0.05	-0.01***
AC	1,500	0.19	0.05	1,062	0.16	0.05	438	0.21	0.05	-0.06***
SSN	1,500	0.36	0.14	1,062	0.43	0.11	438	0.26	0.17	0.17***
Asset	1,500	0.81	0.11	1,062	0.80	0.11	438	0.81	0.11	-0.01*

Treatment group comprises households exposed to conflicts occurring before September 2012 and after April 2011. The control group comprises households exposed to conflicts occurring after September 2012 and before July 2017.[6]. Food ratio for share of per capita household food expenditure; The *t*-test refers to mean differences between the exposed and control groups. $^{***}P < 0.01$,$^{**}P < 0.05$,$^{*}P < 0.1$.

represented in equations 4 and 5 below:

$$FS_{i1} = \delta + \rho Conflict_i + \gamma FS_{i0} + \beta X_{i0} + \epsilon_{i}, \tag{4}$$

where FS_{i1} denotes the levels of food (in)security for household i measured at period $POST$, $Conflict_i$ is a dummy variable indicating exposure to the conflict or the conflict intensity represented as the battle fatalities, which is equal to zero when the dichotomous $Conflict_i$ equals zero, and strictly positive when $Conflict_i$ equals one. FS_{i0} is the baseline level of food (in)security, X_{i0} is the baseline household characteristics, while ϵ_i is the idiosyncratic error term. Given the household controls, equation 4 yields an unbiased estimate of ρ, the impact of exposure to the conflict on the outcomes. Nevertheless, to capture potential sources of bias relating to unobserved household characteristics that may be correlated with conflict exposure and household food (in)security, the standard DiD model is specified as follows:

$$FS_{it} = \alpha + \beta_1 Conflict_i + \beta_2 POST_t + \beta_3 Conflict_i \times POST_t + H_i + \varepsilon_{it}, \tag{5}$$

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

Table 3: Effect of Conflict Exposure on Food (In)security

A: Conflict exposure within 7 km

Variables	(1) CSI	(2) FCS	(3) Food ratio	(4) CSI	(5) FCS	(6) Food ratio
Conflict × *POST*	1.287***	-1.384	0.072***	1.240**	-1.942	0.086***
	(0.257)	(0.858)	(0.008)	(0.502)	(1.566)	(0.015)
Baseline CSI	0.884***					
	(0.027)					
Baseline FCS		0.343***				
		(0.014)				
Baseline food ratio			0.103***			
			(0.010)			
Baseline controls	Yes	Yes	Yes	No	No	No
Household fixed effect	No	No	No	Yes	Yes	Yes
Constant	1.277*	41.070***	0.721***	12.962**	53.421***	1.297***
	(0.691)	(2.318)	(0.021)	(5.527)	(16.401)	(0.151)
Observations				3,000	3,000	3,000
Number of households	1,500	1,500	1,500	1,500	1,500	1,500

B: Conflict intensity (no. of fatalities)

Variables	(1) CSI	(2) FCS	(3) Food ratio	(4) CSI	(5) FCS	(6) Food ratio
Conflict intensity (fatalities in 100s)	3.394***	-12.232***	0.204***	2.281***	-0.456	0.075***
	(0.561)	(1.891)	(0.062)	(0.561)	(1.930)	(0.006)
Baseline CSI	0.951***					
	(0.026)					
Baseline FCS		0.471***				
		(0.017)				
Baseline food ratio			0.281***			
			(0.013)			
Constant	0.226	31.665***	0.623***	8.778***	27.734***	0.872***
	(0.664)	(2.263)	(0.021)	(2.502)	(7.424)	(0.069)
Baseline controls	Yes	Yes	Yes	No	No	No
Household fixed effects	No	No	No	Yes	Yes	Yes
Observations				3,000	3,000	3,000
Number of households	1,500	1,500	1,500	1,500	1,500	1,500

Notes: food ratio, share of household per capita food expenditure; standard errors in parentheses. ***$P < 0.01$,** $P < 0.05$, *$P < 0.1$.

where FS_{it} is the food security indicator and β_3 is the *DiD* parameter obtained through the interaction of $Conflict_i$ and the post exposure period (*POST*), H_i indicates household fixed effects and ε_{it} is the error term. Therefore, Equation 5 exploits the panel structure of the data by allowing the before and after comparison of the outcomes.

4.3 Estimates of direct effects

Using the various measures of the conflict exposure, the application of equations 4 and 5 yields the results reported in Table 3. Panel A of Table 3 reports estimates of the direct effects

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

Table 4: Impact of Baseline Resilience Levels on the Food Security During Exposure to the Conflict

Variables	(1) CSI	(2) CSI	(3) CSI	(4) CSI	(5) CSI	(6) FCS	(7) FCS	(8) FCS	(9) FCS	(10) FCS	(11) Food ratio	(12) Food ratio	(13) Food ratio	(14) Food ratio	(15) Food ratio
$Conflict \times POST$	1.386***	1.625***	1.052*	2.064***	1.211**	-5.394***	-2.946*	-1.500	-0.687	-3.991**	0.079***	0.081***	0.078***	0.071***	0.078***
	(0.527)	(0.540)	(0.547)	(0.535)	(0.534)	(1.656)	(1.693)	(1.715)	(1.684)	(1.680)	(0.015)	(0.016)	(0.016)	(0.016)	(0.016)
$RCI^{high} \times Conflict \times POST$	-0.380					9.119***					0.016				
	(0.431)					(1.353)					(0.012)				
$ABS^{high} \times Conflict \times POST$		-0.788*					2.000					0.007			
		(0.417)					(1.315)					(0.012)			
$AC^{high} \times Conflict \times POST$			0.365					-0.914					0.013		
			(0.418)					(1.316)					(0.012)		
$SSN^{high} \times Conflict \times POST$				-1.783***					2.808**					-0.030***	
				(0.417)					(1.319)					(0.012)	
$Asset^{high} \times Conflict \times POST$					0.0739					4.579***					0.017
					(0.420)					(1.324)					(0.012)
Household FE ?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	1.030***	1.030***	1.030***	1.030***	1.030***	54.50***	54.50***	54.50***	54.50***	54.50***	0.747***	0.747***	0.747***	0.747***	0.747***
	(0.357)	(0.357)	(0.357)	(0.357)	(0.357)	(1.121)	(1.132)	(1.133)	(1.131)	(1.129)	(0.010)	(0.009)	(0.009)	(0.009)	(0.009)
Observations	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Number of households	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500

Notes: Food ratio = share of household per capita food expenditure; standard errors in parentheses. $^{***}P < 0.01$, $^{**}P < 0.05$, $^{*}P < 0.1$.

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

Table 5: Effects of Conflict Exposure on Resilience Capacity

Variables	(1) RCI	(2) RCI	(3) ABS	(4) ABS	(5) SSN	(6) SSN	(7) AC	(8) AC	(9) Asset	(10) Asset
Conflict × *POST*	-0.097**		-0.065**		0.190***		-0.076**		-0.107	
	(0.044)		(0.032)		(0.063)		(0.031)		(0.077)	
Fatalities(*in*100*s*)		-0.137***		-0.104***		1.653**		-0.251***		-0.222***
		(0.021)		(0.021)		(0.792)		(0.038)		(0.046)
Household FE ?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	1.559***	1.593***	1.675***	1.625***	4.211***	3.782***	1.559***	1.559***	7.914***	7.881***
	(0.189)	(0.180)	(0.059)	(0.056)	(0.203)	(0.196)	(0.067)	(0.064)	(0.149)	(0.140)
Observations	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Households	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500

Notes: Standard errors in parentheses. ***$P < 0.01$, **$P < 0.05$, *$P < 0.1$.

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

of the conflict exposure $Conflict_i$ denoted as a dummy variable, whereas panel B reports direct effects of the conflict intensity. In panel A, the estimates indicate significant negative effects of the conflicts on the various indicators of food security. Estimates in panel A: columns 1, 2 and 3 derive from equation 4 estimated without household fixed effects, and indicate that exposure is associated with an increase of about 1.29 points in the CSI, about 7.2% increase in the food expenditure share (food ratio) and no significant effect on FCS. The DID estimates reported in panel A: columns 4, 5 and 6 are prescriptively similar to the previously discussed estimates. Mostly, estimates regarding the FCS are insignificant, whereas those of the CSI and food ratio increased by 1.24 points and 8.6%, respectively. In magnitude, the increase in the CSI and food ratio constitutes 69% and 11 percentage points of their respective pre-exposure pooled means. Similarly, most of the outcomes respond strongly to the conflict intensity as shown in panel B. Based on the DID estimations in columns 4, 5 and 6, a unit increase in fatalities increases the CSI by about 0.023 points and the food ratio by about 0.075%, with no effect on the FCS. However, ignoring household fixed effects, a unit increase in fatalities is associated with about 0.12 points reduction in FCS. There are several discussions about the nature of households' consumption trade-offs during shocks, in terms of quality (represented by indicators of dietary diversity such as FCS) and quantity (represented by indicators such as CSI) (Dercon, 2002; Jensen & Miller, 2010). In the current estimates, quality seems to have been traded off for quantity, but there might as well be other nuances, some of which might operate resilience capacity, which is addressed in Section 4.4. In general, the models without the fixed effects seem to overestimate the relevant effects, as unaccounted fixed effects induce positive bias in the estimates, hence, the preference for the fixed effects model. Finally, in columns 1, 2 and 3, the initial values of the outcomes are included, and they significantly predict the current values as expected.

4.4 The role of resilience capacity

The main question of this section is how much resilience is required to cushion the households against adverse stressors. However, since conflict might as well affect resilience, all estimations in this subsection use pre-conflict levels of resilience, which also accords with the literature on resilience insurance of risks (Alinovi *et al.*, 2010). Specifically, the pooled estimation sample is partitioned and designated as low and high resilience capacity groups of households according to whether baseline resilience capacity was below or above the resilience of the median household. Thereafter, the following equation is estimated:

$$FS_{it} = \alpha + \beta_2 POST_t + \beta_3 Conflict_i \times POST_t + \eta Conflict_i \times R_{i0}^{high} \times POST_t + H_i + \varepsilon_{it}, \quad (6)$$

where R_{i0}^{high} is a a dummy variable indicator of whether the resilience capacity of the household at baseline exceeds the median resilience among the pool of households. The R_{i0}^{high} is computed from the overall resilience index as well as from the separate indices of the four pillars. The rest of the equation notations remain as described in Equation 5. The parameter of interest is η, which captures the differential effects on households of high versus low resilience capacities. Similar to Equation 5, equation 6 exploits the panel structure of the data through within transformation, and the panel structure allows time-invariant household-specific unobservable factors to be differenced out.

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

The results reported in Table 4 indicate that resilience indeed absorbs food security shocks. The estimated interactions in the Table 4 generally highlight that households of low level of resilience are more severely affected by the conflict than those of high resilience capacity are, which is observed across the dimensions of food security. Comparatively, the resilience pillar of SSN is the most influential in attenuating shocks in terms of magnitude of effects and spread across the food (in)security dimensions. The extant literature supports this, which has already established that SSN are important pools of resources for the mitigation of sudden shocks, most times supported by other pillars of resilience such as ABS and AC (Bruck *et al.*, 2019; Smith & Davies, 1995). Particularly, while the effect of the conflict on the outcome of FCS as reported in Table 3 is insignificant, Table 4 shows that households with higher overall resilience capacity seem to have gained in food security. Estimated as $\alpha + \eta$, high overall resilience capacity is associated with a gain of about 4 FCS points, SSN alone with about 3 FCS points, and high assets with about half an FCS point. The strong response of FCS to RCI is somewhat puzzling, especially from the perspectives of households under destabilising conflict and requires further accounting. It might be argued that SSN comprising public and private remittances to households reacts sharply to emergencies, and thus accounts for much of this effect. Thus, in Table A5, the entire variables used to compute the RCI are included in the estimation to explore the possibility that the entire interaction effect may be accounted by a few variables. Nevertheless, the estimate of interest did not change significantly, rather the overall effect of the conflict disappears, indicating that the conflict impacts on the FCS only through the variables constituting household resilience capacity. Among the variables constituting SSN, only the variables indicating whether the household was migrant are significant, but all the included variables collectively could not fully account for the estimate of interest, which is the triple interaction coefficient of resilience, conflict and post. Another potential mechanism might derive from the interference of the conflict with the inseparable production and consumption of agricultural households (Bardhan & Udry, 1999). Hoek (2017) describes the disruption of local markets by the BH conflict, which prevents the households from engaging in the usual market exchange of commodities. A plausible consequence of this might be that households discouraged from routine engagement in market exchanges would then resort to autoconsumption of home production, thereby contributing to multiplying dietary diversity. This is partially supported by the fact that proximity to markets accounts for a significant part of the FCS increase in Table A6, and this pattern is also reported in George *et al.* (2020). Unfortunately, the precise location of markets is not available in the data used in this study, which prevents further investigation of this intuition through strategies that would have accounted for conflict attacks within market locations.

5. Longer term effects

5.1 Conflict exposure and the household resilience capacity

The preceding section demonstrates the importance of resilience in protecting household food security despite the conflict shocks. However, conflict could also diminish resilience through the destruction of the various pillars upon which resilience is anchored such as assets and ABS (Justino, 2012; Minoiu & Shemyakina, 2014). In large parts, this portends the critical channel that extends current shocks to long-term consequences—described by Bene *et al.* (2016) as a 'vulnerability trap'. This section estimates the empirical approximation of this

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

relationships. To do this, the empirical specification developed in Section 4.2 is replicated in equation 7 below:

$$RC_{it} = \alpha + \beta_1 Conflict_i + \beta_2 POST_t + \beta_3 Conflict_i \times POST_t + H_i + \varepsilon_{it}. \quad (7)$$

All variables and parameters remain as described in Section 4.2, except that the outcome variable RC_{it} stands for the overall resilience index or its pillars denoted by ABS, SSN, AC and Assets. The inclusion of household fixed effects H_i accounts for some time-invariant unobserved household characteristics that may be correlated with exposure to the conflict.

The results in Table 5 show that the exposure to the conflict is negatively associated with overall resilience and most of its pillars—except the SSN, which actually increased. The RCI declined by 0.097 points—in the magnitude of about 42% of pre-exposure mean. The ABS declined by 32% (0.065 points reduction), and AC declined by 40% (0.076 points reduction). As for Assets, the reduction was insignificant, and the study attributes this to the nature of the BH conflict being a guerrilla rather than a full-blown war. Such conflicts use mainly the strategies of kidnappings, petty thefts and scaremongering, which may not have enough intensity to significantly decimate assets by destruction or forced sales (Baliki *et al.*, 2018; Falode, 2016; Hoddinott, 2006).

The increase in SSN aligns with the previous findings (e.g Bruck *et al.*, 2019). The average effect on the SSN is 0.19 points—about 56% of the pre-exposure mean. However, the incentive structures of SSN make the long-term extrapolation of this effect complex. Increased safety nets may safeguard household welfare during shocks or enable them to quickly recover lost economic welfare, inclusive of food security. Yet at the same time, disaster transfers can create moral hazard problems that may produce the so-called conflict merchants who create violence to attract aid (d'Errico & Giuseppe, 2016; Heemskerk *et al.*, 2004). Nevertheless, this effect should be interpreted cautiously given that the exposed households were slightly more endowed with safety nets prior to conflict exposure, creating some doubts on the attribution of the observed increases to responses targeted at households exposed to the conflict. The effect on safety nets aside, other pillars are negatively affected; AC, which incorporates informal networks within and outside households, reduced, so did access to critical infrastructures, which are part of the ABS. Hence, except when timely policies are well targeted with respect to these aspects, the above results taken together may suffice to conclude in favor of negative long-run consequences within this partial equilibrium framework. In fact, Sanders & Weitzel (2013) argue that except when institutional resources are rapidly restored after violent conflicts, upsurge in aid during conflicts may have negative social and economic consequences through destructive entrepreneurship. Nevertheless, a general equilibrium framework may be most appropriate to reach such a conclusion, especially in view of the lack of conclusion on the domain of safety nets.

6. Robustness checks

Results in the preceding sections established rather strong negative effects of the conflict, directly on food security but attenuated through the resilience capacity. The conflict also produced potential long-term effects through the reduction of the level of household resilience capacity. However, these effects are obtained conditional to the controls for observable characteristics and the study sample restriction strategy, which assumes a balanced

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

distribution of unobservable characteristics (potential confounders) between the treated and control groups. This section tests the robustness of these results by relaxing some of the critical assumptions of the previous estimations, particularly relating to critical resilience capacity thresholds and sample selection that might bias the results. For the resilience thresholds, Tables A7, A8 and A9 replace the thresholds derived based on the median level of household resilience with the top quartiles of resilience in the estimations, and the results remain conclusively similar. Similarly, to further disaggregate the estimated effects of the conflict on resilience as reported in Table 5, the original variables used to compute the resilience indices are employed as the outcome variables and estimated. While the results reported in Table A6 demonstrate that the conflict affected most of the original variables across the various resilience pillars, much of the effects fall on the components of the SSN.

6.1 Selection into conflict exposure

Although the determination of exposure and control groups by means of realised and future exposure to the conflict strongly suggests balance in treatment confounders, there remains some chance that time-varying confounders unrelated to the conflict might disrupt the parallel trend assumption and bias the estimations. In this subsection, I pursue a test of any indication of this that might have started during the pre-treatment period. Following the sample restriction adopted in the study, I estimate the probability of being included in the exposure group based on baseline control characteristics. The probability is specified as follows:

$$Conflict_{ic1} = \alpha + X'_{i0}\delta + \theta_c + \epsilon_{ic1}, \tag{8}$$

where $Conflict_{il}$ is a dummy variable that takes value 1 if $household_i$ living in community c is included in the exposure group (7 km buffer), and zero otherwise. $X'_{i0}\delta$ is a vector of household and household head characteristics used as control in the previous estimations, and ε_{ijs} is the error term. On the premise that certain community characteristics are important determinants of conflict onset, θ_c is included in the selection model. θ_c denotes a vector of community dummy variables, where the survey enumeration areas are used as proxies.

Table A10 reports the results estimated by binary probit model. Clearly, exposure is not selective on the observed control variables. Additionally, indicators of resilience capacity are included to further assess the randomness of exposure even in this dimension. The results implicated the SSN dimension of resilience capacity, which is more favorable to the exposure group at the baseline. Therefore, this has to be remembered while interpreting this aspect of the estimations. The implication might be that the exposed group has a stronger external base of resilience that could be leveraged during emergencies, and this might be a source of potential bias to the estimated role of resilience capacity and its pillars. To further ensure robustness of this aspect of the analyses particularly in relation to the puzzling finding in the case of FCS, the entire array of the first stage variables used in the computation of the pillars of resilience is additionally employed in the estimation of the role of resilience capacity in Table A5. The finding did not significantly change, except that the direct effect of the conflict was taken over by the added variables.

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

6.2 Alternative measure of exposure

In order to partition the sample into exposed and control households, the paper creates a series of buffers around any conflict event, some of which prove too large to allow the separation of the two groups of households. The largest radius that allows reasonable separation is around the 7 km radius, which makes it the reference radius of exposure for the study. Nevertheless, in this section, the smaller alternative buffer (5 km radius) is used. All the previous estimations were repeated under the new exposure measure and the new sets of estimations mirror the former. However, in some cases, coefficients appear stronger but are never statistically different from their previous levels. The estimated baseline estimation on food security is reported in Table A11, while the rest of the results are retained by the author to conserve space. The remaining results are available from the author on demand.

7. Conclusion and policy recommendations

Using three main indicators of food (in)security, the CSI, share of food expenditure per capita (food ratio) and the FCS, this paper demonstrates that exposure to the BH conflict caused the households to move down the ladder of food security. The overall effects of the conflict are substantial and negative on all the dimensions of food security. However, these overall effects hide substantial heterogeneities across levels of resilience capacity. These heterogeneities are further explored by comparing households of high and low levels of resilience through a model of triple interactions of resilience, conflict exposure and time. The estimations yield the unambiguous prediction that resilience protects household welfare during conflict shocks in line with the theoretical prediction of resilience as a place holder for household welfare. While SSN dominate the other pillars of resilience in absorbing the shocks, other pillars also play significant roles.

It is anticipated that violent conflict might decimate resilience, and thus push the households into traps of poverty and vulnerability to food insecurity. Hence, it was further estimated that the conflict reduced the overall resilience capacity by 42%, ABS by 32% and AC by 40%. In contrast, the index of SSN increased over the same period. The increase in SSN may reflect humanitarian aids from donor agencies and private individuals, which is anticipated in this type of situation. In all, this study supports the ongoing arguments about the merits of the resilience approach to development, which aims to enhance the ability of systems (households, communities and states) to withstand and recover from shocks. The study demonstrates that resilience cushions shocks, while being susceptible to the same. Therefore, resilience deserves important consideration during post-disaster interventions.

While short-term interventions such as food and cash aids may curtail immediate and direct welfare losses, serial vulnerability may only be eliminated through interventions rebuilding resilience. Advising on the specific projects for enhancing resilience lies beyond the scope of this study. However, it is clear from this study that the enabling environment for resilience comprises public use services such as markets, roads, health facilities and other basic infrastructure that policy would be able to target. To incorporate these in development, public policies in shock-prone regions need to be multi-sectoral and forward looking. The paper invites governments, inter-governmental and non-governmental organisations to incorporate the enhancement of resilience in future intervention programs.

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

While the study has employed a number of rigorous estimation procedures to arrive at the reported estimates, no strong claim is being made as to causality given that certain aspects of the estimations do not yield to clear-cut identification. In particular, it may be acknowledged that whereas the computation of the resilience index follows a well-established procedure, the constructed index may not fully capture the essence of the concept. Resilience being multifaceted and data driven, its computation may easily be compromised (see Bruck *et al.*, 2019; Smith & Davies, 1995). In this light, the structural relationships underlying the concept of resilience capacity risks being undermined due to data quality, and in turn compromising the estimated effects. This, therefore, invites cautious interpretation of this aspect of the results.

Acknowledgments

I am thankful for comments received from my PhD supervisors; Isabelle and Jean-Noel and two anonymous referees from this journal.

Supplementary material

Supplementary material is available at *Journal of African Economies* online.

References

Abadie A. (2006) 'Poverty, Political Freedom, and the Roots of Terrorism', *American Economic Review*, 96(2): 50–6.

Adamu P. I., Okagbue H. I., Akinwumi I., Idowu C. (2021) 'Trends of Non-communicable Diseases and Public Health Concerns of the People of Northeastern Nigeria Amidst the Boko Haram Insurgency', *Journal of Public Health*, 29: 553–561.

Adelaja A., George J. (2019) 'Effects of Conflict on Agriculture: Evidence from the Boko Haram Insurgency', *World Development*, 117: 184–95.

Adesoji A. (2010) 'The Boko Haram Uprising and Islamic Revivalism in Nigeria', *Africa Spectrum*, 45(2): 95–108.

Alinovi L., Mane E., Romano D. (2008) 'Towards the measurement of household resilience to food insecurity: applying a model to palestinian household data', in *Deriving Food Security Information From National Household Budget Surveys*. Rome, Italy: Food and Agriculture Organization of the United Nations, pp. 137–52.

Alinovi L., Mane E., Romano D. (2009) Measuring household resilience to food insecurity: application to palestinian households. EC-FAO Food Security Programme Rom.

Alinovi L., Mane E., Romano D. (2010) 'Measuring household resilience to food insecurity: an application to palestinian households', in R. Benedetti, M. Bee, G. Espra, F. Piersimoni (eds), *Agricultural Survey Methods*, pp. 2–30.

Baliki G., Bruck T., Stojetz, W. (2018) *Drivers of resilience and food security in north-east nigeria: Learning from micro data in an emergency setting*.

Barbara S., Ruth C., Victor N., Romaric G., Etel G., Babacar S. (2012) 'West African Food Composition Table', Food and Agriculture Organization.

Bardhan P., Udry C. (1999) *Development Microeconomics*. Oxford: Oxford University Press.

Bene C., Headey D., Haddad L., von Grebmer K. (2016) 'Is Resilience a Useful Concept in the Context of Food Security and Nutrition Programmes? Some Conceptual and Practical Considerations', *Food Security*, 8(1): 123–38.

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

Bertoni E., Maio M. D., Molini V. Nisticò R. (2018) *Education is forbidden: the effect of the Boko Haram Conflict on Education in north-east Nigeria* . ID: 271688.

Blattman C., Miguel E. (2010) 'Civil War', *Journal of Economic Literature*, 48(1): 3–57.

Bruck 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: 203–23.

Campbell J. (2019) Nigeria security tracker: from africa program and nigeria on the brink. Technical Report p29483. The US Council on Foreign Relations.

Campbell J., Harwood A. (2018) *Boko Haram's deadly impact*. Technical Report. The US Council on Foreign Relations.

Cherchye L., Rock B. D., Vermeulen F. (2007) 'The Collective Model of Household Consumption: a Nonparametric Characterization', *Econometrica*, 75(2): 553–74.

Chukwuma A., Ekhator-Mobayode U. E. (2019) 'Armed Conflict and Maternal Health Care Utilization: Evidence from the Boko Haram Insurgency in Nigeria', *Social Science & Medicine*, 226: 104–12.

Ciani F., Romano D. (2014) 'Testing for household resilience to food insecurity: evidence from Nicaragua', in *2014 Third Congress, June 25–27, 2014, Alghero, Italy*. Italian Association of Agricultural and Applied Economics (AIEAA).

d'Errico M. and Giuseppe S. D. (2016) A dynamic analysis of resilience in Uganda.

d'Errico M., Romano D., Pietrelli R. (2018) 'Household Resilience to Food Insecurity: Evidence from Tanzania and Uganda', *Food Security*, 10(4): 1033–54.

D'Souza A., Jolliffe D. (2013) 'Conflict, Food Price Shocks, and Food Insecurity: The Experience of Afghan Households', *Food Policy*, 42: 32–47.

Dercon S. (2002) 'Income Risk, Coping Strategies, and Safety Nets', *The World Bank Research Observer*, 17(2): 141–66.

Falode J. A. (2016) 'The Nature of Nigeria's Boko Haram War, 2010–2015: A Strategic Analysis', *Perspectives on Terrorism*, 10(1): 41–52.

FAO (2015) *WFP (2014) the State of Food Insecurity in the World 2014: Strengthening the Enabling Environment for Food Security and Nutrition*. Rome: FAO.

FAO (2016). Rima - ii resilience index measurement and analysis - ii. Technical Report ISBN 978–92–5-109235-4. Food and Agricultural Organisation of United Nations.

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.

Heemskerk M., Norton A., de Dehn L. (2004) 'Does Public Welfare Crowd Out Informal Safety Nets? Ethnographic Evidence from Rural Latin America', *World Development*, 32(6): 941–55 ID: 271773.

Hoddinott J. (2006) 'Shocks and Their Consequences Across and Within Households in Rural Zimbabwe', *The Journal of Development Studies*, 42(2): 301–21.

Hoek J. V. D. (2017) Agricultural market activity and Boko Haram attacks in northeastern Nigeria.

Iyekekpolo W. O. (2016) 'Boko Haram: Understanding the Context', *Third World Quarterly*, 37(12): 2211–28.

Jensen R. T., Miller, N. H. (2010) A revealed preference approach to measuring hunger and undernutrition.

Justino P. (2012) 'Shared Societies and Armed Conflict: Costs, Inequality and the Benefits of Peace', *IDS Working Papers*, 2012(410): 1–23.

Kimenyi M., Adibe J., Djire, M. Jirgi, A. J. (2014) The impact of conflict and political instability on agricultural investments in mali and nigeria.

Kozlowska K., d'Errico M., Pietrelli R. Giuseppe, S. D. (2015) Resilience analysis in Burkina Faso.

Lovon M., Mathiassen A. (2014) 'Are the World FGood Programme's Food Consumption Groups a Good Proxy for Energy Deficiency?' *Food security*, 6(4): 461–70.

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

Marc A., Verjee N., Mogaka S. (2015) *The Challenge of Stability and Security in West Africa*. The World Bank.

Maxwell D. G. (1996) 'Measuring Food Insecurity: the Frequency and Severity of "Coping Strategies"', *Food Policy*, 21(3): 291–303.

Maxwell D., Ahiadeke C., Levin C., Armar-Klemesu M., Zakariah S. Lamptey G. M. (1999) Alternative food-security indicators: revisiting the frequency and severity of 'coping strategies. ID: 271787.

Messer E., Cohen M. J. (2007) 'Conflict, Food Insecurity and Globalization', *Food, Culture & Society*, 10(2): 297–315.

Minoiu C., Shemyakina O. N. (2014) 'Armed Conflict, Household Victimization, and Child Health in Côte d'ivoire', *Journal of Development Economics*, 108: 237–55.

Omeni A. (2018) 'Boko Haram's Covert Front', *Journal of African Conflicts and Peace Studies*, 4(1): 2.

Onapajo H. (2017) 'Has Nigeria Defeated Boko Haram? An Appraisal of the Counter-Terrorism Approach Under the Buhari Administration', *Strategic Analysis*, 41(1): 61–73.

Osabohien R. (2018) 'Contributing to Agricultural Mix: Analysis of the Living Standard Measurement Study – Integrated Survey on Agriculture Data Set', *Data in Brief*, 20: 96–100.

Pinstrup-Andersen P., Shimokawa S. (2008) 'Do Poverty and Poor Health and Nutrition Increase the Risk of Armed Conflict Onset?' *Food Policy*, 33(6): 513–20.

Raleigh C., Linke A., Hegre H. Karlsen J. (2010) 'Introducing ACLED: An Armed Conflict Location and Event Dataset: Special Data Feature', *Journal of Peace Research*, 47(5): 651–660.

Sanders M., Weitzel U. (2013) 'Misallocation of Entrepreneurial Talent in Postconflict Environments', *Journal of Conflict Resolution*, 57(1): 41–64.

Smith M. B., Davies S. (1995) 'Famine Early Warning and Response: the Missing Link', *Intermediate Technology Publications*.

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: 358–76.

Spedding C.R.W. (1988) 'A systems approach to agriculture', in *An Introduction to Agricultural Systems*. Dordrecht:Springer, pp. 15–40.

Tendall D., Joerin J., Kopainsky B., Edwards P., Shreck A., Le Q., Kruetli P., Grant M., Six J. (2015) 'Food System Resilience: Defining the Concept', *Global Food Security*, 6: 17–23.

WFP (2008) 'Food Consumption Analysis: Calculation and Use of the Food Consumption Score in Food Security Analysis', *United Nations Vulnerability Analysis and Mapping Branch*.

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

Appendix

Table A1: Definition of Pillars and Observed Predictors

Variable	Definition/description
ABS	**Measuring tendency to access basic welfare support services**
Infrastructure index	Index of dwelling quality computed using principal component analysis based on the ownership of household items such as personal house, modern roof, non-dirty floor, running water and electricity.
km to secondary school	Distance
km to primary school	Distance
km to health services	Distance
km to market	Distance
Assets	**Measuring, inter alia, the tendency for consumption smoothening using owned assets**
Agricultural asset index	Index of agricultural assets computed using principal component analysis based on the onwership of specific agricultural tools e.g hoe, plough, harrow, tractor harvesting and thrashing machines, reapers, water pumps, etc.
Wealth index	Index of non-productive assets computed using principal component analysis based on the onwership of specific household assets e.g telephone, fridge, furniture,lantern, computer, utensil, television, radio, lamp, mosquito nets, iron, stove, water-heater, stereo, books, antenna, motor vehicle, motorcycle and bicycle.
Land owned	Hectares of land owned per capita
Tropical livestock units	TLU is a weighted sum of the number of different livestock owned by the households. They are converted as follows: Camel 1, Cattle 0.7, donkey/mules/horses 0.55, sheep/goatss 0.1, chicken 0.01.
AC	**Measuring, inter alia, the tendency to maintain welfare using human capital endowment**
Income diversification	Principal component index with dummies for income from (1) agriculture and fishing wages; (2) non-agriculture wages; (3) farming production; (4) livestock and fishing production; (5) non-agriculture business; (6) transfers and (7) other income
Average education	Average years of education among household members
participation rate	Number of active household members divided by household size
SSN	**Measuring tendency to receive sucour from family and other social networks**
Private transfer in naira	Monthly amount received per capita
Other transfer in naira	Monthly amount received per capita
Scholarship (yes or no)	Dummy variable
Has at least one migrant	Dummy variable

Notes: Bold fonts = pillars; for all indices, higher values represent higher attribute

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

Table A2: Summary Statistics for Variables Used to Compute the Resilience Indices

	PRE			POST		
	Treatment	Control	*t*-test	Treatment	Control	*t*-test
RCI	0.310	0.280	0.030	0.180	0.260	-0.080*
ABS	0.190	0.222	-0.032	0.140	0.220	-0.080
Infrastructure index	-0.170	-0.130	-0.040	-0.220	-0.150	-0.070*
Distance to primary school (km)	19.740	20.220	-0.480	28.310	21.440	6.870*
Distance to secondary school (km)	32.020	42.050	-10.030*	37.020	40.110	-3.090*
Distance from health services (km)	34.160	43.760	-9.600	51.190	44.170	7.020**
Distance to market (km)	30.700	29.980	0.720	31.200	29.500	1.700
Distance to major road (km)	18.100	30.140	-12.040**	26.100	25.210	0.890
Asset	0.210	0.189	0.021	0.150	0.260	-0.110*
Index of agricultural asset	0.240	0.170	0.070	0.080	0.190	-0.110
Index of non-farm business assets	-0.010	-0.030	0.020	-0.060	-0.020	-0.040*
Index of household wealth	0.170	0.190	-0.020	0.120	0.350	-0.230
Tropical Livestock Unit	0.380	0.270	0.110	0.210	0.290	-0.080*
AC	0.380	0.400	-0.020	0.250	0.370	-0.120**
Participation index	0.560	0.450	0.110	0.360	0.490	-0.130*
HH average years of education	5.010	5.170	-0.160	5.120	5.330	-0.210
Dependency ratio	0.880	1.430	-0.550	0.890	1.540	-0.650
Diversity of income sources	0.810	0.840	-0.030	0.680	0.850	-0.170*
SSN	0.220	0.190	0.030	0.390	0.200	0.190***
Transfers (naira)	297	203	94	564	223	341**
Other transfers (naira)	205	186	19	880	156	724**
Scholarship (yes or no)	0.560	0.490	0.070	0.670	0.440	0.230*
Has a migrant (yes or no)	0.290	0.300	-0.010	0.570	0.260	0.310*

Notes: *t*-test reports mean differences (treatment minus control). ***$P < 0.01$, **$P < 0.05$, *$P < 0.1$.

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

Table A3: Factor Loadings for Resilience Capacity Index and Pillars

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Uniqueness
Resilience capacity index						
Asset	0.67	0.22	0.26	NA	NA	0.95
AC	0.78	-0.22	0.39	NA	NA	0.75
SSN	0.58	0.43	0.28	NA	NA	0.81
ABS	0.41	0.18	-0.61	NA	NA	0.88
Asset						
Index of agricultural asset	0.77	0.12	0.04	NA	NA	0.95
Index of non -farm business asset	0.29	-0.22	0.11	NA	NA	0.65
Index of household wealth	0.38	0.23	0.08	NA	NA	0.81
Tropical Livestock Unit	0.42	0.18	-0.08	NA	NA	0.93
AC						
Participation index	0.63	0.21	0.08	NA	NA	0.92
HH average years of education	0.21	0.34	0.22	NA	NA	0.71
Dependency ratio	0.45	0.18	-0.23	NA	NA	0.94
Diversity of income sources	0.55	0.44	0.67	NA	NA	0.88
SSN						
Transfers (naira)	0.65	0.34	0.19	NA	NA	0.92
Other transfers (naira)	0.54	-0.45	0.33	NA	NA	0.87
Scholarship (yes or no)	-0.46	0.37	0.26	NA	NA	0.66
Has a migrant (yes or no)	0.66	0.4	0.24	NA	NA	0.95
ABS						
Infrastructure index	0.49	0.18	-0.15	0.34	0.46	0.93
Distance to primary school (km)	0.22	0.38	-0.32	0.33	0.37	0.68
Distance to secondary school (km)	0.39	0.45	0.11	0.45	-0.11	0.74
Distance from health services (km)	0.64	0.35	-0.22	0.39	-0.44	0.95
Distance to market (km)	0.77	0.41	0.44	0.29	0.11	0.96
Distance to major road (km)	0.34	0.53	0.27	0.31	0.25	0.82

Notes: NA is obtained when indicated factor number does not apply to component

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

Table A4: Probit Estimation of Sample Attrition

Variables	(1) Attrition	(2) Attrition	(3) Attrition	(4) Attrition	(5) Attrition
Conflict	-0.0005	0.0005	0.0047	-0.0016	0.0020
	(0.0544)	(0.0543)	(0.0546)	(0.0543)	(0.0544)
Urban	0.0125	0.0148	0.0096	0.0141	0.0150
	(0.0182)	(0.0180)	(0.0189)	(0.0180)	(0.0180)
Age of head	0.0003	0.0003	0.0003	0.0003	0.0003
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
HH head is a wage worker	0.0045	0.0064	0.0054	0.0064	0.0063
	(0.0128)	(0.0127)	(0.0127)	(0.0127)	(0.0127)
Household size	-0.0032***	-0.0022*	-0.0031**	-0.0022*	-0.0030**
	(0.0012)	(0.0013)	(0.0012)	(0.0013)	(0.0012)
Female head	-0.0188	-0.0192	-0.0187	-0.0193	-0.0190
	(0.0152)	(0.0152)	(0.0152)	(0.0152)	(0.0152)
HH head is literate	0.0092	0.0118	0.0103	0.0118	0.0112
	(0.0080)	(0.0079)	(0.0079)	(0.0079)	(0.0079)
Ratio of children	0.0239	0.0179	0.0231	0.0179	0.0229
	(0.0195)	(0.0197)	(0.0195)	(0.0197)	(0.0195)
HH head is never married	-0.0111	-0.0119	-0.0119	-0.0119	-0.0125
	(0.0234)	(0.0234)	(0.0234)	(0.0234)	(0.0234)
RCI	0.0020				
	(0.0030)				
ABS		-0.0161*			
		(0.0087)			
SSN			-0.0090		
			(0.0109)		
AC				-0.0172*	
				(0.0093)	
Asset					-0.0036
					(0.0031)
Constant	-0.0041	0.0189	0.0049	0.0302	0.0215
	(0.0862)	(0.0869)	(0.0867)	(0.0879)	(0.0888)
Observations	1,703	1,703	1,703	1,703	1,703
Pseudo R2	0.3171	0.3173	0.3172	0.3173	0.3172

Notes: Standard errors in parentheses. *** $P < 0.01$, ** $P < 0.05$, * $P < 0.1$.

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

Table A5: Effects of Resilience on FCS, Disaggregated

Variables	FCS
Conflict × *Post*	-0.966
	(1.055)
Conflict × RCI^{high} × *Post*	3.406***
	(0.616)
SSN	
cash transfer	-4.847
	(8.361)
In-kind gift	9.473
	(9.763)
Has migrants	7.789***
	(1.324)
Scholarship	2.795
	(1.791)
ABS	
Infrastructure index	4.141
	(15.757)
Distance to primary school	15.906***
	(4.808)
Distance to secondary school	16.859***
	(4.999)
Distance to market	16.301***
	(4.843)
Distance to health services	83.809
	(62.133)
Distance to major road	6.795
	(5.068)
Asset	
Farming asset index	-120.323*
	(65.697)
Non-farming asset index	1.184
	(9.579)
Household asset index	0.011
	(0.035)
Tropical livestock unit	4.303***
	(1.568)
AC	
Labour force participation rate	0.301*
	(0.168)
Average years of education	-2.705***
	(0.920)
Dependency ratio	1.223
	(2.527)
Diversity of income sources	1.344
	(3.174)
Usual controls	yes
Observations	3,000
Number of hhid	1,500

Standard errors in parentheses. ***$P < 0.01$, **$P < 0.05$, *$P < 0.1$.

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

Table A6: Effects of the conflict on resilience, disaggregated levels

SSN

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Conflict × *Post*	1.921***		0.007***		0.051***		0.010	
fatalities		ns		ns		ns		0.004***

Columns: (1 - 2) log of cash tranfer + 1; (3 - 4) log of in-kind transfer + 1;
(5 - 6) HH has migrant; (7 - 8) member of HH has scholarship

Assets

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Conflict × *Post*	-0.013***		ns		ns		-0.015**	
fatalities								

Columns: (1 - 2) farming asset index; (3 - 4) nonfarm asset index;
(5 - 6) wealth index; (7 - 8) Tropical Livestock unit

Adaptive Capacity (AC)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Conflict × *Post*	-0.017**		ns		ns		-0.001**	
fatalities		ns		ns		ns		ns

Columns: (1 - 2) Participation index; (3 - 4) Average years of education;
(5 - 6) Dependency ratio; (7 - 8) Income diversity

ABS

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Conflict × *Post*	-0.017**		ns		ns		-0.001**	
fatalities		ns		ns		ns		ns

Columns: (1 - 2) Infrastructure index; (3 - 4) Distance to health services;
(5 - 6) Distance to town; (7 -
8) Distance to market

Standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ ns indicates that there is no significant effect. ABS omits distance to primary and secondary schools both of which did not have significant variation.

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

Table A7: Top Resilience Capacity Quartiles, Interactions and FCS

Variables	(1) RCI	(2) SSN	(3) AC	(4) ABS	(5) Asset
Conflict × *Post*	-3.125*	-4.277**	-4.263**	-4.253**	-4.253**
	(1.798)	(1.959)	(1.867)	(2.021)	(1.925)
Conflict × *Post* × *Q*2	-2.778				
	(2.398)				
Conflict × *Post* × *Q*3	-0.322				
	(2.646)				
Conflict × *Post* × *Q*4	7.198***				
	(2.586)				
Conflict × *Post* × *Q*2		0.651			
		(2.093)			
Conflict × *Post* × *Q*3		0.365			
		(2.222)			
Conflict × *Post* × *Q*4		-0.637			
		(2.154)			
Conflict × *Post* × *Q*2			0.751		
			(2.491)		
Conflict × *Post* × *Q*3			-0.461		
			(2.527)		
Conflict × *Post* × *Q*4			-0.438		
			(2.656)		
Conflict × *Post* × *Q*2				2.616	
				(2.615)	
Conflict × *Post* × *Q*3				-2.123	
				(2.671)	
Conflict × *Post* × *Q*4				1.622	
				(2.628)	
Conflict × *Post* × *Q*2					4.046
					(2.599)
Conflict × *Post* × *Q*3					0.968
					(2.542)
Conflict × *Post* × *Q*4					4.019
					(2.576)
Observations	3,000	3,000	3,000	3,000	3,000
Number of hhid	1,500	1,500	1,500	1,500	1,500

Standard errors in parentheses. ***$P < 0.01$, **$P < 0.05$, *$P < 0.1$. Q1–Q4 = resilience quartiles. Q1 = reference category

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

Table A8: Top Resilience Capacity Quartiles, Interactions and CSI

Variables	(1) RCI	(2) SSN	(3) AC	(4) ABS	(5) Asset
Conflict × *Post*	1.867***	2.982***	1.569***	2.345***	3.406***
	(0.586)	(0.631)	(0.600)	(0.647)	(0.616)
Conflict × *Post* × *Q*2	-0.461				
	(0.780)				
Conflict × *Post* × *Q*3	-0.318				
	(0.861)				
Conflict × *Post* × *Q*4	0.385				
	(0.842)				
Conflict × *Post* × *Q*2		-1.993**			
		(0.855)			
Conflict × *Post* × *Q*3		-0.741			
		(0.854)			
Conflict × *Post* × *Q*4		-2.679***			
		(0.887)			
Conflict × *Post* × *Q*2			0.390		
			(0.803)		
Conflict × *Post* × *Q*3			0.249		
			(0.814)		
Conflict × *Post* × *Q*4			0.156		
			(0.855)		
Conflict × *Post* × *Q*2				-0.862	
				(0.841)	
Conflict × *Post* × *Q*3				-0.422	
				(0.858)	
Conflict × *Post* × *Q*4				-1.208	
				(0.843)	
Conflict × *Post* × *Q*2					-2.603***
					(0.833)
Conflict × *Post* × *Q*3					-2.264***
					(0.815)
Conflict × *Post* × *Q*4					-1.602*
					(0.825)
Observations	3,000	3,000	3,000	3,000	3,000
Number of hhid	1,500	1,500	1,500	1,500	1,500

Standard errors in parentheses. ***$P < 0.01$, **$P < 0.05$, *$P < 0.1$. Q1–Q4 = resilience quartiles. Q1 = reference category

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

Table A9: Top resilience capacity quartiles, interactions and food ratio

VARIABLES	(1) RCI	(2) SSN	(3) AC	(4) ABS	(5) Asset
Conflict × *Post*	0.078***	0.076***	0.056***	0.060***	0.082***
	(0.015)	(0.016)	(0.016)	(0.017)	(0.016)
conflict × *Post* × *Q*2	-0.026				
	(0.021)				
conflict × *Post* × *Q*3	0.013				
	(0.023)				
conflict × *Post* × *Q*4	-0.008				
	(0.022)				
conflict × *Post* × *Q*2		0.015			
		(0.023)			
conflict × *Post* × *Q*3		-0.010			
		(0.022)			
conflict × *Post* × *Q*4		-0.026			
		(0.023)			
conflict × *Post* × *Q*2			0.017		
			(0.022)		
conflict × *Post* × *Q*3			0.035		
			(0.022)		
conflict × *Post* × *Q*4			0.016		
			(0.023)		
conflict × *Post* × *Q*2				0.000	
				(0.023)	
conflict × *Post* × *Q*3				0.019	
				(0.023)	
conflict × *Post* × *Q*4				0.025	
				(0.023)	
conflict × *Post* × *Q*2					0.015
					(0.023)
conflict × *Post* × *Q*3					-0.031
					(0.022)
conflict × *Post* × *Q*4					-0.028
					(0.022)
Observations	3,000	3,000	3,000	3,000	3,000
Number of hhid	1,500	1,500	1,500	1,500	1,500

Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. AC = Adaptive capacity, Asset = Access to Assets Q1 - Q4 = Resilience quartiles. Q1 = reference category

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

Table A10: Probit Estimation of Selection into Conflict Exposure

Variables	(1) Conflict	(2) Conflict	(3) Conflict	(4) Conflict	(5) Conflict
Urban	-0.0014	-0.0003	0.0101	-0.0004	-0.0006
	(0.0088)	(0.0087)	(0.0091)	(0.0087)	(0.0087)
Age of HH head	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
HH head is wage worker	-0.0032	-0.0029	-0.0033	-0.0026	-0.0033
	(0.0061)	(0.0061)	(0.0061)	(0.0061)	(0.0061)
Household size	0.0001	0.0002	0.0001	0.0004	0.0002
	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)
Female head	0.0022	0.0024	0.0028	0.0022	0.0025
	(0.0073)	(0.0073)	(0.0073)	(0.0073)	(0.0073)
HH head is literate	0.0026	0.0032	0.0035	0.0035	0.0029
	(0.0039)	(0.0038)	(0.0038)	(0.0038)	(0.0038)
Ratio of children	0.0037	0.0035	0.0036	0.0023	0.0034
	(0.0094)	(0.0095)	(0.0094)	(0.0095)	(0.0094)
Head is never married	-0.0001	-0.0004	0.0004	-0.0004	0.0001
	(0.0113)	(0.0113)	(0.0112)	(0.0113)	(0.0113)
RCI	0.0011				
	(0.0014)				
ABS		0.0005			
		(0.0042)			
SSN			0.0196***		
			(0.0052)		
AC				-0.0032	
				(0.0045)	
ASSET					0.0016
					(0.0015)
Village dummies	Yes	Yes	Yes	Yes	Yes
Constant	0.7012***	0.7205***	0.9746***	0.7080***	0.9904***
	(0.0322)	(0.0327)	(0.0328)	(0.0332)	(0.0340)
Observations	1,703	1,703	1,703	1,703	1,703
Pseudo R2	0.4842	0.4842	0.4843	0.4842	0.4842

Notes: Standard errors in parentheses. $^{***}P < 0.01$, $^{**}P < 0.05$, $^{*}P < 0.1$.

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022

Table A11: Food (In)security and Conflict Exposure Within the 5 km Radius of Exposure

A: Conflict exposure within 5 km

Variables	(1) CSI	(2) FCS	(3) Food ratio	(4) CSI	(5) FCS	(6) Food ratio
Conflict × *POST*	1.312***	-1.143	0.075***	1.262**	-1.889	0.088***
	(0.204)	(0.858)	(0.010)	(0.610)	(1.616)	(0.017)
Baseline CSI	0.893***					
	(0.031)					
Baseline FCS		0.347***				
		(0.012)				
Baseline food ratio			0.115***			
			(0.009)			
Baseline controls	Yes	Yes	Yes	No	No	No
Household fixed effect	No	No	No	Yes	Yes	Yes
Constant	1.285*	45.142***	0.813***	10.652**	53.011***	0.771***
	(0.691)	(2.318)	(0.021)	(5.527)	(16.401)	(0.151)
Observations				2,766	2,766	2,766
Number of households	1,383	1,383	1,383	1,383	1,383	1,383

B: Conflict intensity (no. of fatalities)

Conflict intensity (100s of fatalities)	4.102***	-14.311***	0.323***	2.317***	-0.307	0.172***
	(0.342)	(0.210)	(0.010)	(0.224)	(1.462)	(0.033)
Baseline CSI	1.022***					
	(0.026)					
Baseline FCS		0.239***				
		(0.015)				
Baseline Food ratio			0.296***			
			(0.020)			
Constant	0.365	27.119***	0.488***	7.654***	19.225***	0.735***
	(0.543)	(1.800)	(0.031)	(1.913)	(5.326)	(0.053)
Baseline controls	Yes	Yes	Yes	No	No	No
Household fixed effects	No	No	No	Yes	Yes	Yes
Observations				2,766	2,766	2,766
Number of households	1,383	1,383	1,383	1,383	1,383	1,383

Notes: Food ratio = Share of household per capita food expenditure; standard errors in parentheses. $^{***}P < 0.01$, $^{**}P < 0.05$, $^{*}P < 0.1$.

Downloaded from https://academic.oup.com/jae/advance-article/doi/10.1093/jae/ejac015/6647795 by guest on 24 July 2022