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Forced Displacement and Agriculture: Implications for Host Communities

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Abstract: The disruptive effects of conflict and climate-related shocks and their tendencies to cause human population displacements are well documented in the literature. Given the growing number of internally displaced persons (IDPs) worldwide and the resulting population and service demand overload in host communities, it is important to understand the socioeconomic impacts. Because many host communities in developing countries are agriculture dependent, we investigate what happens to key agricultural sector outcomes in host communities when there is an influx of IDPs. For displacements caused by insurgency, communal clashes, and natural disasters, we estimate the impacts on agricultural outputs, employment, wages, and land use. We find that forced displacements generally result in reduced agricultural production due to lower land and labor productivity. Specifically, while the effect of insurgency-driven IDP influx is negative, it is positive for communal violence. Cassava, potatoes, and soya are particularly hard hit. Additionally, while insurgency-driven population influx reduces the agricultural wages of both males and females, it increases the reliance on male and female household labor but has no effect on hired labor. Finally, while insurgency-driven IDP influx does not affect land use and land market activities, it lowers the expected value of land and the number of farm plots harvested. We highlight the opportunity to leverage humanitarian assistance in building local agricultural capacity in host communities.

Keywords: forced displacement; IDPs; insurgency; communal clashes; natural disasters; agricultural production; Nigeria

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1. Introduction

According to the United Nations High Commission for Refugees (UNHCR), the number of forcibly displaced persons globally continues to rise, surpassing 80 million in the year 2020 [1]. Some 46 million of these (58 percent) were internally displaced persons (IDPs), the vast majority of whom will not return home due to ongoing conflicts or near permanent devastations from natural disasters [1,2]. In countries facing major displacements, the original homes of IDPs (or sending communities) are often thinned out due to physical, institutional, and social structure devastation while host communities often become permanent homes for new IDPs [3]. Despite the deployment of humanitarian assistance to host communities, this inter-place reshuffling of population and demand for services often overwhelms such communities and governments must grapple with how to stabilize both the IDP population and long-term residents of host communities.

The influx of IDPs present a host community with a number of challenges. First, they often need assistance from public and private humanitarian agencies [4]. Second, a small percentage of IDPs end up in government-run or non-governmental organizations (NGOs)-run IDP camps while the majority end up within the community, residing with friends and relatives or residing in makeshift accommodations [2]. Third, the host communities are often places with limited capacity to absorb additional populations or fully cater for their humanitarian, educational, health or employment needs. Fourth, the demand for jobs, housing, healthcare, education, and other services and pressures on public utilities

and infrastructure increase, at least in the short term [5]. Fifth, even when humanitarian agencies step in to help, their efforts usually focus on organized IDP camps, not the broader community, while long-term residents must contend with increased competition for resources and opportunities. Sixth, as even the host communities themselves are often exposed to the broader regional devastation that brought about IDP influx in the first place, their ability to step up and meet the needs of the added population is curtailed by market and budgetary constraints [6]. Seventh, because many IDPs move to economies that are agrarian in nature [7], the influx of IDPs exacerbates the standard constraints facing agriculture. Hence, some agricultural aspects of host communities are stressed.

For communities directly impacted by the shocks, the extant literature presents some evidence on the economic, agricultural, housing, infrastructure, health, and other impacts of such shocks. For example, for affected communities, George, Adelaja, and Weatherspoon [8] show the negative impacts of conflict on food security while Adelaja and George [9] examined the impacts of conflict on agriculture. Evidence also exists that shocks create human displacement [5]. The extant literature has also examined how the influx of IDPs affects host communities with respect to employment [10,11], wages [10,12], prices [13], and various other measures of wellbeing [6,14]. However, the impacts of the influx of IDPs on agriculture in host communities have not been examined in the literature, despite the fact that most host communities are agriculture dependent. Filling this gap in the literature is the essence of this paper.

In this study, we investigate the impacts of forced displacement caused by a variety of shocks on various agricultural outcomes in host communities. Specifically, we examine: (1) the effects of added population due to a variety of sources of forced displacement, including insurgency, communal violence, natural disasters, (2) the differential impacts of various sources of displacement, and (3) the differential impacts on aggregate and agricultural output (outputs of specific crops), agricultural employment outcomes (including agricultural wages and employment by gender), and agricultural land use (including land held fallow, acres cultivated, and expected land values). To address endogeneity concerns, we utilize an instrumental variable approach.

Why is this issue important? First, displaced people are often from rural areas where their primary income source and ways of living were agricultural-related. The condition of agriculture in the host communities will determine how quickly things return back to normal for them. Second, government and NGOs who supply food and other aid to host communities can impact local agriculture positively if they emphasize local versus non-local supply reliance. However, the majority of humanitarian assistance relies on supply chains that are extraneous to the host community region due to the difficulties faced in local procurement by entities that may not have previous experience in regions experiencing shocks [15]. One of the arguments against aid is that it crowds out the long-term local capacity to deal with the problem [16].

Third, as many IDPs take residence with host families, they can help boost local production if they are engaged in or are integrated into farm operations. This can boost the local agricultural economy, thereby spurring improved local capacity and resilience. Alternatively, they can contribute to the food and agricultural deficit if they are not productively engaged. That is, if new entrants contribute to agricultural capacity by being absorbed, employment opportunity can be enhanced. If not, agriculture suffers and its capacity to support livelihoods is curtailed. Fourth, areas affected by shocks and the surrounding areas often face heavy food insecurity conditions [8,17]. Because shocks create further food insecurity, the capacity of agriculture to increase its capacity is important.

Nigeria is a good example of a country where forced displacement has impacted host communities in multiple ways. Nigeria has experienced significant forced displacement due to insurgency (e.g., Boko Haram), communal and religious violence (e.g., farmer-herder crisis nationwide, ethnic violence in states like Kaduna), and natural disasters (e.g., droughts, excessive rainfall in some places, and desertification). The number of IDPs in Nigeria in 2019 is estimated at 3.4 million while the number in the Northeast

alone is over 2.7 million [18]. For example, of the 2.7 million IDPs in Northeast Nigeria, only 305,712 live in IDP camps. According to the displacement tracking matrix (DTM) provided by the United Nations International Organization for Migration [19], the rest live in collective settlements centers (where IDPs live together due to associations, but there is no formal management arrangement as with the IDP camps); transitional centers (where IDPs reside temporarily before moving to camps or to collective settlement centers), and host communities that are not collective settlements or transitional settlements (these are people that have been assimilated into the community and do not live in camps) [19]. The large number of non-camp residents suggests possible impacts on agriculture in the community. Given the high volume of IDPs in Nigeria and the fact that the country has overtaken India as the country with the highest number of extreme poor people in the world, the selection of Nigeria as a case study is fully justified.

Our study makes some important contributions to the literature. First, to the best of our knowledge, this is the first study which discerns displacements due to conflicts, natural disasters, and communal clashes in terms of their differential impacts on host communities, especially the food security outcomes. Given that Nigeria, especially Northern Nigeria, has been significantly impacted by forced migration due to a multitude of factors, this is a worthy endeavor. Second, our use of an instrumental variable approach allows us to address the endogeneity concerns associated with the non-random choice of settlement location decisions by IDPs. Finally, our analysis covers areas that are directly in conflict zones and areas that are not. The evidence based on the spillover effects of conflicts in areas that are not in active conflict zones is important in planning and implementing effective humanitarian, resettlement, and rehabilitation programs.

We organize the rest of this paper as follows. In Section 2, we provide a background to the study, conceptualize the impacts of IDP influx on households in a community and present a simple theoretical model to guide our empirical work. Section 3 presents the methodology, which includes the empirical model, data description, and model estimation. In Section 4, we present our empirical results. Section 5 provides the summary and conclusion of the study and presents some policy implications.

2. Effects of IDP Influx on Host Communities and Agriculture

According to the International Displacement Monitoring Center (IDMC), the total number of displaced people by the end of 2019 was 50.8 million. At 33.4 million people, the highest number since 2012, new displacements in 2019 alone (including IDPs and refugees) [2] represented 66 percent of total displacements. In 2019, Sub-Saharan Africa (SSA) was home to 8.1 million newly displaced people (25 percent of the global total).

As shown in the upper part of Figure 1, forced displacements can arise from conflict and violence (including terrorism, insurgency, and communal violence) or from natural disasters (including drought, floods, and extreme temperature). Of the total number of 50.8 million displaced people around the globe by the end of 2019, 45.7 million (or 90 percent) were displaced due to conflict and violence while 5.1 million people (or 10 percent) were displaced by disasters. Of the 33.4 million new displacements around the globe in 2019, 8.5 million (or 25 percent) were displaced due to conflict and violence while 24.9 million people (or 75 percent) were displaced by natural disasters around the globe, the percentage of human displacements caused by natural disaster is growing, compared with conflict. However, over time, the percentage of people displaced by conflict in Africa has been rising [20].

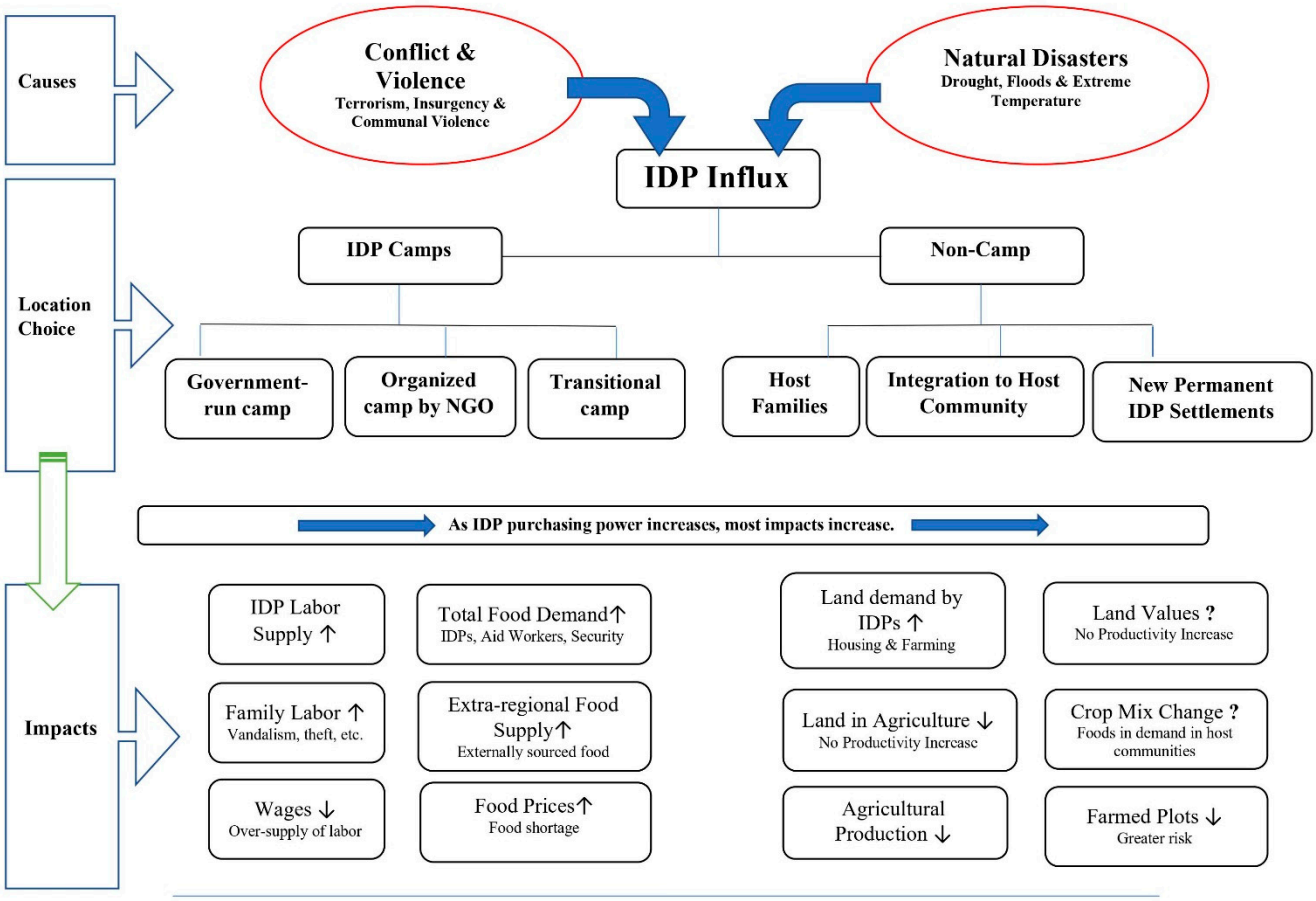

Figure 1. Impacts of IDP influx on agriculture in host communities.

A typical IDP faces a choice of host communities, depending on the cause, nature, and venue of displacement. For example, when human displacement results from violence, the victim may prefer a host community that is farther from his/her original home due to fears about further exposure to violence [3]. For example, in Cameroon and Nigeria, Boko Haram has escalated its attacks on refuge sites and IDP camps in recent years [20]. Within a specific community, he/she also faces a choice of specific places. For example, a new migrant into a host community faces several camp-type choices, including (a) government-run camps, (b) organized camps by NGOs, and (c) transitional or makeshift camps. An IDP may also choose to reside in a host community with a host family or become integrated into the host community as an independent citizen. The latter type is usually one with sufficient knowledge, skills, or assets to quickly settle down.

Usually, a displaced person with options prefers to reside with a host family rather than in an IDP camp [15] due to potential security concerns about camps, better economic prospects, possibilities of social networking, and opportunities to pursue local integration. Figure 1 also shows the location choices of IDPs coming into a community.

Obviously, an IDP with limited resources may prefer organized camps by governments and NGOs who can provide some level of food and non-food humanitarian support. While such organized camps offer some stable support, they may be too restrictive for families with existing family connections in the host community or the ability to buy land to resume farming or buy new homes to restart their businesses. Because camps often only provide temporary shelter and do not allow people to live meaningful lives in the long run, [21] IDPs may eventually leave to engage in normal economic activities in the host communities. This movement can have significant impacts on community livelihood and viability. Depending on the volume and mix of IDPs that descend on a community, supply, and demand for food and agriculture products can be positively or negatively affected.

Some of these effects are discussed next. It is noteworthy that some host communities may be hostile to IDSs because they are often afraid of the long-term implications of accepting them.

Figure 1 also shows the various types of impacts that an influx of IDPs can have on agriculture in a host community. An IDP influx means new mouths to feed and added demand for food and non-food items. Obviously, needs are dependent on the share number of new IDPs and their purchasing power. Effective demand is also affected by the purchasing power of IDPs which depends on their wealth status. In an environment where the supply of food is restricted, needs and demand can significantly exceed supply, driving up food prices and the process of specific crops [22]. In their attempt to provide food and other relief materials to the community, domestic and international NGOs as well as government agencies can put further stresses on demand. Similarly, the greater presence of security agencies and camp support staff and administration can create added demand for food and non-food items.

Aid provision often relies on extra-regional supply chains due to the limited capacity of local food systems to respond to escalating demand [15]. The same applies to the food needs of security agencies. If relief and government agencies work assiduously to patronize local enterprises, there is a potential for local production capacity to be increased, depending on how opportunity driven local production systems are. As IDPs can provide cheap labor, the influx of new IDPs can expand the supply of labor, which can drive down wages paid to existing and new workers [14]. On the other hand, short-term limitations on the availability of other agricultural inputs (seeds, fertilizer, pesticides, and mechanical inputs) may make it difficult to expand local production capacity. The demand for land is expected to rise to accommodate the housing and agricultural needs of new entrants. Evidence of increased agricultural production suggests that much of the growth in agricultural production in Africa comes from land expansion, not increased labor productivity [23]. This suggests that the ability to increase local production of agricultural products is limited for host communities.

Crop mix changes can also be expected in a host community. For example, the product mix is expected to shift toward crops which are less land intensive, crops which are better suited toward the needs of new IDPs, and crops which are purchased in bulk by relief agencies and government programs that support humanitarian efforts. For example, high nutrient cash crop items such as beans may be more favored while the heavier items such as soya, potatoes, and sorghum may be less favored. Additionally, the agricultural impacts can depend on the closeness of the host community to where the crisis or shock occurred. For example, a terrorism-related shock will probably have more far-reaching adverse effects on the landscape, vis-à-vis a communal violence or flood-related shock [24].

While forced displacement can have varied impacts on a community, we hypothesize that in the short run, it would adversely affect agricultural production in general due to fixities in the availability of land and in the supplies of other agricultural inputs, but that it may enhance the production of some specific agricultural products. We hypothesize based on Adelaja and George [9] that farm households will consolidate their efforts on fewer plots based on the risks associated with farming remote lands, especially those which are marginal. We also hypothesize that displacements caused by violence will have more detrimental impact on agriculture in host communities. We further hypothesize that forced displacements will result in reduced wages for hired workers but may force farm owners and operators to increase their efforts on the farm because of the increased need to protect their crops from vandalism and theft. We have no expectation about the impact on land values. This, however, depends on the demand for land for agriculture and farming by new entrants.

It is noteworthy that many IDPs, especially those displaced by conflict, prefer not to return home due to safety and security concerns, damage to their original homes and communities, lack of essential services and opportunities in their home communities, their limited wealth status, and better economic opportunities in destination communities [25].

For example, displaced people can spend more than 17 years in a combination of camps and host communities [3]. Hence, many IDPs are assimilated into their host communities.

Note also that the causes of forced displacement could also impact negatively on domestic trade of agricultural inputs [9,17] and on agriculture [25].

Obviously, the impact of an IDP influx on a community can be assessed at the individual farm household level or at the overall community level. Because of the diversity of household compositions and the fact that households can be aggregated in drawing inferences about the community, it is an ideal unit of analysis. The impact on a typical household will obviously be reflective of the impact on the community. In this analysis, we focus on household impacts since data at the household level is readily available and IDP influx can also be measured at the level of the community in which each household resides.

3. Forced Displacement in Nigeria

Since 2010, the Boko Haram insurgency has caused significant displacement in the northern parts of Nigeria. Over 3.4 million people have been displaced, including over 2.7 million IDPs in northeastern Nigeria, over 684,000 IDPs in Cameroon, Chad, and Niger, and 294,000 refugees in the four countries [2]. The crisis has been exacerbated by conflict-induced food insecurity and severe malnutrition, which have risen to critical levels in all four countries. Despite the efforts of governments and humanitarian aid agencies, in 2019, some 3.5 million people remain food insecure in the Lake Chad Basin region and will depend on future assistance. In addition, violence between herders and farmers in the country's central states, known as the Middle Belt, triggered 23,000 new displacements, and small-scale displacements triggered by land disputes and communal violence were also recorded in the southern states of Osun and Rivers [2]. With the Boko Haram insurgency nearing its 10th year of outset, the impact on local population is yet to be effectively assessed.

As discussed above, Nigerian's experience with multiple drivers of displacement provides a unique opportunity to analyze their differential impacts. Specifically, IDPs who were displaced due to the Boko Haram insurgency face some additional challenges with respect to their adaptation to the host community. First, Boko Haram is known to have sympathizers in the civilian population and is often accused of infiltrating displaced populations to expand their operations. While there is very little evidence of such activities, host communities are often afraid of IDPs migrating from active conflict zones, making their integration process difficult. Second, evidence suggests that Boko Haram actively targets refugees and IDPs, which are soft targets, but can attract national and international media attention. In both Cameroon and Nigeria, the number of attacks targeting IDP camps and refuge sites has increased notably in the last few years [20,26]. The fear that IDPs will bring in risky attention from the insurgents often prevents local communities from being affable to the guest populations. Third, IDPs displaced by armed conflicts often do not want to return to their home base since they fear the absence of safety, economic opportunities, and essential services [27]. Unlike other temporary IDPs, host communities are often afraid of the long-term implications of accepting IDPs due to conflict.

Our goal in this paper is to provide empirical evidence on the net effect of the influx of IDPs into communities, based on a case study of Nigeria. It is important to know if and how agriculture is impacted and whether host communities have medium or long-term sustainable ways to tackle shortages created in local agricultural production and the possible food insecurity challenges. Our findings are useful in developing programs designed to increase local agricultural capacity or build it back.

In the next section, we describe the data and the methodology used in our empirical analysis of the impact of IDP influx on household-level food security.

4. Empirical Methodology and Data

In this section, we present the empirical methodology and describe the data used in the analysis.

4.1. Empirical Methodology

We empirically estimate the impacts of forced displacement on agricultural outcomes at the household level for a sample of Nigerian households. The outcomes used in our analysis include total agricultural output, area harvested, output of specific crops, amount of household and hired labor, agricultural wages, and various measures of land ownership and use patterns. We estimate several variations of the following empirical model:

$$Y_{it} = \alpha + \beta(IDPinflow_{ist-1}) + \gamma X_{it} + \mu_i + \tau_t + \epsilon_{it} \quad (1)$$

where the subscripts i, s, and t represent household, local government area (LGA), and survey year, respectively. Y_{it} represents agricultural outcomes for household i in survey year t. Our main independent variable, $IDPinflow_{ist\ -\ 1}$, is measured as the number of IDPs living in household i's LGA during time period $t - 1$. X_{it} is the vector of time-varying household-level control variables which explain various agricultural outcomes. μ_i and τ_t are the household and survey year fixed effects, respectively. ϵ_{it} is the error term, clustered at the LGA level. We estimate the models using the fixed effects estimation method.

While the lagged displacement variable reduces concerns of reverse causality between agricultural outcomes and IDPs vis-à-vis a contemporaneous variable, it does not fully alleviate possible endogeneity concerns. Although we study forced displacement, the choice of destination locations by IDPs is still random. IDPs make temporary or permanent settlement decisions based on the place characteristics of potential host communities and their preferences. These factors may be correlated with various household-level characteristics, thereby raising endogeneity concerns. In other words, if IDP inflows are correlated with the time-varying characteristics of the household's resident LGA, OLS estimates might be biased. To address this, we use an instrumental variable (IV) approach. The IV approach is preferred over regular OLS regression methods owing to endogeneity concerns caused by non-random location choices made by IDPs. The regressions pass all the standard checks for the IV estimation procedure. Kleibergen–Paap LM test statistics are significantly large suggesting the models are well identified. Statistically significant Cragg–Donald Wald F-statistic values rule out the possibility of the weak instruments problem.

The extant empirical literature uses different instrumental variables to represent the forced displacement, including the distance to the border with the country of origin of the refugees [11] or the distance from the capital or the nearest larger city in the country of origin [27]. We closely follow Depetris-Chauvin and Santos' approach [13], which used the weighed sum of IDP outflows from all municipalities (except the receiving host city), with the weights being the inverse of the road distance between the host city and each municipality of origin. Since our forced displacement variable is measured as the number of IDPs living in the household's local government area (LGA), our instrumental variable is defined as the weighted sum of all IDP outflows from other LGAs except the household's resident LGA. We call this variable Receptivity_st following Depetris-Chauvin and Santos [13]. The underlying assumption is that the outflow of IDPs from other LGAs is positively correlated with the influx of IDPs into the given LGA. We use the inverse of distance between two LGAs as the spatial weight. The inverse distance weight measure provides more weight to outflows that are closer to the LGA in consideration.

For effective implementation of the IV approach, the receptivity variable has to satisfy two main assumptions. First, the receptivity variable has to be highly correlated with the endogenous variable. Since IDP outflows of other LGAs directly affect an LGA's IDP inflows, this assumption is fairly satisfied. Moreover, we conduct statistical tests which confirm the high correlation between the instrument and the endogenous variable. Second, the receptivity variable must meet the exclusion criteria, i.e., the receptivity variable only affects agricultural outcomes through the channel of IDP inflows.

4.2. Data

We use two main data sources for this empirical analysis. Data on household-level agricultural outcome variables are extracted from Nigeria Bureau of Statistic's General

Household Survey (GHS) data. This dataset is longitudinal in nature and extends from 2010 to 2019 across four waves. The data is collected at three levels: household, farm, and individual. For the purpose of the analysis, we aggregate all the required information at the household level to construct variables used in the empirical analysis. We only use the third and fourth waves, owing to the availability of commensurate forced displacement data (2015–2019).

Our basic unit of analysis is the household. The main dependent variables are agricultural outcomes, including output, area harvested, employment outcomes, and different land use variables. Agricultural area harvested is measured in hectares. Total agricultural output is measured in tons while outputs of specific crops are measured in kgs. We do so because most farmers grow multiple crops and on average, the outputs of specific crops are significantly smaller than the total agricultural output. Using tons to capture the outputs of specific crops will yield coefficients which are very small and harder to interpret. We also measure agricultural labor by household members and hired workers in hours. Agricultural wages are measured in naira (NGN), the Nigerian currency. Note that as of 31st December 2019, NGN 360 was equivalent to USD 1. We also use multiple household-level control variables from the dataset, including household size, number of children in the household, age, and gender of the household head. Climate-related variables such as annual mean temperature, rainfall, and soil quality are also included. We also control for various geographic variables, including distance to the nearest road, population center, and market.

As discussed above, our main independent variable, forced displacement, is measured as the total number of IDPs living in a household's LGA. We use the survey data from the displacement tracking matrix by the International Organization for Migration (IOM) to construct the forced displacement variable. This survey collects information on the number of IDPs in Northern Nigeria from 2015 to 2019. It is collected every three months and provides a fairly accurate estimate of the total number of IDPs at the LGA level, allowing us to construct the main independent variable. The dataset also records the origin LGA of the IDPs, enabling us to construct the instrumental variable, receptivity. We also classify IDP influx by type, displacements due to (1) armed conflicts, (2) communal violence, and (3) natural disasters based on the dataset.

5. Empirical Results

Empirical results are presented in Tables 1–6. The results in Table 1 show the impacts of IDP inflow into a community on total output (models 1 and 2) and agricultural areas harvested (models 3 and 4). Note that models 1 and 3 exclude controls while models 2 and 4 include controls. Obviously, models 2 and 4 are preferred and models 1 and 3 are only reported for comparison purposes. The results in Table 2 show the impacts of IDP influx on agricultural output (models 1 to 3) and on area harvested (models 4 to 6) due to insurgency, communal violence, and natural disasters. Note that all models in this table include controls. The results in Table 3 show the impacts of IDP influx on the outputs of 12 specific crops using models with controls. The results in Table 4 show the impacts on household labor hours (models 1 to 4) and on hired labor hours (models 5 to 8) for total IDP inflow and inflow due to insurgency, communal violence, and natural disasters. The results in Table 5 show the impacts on wages of hired men (models 1 to 4) and on wages of hired women (models 5 to 8) for total IDP inflow and inflow due to insurgency, communal violence, and natural disasters. Finally, in Table 6, we report the impacts of IDP inflow on six alternative land uses and land values.

Table 1. Impacts of forced displacement on output and area harvested.

	(1)	(2)	(3)	(4)
	Output (Tons)		**Area Harvested (Hectares)**	
IDPs (total)	−0.000111 *	−0.000163 **	0.0809	0.119
	(−1.87)	(−2.33)	(0.72)	(1.23)
Distance to nearest road		−0.0142		258.0 ***
		(−0.33)		(2.87)
Distance to nearest population center		0.00840		133.5 ***
		(0.41)		(3.64)
Distance to nearest market		−0.000218		25.96
		(−0.02)		(1.21)
Annual mean temperature		0.0539		92.69
		(1.41)		(1.46)
Total 12-month rainfall (mm)		0.00553 ***		−1.135
		(2.96)		(−0.45)
Soil quality		0.186		1030.4
		(0.23)		(1.00)
Female-headed household		−1.557 ***		−2703.5 **
		(−2.89)		(−2.60)
Age of household head		−0.00507		−43.83 **
		(−0.41)		(−1.99)
Household size		0.252**		864.1***
		(2.33)		(3.70)
No. of children		−0.251*		−299.5
		(−1.84)		(−0.96)
Constant	4.129 ***	−14.90	9849.5 ***	−26795.0
	(7.79)	(−1.43)	(9.63)	(−1.57)
F	3.483	4.966	0.525	8.882
idstat	5.426	6.963	5.426	6.963
N	1830	1830	1830	1830

Notes: t-statistics are in parentheses. Asterisks, *, **, and *** represent $p < 0.10$, $p < 0.5$, and $p < 0.01$, respectively. All models include survey year fixed effects.

Table 2. Impacts of types of forced displacement on output and area harvested.

	(1)	(2)	(3)	(4)	(5)	(6)
	Output (Tons)			**Area Harvested (Hectares)**		
IDPs (due to insurgency)	−0.000346 ***			−0.00232		
	(−2.89)			(−1.33)		
IDPs (due to communal violence)		0.00889 **			0.0596	
		(2.02)			(1.17)	
IDPs (due to natural disasters)			0.0378			0.253
			(1.62)			(1.08)
Distance to nearest road	0.00249	0.0943	−0.292 **	−0.132	0.483	−2.106
	(0.06)	(0.85)	(−2.26)	(−0.51)	(0.60)	(−1.24)
Distance to nearest population center	0.0263	0.00172	0.0403 *	−0.0486	−0.214	0.0452
	(1.29)	(0.03)	(1.71)	(−0.35)	(−0.52)	(0.31)
Distance to nearest market	0.00874	−0.0335	0.0186	−0.109	−0.392	−0.0424
	(0.84)	(−0.92)	(1.45)	(−1.12)	(−1.08)	(−0.52)
Annual mean temperature	0.0671 **	0.0303	0.0133	−0.561	−0.808	−0.922
	(2.02)	(0.35)	(0.25)	(−1.29)	(−0.95)	(−1.23)
Total 12-month rainfall (mm)	0.00507 **	−0.00251	0.00445 **	−0.00929	−0.0600	−0.0134
	(2.59)	(−0.53)	(2.10)	(−0.94)	(−1.17)	(−1.10)
Soil quality	1.283 **	1.189	1.617 *	−8.305	−8.932	−6.064
	(1.99)	(1.04)	(1.95)	(−1.38)	(−1.05)	(−1.12)
Female-headed household	−1.812 ***	−1.679	−2.712 **	−8.916	−8.027	−14.94
	(−3.54)	(−1.44)	(−2.13)	(−1.60)	(−0.98)	(−1.22)
Age of household head	−0.00794	0.00890	−0.00423	−0.160	−0.0470	−0.135
	(−0.64)	(0.45)	(−0.25)	(−0.89)	(−0.24)	(−0.72)

Table 2. *Cont.*

	(1)	(2)	(3)	(4)	(5)	(6)
	Output (Tons)			**Area Harvested (Hectares)**		
Household size	0.221 **	0.00919	−0.0401	−1.944	−3.365	−3.695
	(2.05)	(0.04)	(−0.17)	(−1.26)	(−1.14)	(−1.18)
No. of children	−0.160	0.101	−0.116	2.220	3.969	2.516
	(−1.14)	(0.32)	(−0.68)	(1.08)	(1.09)	(1.06)
Constant	−21.49 **	−4.523	−6.827	209.6	323.3	307.9
	(−2.17)	(−0.17)	(−0.45)	(1.36)	(1.10)	(1.28)
r2	−0.0138	−2.948	−1.892	−0.00481	−0.223	−0.145
F	4.932	1.776	4.147	0.345	0.181	0.220
idstat	11.62	4.604	2.969	11.62	4.604	2.969
N	1830	1830	1830	1830	1830	1830

Notes: t-statistics are in parentheses. Asterisks, *, **, and *** represent $p < 0.10$, $p < 0.5$, and $p < 0.01$, respectively.

Table 3. Impacts of forced displacement on output of specific crops.

	(1) Beans	(2) Cassava	(3) Cocoyam	(4) Groundnut	(5) Sorghum	(6) Maize	(7) Millet	(8) Rice	(9) Potato	(10) Soya	(11) Tomato	(12) Oil
IDPs (total)	0.00931 *	−0.0129 **	0.000268	0.00372	−0.0155	−0.00765	0.00403	0.00427	−0.00183 *	−0.00460 **	−0.000357	−0.000516
	(1.89)	(−2.08)	(0.94)	(0.91)	(−1.64)	(−0.88)	(0.54)	(0.44)	(−1.95)	(−2.18)	(−1.48)	(−1.38)
Constant	−1036.8 **	−799.5	−16.84	−372.1	1847.8	5784.4 *	−679.0	−5307.3	1129.5 **	925.2 **	28.46	85.34 **
	(−2.19)	(−1.22)	(−0.61)	(−0.80)	(0.95)	(1.84)	(−0.85)	(−1.36)	(2.32)	(2.24)	(1.29)	(2.34)
r2	−0.347	−0.465	−0.0559	−0.0740	−0.101	0.0446	0.0820	0.0164	−0.0927	−0.228	−0.140	−0.156
F	4.201	1.761	0.244	3.017	5.798	5.463	4.551	1.925	0.811	1.415	0.388	0.911
idstat	6.963	6.963	6.963	6.963	6.963	6.963	6.963	6.963	6.963	6.963	6.963	6.963
N	1830	1830	1830	1830	1830	1830	1830	1830	1830	1830	1830	1830

Notes: t-statistics are in parentheses. Asterisks, * and ** represent $p < 0.10$ and $p < 0.5$, respectively. The control variables include annual mean temperature, number of children in the household, annual rainfall, distance to population center, distance to the nearest market, female-headed household, and per capita food expenditure. Temperature is measured in degree Celsius. Rainfall is measured in millimeters. Both distance variables are in kilometers. Per capita food expenditure is in naira (NGN) (as of 31 December 2019, NGN 360 = USD 1).

Table 4. Impacts of forced displacement on employment outcomes.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Household Labor Hours				**Hired Labor Hours**			
IDPs (total)	0.0116				0.00569			
	(1.46)				(0.61)			
IDPs (due to insurgency)		0.0245 **				0.0121		
		(1.99)				(0.64)		
IDPs (due to communal violence)			−0.630				−0.310	
			(−1.47)				(−0.62)	
IDPs (due to natural disasters)				−2.654				−1.307
				(−1.32)				(−0.60)
Constant	−3475.7 ***	−3010.5 ***	−4211.6 *	−4046.6 ***	−732.1	−503.0	−1094.4	−1013.2
	(−3.47)	(−3.39)	(−1.96)	(−3.34)	(−0.79)	(−0.81)	(−0.64)	(−0.74)
r2	−0.162	0.101	−1.303	−0.663	−0.00962	0.00556	−0.0621	−0.0334
F	4.931	7.010	2.896	5.395	4.855	4.596	2.470	2.855
idstat	6.975	11.56	4.586	2.929	6.975	11.56	4.586	2.929
N	1830	1830	1830	1830	1830	1830	1830	1830

Notes: t-statistics are in parentheses. Asterisks, *, **, and *** represent $p < 0.10$, $p < 0.5$, and $p < 0.01$, respectively. The control variables include annual mean temperature, number of children in the household, annual rainfall, distance to population center, distance to nearest market, female-headed household and per capita food expenditure. Temperature is measured in degree Celsius. Rainfall is measured in millimeters. Both distance variables are in kilometers. Per capita food expenditure is in naira (NGN) (as of 31 December 2019, NGN 360 = USD 1).

Table 5. Impacts of forced displacement on agricultural wages.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Hired_Men_Wage				Hired_Women_Wage			
IDPs (total)	−0.0665 **				−0.0982 **			
	(−2.51)				(−1.98)			
IDPs (due to insurgency)		−0.0840 **				−0.118 *		
		(−2.33)				(−1.97)		
IDPs (due to communal violence)			−5.946				454.5	
			(−0.69)				(0.01)	
IDPs (due to natural disasters)				28.76				18.63
				(1.09)				(1.05)
Constant	1015.5 ***	933.3 ***	1086.0	620.6 ***	1481.3 ***	1295.4 ***	46839.1	809.5 ***
	(6.43)	(6.75)	(1.58)	(4.09)	(4.20)	(4.42)	(0.01)	(2.61)
r2	−0.104	−0.0806	−68.63	−3.103	−0.164	−0.0817	−610019.6	−1.896
F	4.440	4.296	0.168	5.198	1.470	1.548	0.0000217	1.828
idstat	12.83	8.094	0.515	1.380	11.36	7.468	0.0000494	1.435
N	1353	1353	1353	1353	499	499	499	499

Notes: t-statistics are in parentheses. Asterisks, *, **, and *** represent $p < 0.10$, $p < 0.5$, and $p < 0.01$, respectively. The control variables include annual mean temperature, number of children in the household, annual rainfall, distance to population center, distance to nearest market, female-headed household and per capita food expenditure. Temperature is measured in degree Celsius. Rainfall is measured in millimeters. Both distance variables are in kilometers. Per capita food expenditure is in naira (NGN) (as of 31 December 2019, NGN 360 = USD 1).

Table 6. Impacts of forced displacement on types of land use.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Land (Purchased)	Land (Rented)	Land (Free)	Land (Family Inheritance)	Fallowed Land	No. of Plots	Expected Value of Land
IDPs (total)	−0.00491	0.0149	0.0220	0.0246	0.00332	−0.0000295 *	−0.00975 ***
	(−0.25)	(1.02)	(0.88)	(0.36)	(0.92)	(−1.91)	(−2.69)
Constant	574.7	−3948.4	5002.1	−22444.3	662.8	1.237	1297.2 ***
	(0.16)	(−1.54)	(0.87)	(−1.61)	(0.76)	(0.50)	(2.86)
r2	0.0292	−0.0304	0.000272	0.0760	0.00107	−0.203	−1.122
F	1.627	1.952	1.346	4.399	1.030	4.101	3.020
idstat	1830	1830	1830	1830	1830	1830	1830

Notes: t-statistics are in parentheses. Asterisks, * and *** represent $p < 0.10$ and $p < 0.01$, respectively. The control variables include annual mean temperature, number of children in the household, annual rainfall, distance to population center, distance to nearest market, female-headed household and per capita food expenditure. Temperature is measured in degree Celsius. Rainfall is measured in millimeters. Both distance variables are in kilometers. Per capita food expenditure is in naira (NGN) (as of 31 December 2019, NGN 360 = USD 1).

We examine first the results of Table 1. As discussed in the previous section, the IDP variable is instrumented using the receptivity variable. In model 1, forced displacement has a significant and negative impact on the total agricultural output at the 10 percent significance level. This result holds at the 5 percent significance level in model 2 where we add control variables. On the other hand, the influx of IDPs has no significant impact on the amount of area harvested at the household level (see models 3 and 4).

The findings reported in Table 1 that forced displacement negatively impacts total agricultural output can be explained as follows. First, the population pressure resulting from incoming IDPs could lead to some agricultural land being redirected toward non-agricultural purposes. For instance, a previous study estimates that the construction of emergency shelters for IDPs in Haiti used up around five percent of the country's forest cover [28]. Similarly, the establishment of refugee camps in northern Cameroon significantly reduced grazing areas previously available to the local population [28]. Second, the influx of IDPs invites sizable amounts of national and international aid, which could satisfy some or all of the new demand induced by the IDPs. This could negatively impact local agricultural production. Fitzpatrick and Storey [16] argue that one of the most persistent objections to food aid is the view that it is an obstacle to local agricultural production in the recipient country. This is attributed to negligence of the local governments to their own agricultural sectors (policy disincentive), mismatch between new aid-induced food tastes

and the local demand, and decreasing prices forcing local farmers to produce less. Third, previous studies have shown that armed conflicts and other forms of shocks can negatively impact the availability of agricultural inputs in affected places and surrounding areas [9]. Since IDP camps and host communities are often closer to the conflict zones, the shortage of non-labor inputs can negatively impact the level of agricultural activities.

Next, we examine the role of control variables in explaining the agricultural outcomes from models in Table 1. As expected, annual rainfall and household size are positively related to agricultural output while the number of children in the household has a negative effect. Female-headed households produce significantly less output, compared with their male headed counterparts. None of the other variables has a significant effect on the output.

Now we examine the determinants of total area harvested. As shown in Table 1, an increase in the distance to the nearest road and distance to the nearest population center leads to an increase in the area harvested. This result is not surprising given the fact that large agricultural lands are located in rural areas, away from main population centers and better road networks. Similarly, household size has a positive impact on the area harvested. However, female-headed households harvest relatively less area compared to their male counterparts. Age of household head also has a negative impact on the area harvested.

Next, we examine the impacts of forced displacement by type on the total output and area harvested (see Table 2). In models 1 and 2, the forced displacement due to insurgency negatively impacts total agricultural output whereas forced displacement due to communal violence positively impacts total output. In Northern Nigeria, the main focus of our empirical analysis, the primary cause of forced displacement is armed conflicts. All the factors that could lead to a decline in output, including population pressure, aid-induced expenditure shock, and fall in agricultural prices are much likely to be in play in areas which attracts conflict-driven IDPs. In areas where the IDP influx is driven by communal violence, the relative magnitude of these factors is much less and might temporarily drive up local agricultural production.

In Table 3, we present results for the impacts of forced displacement on output of specific crops (which crops are the most affected by the IDP influx). IDPs negatively impact the production of cassava, potato, and soya. As discussed earlier, the impacts on local production of specific crops will depend on the new food tastes induced by aid. For other crops, there is no significant impact of forced displacement on their outputs.

Next, we examine the effects of forced displacement on employment outcomes (see Table 4). Overall, forced displacement has no significant impacts on employment outcomes, except for household labor hours. In model 2, IDPs due to insurgency positively impact household labor hours. Because IDPs often engage in non-agricultural jobs, this may crowd out the local the employment of local people in agriculture and force agricultural households to devote more effort to the farm. In addition, IDPs from areas facing insurgency and communal violence are often deemed suspicious by the local communities, thereby increasing the monitoring costs for hired labor. Similarly, one can expect the incidence of theft and theft to increase as a more diverse set of people move into the community. Moreover, empirical evidence suggests that forced displacement could cause non-farm unemployment and lower wages in host communities, thereby displacing the local workforce from labor markets [28]. This workforce could be forced to work on their own farms to maintain their livelihoods.

Next, we examine how forced displacement impacts agricultural wages in host communities (see Table 5). As shown in models 1 and 5, the influx of IDPs significantly reduces the daily agricultural wages for both men and women. This suggests that forced displacement increases labor supply in the agricultural sector, thereby pulling down wages in the host communities. This is especially true if total output does not change or even decreases, as shown in Table 1. Results in models 2 and 6 show that the decline in agricultural wages in host communities is primarily driven by IDPs due to insurgency. This result is consistent with previous studies which suggest that wages of unskilled workers in host communities go down as a result of forced displacement [3].

In Table 6, we report the impacts of forced displacement on different land-related variables. Forced displacement does not have any significant effects on the methods of land acquisition by the local households. The proportion of land purchased, rented, received as free, or inherited are not significantly impacted. The amount of fallowed land also remains unaffected. However, the influx of IDPs negatively impacts the total number of plots and the expected value of land.

Tables A1–A3 show results for impacts of IDPs due to insurgency, communal violence, and natural disasters, respectively, on outputs of specific crops. Results in Table A1 show that insurgency led IDP influx reduces output for cassava, potato, and soya, suggesting that results in Table 3 are primarily driven by insurgencies. However, IDPs due to communal violence and natural disasters have no significant impact on crop outputs.

6. Summary and Conclusions

Many developing countries are experiencing growing exposure to human, health, climate, and environmental shocks which complicate stability and make achieving human development goals more difficult. A significant body of literature has examined how such shocks affect people in communities that are directly affected. Specifically, there is growing evidence of the detrimental impacts of such extraneous shocks as terrorism, communal violence, farmer-herder conflicts, drought, desertification, and extreme temperatures on critical elements of development such as agriculture, incomes, wages, employment, food security, land use, and human displacement. A general conclusion that could be drawn from such studies is that these shocks disrupt agriculture, markets and trade, compromise food security, rollback past development achievements, contribute to poverty and human suffering, and challenge key institutional arrangements that are critical to growth, development, and sustainability.

The fact that these shocks often lead to the forced displacement of people, families, and communities exacerbates their disruptive impacts. Often, communities that are remote from the direct theater of impact absorb large numbers of displaced people who may overwhelm the host communities' capacity to cope. New entrants, who are often poor, bring to host communities added demand for food and non-food items which their existing system are not always able to absorb. Because of the large number of forcibly displaced people around the globe, it is important to better understand how the added demands of new entrants enhance or compromise the key development indicators and the status and conditions of host communities, especially with respect to agriculture.

In this paper, we focus on Nigeria, a nation which has experienced in recent years a myriad of shock, from drought to violent conflicts to terrorism. Since agriculture is an important element of food security and human development, especially in Africa, we specifically examine how these shocks affect agricultural production and performance not in the direct theaters of action, but in remote host communities that have to grapple with the expanded spatial impact. We show that agriculture in host communities is indirectly adversely affected by shocks through the pathway of forced human displacement. Specifically, forced displacement generally results in reduced agricultural production in host communities due to lower land and labor productivity. We also find that while the effect of insurgency-driven forced displacement on agricultural production in host communities is negative, for communal violence, it is positive due possibly to the fact that victims of the former are more devastated, are usually more numerous, and more significantly worsen the poverty status of host communities.

We also find differential impacts on specific crops, perhaps due to the relative differences in crop exposure to theft and vandalism and to the relevance of crops to relief efforts. Furthermore, while insurgency-driven population influx reduces the agricultural wages of both males and females, it increases the reliance on male and female household labor but has no effect on hired labor. Finally, while insurgency-driven IDP influx does not affect land use and land market activities, it lowers the expected value of land and the number of farm plots harvested. These findings suggest that host communities are set back, at least

in the short run, and efforts may be needed to revitalize agriculture in host communities, rather than just focusing on humanitarian assistance. These disruptions may also offer opportunities to build back better in ways that considers the opportunities inherent in higher population and a more diverse mix of host community residents.

Host communities often experience heightened presence of local, state, regional, national, and international relief agencies. Relief efforts are usually focused on these communities due to the difficulties and security risks associated with addressing the needs of victims that are still trapped in their original communities. These agencies rely mostly on food and non-food supply chains that are extraneous to the host communities. Despite the enhanced supply of relief materials, our study suggests that local agriculture suffers. Reduced agricultural activity in host communities may arise from the crowding out of long-term farmers, added security problems and concerns, increased incidence of theft of and vandalism to agricultural crops, disruptions in local agricultural markets, logistical challenges due to destroyed or disrupter road and transportation infrastructure, the possibility that farm household members may be distracted by employment opportunities with IDP camps and relief agencies, the inability of local farmers to tap into supply opportunities offered by relief agencies, and a host of other factors.

The fact that production activities in agriculture decline when there are more mouths to feed suggests the need for policymakers to consider issues related to rebuilding of the agricultural capacity of host communities. In essence, because forced displacement may affect the structure of host communities, there may be opportunities to adopt building back better strategies in repositioning agriculture while addressing humanitarian problems. Meeting the added demand in a host community through the development of local agricultural capacity may well be a more sustainable pathway to regional food security and poverty reduction than over-reliance on the import of food and relief materials. Indeed, the excess demand created by added population in host communities may be an opportunity to drive economic development in those communities. Without such locally focused efforts, host communities may be left in worse shape than they were before the shocks that overwhelmed them with forcibly displaced people.

One implication of this study stems from the fact that the majority of IDPs reside independently and with relatives and friends in host communities where government and NGO relief efforts are not concentrated rather than in formal IDP camps which are often better serviced. That is, non-camp-based IDPs must rely on the productive capacities of the host communities to meet their added demand for food. In the absence of that capacity, food security is compromised. This further buttresses the point made above that strategies may be needed to beef up the agricultural economy in host communities, or sustainable development of agriculture may be constrained.

The major contribution of this paper is its examination of the agricultural spillover effects of various types of shocks to host communities through the forced displacement of people. Our comparison of various types of shock as causes, various agricultural outcomes, and various specific crops are also novel. With this study, what is known about how agriculture is affected can now be extended to host communities.

There are other aspects of the impacts of forced displacement on host communities that warrant future examination. For example, the stresses on basic infrastructure (e.g., water, sanitation, healthcare, and other public services) needs to be better understood. Additionally, the assimilation and integration pathways such as entrepreneurial and employment opportunities that IDPs use to revive their livelihoods need to be better understood. The successes of past attempts to support the rehabilitation of IDPs in host communities are also important.

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Appendix A

Table A1. Impacts of forced displacement due to insurgency on output of specific crops.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Beans	**Cassava**	**Cocoyam**	**Grdnut**	**Soghum**	**Maize**	**Millet**	**Rice**	**Potato**	**Soya**	**Tomato**	**Oil**
IDPs (due to insurgency)	0.0199 **	−0.0268 **	0.000573	0.00802	−0.0322 *	−0.0152	0.00876	0.00912	−0.00387 **	−0.00968 **	−0.000752	−0.00108
	(2.55)	(−2.56)	(1.01)	(1.01)	(−1.67)	(−0.80)	(0.56)	(0.45)	(−2.11)	(−2.56)	(−1.62)	(−1.45)
Constant	−655.2	−1302.6 **	−5.847	−217.5	1246.5	5509.9 *	−508.7	−5132.8	1056.1 **	742.2 **	14.22	65.10 **
	(−1.64)	(−2.22)	(−0.32)	(−0.55)	(0.72)	(1.88)	(−0.83)	(−1.44)	(2.25)	(2.11)	(0.97)	(2.16)
r2	−0.0177	−0.0237	−0.00837	0.0117	−0.00675	0.0493	0.119	0.0208	0.0404	−0.0296	−0.0157	−0.0247
F	5.325	2.012	0.273	2.155	3.382	5.514	4.165	1.885	0.910	1.250	0.366	0.992
idstat	11.56	11.56	11.56	11.56	11.56	11.56	1830	1830	1830	1830	1830	1830
N	1830	1830	1830	1830	1830	1830	−508.7	−5132.8	1056.1 **	742.2 **	14.22	65.10 **

Notes: t-statistics are in parentheses. Asterisks, * and ** represent $p < 0.10$ and $p < 0.5$, respectively. The control variables include annual mean temperature, number of children in the household, annual rainfall, distance to population center, distance to nearest market, female headed household and per capita food expenditure. Temperature is measured in degree Celsius. Rainfall is measured in millimeters. Both distance variables are in kilometers. Per capita food expenditure is in Naira.

Table A2. Impacts of forced displacement due to communal violence on output of specific crops.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Beans	**Cassava**	**Cocoyam**	**Grdnut**	**Soghum**	**Maize**	**Millet**	**Rice**	**Potato**	**Soya**	**Tomato**	**Oil**
IDPs (due to communal violence	−0.513 *	0.691 *	−0.0148	−0.206	0.828	0.393	−0.225	−0.235	0.0996	0.249 *	0.0194	0.0278
	(−1.97)	(1.80)	(−0.99)	(−1.04)	(1.44)	(0.77)	(−0.54)	(−0.44)	(1.63)	(1.95)	(1.36)	(1.29)
Constant	−1632.2	14.14	−33.98	−610.8	2825.3	6258.1 *	−938.4	−5580.1	1246.0 **	1217.2	51.14	118.0
	(−1.00)	(0.01)	(−0.58)	(−0.76)	(0.96)	(1.81)	(−0.68)	(−1.26)	(2.00)	(1.64)	(0.80)	(1.22)
R^2	−1.842	−2.554	−0.289	−0.490	−0.617	−0.00510	−0.0997	0.00367	−0.845	−1.152	−0.819	−0.920
F	1.926	0.541	0.189	1.618	2.669	10.40	2.178	1.409	0.656	1.195	0.305	0.353
idstat	4.586	4.586	4.586	4.586	4.586	4.586	4.586	4.586	4.586	4.586	4.586	4.586
N	1830	1830	1830	1830	1830	1830	1830	1830	1830	1830	1830	1830

Notes: t-statistics are in parentheses. Asterisks, * and ** represent $p < 0.10$ and $p < 0.5$, respectively. The control variables include annual mean temperature, number of children in the household, annual rainfall, distance to population center, distance to nearest market, female headed household and per capita food expenditure. Temperature is measured in degree Celsius. Rainfall is measured in millimeters. Both distance variables are in kilometers. Per capita food expenditure is in Naira.

Table A3. Impacts of forced displacement due to natural disasters on output of specific crops.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Beans	**Cassava**	**Cocoyam**	**Grdnut**	**Soghum**	**Maize**	**Millet**	**Rice**	**Potato**	**Soya**	**Tomato**	**Oil**
IDPs (due to natural disasters)	−2.159	2.910	−0.0622	−0.869	3.489	1.653	−0.950	−0.989	0.420	1.050	0.0816	0.117
	(−1.53)	(1.51)	(−0.90)	(−0.94)	(1.25)	(0.74)	(−0.53)	(−0.44)	(1.39)	(1.49)	(1.21)	(1.16)
Constant	−1498.0 *	−166.7	−30.11	−556.8	2608.5	6155.4 *	−879.4	−5518.7	1219.9 **	1152.0 **	46.07	110.7 *
	(−1.81)	(−0.15)	(−0.70)	(−0.91)	(1.06)	(1.82)	(−0.78)	(−1.28)	(2.26)	(2.07)	(1.22)	(1.94)
R^2	−1.119	−1.603	−0.181	−0.297	−0.449	0.00732	0.0131	0.0107	−0.529	−0.864	−0.522	−0.599
F	3.665	1.309	0.257	1.604	1.530	4.736	3.659	1.824	0.781	0.940	0.348	0.657
idstat	2.929	2.929	2.929	2.929	2.929	2.929	2.929	2.929	2.929	2.929	2.929	2.929
N	1830	1830	1830	1830	1830	1830	1830	1830	1830	1830	1830	1830

Notes: t-statistics are in parentheses. Asterisks, * and ** represent $p < 0.10$ and $p < 0.5$, respectively. The control variables include annual mean temperature, number of children in the household, annual rainfall, distance to population center, distance to nearest market, female headed household and per capita food expenditure. Temperature is measured in degree Celsius. Rainfall is measured in millimeters. Both distance variables are in kilometers. Per capita food expenditure is in Naira.

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