Effect of Conflict and Food Price Shocks on Calorie Intake and Acute Malnutrition in Nigeria: A Micro-Panel Data Analysis

Contributed Paper prepared for presentation at the 93rd Annual Conference of the Agricultural Economics Society, University of Warwick, England
15 - 17 April 2019

Olusegun Fadare[1]; Dare Akerele[2]; George Mavrotas[1]; Adebayo Ogunniyi[1]*

[*]Olusegun Fadare
o.fadare@cgiar.org
[1]International Food Policy Research Institute, 1201 Eye Street NW, Washington, DC 20005-3915, USA.
[2]Department of Agricultural Economics and Farm Management, Federal University of Agriculture, Abeokuta, Nigeria

Abstract

Food insecurity and malnutrition are being worsened in countries that are exposed to armed conflict. Nigeria has witnessed a decade of protracted armed conflict and civil unrest. Many civilians have died and some farming communities have been sacked as a result. This study uses fixed-effect and random-effect models on a nationally-representative household panel data– Nigeria Living Standard Measurement Survey and Armed Conflict and Event Location Data, to examine the linkages between conflict, food price shocks, and calorie intake and acute malnutrition (wasting) among children. The prevalence of calorie intake inadequacy and wasting increase across the years in conflict-prone areas. Empirical results suggest that increases in food prices, especially staples have a depressing effects on calorie intake and increasing influence on wasting prevalence. Surprisingly, there appears to be a decrease likelihood of wasting among households in conflict-prone areas despite relatively low level of calorie intake. This result may be indicative of access to certain nutrition-related non-food factors capable of reinforcing the available calorie intake in the areas. Although sensitively guided food pricing policy and prevention of conflicts are critical for improve calorie intake and nutrition outcome, greater reduction in wasting prevalence may be achieved if other nutrition-related factors are considered.

Keywords: *Conflict, food price, energy intake, hunger, wasting*

JEL code: *D6, D74, E31*

1. Introduction

The problem of food insecurity, hunger and malnutrition appears not to be reducing for most countries in sub-Sahara Africa when compared with the progress made in South Asia region in the last decade. Nigeria situation is particularly dire as undernourishments increased from 5.9% in 2008 to 7% in 2016 (Von Grebmer, 2016). The State of Food Security and Nutrition in the World 2018 estimated that about 21million people in Nigeria are undernourished between 2015 and 2017, up from about 9million in 2006. Acute malnutrition among children under 5 years also moved form 14% in 2008 to 18% in 2013 (NDHS, 2014) and about 3.4 million children are still affected by wasting in 2017 (World Health Organization, 2018). The report generally shows that food insecurity and undernutrition prevalence for Nigeria are among the worse globally. Myriads of interconnected factors can give rise to these outcomes. These include, among others, shocks in food prices, socio-demographic changes, and in recent times, threat to peace and security, occasioned by armed conflicts, violence and terrorists attack on rural and farming communities in Nigeria (Grote, 2018)

Violent conflicts in the forms of abductions, killings and forced displacements of people can hamper market efficiency (Verwimp *et al.*, 2010). Conflict can induce food price shocks as a result of decrease in agricultural productivities and market disruption which leads to higher transactions costs. These, by extension, will increase the level of food insecurity (D'Souza and Jolliffe, 2013) and reduce people's networks (Justino, 2011). One of the possible responses to increase in food prices is the propensity of households to shift from the consumption of quality diets to those of less quality (FAO, 2016; Thompson, 2009; Adebayo *et al.*, 2016). For instance, Mkhawani *et al.* (2016) found that high food prices are responsible for downgrading dietary quality and total caloric intake. More households tend to be vulnerable to nutrition and health shocks emerging from reduced total energy intake and deteriorating immune system (Brinkman *et al.*, 2009; Andreyeva *et al.*, 2010).

Meanwhile, areas affected by conflict may also be benefiting from humanitarian assistance (Carroll *et al.*, 2017; ReliefWeb 2019; Ecker *et al.*, 2019) which may cushion the effect of food price shocks on food security and nutrition of the people. While this may be hypothesized, other areas less prone to conflict may also not be better off as a result of spillovers such conflict may create. There may be exodus of undernutrition and increased pressure on available resources in a

new location. Whether occurrence of violent conflicts and shocks in food prices can substantially influence calorie intake and prevalence of wasting (acute malnutrition) among households in Nigeria are examined in this paper using two rounds of nationally-representative household panel data from the Nigeria Living Standards Measurement Survey – integrated Survey on Agriculture (LSMS-ISA) 2013 and 2016 (NBS and World Bank, 2013/2016). This data provides adequate information on household food consumption and children anthropometric measures from where we computed our outcome variables. In addition, it contains information on the households' sociodemographic characteristics and other suitable control variables. This data was also reinforced with some food price data from National Bureau of Statistics (NBS) for the year, month and locations where LSMS data were collected. We merged the NBS and LSMS data with the Armed Conflict and Event Location Data (ACLED) using the event locations code with the corresponding enumeration area code in the LSMS datasets. The dearth of micro-level conflict data in national household surveys has limited, to a large extent, inferences that could be made on the outcomes measured in this study. The ACLED data therefore provides an opportunity to innovatively locate households living in conflict prone areas within a micro-panel household surveyed data.

2. Conflict Situation and Emergence in Nigeria

The incidence of conflict of different types and magnitude in some regions of Nigeria has increased significantly over the last decade. Though no civil war in Nigeria in the last decade, but increase armed conflict and civil unrest have led to the death of many civilians and the sack of some farming communities who are now located in the Internally Displaced Camps (IDPs) and living in host communities, making it harder to access them with assistance and putting additional pressure on the already stretched resources of these communities. Only in Borno, Adamawa and Yobe, 7.1 million people have been estimated to be in need of humanitarian assistance in 2019 (ReliefWeb, 2019). This situation has presented a critical developmental challenge that threatens efforts to end food insecurity and malnutrition in Nigeria (World Bank, 2018).

Conflict is a key driver of situations of severe food crisis, re-emerged famines, hunger and under-nutrition which are significantly worse where conflicts are prolonged and institutional capacities weaken (World Health Organization, 2018). Nigeria has been plagued by various forms of violence, most prominently are those linked to violent extremism in the Northeast and communal

conflicts between herders and farmers in the central and southern zones (Ojewale and Appiah-Nyamekye, 2018). Farmers and herdsmen clashes are feuds that have led to malevolent destruction of lives and properties over the years, largely across Africa and Nigeria in particular (Okoli and Atelhe, 2014). Initially, this protracted conflict had predominantly occurred in the middle belt states of Nigeria but have now spread to other part of the country.

The magnitude of violence against civilian events have spiked in recent time, over 2,500 were reported dead in 2016, 62,000 people displaced, $13.7 billion lost to the farmer-herder clashes and 47% of the internally-generated revenue in the affected states lost due to farmer-herder clash (FAO, IFAD, UNICEF, WFP and WHO, 2017). Conflict reduces the capacity of federal and state government to create infrastructure and develop other productive sector of the economy (Mavrotas, 2011). Conflict events in northern Nigeria have left no fewer than 1.7 million people internally displaced within the country as at third quarter of 2017, and most seek shelter in other poor, rural communities, straining their already scarce resources. Violence has disrupted agricultural and other livelihood activities, putting more people into poverty and food inaccessibility. Large number of people in conflict affected areas in Nigeria are inaccessible to humanitarian assistance and markets are in deplorable condition (ReliefWeb, 2019). Human welfare is threatened when there is destruction of crops and livestock which are the main sources of staple and non-staple food in Nigeria.

3. Data Description and Descriptive Results

Data description

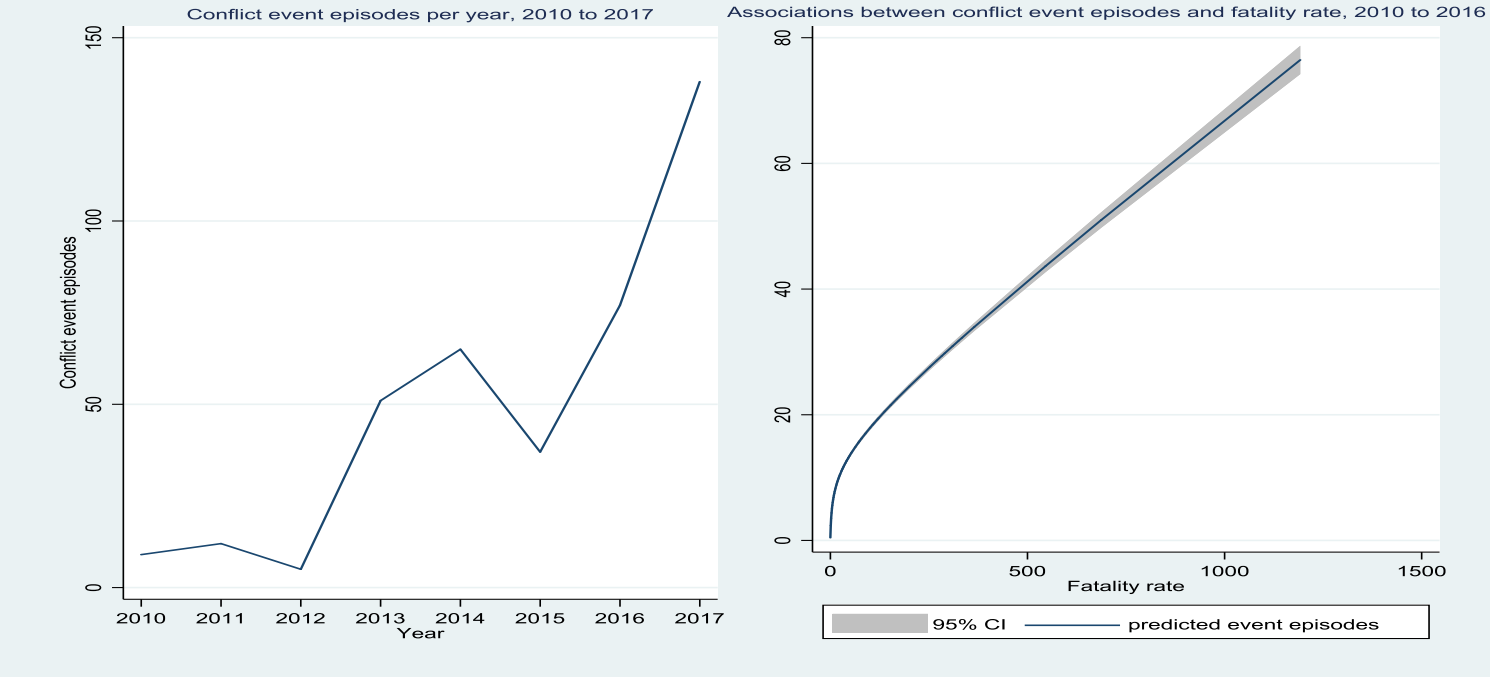
Using nationally-representative household panel data from the Nigeria Living Standards Measurement Survey – integrated Survey on Agriculture (LSMS-ISA) collected by the National Bureau of Statistics (NBS) of Nigeria with support from the World Bank, and conflict events data from the Armed Conflict Location and Event Data (ACLED) project (Raleigh *et al.,* 2010). The LSMS datasets are collected in waves. For the present study we used wave 2 (2013) and wave 3 (2016) which are the post-harvest cropping periods seasons. Relevant to the this study are information on weekly quantity of foods consumed by the households, socioeconomic characteristics of the households such as household size, income (proxy by total expenditure) of the household, sex, marital status, and educational of household head and spouse, and child morbidity. The ACLED contains information notes on the actual conflict events such as battles,

violence against civilians, explosions/remote violence, and riots/protests events. These were distilled and then merged by their event locations with the corresponding enumeration area code in the LSMS datasets for each survey round. The weekly quantities of different food consumed were converted to calories, and the daily calories per adult equivalent was computed for each household. The observations for the model for per capita calorie intake is 8,017 while that of wasting is 2,872 for the two rounds. This is because information on wasting was only available for households with at least a child under five in each of the post-harvest cropping season. The panel nature of the data helps in accounting for the unobserved household-level heterogeneity and seasonality.

Episodes of communal violence in Nigeria, 2010-2017

Figure 1 shows episodes of attacks on farmers and farming communities in Nigeria between 2010 and 2017 as calculated based on the number of event occurrence (left panel). Also showing the fatality rates in association with event episodes (right panel).

Figure 1: Conflict event episodes and association with fatality rates in Nigeria, 2010 to 2017



Source: Authors' computation based on ACLED 2010 to 2017

Table 1 shows the proportion of households that are exposed to violent conflict by geopolitical zones in Nigeria. Conflict events are largely concentrated in three geopolitical zones of Nigeria: north-central- 35.16%, north-east- 41.32%, and south-south- 38.65%. The northern regions (north-east in particular) have been ravaged by violent extremist while the north central has in recent years seen an unprecedented increase in farmers-herders clashes. The south-south region on the other hands (mainly the oil-rich states) has long history of civil unrest borne by the perceived resources miss-allocation and marginalization and this often lead to violent event of attack on communities and kidnaping.

Table 1: Households exposure to conflict events by geopolitical zones in Nigeria

Zone	No exposure to conflict	Exposure to violent conflict	Total
North-central	64.84	35.16	100.00
North-east	58.68	41.32	100.00
North-west	87.46	12.54	100.00
South-east	67.71	32.29	100.00
South-south	61.35	38.65	100.00
South-west	70.94	29.06	100.00
Total	69.09	30.91	100.00

Source: Authors' based on Nigeria LSMS-ISA 2013/2016 and ACLED Project 2013/2016

We group households into three categories based on their level of exposure to conflict events as follow: exposure to terrorist attacks and remote violence such as farmer-herders and communal clashes (high level of conflict exposure); exposure to riots and protests (medium level of conflict exposure); and no exposure to conflicts (lower level of conflict exposure).

Measuring household calorie intake

As mentioned earlier, we used quantity of food multiply by the value of calorie content in each of the food item consumed by the household in the past 7 days and then converting it to per capita adult equivalence per day for each household.

Measuring acute malnutrition in children

Wasting or acute malnutrition in children under five years was measured using their anthropometric measures of length/height and weight. The WHO Anthro software was used to

compute the index which helps in flagging out any value that is out of range, thereby producing only acceptable index, the z scores. Technically, a child is considered acutely malnourished or wasted if weight for height z-score (WHZ) for that child is less than minus 2 standard deviation below the median measurement for the reference population – i.e. WHZ<-2SD (Onis *et al.*, 2004). WHZ<-3SD is severe acute child malnutrition. Children who belong to any of these categories are considered too thin for their height. Acute malnutrition measures short term malnutrition in children, which is an ongoing undernutrition that has produced a substantial weight loss, usually as a consequence of acute food shortage and/or severe diseases such as chronic diarrhea. The focus of this study is to measure outcome of this nature since food prices shocks and conflict events lead to acute food shortage and could limit households' access to basic needs like water and sanitation or health care services.

This study's analysis is at household level rather than individual, and households are grouped into those that have at least one wasted child and those with no wasted child. Based on the foregoing, there is no link between child information such as sex and age in our empirical analysis, we are also not worried about linking a child from one survey round to another.

Non-parametric estimate of association between conflicts, calorie intake and wasting

We provide the non-parametric results of the key variables of investigation to first establish the association between conflict events, and calorie intake and acute malnutrition, also across Nigeria six geopolitical regions. Results in Table 2 show that calorie intakes increase across the years, and acute malnutrition also increase in the households between 2013 and 2016. The prevalence of acute malnutrition (WHZ<-2SD) increased from 12% to 14% and severe acute malnutrition (WHZ<-3SD) from 3% to 6% in conflict-prone areas between 2013 and 2016. While households in conflict-prone areas reduced calorie intake, acute malnutrition seems to also reduce. A disaggregation of the results by geopolitical regions show that per calorie intake inadequacy and acute malnutrition in the three conflict-prone regions (north-central, north-east and south-south) are not worse off than the other regions less prone to conflict. Generally, calorie intake inadequacy and wasting among the households increase between these years and are wide spread across the six geopolitical regions of Nigeria.

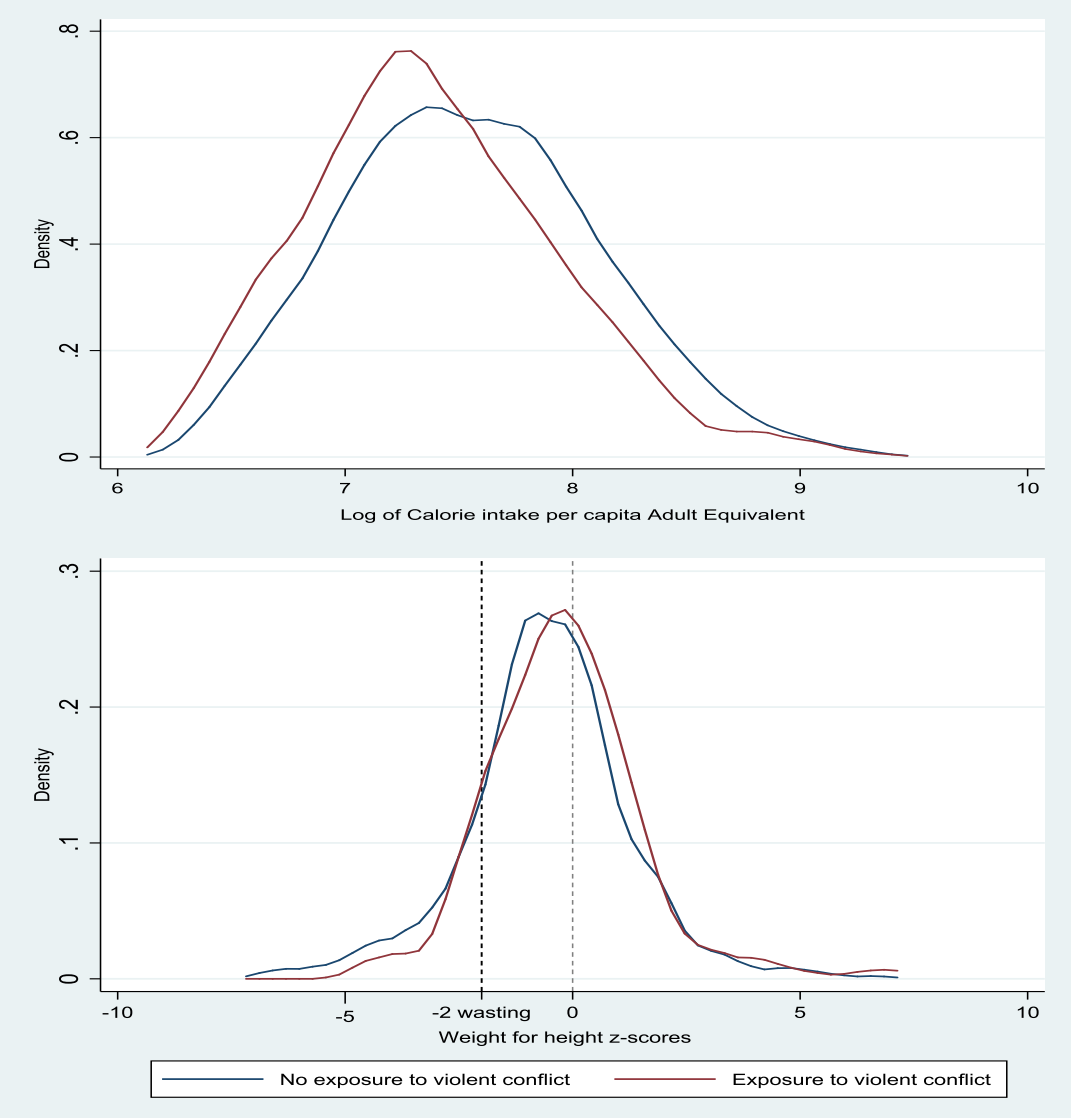
Table 2. Calorie intake and acute malnutrition by conflict exposure and geopolitical regions in Nigeria

	Per capita calorie intake per adult equivalence						Weight for height z scores					
	2013		2016		Pool		2013		2016		Pool	
	Mean (SD)	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	N
No exposure to conflict	2004.72 (1208.44)	3067	2258.25 (1415.85)	3057	2127.02 (1318.59)	6124	-0.57 (1.58)	1021	-0.66 (1.89)	1099	-0.62 1.75	2120
Exposure to conflict	1969.74 (1216.14)	1372	1982.37 (1310.91)	1322	1976.14 (1264.85)	2694	-0.51 (1.47)	461	-0.41 (1.80)	434	-0.46 (1.65)	895
North-central	2125.82 (1245.19)	760	2163.66 (1329.51)	758	2144.66 (1287.58)	1518	-0.36 (1.83)	293	-0.22 (2.07)	242	-0.09 (1.96)	535
North-east	2191.61 (1217.48)	661	2548.33 (1417.27)	618	2374.62 (1335.19)	1279	-0.45 (1.38)	311	-0.33 (1.96)	306	-0.39 (1.72)	617
North-west	2148.10 (1170.90)	847	2806.39 (1482.94)	869	2484.32 (1378.86)	1716	-0.80 (1.62)	397	-1.04 (1.98)	448	-0.93 (1.82)	845
South-east	1766.16 (1043.95)	693	1983.40 (1425.86)	707	1873.87 (1252.29)	1400	-0.42 (1.35)	148	-0.58 (1.64)	164	-0.50 (1.50)	312
South-south	2014.21 (1366.84)	724	1955.23 (1374.98)	698	1985.64 (1370.62)	1422	-0.49 (1.44)	205	-0.53 (1.57)	200	-0.51 (1.50)	405
South-west	1848.10 (1160.18)	743	1702.80 (1020.70)	729	1780.71 (1099.73)	1472	-0.51 (1.40)	125	-0.58 (1.50)	173	-0.55 (1.46)	298
Total	1994.02 (1210.77)	4439	2168.04 (1388.30)	4379	2079.32 (1303.65)	8818	-0.55 (1.55)	1482	-0.59 (1.87)	1533	-0.57 (1.72)	3015

Source: Authors' based on Nigeria LSMS-ISA 2013/2016 and ACLED Project 2013/2016
Note: N is number of observations, SD is standard deviation put in parentheses.

The kernel density plots of the distribution of calorie intake of the households (Fig 1 left panel) and weight for height z-score (Fig 1 right panel) for children under five years of age are presented below. The results show that distributions of per capita calorie intakes of household shift to the right in areas less prone to conflict suggesting a positive association between calorie intake and conflict events. On the other hand, the distributions of WHZ do not show a marked difference between conflict-prone areas and less conflict-prone areas as observed in WHZ curve slightly tending towards the left in areas prone to conflicts.

Figure 2: Associations between calorie intake and wasting in conflict-prone and less conflict-prone locations



Source: Authors' based on Nigeria LSMS-ISA 2013/2016 and ACLED Project 2013/2016

Table 3: Descriptive statistics of variables employed in regression analysis

Variable	Log of Calorie intake per capita AE			WHZ <-2.0 SD (Wasting)		
	2013	2016	Pool	2013	2016	Pool
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Log calorie intake per capita EA	7.49 (0.55)	7.54 (0.58)	7.55 (0.57)			
Child is wasted (WHZ <-2.0SD) (0/1)				0.14	0.17	0.16
Child is wasted (WHZ <-3.0SD) (0/1)				0.04	0.09	0.07
Prices of cereal	0.00 (0.04)	0.02 (0.03)	0.01 (0.04)	0.00 (0.05)	0.02 (0.03)	0.01 (0.04)
Price of root and tuber	0.00 (0.05)	0.01 (0.04)	0.01 (0.04)	0.01 (0.04)	0.01 (0.04)	0.01 (0.04)
Price of pulses	0.00 (0.02)	0.00 (0.01)	0.00 (0.02)	0.00 (0.02)	0.00 (0.02)	0.00 (0.02)
Price of fat and oil	0.00 (0.01)	0.01 (0.02)	0.00 (0.02)	0.00 (0.01)	0.01 (0.02)	0.00 (0.02)
Price of fruits	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Price of vegetables	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Price of egg	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Price of meat	0.00 (0.05)	0.00 (0.03)	0.00 (0.04)	0.01 (0.05)	0.00 (0.03)	0.00 (0.04)
Price of fish	0.00 (0.02)	0.00 (0.08)	0.00 (0.06)	0.00 (0.02)	0.00 (0.08)	0.00 (0.05)
Price of milk and dairy products	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Price of sweet and sweeteners	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Price of miscellaneous food	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Price of non-food items	0.27 (0.19)	0.24 (0.18)	0.26 (0.18)	0.25 (0.18)	0.23 (0.16)	0.24 (0.17)
Explosions and remote violence (0/1)	0.30	0.30	0.30	0.30	0.27	0.29
Riots and protests events (0/1)	0.06	0.10	0.08	0.06	0.08	0.07
No violent events (0/1)	0.64	0.60	0.62	0.64	0.64	0.64
Household experienced other shock events (0/1)	0.39	0.32	0.35	0.38	0.33	0.36
Household in the low income tercile (0/1)	0.29	0.40	0.35	0.32	0.40	0.36
Household in the middle income tercile (0/1)	0.33	0.33	0.33	0.34	0.34	0.34
Household in the high income tercile (0/1)	0.38	0.26	0.32	0.35	0.26	0.31
Household with married couple (0/1)	0.67	0.57	0.62	0.76	0.63	0.70
Household practices agriculture (0/1)	0.70	0.64	0.67	0.75	0.69	0.72
Household head is male (0/1)	0.79	0.76	0.77	0.84	0.78	0.81
Household head is less than 30 years old (0/1)	0.16	0.17	0.17	0.24	0.27	0.26
Household head is 30 and 49 years old (0/1)	0.37	0.31	0.34	0.54	0.46	0.50
Household head is 50 years old and above (0/1)	0.47	0.52	0.49	0.22	0.27	0.24
Father had education above primary (0/1)	0.70	0.74	0.72	0.69	0.75	0.72
Mother had education above primary (0/1)				0.48	0.40	0.44
Household size is 5 and below (0/1)				0.26	0.14	0.20
Household size is 6 to 10 (0/1)				0.57	0.61	0.59
Household size is 11 to 15 (0/1)				0.16	0.21	0.18
Household size is 16 and above (0/1)				0.02	0.04	0.03
Household consumed 6 of 12 food groups (0/1)				0.93	0.96	0.95
Household had at least a morbid child (0/1)				0.31	0.39	0.35
Household used improved drinking water (0/1)				0.45	0.50	0.48
Household used improved toilet (0/1)				0.49	0.55	0.52
Number of observations	3,958	4,059	8,017	1,414	1,458	2,872

4. Econometric Estimation Strategy

We specified two models for household level analysis: the effect of food price shocks and conflict on calorie intake using fixed-effect Linear Panel regression, equation (*i*); and the effect of food price shocks and conflict on prevalence of wasting using random-effect Probit model, equation (*ii*). The Lineal Panel Regression model for calorie intake is specified as:

$$C_{it} = \sum \omega_d S_{dit} + \sum \gamma_a O_{ait} + \sum \partial_c C_{cit} + \emptyset I_{it} + \sum \beta_k X_{kit} + \alpha_i + e_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (i)$$

The Probit model for child wasting is stated as:

$$N^*_{it} = \sum \omega_d S_{dit} + \sum \gamma_a O_{ait} + \sum \partial_c C_{cit} + \emptyset I_{it} + \sum \beta_k X_{kit} + \sum \delta_p U_{pit} + \alpha_i + e_{it} \ldots\ldots (ii)$$

$$N_{it} = 1(N^*_{it} > 0)$$

$$prob\,(N_{it} = 1|(\sum \omega_d S_{dit} + \sum \gamma_a O_{ait} + \sum \partial_c C_{cit} + \emptyset I_{it} + \sum \beta_k X_{kit} + \sum \delta_p U_{pit}, \alpha_i)$$
$$= H(\sum \omega_d S_{dit} + \sum \gamma_a O_{ait} + \sum \partial_c C_{cit} + \emptyset I_{it} + \sum \beta_k X_{kit} + \sum \delta_p U_{pit} + \alpha_i)$$

Where H(.) is a standard normal distribution function. C_{it} captures the per capita daily calorie intake in equation (i) and in equation (ii) N_{it} represents a dummy variable equaling one (1) if household report child wasting in household *i* at time *t* respectively, and zero (0) otherwise. The explanatory variables for equation (i) are as follows: *S, O, C, I,* and *X* denote vectors of shocks in prices of foods[1] and non-food items, other shocks, conflict events, and log of income per capita, and sociodemographic characteristics of households respectively. In addition to the explanatory variables already contained in equation (i), equation (ii) included more variables that also determine child nutritional outcome. The additional explanatory variables are: household size, household dietary diversity, household child morbidity status, access to improved drinking water and access to improved toilet among other household sociodemographic characteristics as contained in equation (i) which are captured in vector U. α_i represents fixed effect for model I (equation i) and random effects for Model II (equation ii), while e_{it} is the error term.

[1] Expenditure weighted food group price shocks. There are twelve food groups and each one has its own estimated price shocks.

5. Results and Discussion

Regression results of the effect of conflicts and food price shocks on calorie intake and wasting among Nigeria household

Presented in Table 4 are the results of the effects of conflict and food price shocks on calorie intake. The results show that shocks in the prices of cereal, root and tubers, and non-food items as well as households being in areas affected by conflicts are strongly negatively associated with household calorie intake. Households in areas experiencing explosions and remote violence, and riots and protests events had lower calorie intake compared to households living in less conflict-prone areas. Other controlled variables that have a depressing effect on calorie consumption include the specificity of households being in the low and middle income tercile, male headship of household, household heads having primary education and below, non-engagement of households in faming activities, and household head being below 31 years of age. Contrary to expectation, results show that shocks in the prices of pulses, fat and oil, fruit, egg and meat are strongly and positively associated with increase calorie intake. As mentioned earlier the results presented here are for post-harvest, which may bias the result downward. Akerele *et al.* (2017), using LSMS-ISA data for Nigeria found that calories intake among households in Nigeria is lower in post-planting than in post-harvest.

The results of the effect of conflict and food price shocks on wasting experience in household is presented in Table 5. We find that shocks in the price of cereal, fat and oil, fish, and milk and milk product significantly increase the probability of household having at least one child with acute malnutrition, but shock in price of pulse reduce it. While households in location where there are explosions and remotes violence do not show statistical significant association with the probability of households having a wasted child, households in areas with riots and protest significantly reduced the probability of having a wasted child as compared to household where there is not violent events.

Table 4. Regression result of effect of food price and conflict on calorie intakes

log of Calorie Adult Equivalent per capita consumed	Model 1		Model 2	
	Coefficient	Std. Err.	Coefficient	Std. Err.
Price of cereal	-0.681***	0.252	-0.908***	0.320
Price of root & tuber	-0.979***	0.183	-0.907***	0.236
Price of pulses	1.035**	0.482	0.960*	0.545
Price of fat & oil	3.129***	0.508	2.859***	0.616
Price of fruits	25.75**	11.28	26.40*	15.17
Price of vegetables	-13.53	12.72	-12.17	12.83
Price of egg	14.47***	4.130	20.66***	7.757
Price of meat	0.437**	0.171	0.212	0.238
Price of fish	-0.141	0.117	-0.131	0.117
Price of milk & dairy products	5.554	23.54	5.171	23.58
Price of sweet & sweeteners	1.276	29.22	1.007	29.29
Price of miscellaneous food	-0.917	11.81	-0.438	11.83
Price of non-food items	-0.968***	0.0615	-0.958***	0.0616
Explosions and remote violence (0/1)	-0.0599***	0.0196	-0.0715***	0.0220
Riots and protests event (0/1)	-0.0755***	0.0273	-0.0685**	0.0323
No violent events (Base)				
Household experienced at least 2 shock events (0/1)	-0.00774	0.0174	-0.00986	0.0173
Household in the low income tercile (0/1)	-0.219***	0.0268	-0.219***	0.0268
Household in the middle income tercile (0/1)	-0.0855***	0.0201	-0.0860***	0.0201
Household in the high income tercile Base				
Father has education above primary (0/1)	0.0554**	0.0246	0.0551**	0.0245
Household with married couple (0/1)	0.0259	0.0307	0.0261	0.0306
Household practices agriculture (0/1)	0.0604**	0.0296	0.0620**	0.0297
Household head is male (0/1)	-0.113*	0.0650	-0.113*	0.0652
Household head is less than 30 years old (0/1)	-0.0819**	0.0401	-0.0790*	0.0404
Household head is between 30 and 49 years old (0/1)	-0.0876***	0.0330	-0.0839**	0.0331
Household head is 50 years old and above Base				
Violence and Food Prices Interaction				
Riots and protests event #Price of cereal			0.574	0.876
Explosions and remote violence #Price of cereal			0.494	0.525
Riots and protests event #Price of root & tuber			-0.885	0.642
Explosions and remote violence #Price of root & tuber			0.000542	0.394
Riots and protests event #Price of pulses			0.228	1.955
Explosions and remote violence #Price of pulses			0.620	1.271
Riots and protests event #Price of fat & oil			5.719***	1.961
Explosions and remote violence #Price of fat & oil			-0.330	1.141
Riots and protests event #Price of fruits			-30.54	28.03
Explosions and remote violence #Price of fruits			13.27	24.76
Riots and protests event #Price of egg			-10.91	10.95
Explosions and remote violence #Price of egg			-9.925	8.973
Riots and protests event #Price of meat			1.148**	0.540
Explosions and remote violence #Price of meat			0.227	0.339
Constant	7.937***	0.0673	7.935***	0.0675
Observations	8,017		8,017	
Number of hhid	4,644		4,644	
R-squared	0.114		0.119	

*** p<0.01, ** p<0.05, * p<0.1

Besides food prices and conflicts, other covariates that contribute to the probability of household having a wasted child are the economic status of households (either as the low or medium income level), household head younger than 30 years, occurrence of child morbidity, parental education level at primary and below, and large household size. Household with at least a morbid child produce a depressing effects on wasting. Human capital, captured as parental education is found to have positive growth effect on food security while also reducing wasting. Education is an important contribution to household food and nutrition security. Similar result has been reported in some studies in Nigeria (Fadare *et al.,* 2019a). Higher household size and older mother can have a growth effect on wasting reduction. More members within the households may increase competition for resource allocation, especially in rural poor settings (Fadare *et al.,* 2019b).

Generally, strong positive relationship was established between conflict and reduction in calorie intake. This may be a direct consequence of reduction in farming activities and agricultural productivities in conflict-affected areas as the result also suggests that agricultural households increase calorie intake. Meaning that any disruption in agricultural activities of these households may have a negative effect on the amount of calorie available for households. On the other hands, the decrease likelihood of wasting among households in conflict-prone areas (riot and protests) despite relatively low level of calorie intake may be indicative of access to certain nutrition-related non-food factors capable of reinforcing the available calorie intake in the areas.

Table 5. Regression result of effect of food price and conflict on child wasting

Child wasting (WHZ<-2 SD)	Model 1		Model 2	
	Coefficient	**Std. Err.**	**Coefficient**	**Std. Err.**
Prices of cereal	1.657**	0.838	2.791**	1.088
Price of root & tuber	0.263	0.803	0.421	0.799
Price of pulses	-4.022**	1.772	-5.945***	2.035
Price of fat & oil	3.354*	1.820	4.436**	2.084
Price of fruits	-56.42	57.29	-61.32	57.17
Price of vegetables	24.66	49.79	19.56	49.87
Price of egg	1.954	21.06	0.0326	20.92
Price of meat	0.600	0.772	0.632	0.773
Price of fish	2.030***	0.701	1.918**	0.894
Price of milk & dairy products	187.3***	60.31	221.2***	68.85
Price of sweet & sweeteners	102.1	87.04	97.91	86.87
Price of miscellaneous food	-24.89	44.66	-21.65	44.62
Price of non-food items	-0.330	0.237	-0.286	0.237
Explosions and remote violence (0/1)	-0.112	0.0725	-0.0333	0.0813
Riots and protests event (0/1)	-0.258**	0.131	-0.277*	0.163
No violent event Base				
Household experienced at least 1 shock event (0/1)	0.0112	0.0659	0.0104	0.0660
Household in the low income tercile (0/1)	0.170*	0.0968	0.158	0.0968
Household in the middle income tercile (0/1)	0.203**	0.0850	0.194**	0.0850
Household in the high income tercile Base				
Father had education above primary (0/1)	-0.166**	0.0818	-0.156*	0.0820
Mother had education above primary (0/1)	-0.276***	0.0786	-0.270***	0.0787
Household with married couple (0/1)	0.0567	0.105	0.0607	0.105
Household practices agriculture (0/1)	0.0104	0.0842	0.0167	0.0843
Household head is male (0/1)	0.0418	0.0924	0.0383	0.0923
Household head is less than 30 years old (0/1)	0.240**	0.105	0.235**	0.105
Household head is between 30 and 49 years old (0/1)	-0.0200	0.0841	-0.0178	0.0841
Household head is 50 years old and above Base				
Household size is 5 and below (0/1)	-0.372*	0.196	-0.402**	0.196
Household size is 6 to 10 (0/1)	-0.375**	0.183	-0.404**	0.183
Household size is 11 to 15 (0/1)	-0.361**	0.181	-0.383**	0.181
Household size is 16 and above Base				
Household consumed 6 of 12 food groups previous week (0/1)	-0.102	0.135	-0.0976	0.135
Household had at least a morbid child (0/1)	0.158**	0.0642	0.159**	0.0643
Household had improved sources of drinking water (0/1)	0.0297	0.0690	0.0231	0.0691
Household used improved toilet (0/1)	-0.0249	0.0663	-0.0159	0.0664
Violence and Food Prices Interaction				
Riots and protests event #Price of cereal			-3.178	4.342
Explosions and remote violence #Price of cereal			-3.357*	1.769
Riots and protests event #Price of pulses			20.88*	11.22
Explosions and remote violence #Price of pulses			7.480	4.697
Riots and protests event #Price of fat & oil			16.17	10.80
Explosions and remote violence #Price of fat & oil			-6.686	4.543
Riots and protests event #Price of fish			1.384	5.406
Explosions and remote violence #Price of fish			0.242	1.456
Riots and protests event #Price of milk & dairy products			-91.40	270.3
Explosions and remote violence #Price of milk & dairy products			-143.9	152.8
Constant	-0.673**	0.282	-0.688**	0.282
Observations	2,872		2,872	
Number of hhid	2,083		2,083	

*** p<0.01, ** p<0.05, * p<0.1

6. Concluding Remarks

Food insecurity and malnutrition are being worsened in countries that are exposed to armed conflict, Nigeria as an example. Conflict-induced food price shocks often time results from decrease in agricultural productivities and market disruption which can lead to higher transactions costs. Humanitarian assistance are being extended to households in conflict-prone region to cushion the effect of food price shocks on food security and nutrition of the people. It could also be hypothesized that other areas less prone to conflict may not be better off as a result of spillovers such conflict may create. We used a nationally representative household panel data with conflict events data to examine, among others, the roles of conflicts and shocks in food prices in determining calorie intake and acute malnutrition among children in Nigeria. We estimated the fixed effect and the random effect on the panel data on the model I and II respectively, having being validated as the more appropriate for each model based on Hausman's test.

Our results show that food price shocks (cereal, and root and tuber in particular) is strongly and positively associated with low calorie intake and wasting. This implies that the price shocks had a direct negative growth effect on the purchasing power of the households. Though shocks in the price of some food groups are seeing contributing to more calorie intakes and showing a likelihood of reducing child wasting experienced by household. The result shows a general trend that increases in food prices especially staples has a depressing effects on food security and nutrition. Moreover, exposure to all forms of violent conflicts dampened household food security, while exposure to riots and protests event type had decrease likelihood of wasting among households in that areas. The decrease likelihood of wasting among households in conflict-prone areas may be indicative of access to certain nutrition-related non-food factors capable of reinforcing the available calorie intake in the areas. Although sensitively guided food pricing policy and prevention of conflicts are critical for improve calorie intake and nutrition outcome, greater reduction in wasting prevalence may be achieved if other nutrition-related factors are considered. Efforts to curtail extreme price rise, prevent conflicts (such as farmer-herder violence and communal violence), and provide healthy condition that reduces child morbidity should be intensified to enhance calorie intake and reduce acute malnutrition in the country.

References

Adebayo, O., Olagunju, K., Kabir, S.K. and Adeyemi, O. 'Social crisis, terrorism and food poverty dynamics: evidence from Northern Nigeria'. *International Journal of Economics and Financial Issues*, Vol. *6*, (2016) pp.1865-1872.

Akerele, D., Sanusi, R.A., Fadare, O.A. and Ashaolu, O.F. 'Factors influencing nutritional adequacy among rural households in Nigeria: How does dietary diversity stand among influencers?.' *Ecology of food and nutrition*, Vol. *56* (2017), pp.187-203.

Andreyeva, T., Long, M.W. and Brownell, K.D. 'The impact of food prices on consumption: a systematic review of research on the price elasticity of demand for food'. *American journal of public health*, Vol. 100 (2010), pp.216-222.

Brinkman, H.J., De Pee, S., Sanogo, I., Subran, L. and Bloem, M.W. 'High food prices and the global financial crisis have reduced access to nutritious food and worsened nutritional status and health.' *The Journal of nutrition*, Vol. 140, (2009) pp.153S-161S.

Carroll, G. J., Lama, S. D., Martinez-Brockman, J. L., and Pérez-Escamilla, R. 'Evaluation of Nutrition Interventions in Children in Conflict Zones: A Narrative Review.' *Advances in Nutrition*, Vol. *8* (2017), pp. 770-779.

De Onis, M., Blössner, M., Borghi, E., Morris, R. and Frongillo, E.A. Methodology for estimating regional and global trends of child malnutrition. *International journal of epidemiology*, Vol. *33* (2004), pp.1260-1270.

Ecker, O., Maystadt, J. F., and& Guo, Z. (2019). '*Can unconditional cash transfers mitigate the impact of civil conflict on acute child malnutrition in Yemen?: Evidence from the national social protection monitoring survey'* Vol. 17 (2019). International Food Policy Research Institutes.

Fadare, O., Amare, M., Mavrotas, G., Akerele, D. and Ogunniyi, A. 'Mother's nutrition-related knowledge and child nutrition outcomes: Empirical evidence from Nigeria.' *PloS one*, Vol. *14* (2019), p.e0212775.

Fadare, O., Mavrotas, G., Akerele, D. and Oyeyemi, M. 'Micronutrient-rich food consumption, intra-household food allocation and child stunting in rural Nigeria'. *Public health nutrition*, Vol. *22* (2019), pp.444-454.

FAO, I., 2016. WFP (2015), 'The State of Food Insecurity in the World 2015. Meeting the 2015 international hunger targets: taking stock of uneven progress.' *Food and Agriculture Organization Publications, Rome.*

FAO, IFAD, UNICEF, WFP and WHO. 2017. The State of Food Security and Nutrition in the World 2017. Building resilience for peace and food security. Rome, FAO.

Grote, U. (2018). IFPRI: Global Food Policy Report 2018. *Food Security: The Science, Sociology and Economics of Food Production and Access to Food*, *10*(6), 1665-1667.

Justino, P., 'Violent conflict and human capital accumulation'. *IDS Working Papers*, (379), (2011) pp.1-17.

Mavrotas, G. (ed.) (2011), *Security and Development,* Edward Elgar Publishers.

Mkhawani, K., Motadi, S.A., Mabapa, N.S., Mbhenyane, X.G. and Blaauw, R. 'Effects of rising food prices on household food security on female-headed households in Runnymede Village, Mopani District, South Africa.' *South African Journal of Clinical Nutrition*, Vol. 29, (2016) pp.69-74.

NBS (National Bureau of Statistics) and World Bank. (2013). 'Living Standards Measurement Study-Integrated Surveys on Agriculture (LSMS-ISA). Nigeria Post-harvest Survey Data.' www.worldbank.org/lsms-isa.

NBS (National Bureau of Statistics) and World Bank. (2016). 'Living Standards Measurement Study-Integrated Surveys on Agriculture (LSMS-ISA). Nigeria Post-harvest Survey Data.' www.worldbank.org/lsms-isa.

NDHS (2013). National Population Commission and ICF International. Nigeria Demographic and Health Survey 2013'. Abuja, Nigeria, and Rockville, Maryland, USA: NPC and ICF International. 2014.

Ojewale, O. and Appiah-Nyamekye, J., 2018. 'Nigerians worried about violent clashes, praise government efforts to address armed extremism.'

Ojewale, O., and Appiah-Nyamekye, J. (2018). Nigerians worried about violent clashes, praise government efforts to address armed extremism.

Okoli, A.C. and Atelhe, G.A. 'Nomads against natives: A political ecology of herder/farmer conflicts in Nasarawa state, Nigeria.' *American International Journal of Contemporary Research*, Vol. *4* (2014), pp.76-88.

Raleigh, C., Linke, A., Hegre, H. and Karlsen, J. 'Introducing ACLED: an armed conflict location and event dataset: special data feature.' *Journal of peace research*, Vol. *47* (2010), pp.651-660.

ReliefWeb 2019. "Needs Humanitarian Overview." ReliefWeb, February, 2019. https://reliefweb.int/sites/reliefweb.int/files/resources/01022019_ocha_nigeria_humanitarian_needs_overview.pdf

Thompson B (2009). Impact of the Financial and Economic Crisis on Nutrition – Policy and Programme Responses. Rome: FAO.

Verwimp, P., Bundervoet, T. and Akresh, R., 2010. '*The Impact of Violent Conflict on Child Health: What Are the Channels?'* (No. 6). MICROCON-A Micro Level Analysis of Violent Conflict.

Von Grebmer, K., Bernstein, J., Nabarro, D., Prasai, N., Amin, S., Yohannes, Y., Sonntag, A., Patterson, F., Towey, O. and Thompson, J., (2016). '*2016 Global hunger index: Getting to zero hunger*.' International Food Policy Research Institute.

World Bank (2018), Fragility Conflict and Violence, World Bank, Washington, DC. Accessed at: http://www.worldbank.org/en/topic/fragilityconflictviolence.

World Health Organization. (2018). '*The State of Food Security and Nutrition in the World 2018: Building climate resilience for food security and nutrition*.' Food & Agriculture Organization.