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HOW CONFLICTS AFFECT LAND EXPANSION BY SMALLHOLDER FARMERS: EVIDENCE FROM NIGERIA

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ACRONYMS

ACLED	Armed Conflict Location and Event Data
APRA	Agricultural Policy Research in Africa
BAY	Borno, Adamawa and Yobe
BH	Boko Haram
CPI	casualties per incident
FH	Fulani herdsmen
IDP	internally-displaced person
IDS	Institute of Development Studies
LCF	large commercial farm
LGA	local government area
MSF	medium-sized farm
PRIO	Peace Research Institute of Oslo
SHF	smallholder farmer
SME	small and medium-sized enterprise

EXECUTIVE SUMMARY

The expansion of smallholder farms into larger farm sizes is a key strategy for growing agriculture in sub-Saharan Africa. This strategy could simultaneously expand farm incomes while addressing poverty since the majority of farms in sub-Saharan Africa are smallholder farms. While research has documented the adverse role of conflicts on agricultural production and the implications for land use, there is limited existing research on the possible role of conflicts in stymying the ability of smallholder farmers to transition into larger-scale farming. Specifically, evidence is lacking on the impacts of conflicts in areas that are not directly within active conflict zones.

In this paper, we investigate the impacts of conflict on the ability of smallholder farmers (SHFs) to transition to larger scales in two regions that are not in a traditional conflict zone. To guide our empirical analysis, we develop a household utility maximisation model to explain choices made by farm households in response to conflict. Conflict types examined include riots, demonstrations, battles, farmer–herder conflicts, and terrorist attacks, but we use associated fatalities as a single standard conflict intensity measure. The use of the database obtained by Agricultural Policy Research in Africa (APRA) allowed us to observe the impact of conflict intensity on agriculture in the Kaduna and Ogun states of Nigeria, two regions that are not in a traditional conflict zone.

We find that increased conflict intensity reduces the likelihood of farmers expanding from small to larger land-holdings, with a more detrimental effect on the ability to engage in farm-led, vis-à-vis non-farm-led, expansion supported by off-farm activities. This suggests that conflicts are not only detrimental to agricultural production in nearby non-conflict zones, but they also diminish the ability of smallholder farmers to scale up. We also find that droughts negatively impact on farm transition, also with more detrimental effects on the probability of farm-based, vis-à-vis, non-farm-based transition. This finding suggests that drought effects include limits on the expansion of smallholder farms. We further find that education, assets, and off-farm income opportunities aid the transition of SHFs to larger-scale farming. This highlights the possible roles of resilience factors in mitigating the effects of shocks.

Given the findings summarised above, our study highlights the need for policymakers to be concerned about the detrimental effects of conflict on the abilities of farmers to scale up their operations, even beyond areas known to be major active conflict zones. We therefore recommend that policymakers consider the roles of conflicts in designing policies and programmes aiming to improve the ability of farmers to transition from small to medium/large-scale farming.

Keywords: conflicts, smallholder farmers, farm expansion, APRA, fatalities, Kaduna, Ogun, Nigeria.

1 INTRODUCTION

The term 'smallholder farmers' (SHFs) refers to farmers operating small land parcels.[1] About 41 million of the total of 51 million farms in Africa (80 per cent) are SHFs operating less than two hectares (ha) (Lowder, Skoet and Raney 2016).[2] While these SHFs only produce 30 per cent of Africa's total agricultural output (Herrero *et al*. 2017), their products are mainly for subsistence (home use) and domestic (in-country) consumption. Therefore, SHFs play an important role in Africa's food security. The fact that SHF households represent about 70 per cent of Africa's total population further suggests that they are key to poverty alleviation in many countries (*ibid*.).

Given their large population and low-income status, it is hard to imagine how poverty and food insecurity can be substantially reduced in Africa without transforming SHFs in one form or another. Indeed, there are two key options to simultaneously address poverty, increase agricultural-based employment, improve food security, and mitigate the security implications of underemployment in rural areas where most SHFs live in Africa (see AGRA 2017). Option 1 is to improve the productivity of SHFs and better connect them to the growing number of larger producers and small to medium enterprises (SMEs) along the value chain, thereby improving their incomes and employment capacity. With mixed cropping, SHFs already show impressive capacity to create jobs (FAO and OECD 2014). Option 2 is for SHFs to transition into larger-scale farmers who are already (a) growing in number, (b) better connected to market opportunities, (c) showing significant downstream and upstream impacts on the entire food value chain, and (d) showing huge multiplier effects on the overall economy (Hazell 2017).

Regarding option 1, the number of SHFs is increasing in most countries (Djurfeldt, Aryeetey and Isinika 2011). However, a Nigerian study by Muyanga *et al*. (2019), shows that only 6 per cent of farms which started off small were able to transition to medium-sized farms (MSFs) in three decades. Those not able to transition must improve efficiency and productivity and employ more people in order to help move people out of poverty and food insecurity. How far the productivity and efficiency of SHFs can increase without expanding their farmland base is an important policy-related question.

Regarding option 2, several issues arise. First, because the MSFs and large commercial farms (LCFs) that the SHFs can aspire to grow into are typically more mechanised and use less labour-intensive technologies, it is unclear whether the employment benefits from having fewer but larger farms will outweigh those of having many smaller farms. Second, if indeed many SHFs are displaced as MSFs grow in number, how would they now be employed and would this create even more poverty? Third, given the myriad of existing obstacles to their transition, how easy will it be to scale up SHFs? These policy and strategy options can only be optimally balanced if quality evidence-based information exists on the plight of SHFs in Africa.

The rapidly growing middle class and recent urbanisation trends in many parts of Africa present new opportunities to pursue the two strategy options above simultaneously. With these trends, the demand for processed foods, meats, fruits, vegetables, and similar products, which many SHFs do not currently actively produce, is growing rapidly (Reardon *et al*. 2014). Because these products are now largely imported, the economies of many African countries face extra foreign exchange burdens (Shaban 2017). With appropriate policies and programmes, SHFs can be aided to either take advantage of these opportunities at their current scale or at their scaled-up levels. Recent evidence of changing land ownership structures in sub-Saharan Africa and of a growing number of MSFs (Chamberlin, Jayne and Headey 2014; Jayne, Meyer and Traub 2014) further suggests that scaling up SHFs is indeed possible.

Farmers with the capacity to scale up and benefit from being larger must overcome various obstacles to their expansion. Many studies have documented the constraints that mitigate the ability of SHFs to expand their land base (AGRA 2017; Graeub *et al.* 2016; FAO 2011).[3, 4] However, in the literature, limited attention has been devoted to the roles of conflicts as barriers to the scale-up of SHF land-holdings. In the existing literature, conflicts have been shown to be detrimental to agricultural production, as they affect cropping

practices (Bozzoli and Brück 2009) and reduce agricultural productivity and the outputs of specific crops (Adelaja and George 2019a). This is partly because conflicts constrain access to labour (Kondylis 2010) and optimal land use and allocation choices (Adelaja and George 2019b), while adversely affecting the optimal investment choices of farmers (Arias, Ibáñez and Zambrano 2018). Anecdotal evidence also suggests that product and input markets are adversely affected, as conflicts reduce access to farm inputs and reduce market opportunities and raise product prices (Awodola and Oboshi 2015). Evidence is also growing that climate-related factors exacerbate the challenges emanating from conflict, thereby adversely affecting agriculture independently (Niles and Salerno 2018; Moore, Baldos and Hertel 2017). Improved evidence on the detrimental effect of conflict on the ability of SHFs to scale up is therefore needed.

The human displacement effects of conflicts are often quite visible, especially where conflict has been persistent for longer periods and involves significant human casualties (Haar and Leeuwen 2019). In many conflict zones, farmers have to migrate and become internally-displaced persons (IDPs) or refugees (UNHCR 2018). There is growing evidence that conflicts result in increased demand for land, even in distant places, as IDPs seek to resettle and regain their livelihoods (Haar and Leeuwen 2019). That is, the impacts of conflict can be palpable beyond the immediate conflict zones. Therefore, one expects that conflicts are added barriers to the scale-up of SHFs, even in places that are distant from a major conflict zone. This highlights the importance of understanding how conflict impacts on the ability of SHFs to scale up beyond conflict zones.

Nigeria is a perfect laboratory to explore the added burdens facing SHFs in expanding their land-bases. The ongoing Boko Haram (BH) insurgency in the northeast states of Borno, Adamawa, Yobe, Bauchi, Gombe, and Taraba resulted in over 2.5 million IDPs and over 300,000 international refugees in Chad, Niger, and Cameroon (UNHCR 2018). Some of these IDPs are now residents of formal and informal IDP camps across the north while others have moved to and established more permanent residency in places such as Abuja, Kaduna State, and Kano State. More recently, these destination places have also experienced increased pastoral violence, as Fulani herdsmen (FHs), who historically only grazed their animals seasonally in the Middle Belt and Southern Nigeria, are increasingly grazing at these destinations and for longer periods of time. In addition, Northern Nigeria, including Kaduna State, has experienced growing drought incidents as a result of climate change. It has also experienced growing incidents of many forms of violence.

The recently completed APRA survey for Nigeria provides a rare opportunity to obtain answers to fundamental policy questions on critical impediments to the transition from SHFs to MSFs and LCFs. Survey questions yielded information on key standard exogenous factors (variables) which can shape farm production, profitability, and land-use decisions. The section of the survey which focused on farmers who made the transition to larger-scale farming is an upgrade over many conventional data sets, as it allows deeper exploration of the roles of various factors in the process of transitioning to larger-scale farming. For example, the roles of conflict-related variables, climate factors, assets, historical land tenure factors, and farm management factors in facilitating the scale-up of farming activities can be discerned through statistical analysis. Results from such analysis are useful in determining which factors can be shaped through policy to enable households to expand the scales of their operations.

The APRA survey covered Kaduna State (in the northwest of Nigeria) and Ogun State (in the southwest of Nigeria). Although the bulk of the BH attacks were in the northeast of Nigeria, Kaduna State experienced several direct attacks from BH (ACLED 2019). Kaduna State also experienced spillover effects of BH's direct attacks in the northeast in terms of an increase in numbers of IDPs, and possibly through impacts on input and product markets, as well as interstate trade. Kaduna State farmers also faced instances of FH conflicts resulting from transhumance. Therefore, data from Kaduna allows deeper analysis of the possible effects of conflict in an area that is not an active conflict zone like the northeast. In Ogun State's case, BH's presence was not significant, but other minor conflicts occurred. Because the APRA survey data is geocoded, it can be spatially joined with Armed Conflict Location and Event Data (ACLED) to accurately measure the exposure of each farm household to conflict-related events. Similar analysis is possible for other forms of extraneous shocks (e.g. climate-related factors).

In this study, we examine the effects of conflict on the ability of SHFs to expand their operations. Our conflict incidents range from the more extreme and lethal ones such as terrorist attacks, pastoral violence, and other battles, to the less lethal ones such as protest and riots. Since we base our study on data from Kaduna and Ogun states, two very different states in terms of conflict exposure by type, we standardise our measure

of conflict exposure by focusing on fatalities from conflicts as the indicator of conflict intensity.[5] We also explain the roles of control variables such as climate-related factors (e.g. precipitation, temperature, and droughts) and factors reflecting farm and household structures (e.g. education, inheritance, off-farm income, and assets).

The rest of this paper is organised as follows. In Section 2, we explain the APRA data from Kaduna and Ogun states on conflict and other hypothesised exogenous factors, and review the literature on the relationships between conflict and agriculture, land, and other factors important to farm households. We then briefly explore the implication of existing research for the scale-up of farmers. In Section 3, we present a conceptual model to explain the roles of conflict shocks in farmers' decisions to expand their operations. In that section, we also present our main research questions or hypotheses: (1) 'How does conflict affect the transition potential from SHF to larger operations', and (2) 'How does conflict affect whether the transition is farm-led (funded through farm operations) or non-farm-led?' (funded through off-farm activities). In Section 4, we describe Kaduna and Ogun states, our research venues; the nature of the data;[6] our various control factors; and our empirical framework. In Section 5, we present and explain our main empirical results. Our conclusions and policy recommendations appear in Section 6.

2 UNDERSTANDING THE IMPACTS OF ARMED CONFLICT ON AGRICULTURE

We define armed conflict as a state of open, often prolonged fighting, battle or war, arising from disagreement or disharmony between persons, groups or ideas, where physical force is used to resolve competing claims or interests. While a violent conflict may involve only non-state actors, often, the term refers to violence involving at least one government. Conflicts range from civil unrest (e.g. rioting or protesting) to more lethal and complex forms (e.g. group violence, remote violence, civil wars and terrorist attacks).

From 1997 to 2018, ACLED (2019) reports 13,339 incidents of violent conflicts for Nigeria; 2,962 for the northeastern states of Borno, Adamawa and Yobe (BAY states), the three primary states at the centre of Boko Haram attacks; 543 incidents for Kaduna State and 236 incidents for Ogun State (see Table 6.1). The corresponding casualties are 67,361 (5.04 per incident), 30,359 (10.25 per incident), 5,738 (10.57 per incident), and 333 (1.41 per incident) respectively (see Table 6.1). Kaduna State is not located in the northeast, which houses the BAY states. However, the intensity of its exposure to conflict, measured by casualties per incident (10.57), surpasses the national average (5.04) and the average for the BAY states (10.25).

Table 6.1 Armed conflict incidents and casualties in Nigeria, 1997–2018

Year	Incidents				Casualties			
	Nigeria	BAY States	Kaduna	Ogun	Nigeria	BAY States	Kaduna	Ogun
1997	144	1	3	3	481	0	1	4
1998	155	7	6	3	1305	46	52	0
1999	205	5	10	7	1804	14	133	56
2000	169	9	24	3	3348	34	1904	3
2001	120	16	4	9	2196	50	21	24
2002	163	11	5	2	1155	70	250	10
2003	207	18	2	3	977	104	17	1
2004	277	19	4	1	2389	53	0	2
2005	198	6	2	8	108	4	4	12
2006	120	9	0	2	126	24	0	7
2007	200	14	1	1	335	18	0	0
2008	209	9	3	7	1002	29	2	7
2009	228	23	9	4	2219	819	3	25
2010	482	40	8	11	1912	44	20	12
2011	347	126	42	0	2481	544	1323	0
2012	923	301	63	17	2980	1241	270	12
2013	1,052	288	41	29	4721	2887	150	14
2014	1,513	406	63	32	11538	7565	537	10
2015	1,674	448	49	22	10933	8602	432	8
2016	1,406	331	58	24	4884	2871	200	98
2017	1,636	445	61	23	4850	3103	126	16
2018	1,911	430	85	25	5617	2237	293	12
TOTAL	13,339	2,962	236	543	67361	30359	5738	333

Source: ACLED (2019).

In addition to sporadic BH attacks, Kaduna has been the venue of various violent uprisings, including ethnic, communal, religious and pastoral clashes (see Table 6.2). In contrast, Ogun State in the southwest region of Nigeria experienced relatively fewer conflict incidents and fatalities between 1997 and 2018. Furthermore, the main types of armed conflict in Ogun State were protests and riots, which can be considered as low-grade incidents. While Kaduna featured higher levels of FH, BH and military violence, the incidences were much lower in Ogun State. Note also the virtual absence of Christian and Muslim militia and Boko Haram violence in Ogun State.

Figure 6.1 provides information on the trajectories of violent conflicts in Nigeria, compared to the BAY states and Kaduna and Ogun states. Violent conflict increased in all locations, but the magnitude and rate of the increase in the nation and the BAY states outpaced Kaduna and Ogun states. Figure 6.2 compares the numbers for Kaduna and Ogun states. In Kaduna State, violent conflict started to spike in 2010, compared with Ogun State where it started to spike in 2011. By 2018, the number of incidents in Kaduna State was almost triple that of Ogun. Figures 6.3 and 6.4 further illustrate

Table 6.2 Armed conflict incidents in Kaduna and Ogun states by group, 1997–2018

Group name	Kaduna State	Ogun State
Fulani ethnic militia (Nigeria)	74	9
Boko Haram	28	0
Military forces and police	61	12
Unidentified armed group (Nigeria)	95	35
Protesters (Nigeria)	109	75
Rioters (Nigeria)	64	42
Christian militia (Nigeria)	13	0
Muslim militia (Nigeria)	8	0
Others	30	15
TOTAL	482	188

Source: ACLED (2019).

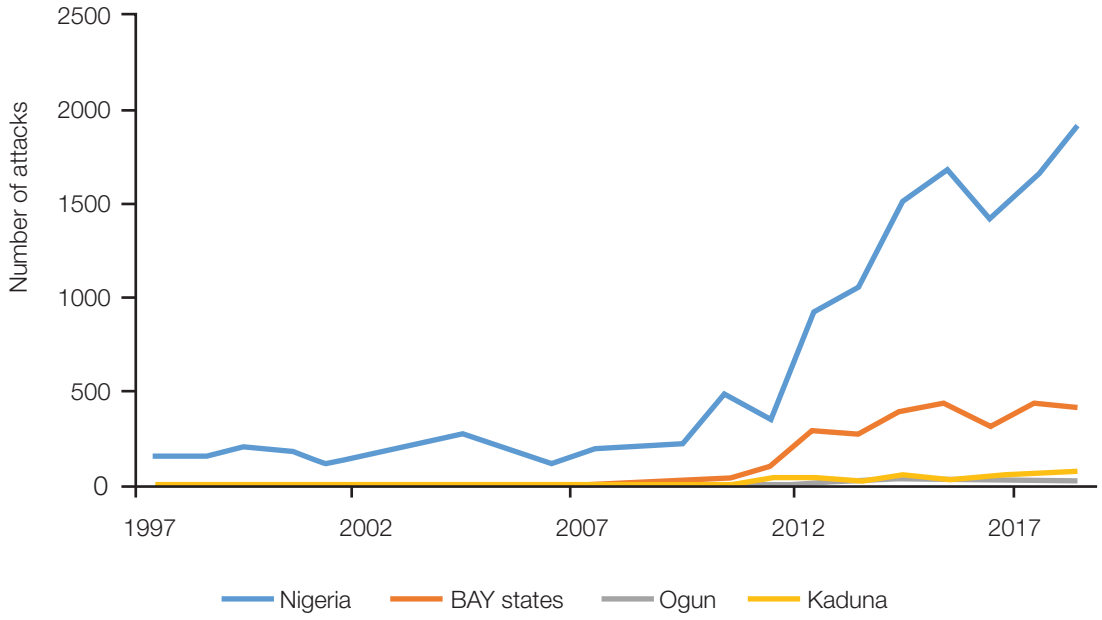
Table 6.3 provides further illustration of the types of armed conflict occurring in Kaduna and Ogun states. For every category of conflict, Ogun State experienced much fewer incidents of violence than Kaduna State. However, percentage-wise, Ogun State was more exposed to protests and riots while Kaduna State was exposed to more battles, pastoral violence, explosions (remote violence), and violence against civilians.[7] These explain the relatively higher numbers of casualties in the greater degree of fatality in Kaduna State, vis-à-vis Ogun, while Table 6.4 breaks down the nature of the incidents in both states. Based on existing literature, we expect that these conflicts adversely impacted on agricultural production, outputs, efficiency, land-use choices, and the agricultural crop mix. However, whether or not they affect the abilities of SHFs to scale up to larger scales is an empirical question, which this paper seeks to address.[8]

Table 6.3 Armed conflict incidents in Kaduna and Ogun states by type of violence, 1997–2018

Type of violence	Kaduna State		Ogun State	
	Number	Per cent	Number	Per cent
Battles	94	15.1	40	9.6
Explosions/remote violence	29	5.8	2	1.1
Protests	123	23.0	82	41.5
Riots	71	13.1	47	22.3
Strategic developments	22	3.7	4	2.1
Violence against civilians	208	39.2	61	23.4
Total	447	100%	236	100%

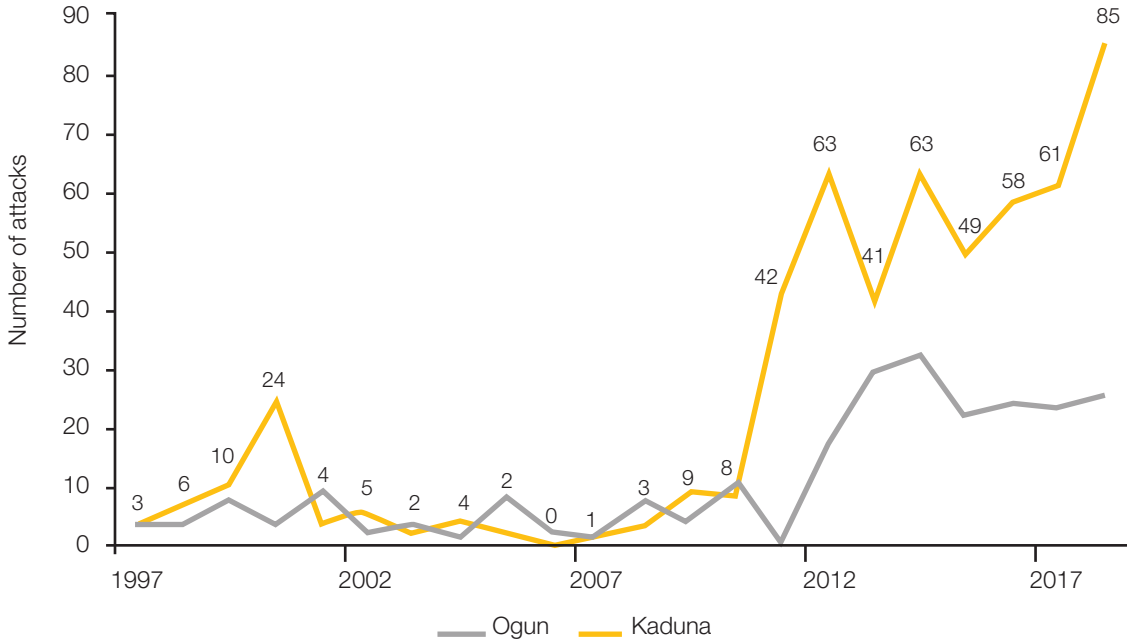
Source: ACLED (2019).

Figure 6.1 Armed conflict incidents in Nigeria, 1997–2018



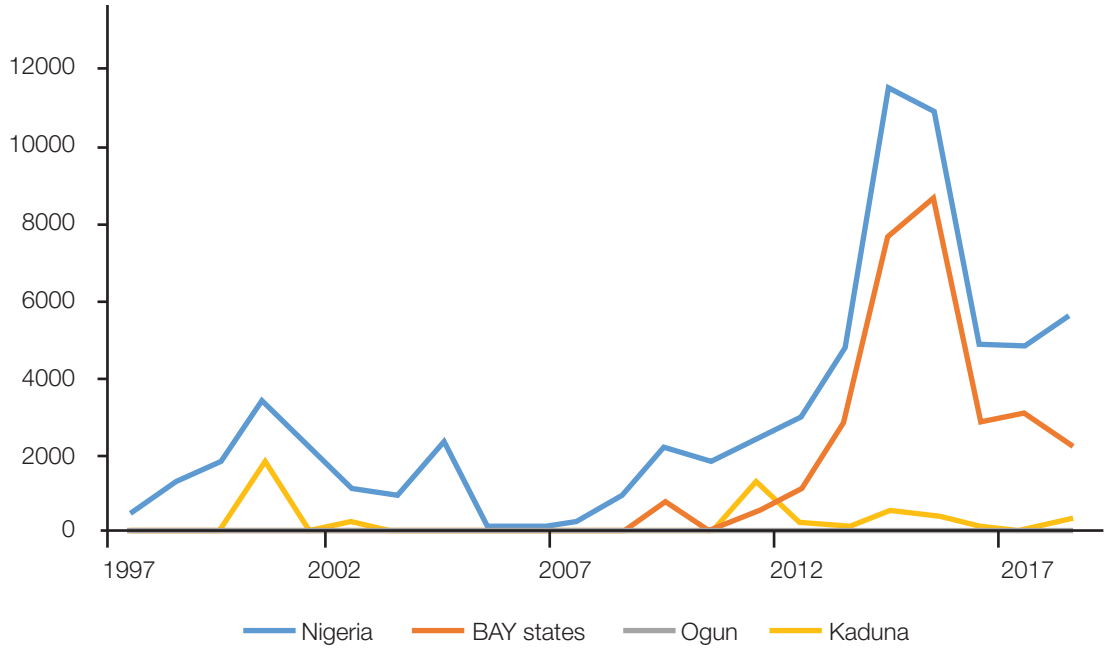
Source: ACLED (2019).

Figure 6.2 Armed conflict incidents in Kaduna and Ogun states, 1997–2018



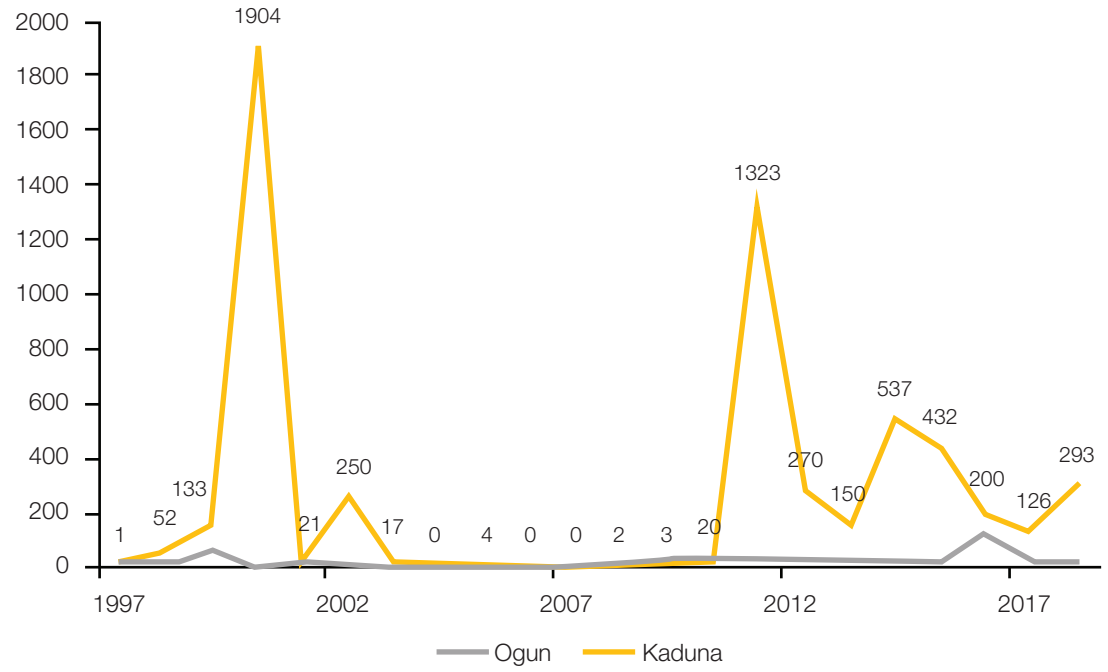
Source: ACLED (2019).

Figure 6.3 Fatalities from armed conflicts in Nigeria, 1997–2018



Source: ACLED (2019).

Figure 6.4 Fatalities from armed conflicts in Kaduna and Ogun states, Nigeria, 1997–2018



Source: ACLED (2019).

Table 6.4 Armed conflicts in Kaduna and Ogun states by subtype of violence, 1997–2018

Type of violence	Kaduna State	Ogun State
Abduction/forced disappearance	12	3
Agreement	1	0
Air/drone strike	0	0
Armed clash	93	40
Arrests	7	0
Attack	196	58
Change to group/activity	6	0
Disrupted weapons use	3	0
Excessive force against protesters	5	4
Government regains territory	1	0
Headquarters or base established	1	0
Looting/property destruction	3	4
Mob violence	25	22
Other	1	0
Peaceful protest	110	77
Protest with intervention	8	1
Remote explosive/landmine/IED	16	2
Shelling/artillery/missile attack	1	0
Suicide bomb	12	0
Violent demonstration	46	25

Source: ACLED (2019).

In areas where armed conflicts are persistent, livelihoods and food systems are significantly undermined, creating a vicious cycle, which results in extended and severe crises. While Kaduna State cannot be considered a conflict zone in terms of Boko Haram, the greater exposure to conflict, vis-à-vis Ogun State, suggests the possibility of a more discernible impact on agriculture. In other words, with respect to Nigeria, Ogun State can be considered a control state in terms of Boko Haram's impact on agriculture, while Kaduna State can be considered a medium-grade state, compared with the BAY states.

The above figures and diagrams beg a number of additional questions. First, since some forms of conflict retard agriculture (see Adelaja and George 2019a), did the type of conflict faced in Kaduna, which is not in the high conflict BAY states of the northeast, affect Kaduna's agriculture? Second, has the type of conflict faced in Ogun State, which is mostly related to riots and protests, affected Ogun State's agriculture? Third, does the greater incidence and fatalities from conflict in Kaduna State have different implications for the progress of agriculture? That is, has Kaduna's agriculture suffered more than Ogun's agriculture? Finally, what implications do these have for the ability of farms in each of the states to expand the bases of their operations? These are among the questions that motivate this study.

One cannot effectively explain the role of conflict in the ability of farmers to expand the scales of their operations without considering other explanatory or control factors. Examples that are particularly relevant in the context of Nigeria are droughts, natural disasters, and precipitation. According to the Global Report on Food Crises (FSIN 2018), these climate-related factors were the main drivers of food insecurity in half of the food crises of 2017.

Droughts are one of the main natural causes of agricultural, economic, and environmental change (Burton, Kates and White 1993; Wilhite and Glantz 1985). Droughts are also the main drivers of conflict. In the northeast, Lake Chad receded by over 80 per cent, adversely affecting the livelihood of farmers in the BAY states. Between 1978 and 2008 in Northern Nigeria, the annual average number of rainy days dropped from 150 to 120, over 350,000 square metres of an already arid region turned desert-like, and desertification progressed at the rate of 0.6 km per year (Federal Ministry of Environment 2012). In most states in Northern Nigeria, 50 to 75 per cent of land areas have become desert-like (International Crisis Group 2017).

Hence, we expect that Kaduna State is more exposed to drought than Ogun State.

With respect to natural disasters, Kaduna State experienced only one flood each in of 2003, 2009, 2012, and 2015, and a storm in 2016, but Ogun State experienced only one flood in 2001, three floods in 2007, and one flood in 2018 (CRED 2016). The total deaths from these natural disasters were 460 in Kaduna State and 192 in Ogun State. The highest number of deaths in Kaduna State was in 2012 (363) while the highest in Ogun State was in 2018, which was 101 deaths. These relatively rare occurrences, however, tend to affect a large number of people. For example, according to CRED (2016), the five incidents in Kaduna State affected 7,462,287 people while Ogun State's five incidents affected 72,872 people. Apparently, Kaduna State's incidents resulted in far more deaths and affected far more people.

3 CONCEPTUAL FRAMEWORK

If a farm household becomes exposed to conflict, its operations can be affected in a number of ways (see Adelaja and George 2019a, 2019b). First, as a result of possible human casualties, injuries, and disabilities, labour supply and quality may be reduced. Deaths, especially of the farm operator, can throw the family into disarray, thereby reducing family labour effort (see Adelaja and George 2019a). Injuries and disabilities can also result in reduced family effort while available hired labour can become scarce (*ibid*.). Furthermore, fears about possible recurrent events may encourage household members to stay close to home and not farm distant plots (Adelaja and George 2019b). The overall reduction in labour input may result in reduced production, land demand, and the desire to expand the farm's operations.

Second, depending on the nature of the conflict and how much destruction it causes, an affected farm household may abandon its operation and escape to other communities, thereby idling their land (*ibid*.). On the other hand, farmers who decide to stay may have access to more land from free transfers from friends and relatives who flee. Third, farmers who later return to their fields may meet with hostile conditions which prevent them from readily resuming normal farming operations. For example, ownership can become more contestable. Fourth, the rental price of land should fall.

Fifth, the impacts on cropping patterns should favour crops that are easier to manage and that meet subsistence needs, especially if input and output markets are adversely affected. Crops such as Cassava are easier to manage and can be left unattended for a while. Chauveau and Richards (2008) showed that such crops are more popular in conflict zones. Ultimately, conflict is expected to reduce the demand for land and, consequently, the desire to expand farmland use.

To further explore how a conflict-related shock may impact on the demand for land expansion, consider the case of a farm household with a planning horizon of $t = 0, 1, \ldots, T$. Note that T is the perceived terminal period. Following Adelaja and George (2019b), we represent the household's utility function as:

$$U(z_t, b_t) = \sum_{t=1}^{t=T} \gamma u(z_t) + \gamma^{T+1} \alpha(b_{t+1}), \quad (1)$$

where Z_t is goods consumed by the household, γ is a discount factor, b is household assets (including savings), and α is the rate of return from such assets. Assume the following farm household production function that is continuous, concave, and increasing in input arguments:

$$Q_t = Q(L_t, A_t, \epsilon_t) \quad (2)$$

where Q_t, L_t, and A_t are output produced, , labour used, and land actively farmed in time period t, respectively. Further assume that is an independently and identically distributed vector of random variables representing conflict- and climate-related shocks. Denote the full income of the farmer as I_t. We express the household's income constraint as the sum of farm profits and returns from assets owned or operated. That is,

$$I_t = w\bar{L} + a\bar{A} + PQ(L_t, A_t, \epsilon_t) - a_t A_t - w_t L_t + (1 + r)b_t \quad (3)$$

where, $\bar{L}$ respectively $\bar{A}$ is the labour endowment, P is the land endowment, is the output price, and a_t and w_t are the rental rate for land and the wage rate. Equation 3 can be expressed as:

$$I_t = \pi_t + (1 + r)b_t. \quad (4)$$

where π_t is the farm profit.

We assume that asset holdings, b , change over time as a function of income (I_t) and consumption (C_t) as follows:

$$b_{t+1} = I_t - C_t \quad (5)$$

From equations (4) and (5),

$$b_{t+1} = \pi_t + (1+r)b_t - C_t \quad (6)$$

Based on equations 1 to 6, $V^n(Q_t, b_t, \epsilon_t)$ is a value function for the household's problem for the t^{th} period. V^n is the maximum expected present value of the utility derived from periods t to T. The latter is a dynamic equivalent of the household's indirect utility function. The optimal choice of z_t, A_t, and L_t obtained by applying the implicit function theorem to the following problem:

$$\max_{z_t, A_t, L_t} \lambda_t = u(z_t) + \gamma E(V^{t+1}(Q_{t+1}, b_{t+1}, \epsilon_t)) \quad (7)$$

subject to

$$Q_{t+1} = f(L_t, A_t, \epsilon_t) \quad (8)$$

And

$$b_{t+1} = (1+r)b_t + PQ - wL_t - aA_t - Pz_t. \quad (9)$$

Note that E (.) denotes expected value.

From the first order conditions for optimal input choice, the input demand function is:

$$A_t = L(a, w, p, \epsilon) \quad (10)$$

From equation 10, the actual land in production, A_t, is a function of the rental rate for land, the wage rate, product prices, and conflict/climate-related shocks. However, actual land in production can be lower than total land owned/operated because the farmer can choose to idle some of the land. Furthermore, the farm household may have access to free land or land abandoned by neighbours and relatives. Therefore,

$$A_t = \bar{A} - A_{It} \quad (11)$$

where $\bar{A}$ is the family's ownership of land and A_{It} is the amount of land idled. Note that in equation (11), we assume that no land is rented in or out and no land is acquired or given away for free. However, equation 11 is easily adjusted to account for these possibilities.

Since $\bar{A}$ is purely fixed in the short term, A_{It} can be represented as:

$$A_{It} = A(a, w, p, \epsilon) \quad (12)$$

In the above, conflict-related shocks directly affect production, but input prices can also be affected. Conflict affects the demand for farmland mainly through the effects on the price of land and directly through ϵ. Taking the derivative of A_t with respect to conflict shocks, one obtains

$$\frac{\partial A_t}{\partial \epsilon} = \frac{\partial f}{\partial a} \cdot \frac{\partial a}{\partial \epsilon} + \frac{\partial f}{\partial \epsilon} \quad (13)$$

The first term on the right side of equation 13 is the change in land demand from lower land prices. As land values drop due to farm abandonment, land availability may increase for remaining households due to temporary management arrangements, caretaking opportunities, and free transfers. The second term is the production shock from a conflict shock through various inputs. The overall effect on farmland demand depends on the signs and relative magnitudes of both terms.

Now consider the fact that the decision of an SHF to scale up to a larger scale is dependent on the nature of his/her current land-holdings $(\bar{A})$, vis-à-vis demand (A_t). Equations 12 and 13 above relate to A_t, not $\bar{A}$. Recall that the current land-holding of the farmers $(\bar{A})$ is related to land demand as follows: $A_t = \bar{A} - A_{It}$. For an SHF, scale-up or transition to larger land size implies that $A_t > \bar{A}$ which requires that $A_{It} < 0$. In essence, excess demand for land $(A_{Et}) = (-A_{It})$. Since in equation 12,

$A_{It}=A(a,w,p,\epsilon)$, the same expression is valid for demand for for A_{Et},except that the expected signs will be the opposites. That is,

$$A_{Et} = A'(a,w,p,\epsilon) \quad (14)$$

where $A_{Et}=-A_{It}$ where $A_{It}<0$ Therefore, equation 13 can be modified as follows:

$$\frac{\partial A_{Et}}{\partial \epsilon} = -[\frac{\partial f}{\partial a}.\frac{\partial a}{\partial \epsilon}+\frac{\partial f}{\partial \epsilon}] \quad (15)$$

The anticipated sign of the effect of conflict on idled land is the opposite of the sign of the effect on excess demand for land, keeping land-holdings constant. Actual scale-up is, however, also a function of affordability, profitability, and other factors.

4 EMPIRICAL FRAMEWORK

4.1 Data

We mainly use three data sources: (1) the APRA household-level survey for data on agricultural outcomes, (2) the Armed Conflict Location and Event Data Project (ACLED) data set for data on armed conflict incidents and (3) the Peace Research Institute of Oslo (PRIO)-GRID data set for data on climate-related factors. The APRA survey records geographic coordinates for all households. Therefore, it was spatially joined with the other two data sets for this analysis. The APRA data set collects information on various household-level agricultural outcomes. Designed to correct for the under-representation of MSFs and LCFs in traditional Living Standard Measurement Surveys, it covers 2,110 households, with 49 per cent of them operating more than 5ha of land. It covers three local government areas (LGAs) each, from both Ogun and Kaduna states, representing both states equally (see Muyanga *et al*. 2019, for a detailed description of how the data were collected). The data set includes a special module on the ability of SHFs to transition to large scales. This allows us to construct our main dependent variables.

Our main dependent variable is a household's ability to transition from small-scale farming to medium/large-scale farming (whether a current MSF or LCF had transitioned from being an SHF in the last five years). Such transition happened to only about 6 per cent of the SHFs in the sample over the past 30 years, but to 47 per cent of current MSFs (*ibid*.). Other dependent variables include whether the transition was farm- or non-farm-led, as well as the methods of land acquisition. Each of these is coded as a binary variable to simplify our empirical analysis.

Our main independent variable is the household's exposure to conflict, measured by the number of fatalities that took place within predefined buffer zones (2, 10, and 20km radius) around each household. These variables were constructed using ACLED, which provides data on armed conflict events and non-violent protests in Africa and Asia by location (Raleigh *et al*. 2010). ACLED codes the actions of actors (such as government, ethnic groups, active political organisation, civilians, and militias), date of battle events, time precision, interaction type, number of fatalities, latitude, and longitude. In terms of attack types, it covers violent activities such as remote violence against civilians, militia interaction, protests, riots, remote violence, and battles. Regarding the conflict variables, the mean counts for conflict incidents were 0.14 within 2km from the farm, 3.58 within 10km from the farm, and 11.75 within 20km from the farm. The respective number of casualties were 0.74, 17.28, and 45.45, suggesting that on average, approximately about 5.15 casualties per incident (CPI) happened within 2km, 4.83 CPI happened within 10km, and 3.87 CPI happened within 20km. Note the diminishing casualty intensity with distance (see Table 6.5). The latter can be explained on the basis of the mix of conflicts in each state and the concentration of more deadly conflicts in Kaduna State.

Our control variables include climate-related factors (drought, temperature, and precipitation) and other factors (e.g. education levels, land inherited, total asset value, off-farm income levels, and migration status). Data on the climate-related factors are extracted from the PRIO-GRID version 2.0 data set (Tollefsen, Strand and Buhaug 2012). The drought variable measures the average proportion of the year the household's grid experienced drought conditions. This is obtained by dividing the number of days the grid experienced drought by the total number of days in a year. It is constructed using the Standardised Precipitation-Evapotranspiration Index (Beguería, Vicente-Serrano and Angulo-Martínez 2010). The average precipitation variable is the yearly total precipitation (in millimetres) in the grid, based on monthly meteorological statistics (Huffman *et al*. 2009). The average temperature variable is the yearly mean temperature (in degrees Celsius) in the grid, based on monthly meteorological statistics from Global Historical Climatology Network/ Climate Anomaly Monitoring System, developed at the Climate Prediction Center, National Oceanic and Atmospheric Administration/National Weather Service (Fan and van den Dool 2008). Other control factors include whether or not the head of the household had completed secondary education, the numbers of hectares inherited, total asset values in thousands of naira, whether or not the household recently migrated, and net off-farm income.

Table 6.5 Summary statistics

Variable	Total				Kaduna				Ogun			
	N	Mean	Min	Max	N	Mean	Min	Max	N	Mean	Min	Max
Dependent variables												
Transition from <5 to >5	1,204	0.10	0	1	583	0.09	0	1	621	0.12	0	1
Land acquisition by inheritance	2,110	0.74	0	1	1,045	0.81	0	1	1,065	0.68	0	1
Land acquisition by purchase	2,110	0.08	0	1	1,045	0.06	0	1	1,065	0.09	0	1
Land acquisition for free	2,110	0.01	0	1	1,045	0.02	0	1	1,065	0.00	0	1
Land acquisition by rent	2,110	0.10	0	1	1,045	0.03	0	1	1,065	0.16	0	1
Farm-led transition	1,204	0.09	0	1	583	0.07	0	1	621	0.11	0	1
Non-farm-led transition	1,204	0.02	0	1	583	0.02	0	1	621	0.01	0	1
Small-scale farming (<5ha)	2,110	0.51	0	1	1,045	0.51	0	1	1,065	0.51	0	1
Medium-scale farming (5–100ha)	2,110	0.49	0	1	1,045	0.49	0	1	1,065	0.49	0	1
Large-scale farming (>100ha)	2,110	0.00	0	1	1,045	0.00	0	0	1,065	0.00	0	1
Control variables												
Completed secondary education	2,110	0.05	0	1	1,045	0.05	0	1	1,065	0.06	0	1
Ancestral land (hectares)	2,110	12.56	0	2015	1,045	12.26	0	2015	1,065	12.87	0	2012
Asset value (1000s of Naira)	2,110	38.83	0	31407	1,044	27.10	0	10040	1,065	50.34	0	31407
Whether the household migrated	2,110	0.17	0	1	1,045	0.11	0	1	1,065	0.24	0	1
Net off-farm income (1000s of Naira)	2,110	263	-102	12416	1,044	231	-66	5880	1,065	295	-102	12416
Proportion of year in drought	2,110	0.08	0.00	0.08	1,045	0.08	0	0.08	1,065	0.08	0	0.08
Average precipitation	2,110	1536	932	1797	1,045	1287	932	1414	1,065	1781	1377	1797
Average temperature	2,110	27.26	25.25	29.09	1,045	26.15	25.25	29.08	1,065	28.35	28.20	28.45
Conflict variables												
Casualties (2km radius)	2,110	0.737	0	40	1,045	1.03	0	40	1,065	0.45	0	25
Casualties (10km radius)	2,110	17.28	0	434	1,045	29.35	0	434	1,065	5.44	0	41
Casualties (20km radius)	2,110	45.45	0	531	1,045	77.42	0	531	1,065	14.08	0	84

Source: ACLED (2019) and Muyanga *et al*. (2019).

In Table 6.5, we present the summary statistics from the various data sets that we used. The total number of observations from the APRA data for Kaduna and Ogun states are 1,045 and 1,065 respectively, for a total of 2,110. For the purpose of this study, we designate SHFs as those with less than five hectares, MSFs as those with five to 100 hectares, and LCFs as those with greater than 100 hectares. Based on our demarcation scheme, SMFs represent 51 per cent of the database while MSFs represent 48.8 per cent (same percentages in Kaduna and Ogun). Only one farm in the sample (.05 per cent) had over 100 hectares. Only 22 per cent of the MSFs had transitioned from SHFs within the previous ten years while 47 per cent had transitioned within the past three decades (Muyanga *et al*. 2019). About 75 per cent of all farms had acquired their land through inheritance, compared to 7.6 per cent through purchase and 1 per cent from no-cost (free) transactions.

Only 10 per cent of the farms in the overall sample rent their land from others. Only 15 per cent of farmers in the overall sample had completed primary education, while only 5 per cent had completed secondary education (slightly greater in Ogun State). On average, the farmers in our sample inherited 12.56 hectares (slightly greater in Ogun State). The average value of assets was N38,830 (much higher in Ogun State). The average net off-farm income was N363,000 (N231,000 in Kaduna and N295,000 in Ogun).

4.2 Empirical model

We estimate the impacts of exposure to pastoral violence on an agricultural outcome variable by mainly using the following logit model:

$$\tau_i = \frac{e^{X_i'\beta}}{1+e^{X_i'\beta}} \qquad (16)$$

where τ_i represents the probability of transition from small-scale farming to larger scales for household i. X_i represents the vector of all independent variables, including the main independent variable measuring each household's exposure to armed conflicts. This variable is measured as the total number of fatalities that happened within a given radius of the individual's location during the one year preceding the interview date. We use 2, 10, and 20km radii measures to construct the buffer zones. We also include multiple household-level control variables which could potentially impact the outcome variables, including education, land inherited, total asset value, off-farm income, and migration status. We implement the logit regressions by first pooling the data from both Ogun and Kaduna states and then treating both states separately. All regressions are estimated using standard errors clustered at the LGA level.

5 EMPIRICAL RESULTS

5.1 Effects of conflict intensity on the probability of transitioning from SHFs to larger sizes

Table 6.6 presents our results for the effects of conflict on our main dependent variable, the likelihood that a current MSF or LCF had transitioned from being an SHF within the previous five years. Because the specific survey question asked in which year the transition happened, we had some latitude in constructing this transition or scale-up variable. However, we selected five years to focus on more recent transitions and conflicts. The dependent variable is a dummy variable for which D=0 indicates a current SHF who did not transition into an MSF or LCF while D=1 indicates a current MSF or LCF which transitioned from being an SHF.

Table 6.6 Effect of conflict intensity on transition from smallholder to medium/large-scale farming

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable: whether the household transitioned from SHF to larger scales						
Fatalities (2km radius)	0.034			0.054		
	(1.64)			(2.64)		
Fatalities (10km radius)		-0.000			0.000	
		(-0.07)			(0.09)	
Fatalities (20km radius)			-0.001***			-0.002***
			(-3.18)			(-2.58)
Completed secondary education				1.321***	1.300***	1.364***
				(2.97)	(2.93)	(2.89)
Land inherited				-0.001***	-0.001***	-0.001***
				(-2.87)	(-3.07)	(-3.42)
Asset value				0.010	0.010	0.009
				(0.81)	(0.79)	(0.74)
Migration status				0.855***	0.828**	0.911***
				(2.75)	(2.58)	(3.06)
Net off-farm income				0.001***	0.001***	0.001***
				(3.12)	(2.97)	(3.22)
Proportion of year in drought				-19.155***	-18.819***	-17.427***
				(-5.01)	(-5.83)	(-6.01)
Precipitation				0.000	-0.000	-0.000
				(0.21)	(-0.27)	(-0.31)
Temperature				0.165	0.216*	0.141*
				(1.38)	(1.77)	(1.68)
Constant	-2.171***	-2.146***	-2.099***	-6.002**	-6.979**	-4.976***
	(-14.63)	(-15.57)	(-16.84)	(-2.27)	(-2.44)	(-2.78)
N	1204	1204	1204	1204	1204	1204
Pseudo-R2	0.00174	0.00000205	0.00224	0.0914	0.0875	0.0924

Notes: ***, ** and * signify, respectively, statistical significance at the 1 per cent, 5 per cent, and 10 per cent levels.
Source: ACLED (2019) and Muyanga *et al*. (2019).

The coefficients of the 2 and 10km conflict radii variables are statistically insignificant. However, for the 20km conflict radii variable, the coefficients are statistically significant and negative at the 1 per cent levels (-0.001 for model without controls and -0.002 for model with controls). That is, based on combined data from Kaduna and Ogun states, only conflicts occurring within 20km retard the probability of a larger farm having transitioned from SHF. This result suggests that it is the cumulative conflict in the broader area of a farm that affects the decision of the farm household not to expand its operation, not conflicts that occur in the more immediate vicinity. For any given farm, the 20km conflict count will clearly be larger than or equal to the 2 or 10km counts. These results may suggest that it is the concern about the broader environment or area of the farm that affects scale-up decisions.

As shown in Table 6.6, the drought variable, measured by the proportion of year that the grid that the household belongs to experienced drought, shows a statistically significant and negative association with the probability of a farm transitioning to a larger scale in the three models it features in. However, the relevant one is model 6, where at -17.427, the estimated coefficient suggests that drought conditions can impede the scaling up process for farmers. The temperature variable is statistically significant and positive at the 10 per cent

Table 6.7 Effect of conflict intensity on reasons for transitions

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: farm-led transition			Dependent variable: non-farm-led transition		
Fatalities (2km radius)	0.053***			0.038*		
	(2.71)			(1.91)		
Fatalities (10km radius)		-0.000			0.001	
		(-0.05)			(1.21)	
Fatalities (20km radius)			-0.003***			-0.001
			(-2.70)			(-0.54)
Completed secondary education	1.072**	1.053**	1.116**	1.950***	1.929***	1.965***
	(2.08)	(2.01)	(2.08)	(5.54)	(5.77)	(5.61)
Land inherited	-0.001**	-0.001***	-0.001***	-0.000	-0.000	-0.000
	(-2.42)	(-2.59)	(-2.71)	(-0.32)	(-0.33)	(-0.35)
Asset value	0.008	0.008	0.007	0.007*	0.007*	0.007*
	(1.00)	(0.98)	(0.91)	(1.89)	(1.89)	(1.72)
Migration status	0.961***	0.933***	1.006***	0.061	0.043	0.079
	(3.19)	(3.04)	(3.46)	(0.12)	(0.08)	(0.15)
Net off-farm income	0.000**	0.000**	0.000***	0.001	0.001	0.001
	(2.48)	(2.29)	(3.04)	(1.54)	(1.55)	(1.42)
Proportion of year in drought	-17.489***	-17.092***	-15.664***	-19.207***	-19.065***	-18.509***
	(-6.11)	(-7.55)	(-10.44)	(-3.12)	(-3.38)	(-3.28)
Precipitation	0.001	0.000	0.000	-0.002***	-0.002***	-0.002***
	(1.13)	(0.96)	(1.39)	(-2.65)	(-2.82)	(-2.82)
Temperature	0.125	0.174*	0.101**	0.244	0.279	0.254
	(1.42)	(1.83)	(2.21)	(1.33)	(1.56)	(1.33)
Constant	-5.933***	-6.860***	-4.912***	-6.505*	-7.228**	-6.509
	(-2.85)	(-2.85)	(-4.66)	(-1.75)	(-1.98)	(-1.52)
N	1204	1204	1204	1204	1204	1204
Pseudo-R^2	0.0729	0.0691	0.0740	0.123	0.122	0.122

Notes: ***, ** and * signify, respectively, statistical significance at the 1 per cent, 5 per cent, and 10 per cent levels.
Source: ACLED (2019) and Muyanga *et al*. (2019).

level in model 6, suggesting that higher temperature locations aid the transition from SHF to larger scales. Surprisingly, high precipitation levels do not enhance a household's potential to transition to large scales.

Regarding other control variables, the results suggest that secondary education and the amount of off-farm income enhance the likelihood of transitioning from SHF to larger farms. In addition, households who migrated from other places are also more likely to undergo transition from SHF to larger scales. On the other hand, the amount of land inherited reduces the transition likelihood, perhaps suggesting that inheritance may be a burden which reduces the motivation to grow. The size of asset value shows no significant relationship with the ability to transition. The latter may well hint at the possibility that the benefits of large assets holdings do not include the ability to expand land-holdings for agricultural production purposes.

5.2 Effects of conflict intensity on how transition of SHFs is accomplished

In Table 6.7, we present the results of our investigation into the effects of conflict on how the transition from SHF to a larger scale was accomplished. In columns 1 to 3, the dummy variable captures whether or not the transition of an SHF is farm-led (meaning that it was financed through farm operations), while in columns 4 to 6, it captures whether or not the transition is non-farm-led (meaning that it was financed through off-farm employment and other off-farm income).[9] The results suggest that conflict retards the ability to engage in farm-led transition, but not the ability to engage in non-farm-led transition.

Regarding control variables, the proportion of the year in which a farm faced drought has a significant and negative relationship with the probabilities of both farm-led and non-farm-led transitions. These suggest that droughts affect both farm operations and non-farm opportunities that are contributory to scale expansion. Also, higher temperatures are associated with a greater probability of farm-led transition, but has no effect on the probability of non-farm-led transition. This is expected, because we expect temperature to be more related to farm operations than to off-farm opportunities. Precipitation is found not to affect the probability of farm-led transition, but to reduce the probability of non-farm-led transition. Considering the fact that many of the farmers in the APRA sample were from areas where more modern road, transportation, and other infrastructure are limited, this finding may reflect the possibility that excessive rainfall crowds out off-farm opportunities by shutting in farmers.

As expected, across the board, the completion of secondary education increases the probabilities of both farm-led and non-farm-led transitions. Education has been shown to positively contribute to farm production, efficiency, and profitability, and also to the ability to engage in and benefit from off-farm opportunities (Okpachu, Okpachu and Obijesi 2014; Oduro-Ofori, Aboagye and Acquaye 2014). While asset value does not influence the probability of farm-led transition, it increases the likelihood of non-farm-led transitions. This suggests that wealthier farmers are more able to leverage their assets against off-farm resources in financing the acquisition of additional land. Land inheritance has the opposite effect, as higher levels of land inheritance reduce the chances that a farm will engage in farm-led transition, but does not affect the chances of non-farm-led transition. This may suggest that many of the farmers who had previously inherited land already had enough land to be classified as MSFs or LCFs.

5.3 Differential effects of conflict: Kaduna versus Ogun states

In tables 6.8 to 6.10, we report results for regressions where we treat Kaduna and Ogun states separately. In Table 6.8, the likelihood of a farm having transitioned from an SHF to a larger scale is regressed on various independent variables, including the conflict measures. For Kaduna State, the significant and positive effect of conflict intensity (when measured at the 2km radius from the farm) on the probability of transitioning to larger-scale farms suggests that conflicts that have more direct impact on the farm actually increase the probability of transitioning. This suggests that a conflict that can destroy a farm or displace a farmer may actually yield the result of expanded scale. Adelaja and George (2019b) found similar results for direct attacks by Boko Haram. They attribute this to the notion that farmers forced to migrate away by conflict end up leaving behind idled parcels, thereby creating opportunities for remaining or new farmers to scale up. Furthermore, the significant and negative effect of conflict intensity (measured at the 20km radius) on the probability of transitioning by small farmers in Kaduna State suggests that conflicts occurring in the broader area could also have a detrimental effect on the probability of transitioning. This is consistent with the findings from the aggregate data.

The negative effect of conflict on the probability of transition is more evident for farmers in Ogun State, vis-à-vis Kaduna State. Specifically, it is negative for the 10 and 20km conflict radii measures. This is surprising, given that the number of armed conflict incidents

Table 6.8 Effect of conflict intensity on transition from smallholder to medium/large-scale farming by states

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable: whether the household transitioned from SHF to larger scales						
	Kaduna State			**Ogun State**		
Fatalities (2km radius)	0.072***			0.012		
	(7.06)			(0.56)		
Fatalities (10km radius)		0.001			-0.029***	
		(0.96)			(-92.02)	
Fatalities (20km radius)			-0.002**			-0.028***
			(-2.04)			(-3.34)
Completed secondary education	1.791***	1.758***	1.937***	0.685	0.654	0.791
	(5.03)	(4.35)	(5.10)	(1.15)	(1.09)	(1.58)
Land inherited	-0.001***	-0.001***	-0.001***	-0.000	-0.001	-0.001*
	(-12.12)	(-26.42)	(-41.28)	(-1.02)	(-1.31)	(-1.95)
Asset value	0.002	0.002	0.001	0.042***	0.043***	0.044***
	(0.47)	(0.56)	(0.35)	(15.53)	(19.00)	(13.52)
Migration status	0.065	0.040	0.208	1.374***	1.452***	1.481***
	(0.17)	(0.10)	(0.55)	(8.90)	(8.60)	(7.00)
Net off-farm income	0.000	0.000	0.001	0.001***	0.001***	0.001***
	(0.93)	(0.97)	(1.24)	(2.84)	(2.97)	(3.00)
Proportion of year in drought	-10.902***	-10.678***	-10.589***	-24.332***	-22.593***	-20.644***
	(-16.32)	(-14.44)	(-7.19)	(-9.80)	(-9.99)	(-6.92)
Precipitation	0.003*	0.003***	0.002***	0.000	0.000	0.000
	(1.92)	(2.71)	(4.78)	(.)	(.)	(.)
Temperature	0.081**	0.205***	0.127***	1.690	2.528***	4.565***
	(2.50)	(7.88)	(2.94)	(1.10)	(3.35)	(18.83)
Constant	-7.426***	-10.936***	-7.904***	-49.222	-72.990***	-130.738***
	(-6.03)	(-7.18)	(-10.25)	(-1.14)	(-3.41)	(-18.79)
N	583	583	583	621	621	621
Pseudo-R^2	0.0669	0.0558	0.0612	0.169	0.183	0.189

Notes: ***, ** and * signify, respectively, statistical significance at the 1 per cent, 5 per cent, and 10 per cent levels.
Source: ACLED (2019) and Muyanga *et al*. (2019).

was significantly higher in Kaduna State. A possible explanation is that repeated exposure to violent conflicts might raise people's ability to deal with them, hinting at a resilience implication. Another is that the greater availability of cheaper labour in Kaduna State, due to IDPs from active conflict zones, makes it easier for farmers to handle conflict shocks.

In both states, drought intensity negatively affects the probability of transitioning to a larger scale. More precipitation means greater probability of transitioning in Kaduna State, but not in Ogun. This is consistent with the fact that Kaduna State experienced more severe droughts, making the marginal product of precipitation much greater in Kaduna State. Again, we confirm that prior land inheritance reduces the chances of transition in both states. As explained above, this may reflect the possibility that many farmers who inherited their land are classified already as larger farmers. Greater asset values increase the probability of scaling to larger sized farms in Ogun State, but not in Kaduna State. An explanation for this is the more market-oriented land-use environment in Ogun State due to the proximity to the 22 million people who live in Lagos.

We found that recent migration has no effect on the probability of transitioning in Kaduna State, but increases the probability in Ogun State. Again, this may reflect the Lagos metropolitan exposure of Ogun State farmers. Also, anecdotal evidence suggests that young entrepreneurs and others with farming interests are migrating from Lagos to Ogun State to take advantage of land incentives offered by the Ogun State government. Recent economic declines in Nigeria also encouraged many youths to explore agricultural opportunities. Due to their greater market orientation,

Table 6.9 Effect of conflict intensity on farm-led transitions by states

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable: whether the household made a farm-led transition						
	Kaduna State			**Ogun State**		
Fatalities (2km radius)	0.073***			0.021		
	(9.97)			(1.22)		
Fatalities (10km radius)		0.001			-0.021***	
		(1.44)			(-7.25)	
Fatalities (20km radius)			-0.001			-0.023***
			(-1.48)			(-3.52)
Completed secondary education	1.598***	1.537**	1.662**	0.538	0.507	0.618
	(2.73)	(2.27)	(2.54)	(0.89)	(0.82)	(1.08)
Land inherited	-0.001***	-0.001***	-0.001***	-0.001	-0.001	-0.002
	(-4.20)	(-5.26)	(-6.70)	(-0.69)	(-0.74)	(-0.64)
Asset value	-0.005	-0.004	-0.004	0.035***	0.035***	0.036***
	(-0.60)	(-0.44)	(-0.51)	(2.97)	(3.02)	(2.92)
Migration status	0.144	0.105	0.193	1.477***	1.525***	1.550***
	(0.58)	(0.50)	(1.03)	(6.84)	(6.74)	(6.51)
Net off-farm income	-0.001	-0.001	-0.001	0.000***	0.000***	0.000***
	(-0.95)	(-0.95)	(-0.84)	(4.29)	(4.25)	(4.23)
Proportion of year in drought	-10.556***	-10.258***	-9.897***	-16.498***	-14.981***	-13.204***
	(-12.74)	(-9.19)	(-6.25)	(-7.00)	(-7.28)	(-5.25)
Precipitation	0.002*	0.003**	0.002***	0.000	0.000	0.000
	(1.75)	(2.42)	(3.07)	(.)	(.)	(.)
Temperature	0.092***	0.210***	0.168***	0.299	1.011	2.596***
	(8.90)	(9.61)	(20.83)	(0.26)	(1.37)	(4.12)
Constant	-7.217***	-10.563***	-9.037***	-10.370	-30.577	-75.502***
	(-3.74)	(-5.59)	(-8.76)	(-0.32)	(-1.46)	(-4.18)
N	583	583	583	621	621	621
Pseudo-R^2	0.0589	0.0468	0.0492	0.137	0.145	0.150

Notes: ***, ** and * signify, respectively, statistical significance at the 1 per cent, 5 per cent, and 10 per cent levels.
Source: ACLED (2019) and Muyanga *et al*. (2019).

we expect these new migrants to come in with greater interests in land than long-term locals.

In contrast, we expect a higher percentage of new farmers in Kaduna State to be IDPs than in Ogun State. Also given the proximity of Kaduna to Abuja, as with the Lagos–Ogun corridor, young entrepreneurs and others with farming interests are migrating from Abuja to Kaduna State to take advantage of land incentives offered by the state government. Such new entrants into farming are much less likely to acquire large parcels. *Increased off-farm income has no effect on the likelihood of transitioning to larger scales in Kaduna State, but increases the probability in Ogun State.* This suggests that when Ogun State farmers engage in off-farm activities, they are more likely to plough their returns into their farms, vis-à-vis Kaduna State farmers. In Table 6.9, we report results for the endogenous dummy variable capturing whether the transition of a farm to a larger scale is farm-led. Again, the negative impacts of armed conflicts on farm-led transition is pronounced for Ogun State (for both the 10 and 20km radii) while the impacts of immediate area conflict is positive for farm-led transition in Kaduna State. As in Table 6.8, drought adversely affects the probability of farm-led transition, but the effects are more pronounced for Ogun State. Also, precipitation has a positive effect on farm-led transition in Kaduna State, but not in Ogun State. The effect of higher temperature on the probability of farm-led transition is mostly positive. New Ogun State migrants are more likely to transition, but new Kaduna State migrants are not. Education increases the probability of farm-led transition in Kaduna State, but not in Ogun State. As expected, the inheritance of land reduces the likelihood of farm-led transition in Kaduna State. However, this is not the case in Ogun

State. Greater asset values mean a greater probability of farm-led transition in Ogun State, but not in Kaduna State.

Results for non-farm-led transition reported in Table 6.10 suggest that conflicts (measured at the 20km radii) reduce the probability of non-farm-led transition in both states, but more so in Ogun than Kaduna State. This is consistent with our findings that Kaduna farmers may be more resilient to conflicts due to their more persistent and violent conflict exposure. As expected, near conflicts (2km) enhance the likelihood of non-farm-led transition in Kaduna State. The results for drought remains largely the same for non-farm-led transition – drought reduces the likelihood of non-farm-led transition more so in Ogun than in Kaduna State. The explanation for this can again be found in the fact that Ogun State farmers, who operate in a nearly drought-free environment, may perceive a drought condition as a more major shock than Kaduna State farmers.

Precipitation increases the likelihood of non-farm-led transition in Kaduna State, but not in Ogun State, suggesting that when it rains more, farmers in Kaduna State are more willing to take the risk of investing their non-farm income in expanding crop production activities. The higher cost of land acquisition and clearing in Ogun State may explain this. Secondary education has greater payoff in terms of the probability of off-farm-led transition in Kaduna, vis-à-vis Ogun State. This may reflect the already higher educational attainment of farmers in Ogun State and the greater marginal product of education in agriculture in Kaduna State. Off-farm income has a positive impact on the probability of non-farm-led transition in both states, but with a larger impact in Kaduna State than Ogun State. Again, given the proximity of Ogun State to Lagos, Ogun State farmers have higher off-farm incomes and,

Table 6.10 Effect of conflict intensity on non-farm-led transitions by states

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable: whether the household made a non-farm-led transition						
	Kaduna State			**Ogun State**		
Fatalities (2km radius)	0.040***			-0.095		
	(5.03)			(-0.88)		
Fatalities (10km radius)		-0.001			-0.768***	
		(-1.02)			(-3.27)	
Fatalities (20km radius)			-0.003***			-0.061**
			(-3.27)			(-2.40)
Completed secondary education	2.010***	2.037***	2.287***	1.201**	1.298**	1.570***
	(5.73)	(6.09)	(6.92)	(2.34)	(2.18)	(5.13)
Land inherited	-0.338	-0.348	-0.359	0.001	0.001	0.001
	(-1.64)	(-1.61)	(-1.52)	(1.35)	(1.02)	(1.22)
Asset value	0.010**	0.010**	0.008*	0.009***	0.005***	0.010***
	(2.02)	(2.01)	(1.72)	(10.49)	(3.74)	(8.09)
Migration status	-0.458	-0.496	-0.066	0.031	-0.055	0.083
	(-0.41)	(-0.42)	(-0.05)	(0.04)	(-0.08)	(0.13)
Net off-farm income	0.002***	0.002***	0.002***	0.001***	0.001***	0.001***
	(4.58)	(4.48)	(5.98)	(5.23)	(11.43)	(4.64)
Proportion of year in drought	-5.281*	-4.834	-5.785	-44.059***	-37.564***	-40.417***
	(-1.86)	(-1.55)	(-1.26)	(-9.31)	(-29.77)	(-7.65)
Precipitation	0.004***	0.004***	0.002***	0.000	0.000	0.000
	(2.77)	(3.21)	(14.31)	(.)	(.)	(.)
Temperature	0.143	0.222	0.048	15.298***	8.441***	22.732***
	(0.78)	(1.27)	(0.35)	(11.36)	(3.14)	(4.96)
Constant	-12.845**	-14.982***	-7.752**	-435.542***	-241.210***	-646.224***
	(-2.46)	(-2.84)	(-2.31)	(-11.42)	(-3.16)	(-4.97)
N	583	583	583	621	621	621
Pseudo-R^2	0.200	0.198	0.210	0.204	0.264	0.250

Notes: ***, ** and * signify, respectively, statistical significance at the 1 per cent, 5 per cent, and 10 per cent levels.
Source: ACLED (2019) and Muyanga *et al*. (2019).

therefore, lower marginal impacts of off-farm income.

Migration status does not have any impact on either state with respect to non-farm-led transition, supporting the notion that recent migrants need more time to get adequately connected to off-farm opportunities. The effects of asset value on the probability of non-farm-led transition is positive in both Ogun and Kaduna states, reflecting the fact that assets are needed to collateralise debt finance through off-farm activities. Again, as with farm-led transitions, inheritance has no effect on non-farm-led transition. Farmers who acquired farmland through inheritance may lack access to land markets.

To explore the association between conflict and farm size, we ran two additional regressions to estimate the relationships between conflict variables and the likelihood of (1) being an SHF (Appendix Table A1), and (2) being an MSF (Appendix Table A2). Note that the dependent variables are dummy variables (where D=0 for MSF while D=1 for SHF in Appendix Table A1; and D=0 for an SHF while D=1 for an MSF in Appendix Table A2). As reported in Table A1, for all radii measures, the probability of a sampled farm currently being an SHF is reduced with greater incidence of conflict, suggesting that larger-scale farms are more likely to experience more lethal conflicts, vis-à-vis SHFs. As reported in Table A2, all the coefficients of conflict intensity now take on positive signs, also suggesting that MSFs attract more lethal conflicts. Other results from Appendix tables A1 and A2 are interesting: larger-scale farming is directly related to education, net farm income, and asset values, but inversely related to drought conditions.

6 CONCLUSIONS AND POLICY RECOMMENDATIONS

The transition of SHFs to larger-scale farmers is often viewed as the key to rural employment, poverty alleviation, economic development, and food security in sub-Saharan countries. Many SHFs in Africa are exposed to conflict which may hinder their abilities to up-scale, as recent literature suggests that conflicts may limit the performance of farmers. In this paper, we examine the impacts of conflicts on the potential for SHFs to transition to larger scales and explore the roles of other control factors. The choice of Kaduna and Ogun states in Nigeria allowed the comparison to places such as Borno State that are directly at the heart of a major crisis like Boko Haram. Evidence already exists on the impacts of conflict on areas directly affected by major crisis. In this paper, our focus is on the impact of conflict in areas that are more normal or remote from the centre of major crises. We particularly focus on a mix of conflicts ranging from terrorist attacks, pastoral violence, remote violence, and civil wars to the less violent ones such as rioting or protesting, but standardised the estimates of their effects by focusing on fatalities. We also explore the effects of a mix of climate-related variables, including droughts.

In general, we find that conflict adversely affects the ability to transition from SHFs to larger scales. The detrimental effect of conflict is found to be greater for farm-led transition than for non-farm-led transition. While we expected that previous inheritance improves the probability of transition, we found otherwise, probably because those with inherited land are more likely to already be large and those that obtained land from the market are the ones more likely to transition by purchasing more land. We found this to be the case more in Kaduna than Ogun State.

Secondary education enhances the potential to transition to larger scales, with greater impacts on the likelihood of non-farm-led transition, vis-à-vis farm-led. These impacts are more relevant in Kaduna, vis-à-vis Ogun State. Greater existing assets enhance the likelihood of non-farm-led transition, but not farm-led transition, with greater positive impacts in Ogun State. Recent migrants have greater potential to transition, but only through farm-led transition. However, this is the case only for Ogun State. Also, off-farm income enhances the transition to larger scales only in Ogun State. Our findings that factors such as education, assets, and favourable climate facilitate the transition to larger-scale farms suggests that they help to mitigate the adverse effects of conflict.

The finding that conflicts retard agriculture is a key one. Although Kaduna State farmers did not suffer anything near the high dose of conflicts faced in the immediate conflict zone of Boko Haram, the fact that these milder forms of conflict affected their agricultural operations is worrisome. The tendency among policymakers is to worry only about the plight of agriculture in conflict zones and therefore to offer in- and post-conflict assistance only to farmers in such areas. This study suggests that policymakers should be concerned about farmers everywhere there is any form of conflict, rather than just focus only on designated areas where major conflicts have grabbed national and global attention.

Our main finding that conflicts retard the potential for SHFs to scale up to larger sizes is even more important a contribution, particularly regarding how to transform SHFs to better address rural poverty and facilitate economic development. Such a finding, even for farmers in Kaduna State where farmers faced less conflict exposure than in the BAY region, suggests that there are longer-term impacts of conflict through the discouragement of growth. We can argue that conflict not only adversely affects agriculture, but it changes the trajectory by blocking expansions that are so fundamental to transformation. Policymakers should therefore be cognisant that even in places facing milder incidence of conflict, there is need to take into consideration its growth prevention effects. Policies to reposition agriculture in- and post-conflict should therefore not necessarily be focused on areas well known to be in conflict zones. The finding that assets, off-farm income, and education can help mitigate the adverse effects of the already well-studied barriers to scale expansion suggest the importance of these factors in addressing barriers to SHFs' transformation.

There are several limitations of this study. First, our main dependent variable is based on a retrospective question in the APRA survey about whether or not

a current MSF or LCF has already expanded its operations. The availability of panel data that records periodic land-holdings and the underlying factors will obviously be more useful in studying the factors that affect the ability to scale up. Second, due to the nature of the APRA data, this analysis is limited to locations in Kaduna and Ogun states. Data from more states will allow a more thorough analysis. Third, the APRA survey was not designed to adequately capture information on resilience indicators. Therefore, in this paper, our investigation into the role of resilience to conflict and other shocks is limited. Finally, due to data limitation and the loss of degree of freedom if we disaggregate the various conflict types, we only use the aggregate conflict and fatalities counts and did not investigate the effects of specific conflict types on scale-up ability.

APPENDIX

Table A1 Effect of conflict intensity on smallholder farming

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable: whether the household engage in smallholder farming						
Fatalities (2km radius)	-0.026*			-0.032**		
	(-1.68)			(-2.31)		
(10km radius)		-0.002**			-0.002***	
		(-2.53)			(-3.38)	
Fatalities (20km radius)			-0.001***			-0.001***
			(-3.45)			(-2.71)
Completed secondary education				-0.490**	-0.473**	-0.469**
				(-2.29)	(-2.26)	(-2.22)
Land inherited				-0.000	-0.000	-0.000
				(-0.74)	(-0.76)	(-0.74)
Asset value				-0.024*	-0.024*	-0.024*
				(-1.83)	(-1.85)	(-1.88)
Migration status				-0.525	-0.508	-0.490
				(-1.48)	(-1.40)	(-1.30)
Net off-farm income				-0.000	-0.000	-0.000
				(-1.47)	(-1.46)	(-1.36)
Proportion of year in drought				11.896*	12.021*	12.078*
				(1.81)	(1.89)	(1.89)
Precipitation				0.000	0.000	0.000
				(0.60)	(0.74)	(0.78)
Temperature				-0.028	-0.055	-0.069
				(-0.24)	(-0.51)	(-0.62)
Constant	0.062**	0.070**	0.075**	-0.091	0.547	0.898
	(2.17)	(2.43)	(2.23)	(-0.04)	(0.30)	(0.47)
N	2110	2110	2110	2109	2109	2109
Pseudo-R^2	0.00152	0.00154	0.00111	0.0552	0.0549	0.0543

Notes: ***, ** and * signify, respectively, statistical significance at the 1 per cent, 5 per cent, and 10 per cent levels.
Source: ACLED (2019) and Muyanga *et al*. (2019).

Table A2 Effect of conflict intensity on medium-holder farming

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable: whether the household engage in medium-holder farming						
Fatalities (2km radius)	0.026*			0.032**		
	(1.68)			(2.32)		
Fatalities (10km radius)		0.002**			0.002**	
		(2.56)			(2.43)	
Fatalities (20km radius)			0.001***			0.001
			(3.53)			(1.41)
Completed secondary education				0.545***	0.531***	0.534***
				(3.11)	(3.10)	(3.09)
Land inherited				0.000	0.000	0.000
				(0.82)	(0.83)	(0.82)
Asset value				-0.000	-0.000	-0.000
				(-1.23)	(-1.24)	(-1.24)
Migration status				0.553	0.537	0.527
				(1.56)	(1.48)	(1.41)
Net off-farm income				0.000*	0.000*	0.000*
				(1.77)	(1.76)	(1.69)
Proportion of year in drought				-12.023*	-12.094*	-12.013*
				(-1.84)	(-1.93)	(-1.92)
Precipitation				-0.000	-0.000	-0.000
				(-0.47)	(-0.63)	(-0.70)
Temperature				0.022	0.049	0.056
				(0.19)	(0.46)	(0.53)
Constant	-0.066**	-0.074**	-0.080**	0.482	-0.129	-0.287
	(-2.22)	(-2.49)	(-2.28)	(0.25)	(-0.07)	(-0.17)
N	2110	2110	2110	2109	2109	2109
Pseudo-R2	0.00155	0.00158	0.00115	0.0266	0.0259	0.0250

Notes: ***, ** and * signify, respectively, statistical significance at the 1 per cent, 5 per cent, and 10 per cent levels.
Source: ACLED (2019) and Muyanga *et al*. (2019).

REFERENCES

ACLED (2019) *Armed Conflict Location & Event Data Project (ACLED) Codebook*, *Version 8*, https://acleddata.com/#/dashboard (accessed 15 October 2020)

Adelaja, A. and George, J. (2019a) 'Effects of Conflict on Agriculture: Evidence from the Boko Haram Insurgency', *World Development* 117: 184–195

Adelaja, A. and George, J. (2019b) 'Terrorism and Land Use in Agriculture: The Case of Boko Haram in Nigeria', *Land Use Policy* 88

AGRA (2017) *Africa Agriculture Status Report 2017: The Business of Smallholder Agriculture in Sub-Saharan Africa, Issue 5*, Nairobi: Alliance for a Green Revolution in Africa

Akresh, R.; Bhalotra, S.; Leone, M. and Osili, U.O. (2012) 'War and Stature: Growing Up During the Nigerian Civil War', *American Economic Review* 102.3: 273–77

Akresh, R.; Verwimp, P. and Bundervoet, T. (2011) 'Civil War, Crop Failure, and Child Stunting in Rwanda', *Economic Development and Cultural Change* 59.4: 777–810

Arias, M.A.; Ibáñez, A.M. and Zambrano, A. (2018) 'Agricultural Production Amid Conflict: Separating the Effects of Conflict into Shocks and Uncertainty', *World Development* 119: 165–84

Awodola, B. and Oboshi, A. (2015) 'Terrorism in Northern Nigeria: A Threat to Food Security in Maiduguri', *Mediterranean Journal of Social Sciences* 6.3: 11–17

Beguería, S.; Vicente-Serrano, S.M. and Angulo-Martínez, M. (2010) 'A Multiscalar Global Drought Dataset: The SPEI Base: A New Gridded Product for the Analysis of Drought Variability and Impacts', *Bulletin of the American Meteorological Society* 91.10: 1351–56

Bozzoli, C. and Brück, T. (2009) 'Agriculture, Poverty, and Postwar Reconstruction: Micro-Level Evidence from Mozambique', *Journal of Peace Research* 46.3: 377–97

Burton, I.; Kates, R.W. and White, G.F. (1993) *The Environment as Hazard*, 2nd ed., New York NY: Guilford Press

Chamberlin, J.; Jayne, T.S. and Headey, D. (2014) 'Scarcity Amidst Abundance? Reassessing the Potential for Cropland Expansion in Africa', *Food Policy* 48: 51–65

Chauveau, J.-P. and Richards, P. (2008) 'West African Insurgencies in Agrarian Perspective: Côte d'Ivoire and Sierra Leone Compared', *Journal of Agrarian Change* 8.4: 515–52

CRED (2016) *Emergency Events Database (EM-DAT): The International Disaster Database*, Centre for Research on the Epidemiology of Disasters, www.emdat.be/classification (accessed 30 April 2018)

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

Djurfeldt, G.; Aryeetey, E. and Isinika, A.C. (2011) *African Smallholders: Food Crops, Markets and Policy*, Cambridge MA: CABI

Fan, Y. and van den Dool, H. (2008) 'A Global Monthly Land Surface Air Temperature Analysis for 1948–Present', *Journal of Geophysical Research: Atmospheres* 113.1

FAO (2011) *Save and Grow: A Policymaker's Guide to the Sustainable Intensification of Smallholder Crop Production*, Rome: Food and Agriculture Organization of the United Nations

FAO and OECD (2014) *Opportunities for Economic Growth and Job Creation in Relation to Food Security and Nutrition: Report to the G20 Development Working Group*, Rome and Paris: Food and Agriculture Organization and Organisation for Economic Co-operation and Development

Federal Ministry of Environment (2012) *Great Green Wall for the Sahara and Sahel Initiative: National Strategic Action Plan*, Abuja: Federal Republic of Nigeria, Ministry of Environment

FSIN (2018) *Global Report on Food Crises 2018*, Food Security Information Network, Rome and Washington DC: Food and Agriculture Organization (FAO), International Food Policy Research Institute (IFPRI) and World Food Programme (WFP)

George, J.; Adelaja, A. and Awokuse, A. (2020) 'The Agricultural Impacts of Armed Conflicts: The Case of Fulani Militia', *European Review of Agricultural Economics*, https://academic.oup.com/erae/advance-article-abstract/doi/10.1093/erae/jbaa022/5904965?redirectedFrom=fulltext (accessed 12 November 2020)

George, J.; Adelaja, A. and Weatherspoon, D. (2020) 'Armed Conflicts and Food Insecurity: Evidence from Boko Haram's Attacks', *American Journal of Agricultural Economics* 102.1: 114–31

Graeub, B.E. *et al*. (2016) 'The State of Family Farms in the World', *World Development* 87: 1–15

Haar, G. van der and Leeuwen, M. van. (2019) 'War-Induced Displacement: Hard Choices in Land Governance', *Land* 8.6: 1–13

Hazell, P. (2017) 'Why an Inclusive Agricultural Transformation is Africa's Way Forward', in AGRA (ed.), *Africa Agriculture Status Report 2017: The Business of Smallholder Agriculture in Sub-Saharan Africa, Issue 5*, Nairobi: Alliance for a Green Revolution in Africa

Herrero, M. *et al*. (2017) 'Farming and the Geography of Nutrient Production for Human Use: A Transdisciplinary Analysis', *The Lancet Planetary Health* 1.1: e33–e42

Huffman, G.J.; Adler, R.F.; Bolvin, D.T. and Gu, G. (2009) 'Improving the Global Precipitation Record: GPCP Version 2.1', *Geophysical Research Letters* 36.17

International Crisis Group (2017) *Herders against Farmers: Nigeria's Expanding Deadly Conflict*, Brussels: International Crisis Group

Jayne, T.S.; Meyer, F. and Traub, L.N. (2014) *Africa's Evolving Food Systems: Drivers of Change and the Scope for Influencing Them*, London: International Institute for Environment and Development (IIED)

Kondylis, F. (2010) 'Conflict Displacement and Labor Market Outcomes in Post-War Bosnia and Herzegovina', *Journal of Development Economics* 93.2: 235–48

Lowder, S.K.; Skoet, J. and Raney, T. (2016) 'The Number, Size, and Distribution of Farms, Smallholder Farms, and Family Farms Worldwide', *World Development* 87: 16–29

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

Moore, F.C.; Baldos, U.L.C. and Hertel, T. (2017) 'Economic Impacts of Climate Change on Agriculture: A Comparison of Process-Based and Statistical Yield Models', *Environmental Research Letters* 12.6

Muyanga, M. *et al*. (2019) *Changing Farm Structure and Agricultural Commercialisation in Nigeria*, APRA Working Paper 26, Brighton: Future Agricultures Consortium

Niles, M.T. and Salerno, J.D. (2018) 'A Cross-Country Analysis of Climate Shocks and Smallholder Food Insecurity', *PLOS ONE* 13.2: e0192928

Oduro-Ofori, E.; Aboagye, A.P. and Acquaye, N.A.E. (2014) 'Effects of Education on the Agricultural Productivity of Farmers in the Offinso Municipality', *International Journal of Development Research* 4.9: 1951–60

Okpachu, A.S.; Okpachu, O.G. and Obijesi, I.K. (2014) 'The Impact of Education on Agricultural Productivity of Small Scale Rural Female Maize Farmers in Potiskum Local Government, Yobe State: A Panacea for Rural Economic Development in Nigeria', *Journal of Research in Agriculture and Food Sciences* 2.4: 26–33

Raleigh, C.; Linke, A.; Hegre, H. and Karlsen, J. (2010) 'Introducing ACLED: An Armed Conflict Location and Event Dataset', *Journal of Peace Research* 47.5: 651–60

Reardon, T. *et al*. (2014) *Urbanization, Diet Change, and Transformation of Food Supply Chains in Asia*, East Lansing MI: Michigan State University

Shaban, A.R.A. (2017) 'Why is Africa Importing $35bn in Food Annually? - AfDB Boss Asks', *Africanews*, 21 April, www.africanews.com/2017/04/21/why-is-africa-importing-35bn-in-food-annually-afdb-boss-asks/ (accessed 15 October 2020)

Tollefsen, A.F.; Strand, H. and Buhaug, H. (2012) 'PRIO-GRID: A Unified Spatial Data Structure', *Journal of Peace Research* 49.2: 363–74

UNHCR (2018) *Global Trends: Forced Displacement in 2017*, Geneva: United Nations High Commissioner for Refugees, www.unhcr.org/globaltrends2017 (accessed 16 October 2020)

Wilhite, D.A. and Glantz, M.H. (1985) 'Understanding the Drought Phenomenon: The Role of Definitions', *Water International* 10.3: 111–120

ENDNOTES

1 With respect to land-holdings, the exact distinction between SHFs and other larger farms is not consistent. Therefore, the definition of SHFs varies between countries, agro-ecological zones, and continents. According to Lowder, Skoet and Raney (2016), SHFs (those holding less than 2 hectares) represent 84 per cent of farms in the world.

2 In comparison, according to Herrero et al. (2017), medium-sized farms (MSFs) operating between two and 20 hectares produce 50 per cent of total agricultural output while large commercial farms (LCFs) operating over 20 hectares account for 20 per cent.

3 Identified constraints to the ability of SHFs to expand their land base include: (a) an inability to expand their land base due to cultural constraints and limited access to capital, (b) limited access to technical inputs and extension services, (c) limited connection to value chains, including larger farms that can uptake their products, (d) limited opportunities to connect to a new generation of agricultural SMEs which are needed along the value chain to provide services to SHFs by buying their products and selling them inputs, (e) an inability to run their farms as businesses due to limited support infrastructure, and (f) limited off-farm income or employment opportunities in rural areas.

4 SME opportunities exist in such areas as trading, farm services, farm processing, urban retail, food service, supermarkets, sorting, grading, quality control, seed provision, and technical assistance.

5 The Armed Conflict Location and Event Database (ACLED) also provides information on perpetrators (e.g. BH, FHs, the military, unidentified armed groups, Christian militia, and Muslim militia).

6 The APRA sample covers three local government areas (LGAs) in each of Kaduna and Ogun states. We join the APRA data with data from ACLED and PRIO (see more details about data sources in the empirical section of this report).

7 Violence by pastoralists has been shown to reduce total agricultural output, the outputs of specific staple crops, and cattle-holdings of farmers, but increase cattle thefts (see George, Adelaja and Awokuse 2020).

8 Note that empirical evidence also shows that conflict adversely affects food security (George, Adelaja and Weatherspoon 2020); calorie intake (D'Souza and Jolliffe 2013), and the nutritional status of children (Akresh et al. 2012; Akresh, Verwimp and Bundervoet 2011; Minoiu and Shemyakina 2014).

9 For farm-led transitions, the dummy variable is defined such that D=1 if an MSF or LCF had gone through farm-led transition, while D=0 for those farms that had not gone through farm-led transition. For non-farm-led transitions, the dummy variable is such that D=1 if an MSF or LCF had gone through non-farm-led transition, while D=0 for those farms that had not gone through non-farm-led transition. Note that the D=0 sample for both sets of regressions only includes current SHFs, as none of them went through any transition.

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