Impact of farmers-herders conflict on livelihoods of farming households in Nigeria's middle-belt region

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Abstract

This research determined the impact of farmers-herders conflict on the livelihoods of farming households in Nigeria's middle belt region using field survey data elicited from 290 respondents chosen through a multi-stage sampling technique. Inferential statistic was used to analyze the collected data. The empirical evidences showed that conflict has affected the livelihoods of highly conflict-prone households both in the short and long runs, thus hampering the rural economy and the national economy in general. Besides, the negative impact of the conflict is more pronounced on the farm income, which owes to farmland invasion by the nomads, thus affecting the income that accrues from the marketable surplus. Furthermore, the extent of conflict has induced discrimination into the various kinds of income earned vis-à-vis highly and less conflict-prone households. Likewise, the income gap due to conflict was more pronounced on farm income, accounting for 79.3% as against the non-farm income which is 55.5%. Generally, it can be inferred that farmers-herders conflict has affected the rural economy in particular and the economy in general. Therefore, the study advise all the concerned stakeholders viz. states and local governments, crop farmers, pastoralists/nomads and communities to accept and embrace the federal government initiatives aimed at finding lasting solutions to farmers-herders conflict in the studied area. This singular act will enhance the food security of the area, avert wanton and incessant bloodbath and loss of properties, contain growth of destitute and enhance harmonious peaceful coexistence in the studied area.

Keywords: Farmers, Herders, Conflict, Income, Nigeria

INTRODUCTION

Many African agrarian countries are experiencing population growth, which is followed by increased demand for space, energy, and arable cropland, both of which have alternative and competitive uses (Vanclay, 2003; Somiyool and Fadairo, 2020). Different parties are constantly fighting over the use of resources such as land and water bodies, resulting in constant clashes and crises that lead to land-use conflict. This condition has intensified in recent years as a result of climate change impacts (Adeniran, 2020), which include the drying up of rivers and other bodies of water, the depletion of soil nutrients due to erosion, and crop failures, among other things (Raleigh, 2010; Soomiyol and Fadairo, 2020).

Conflict over resource use is not rare, and it may not be unnatural, as conflict is not necessarily evil, but it may be a necessary part of human organization's evolution, transition, and growth (Hendershot, 1995; Soomiyol and Fadairo, 2020). If a dispute degenerates into violence, it contributes to violent conflicts, a decrease in productivity, and an excessively downward trend in economic development, rendering it not just unhealthy and villainous, but often counter-productive and progress damaging in every community (Moore, 2005).

According to Nyong and Fiki (2005), a general decline in per capita food production in sub-Sahara Africa has occurred as a result of competitively motivated conflicts between arable crop farmers and herdsmen over land and resource-use, with Nigeria being especially affected due to common occurrences in many parts of the country. Conflicts between settled farmers, crop farmers and herdsmen, fishermen and crop farmers, and others are common among rural land users (Gefu and Kolawole, 2002; Chikodiri and Chukwuemeka, 2019). However, land use conflict between crop farmers and nomadic herdsmen is the most common in Northern Nigeria (Audu, 2013).

The ugly dimension which farmers-herders clashes have assumed is not only threatening the livelihood and the economy-rural and national economies of the nation but also the peaceful coexistence and unity of the country. This shows that the country is sitting on a timing bomb, and if not tame, the conflict is likely to snowball the country into the likes of Somalization- destabilization/ dismember of the decades agreed non-negotiable unity of Nigeria; and Rwanda genocides- ethnic cleansing.

According to the Global Terrorism Index (2015), herders were the fourth deadliest terrorist organization in the world in 2014 (Alao *et al.*, 2019). In nearly every part of Nigeria, conflicts between crop farmers and herders are common (Dimelu *et al.*, 2017; Rukwe *et al.*, 2019). It is a formidable barrier to economic growth, a threat to food security, and a threat to agrarian communities' long-term survival (Dimelu *et al.*, 2017). Despite the fact that most media focused on herdsmen abuse, Vanguard (2017) reported that the Fulani have lost over two million cows to rustlers in the last two years, with over 600 people killed.

The Fulani herdsmen and farmers clash, armed militia and banditry, ethnic and religious disputes, rebel-

lion, armed robbery, widespread poverty, corruption, economic sabotage, and environmental degradation all pose significant internal socio-economic and security challenges to Nigeria (Osaghae and Suberu, 2005; Soomiyol and Fadairo, 2020). The challenges posed by these insecurity drivers have distinct economic, political, and environmental dimensions, each of which has had a major effect on the country's stability, food security, peace, and welfare.

The violent conflict between nomadic herdsmen from Northern Nigeria and sedentary agrarian communities in the central and southern zones has been singled out as having a major socio-economic effect on the citizens of the country, as well as the potential to stymie future growth if efforts are not quickly channeled to provide a long-term solution to the menace (Abbass, 2012). Farmers-herders conflict in Nigeria has inevitably intensified in recent years and is spreading southward, posing a threat to the country's security and stability (International Crisis Group-ICG, 2017). With an estimated death toll of about 2,500 people in 2016, these clashes are becoming just as deadly as the Boko Haram insurgency in Nigeria's northeast. More than 1,300 Nigerians were killed in violence between herders and farmers in the first half of 2018 (ICG, 2018). It now claims roughly six times the number of civilian lives as the Boko Haram insurgency. Despite this, federal and state responses to the crisis have been unsuccessful in containing the situation (ICG, 2017). What were once accidental attacks have developed into premeditated scorched-earth operations in which marauders often ambush villages at night (ICG, 2018).

Drought and desertification have depleted pastures and dried up many natural water sources in Nigeria's far northern belt, forcing large numbers of herders to move south in search of grassland and water for their herds, wreaking havoc on agricultural production and sustainability for north central farmers. Similarly, the expansion of human settlements as a result of population development, public infrastructure expansion, and land acquisition by large-scale farmers and other private commercial investors has deprived herders of grazing reserves designated by the former northern region's post-independence government (Soomiyol and Fadairo, 2020). The bloodshed is being compounded by the growing availability of illegal weapons, both locally produced and smuggled in from neighboring African countries. Thousands of people have been forcibly displaced, and homes, crops, and livestock worth billions of naira have been lost, causing major economic harm to the local and state economies.

People's livelihood resources, especially farming communities', are threatened by conflict because they are so reliant on natural resources for survival. Herders-farmers conflicts have a direct effect on the lives and livelihoods of those involved, but they also disturb and endanger the sustainability of agricultural and pastoral development in West Africa (Moritz, 2010; Dimelu *et al*., 2017; Awotokun, 2020; Sani *et al*., 2021), and inevitably the livelihoods of rural communities.

The livelihoods of households in the north-central region of Nigeria, which are intertwined with agriculture, have been adversely impacted by recent conflict regimes. Dropping national agricultural productivity and its associated implications on national wealth creation and farmer earnings are two major costs arising from Fulani herders-farmers conflicts (Awotokun, 2020). Crop production, not livestock production, is the driving force behind the agricultural sector (CBN, 2018). As a result, the decrease in crop production has an effect on the country's gross domestic product (GDP). Conflicts between herders and farmers have a major impact on agricultural productivity, especially crop production, which is disrupted and reduced. Low agricultural production as a result of the herders-farmers' never-ending crisis has intensified poverty in these conflict zones, as well as surrounding or adjacent populations.

According to a report conducted by Mercy Corps, Nigeria is losing approximately US$13.7 billion due to herders-farmers conflicts. In other words, if herder-farmer disputes did not occur, Nigeria would benefit US$13.7 billion in overall macroeconomic growth (Mercy Corps, 2015a). According to Mercy Corps (2015b), conflict in these conflict-prone communities will cause a household's income to drop by at least 64%, and probably as much as 210 percent. This is because, for security reasons, most of them will be afraid to seek their livelihoods for long periods of time. Food shortages will intensify, leading to starvation, which will eventually result in malnutrition, an epidemic of preventable diseases, child stunting, and an increase in child and maternal mortality. As a result, not only do farmers and herders' earnings suffer, but their general well-being does as well (Awotokun *et al*., 2020). Non-payment of taxes results in a loss of revenue for the different state governments in these areas where disputes are widespread. Conflicts between herders and farmers are expected to cost states an average of 47% of their tax revenue (Mercy Corps, 2015a).

If the situation is not addressed, it may have a more significant effect on people's livelihoods and national food security in general. However, in order to better assist people impacted by the crisis, sufficient information on the dimension and degrees of impact across farming households must be understood in order to better introduce resilient measures to minimize land-use conflict. The recent upsurge in herdsmen and native farmers conflict, though national in nature, has been concentrated primarily in Nigeria's North Central Region and is linked to herdsmen migration (Alao *et al*., 2019), necessitating an analysis of the impact on food security. The impact of conflict on the livelihoods of rural farming communities must be examined in order for stakeholders to react and intervene appropriately. Furthermore, it is important for a well-informed plan for successful and long-term conflict management and resolution. It is in the light of the above that this research theme "impact of farmers-herders conflict on livelihood of farming households in Nigeria's Middle-Belt region" was conceptualized with the aim of having insight- exploratory detail of the consequence on the country's livelihoods. The specific objectives were to determine the effect and impact of farmers-herders conflict on households' livelihood; and, to determine income gap due conflict in the studied area.

RESEARCH METHODOLOGY

The research was conducted in the Nigeria's Middle-Belt region which lies between latitude 10˚ 20' and longitudes 7˚ 45' Greenwich meridian time. The region is majorly characterized by savannah vegetation- northern and southern guinea savannah and alongside a stream of plateau vegetation. The region encompasses six autonomous states (Benue, Kogi, Kwara, Plateau, Nasarawa and Niger states) and a unity territory (Federal Capital Territory Abuja). The mean cumulative annual and monthly rainfall of the region are 1247 ± 167 mm and 104.0 mm, respectively; while the annual mean temperatures hovered around minimum and maximum values of 22.5 ± 0.42˚C and 33.5 ± 0.23˚C respectively. The mean is slightly above 50 percent for the relative humidity and varied between the small range of 50.08 and 52.75 percent (Olayemi *et al.*, 2014). Agricultural activities viz. arable crop farming, fruit crop farming, horticultural crop farming are the major occupations of the inhabitants while allied activities- livestock keeping, bee keeping, hunting; artisanal, Ayurvedic medicines and civil service are the complementary occupations practiced in the region. The research used a multi-stage sampling technique to draw the representative sampling units for the study. Given that farmers-herders conflict has ravaged the entire region which is composed of six autonomous states and a unity territory, and the state of insecurity-kidnapping in exchange for exorbitant ransom, two states viz. Nasarawa and Niger states were conveniently selected. Thereafter, given the stratification of the chosen states into three agricultural zones each, one local government area (LG) was randomly chosen from each of the agricultural zones, thus given a total of six LGAs selected. From each of the selected LGAs, three villages were randomly selected, thus given a total of eighteen villages been selected. The combination of reconnaissance survey and reputable organization viz states' Agricultural Development Programmes (ADP), farming households' enumeration information were used to draw a sampling frame. Using Yamane's scientific sample formula, a representative sample size of 297 respondents was determined.

Yamane's scientific sampling formula is given in equation 1:

$$n = \frac{N}{1 - N(e)^2} \quad \text{..... (1)}$$

Where, N= total population; n= representative sample size; and, e = error gap (0.055)

Subsequently, the determined representative sample size of 297 respondents was drawn using simple random sampling technique (Table 1). However, seven of the questionnaires were found to be extraneous: non-response; thus eliminated from the analysis. Therefore, only a total of 290 valid questionnaires were subjected to the analysis. Information elicitation was done using a well-structured questionnaires complemented with interview schedules. The first and second objectives were achieved using Chow-test statistics and Average treatment effect (ATE); while the last objective was achieved using ATE and Oaxaca-Blinder decomposition model.

Empirical model

Farmers-herders conflict prone index

Step 1:

Exploratory factor analysis: The factor variables were reduced to weights using exploratory factor analysis-principal component. The Kaiser Mayer Olkin (KMO) test of sampling adequacy value is 0.876, a meritorious level, greater than the Kaiser (1974) threshold value of

Table 1: Sampling frame of the farming households

State	Agric. Zone	LGA	Villages	Sampling frame	Sample size
Nasarawa	Central	Akwanga	Nunku	201	20
			Anjida	173	18
			Archia	110	11
	South	Awe	Tunga	160	16
			Azara	240	24
			Baure	152	16
	West	Karu	Ankoma	141	14
			Gitata	240	25
			Panda	210	21
Sub-total	**3**	**3**	**9**	**1627**	**165**
Niger	A	Mokwa	Kudu	124	13
			Dankogi	86	8
			Kpashafu	59	6
	B	Shiroro	Allawa	160	16
			Tegina	61	6
			Kuta	186	19
	C	Mariga	Shadadi	95	10
			Beri	143	15
			Bobi	382	39
Sub-total	**3**	**3**	**9**	**1296**	**132**
Total	**6**	**6**	**18**	**2923**	**297**

0.50, thus suitable for analysis. This indicates that there is a common variable applicable to all the factors and the sample is adequate. Besides, the Bartlett's Sphericity test (BST) was significant at 1 percent, indicating that the rotated variables are not identity matrix. The Varimax rotated matrix generated four factors based on Eigen-value greater than unity and these factors accounted for 67.6 % of the total variation (Table 2). Factor 1, 2, 3 and 4 respectively, are labeled Environmental, human, political and crop destruction causatives.

Step 2: To obtain the conflict prone index, the causal variables were normalized and then multiplied by their respective weight generated from the Varimax rotation. Presented below is the conflict prone index model:

Normalization index

$$I_i = \frac{P_i - \bar{P}}{SD} \quad \text{..... (2)}$$

Where *I* is the normalized value of the ith respondents for a causal component indicator; *P* is the actual causal component value of ith respondents; is the average value of the causal component; and, SD is the standard deviation value of the causal component.

$$CP_i = \frac{\sum_{k=1}^{n} W_k I_k}{\sum_{k=1}^{n} W_k} \quad \text{..... (3)}$$

This can further be expressed as:

$$CP_i = \frac{W_{X1}I_{X1} + W_{X2}I_{X2} + W_{X3}I_{X3} + W_{X4}I_{X4} + W_{X5}I_{X5} + W_{X6}I_{X6} + W_{X7}I_{X7} + \cdots + W_{Xn}I_{Xn}}{W_Y + W_{X1} + W_{X2} + W_{X3} + W_{X4} + W_{X5} + W_{X6} + W_{X7} + \cdots + W_{Xn}} \quad \text{.... (4)}$$

Where, CP_i = conflict-prone index; W= weight; X_1-X_n are the indicators.

$$\textit{Very less affected} =< 1$$
$$\textit{Less affected} =< 2$$
$$\textit{highly affected} = 2\text{-}5$$

Chow F-statistic test

Following Onyenweaku (1997); Amaefula *et al.* (2012), the F-statistics tests for Test for Effect of the conflict, Test for Homogeneity of slopes and Test for Differences in intercepts are given below:

To isolate the effect of conflict, the error sum of squares for income function of: (i) highly conflict affected households (ii) less conflict affected households (iii) pooled data without a dummy variable (iv) pooled data with a dummy variable (highly affected =1, less affected =0) were used.

Test for effect of the conflict:

$$F^* = \frac{[\sum \varepsilon_3^2 - (\sum \varepsilon_1^2 + \sum \varepsilon_2^2)]/[K_3 - K_1 - K_2]}{(\sum \varepsilon_1^2 + \sum \varepsilon_2^2)/K_1 + K_2} \quad \text{..... (5)}$$

Where $\sum \varepsilon_3^2$ and K_3 are the error sum of square and degree of freedom respectively for the pooled stratum (highly and less affected), $\sum \varepsilon_1^2$ and K_1 are the error sum of square and degree of freedom respectively for the highly affected stratum, and, $\sum \varepsilon_2^2$ and K_2 are the error sum of square and degree of freedom respectively for the less affected stratum.

If the F-cal is greater than the F-tab, it implies that conflict had effect on the income of the highly affected stratum.

Test for homogeneity of slope:

$$F^* = \frac{[\sum \varepsilon_4^2 - (\sum \varepsilon_1^2 + \sum \varepsilon_2^2)]/[K_4 - K_1 - K_2]}{(\sum \varepsilon_1^2 + \sum \varepsilon_2^2)/K_1 + K_2} \quad \text{..... (6)}$$

Where $\sum \varepsilon_4^2$ and K_4 are the error sum of square and degree of freedom respectively for the pooled stratum (both highly and less affected strata) with a dummy variable.

If the F-cal is greater than the F-tab, it implies that conflict brings about a structural change or shift in the income parameter.

Table 2: Varimax rotation factor components

Items	Factor 1	Factor 2	Factor 3	Factor 4
Hostilities to one another	0.791			
Lack of compliance to stock routes	0.774			
Indiscriminate bush burning	0.748			
Overgrazing on farmland	0.746			
Attack on cattle by farmers	0.667			
Lack of respect for both parties	0.575			
Poor awareness of stock route		0.780		
Competition for land and water		0.737		
Rivalry between both parties		0.723		
Illegal incursion of farm land by pastoralists		0.679		
Drunkenness		0.572		
Drug abuse			0.775	
Government attitude			0.633	
Stealing of crops/cattle			0.518	0.913
Damage to crops				
Eigen value	**5.981**	**1.766**	**1.210**	**1.183**
% of variance	**39.9**	**11.8**	**8.07**	**7.89**
Cumulative %	**39.9**	**51.6**	**59.7**	**67.6**
KMO	**0.876**			
BST	**1952 (0.000)*****			

Source: Field survey, 2020

Test for differences in intercepts:

$$F^{*} = \frac{[\sum \varepsilon_3^2 - \sum \varepsilon_4^2]/[K_3 - K_4]}{\sum \varepsilon_4^2 / K_4} \quad \text{..... (7)}$$

If the F-cal is greater than the F-tab, it implies that the income of the highly affected stratum differ from that of the less affected stratum.

Average treatment effect (ATE)

It shows the average difference in outcome between units assigned to the treatment and units assigned to the placebo (control). Following Lokshin and Sajaia (2011); Wang *et al.* (2017); Sadiq *et al.*(2020a & b) the equation is given below:

Conflict-prone index of highly affected households is given by: $E(y_{1i}|I = 1; X)$ ..... (8)

Conflict-prone index of less affected households is given by: $E(y_{2i} \mid I = 0; X)$..... (9)

Conflict-prone index of highly affected households if there is no conflict-prone difference is denoted by:
$E(y_{2i} \mid I = 1; X)$ ..... (10)

Conflict-prone index of less affected households if there is no conflict-prone difference is denoted by:

$E(y_{1i} \mid I = 0; X)$ ..... (11)

Where:

E(.) = Expectation operator

y_{1i}= income of the highly affected households (dependent variable)

y_{2i} = income of the less affected households (dependent variable)

I = Dummy variable (1 = highly affected, 0 = less affected)

X = Explanatory variables that is common to both highly and less affected households.

$$\text{ATT} = E(y_{1i} \mid I = 1; X) - E(y_{2i} \mid I = 1; X) \quad \text{.....(12)}$$

$$ATU = E(y_{1i} \mid I = 1; X) - E(y_{2i} \mid I = 1; X) \quad \text{.....(13)}$$

Average Treatment effect on Treated=ATT

Average Treatment effect on Untreated=ATU

Equations (10) and (11) were further simplified as:

$$\text{ATT} = \frac{1}{N_1}\sum_{i=1}^{N_1}[p\ (y_{1i} \mid I = 1; X) - p(y_{2i} \mid I = 1; X)] \quad \text{.....(14)}$$

$$\text{ATU} = \frac{1}{N_2}\sum_{i=1}^{N^2}[\,p\,(y_{2i} \mid I = 0; X) - p(y_{1i} \mid I = 0; X)] \quad \text{.....(15)}$$

Where, N_1 and N_2 are number of highly and less affected households respectively, and p = probability.

Oaxaca-Blinder decomposition model

Using the standard Oaxaca-Blinder procedure (Oaxaca 1973; Blinder 1973) the extent to which the income gap between the highly and less conflict affected households can be explained by differences in observed human capital characteristics (Marwa, 2014; Revathy *et al.*, 2020; Sadiq *et al.*, 2020a&b). The income functions are given below:

$$ln\bar{Y}_H = \beta_0 + \beta_i \sum_{i=1}^{i} X_i + \varepsilon_i \quad \text{.....(16)}$$

$$ln\bar{Y}_L = \beta_0 + \beta_i \sum_{i=1}^{i} X_i + \varepsilon_i \quad \text{.....(17)}$$

Where, $\bar{Y}_{HA}$= average income of highly conflict affected households; $\bar{Y}_{LA}$= average income of less conflict affected households; $X_{i\text{-}n}$= explanatory variables; β_0= intercept; $\beta_{i\text{-}n}$= parameter estimates and, ε_i= stochastic term.

The total difference can be explain by, β

$$\Delta lnY = ln\bar{Y}_H - ln\bar{Y}_L \quad \text{..... (18)}$$

The Oaxaca-Blinder decomposition equation is,

$$ln\bar{Y}_H - ln\bar{Y}_L = \left(\bar{X}_H\hat{\beta}_H - \bar{X}_L\hat{\beta}_L\right) + \left(\bar{X}_L\hat{\beta}_H - \bar{X}_L\hat{\beta}_H\right) \quad \text{.....(19)}$$

$$\therefore ln\bar{Y}_H - ln\bar{Y}_L = (\bar{X}_H - \bar{X}_L)\hat{\beta}_H + \left(\hat{\beta}_L - \hat{\beta}_H\right)\bar{X}_L \quad \text{.....(20)}$$

Where the first $(\bar{X}_H - \bar{X}_L)\hat{\beta}_H$ and the second $(\hat{\beta}_L - \hat{\beta}_H)\bar{X}_L$ terms respectively, capture the endowment effect (characteristics differences between the highly and less affected) and discrimination effect.

RESULTS AND DISCUSSION

Effect of Conflict on Households' Annual Income

A cursory review of the effect of conflict on households' income vis-à-vis farm income, non-farm income and the gross annual income showed that conflict had effect on each of the aforementioned incomes as evidenced by their respective estimated chow test F-statistics which are within the acceptable margin of 10% probability level (Table 3). Thus, it can be inferred that extent of the conflict has created disparity in the various types of incomes earned by the households.

Furthermore, the test of slope homogeneity between the highly affected and less affected households vis-à-vis farm income, non-farm income and the gross annual income, the empirical evidences showed that conflict brought about structural change or shift in the incomes between the highly and less affected households as indicated by their respective estimated chow test F-statistics which are different from zero at 10% probability level. This means that the slopes of the income functions are heterogeneous.

The heterogeneity of the slopes is an indication that the income functions are factor biased. Besides, the results of the test for the differences of the intercepts between the highly and less affected households vis-à-vis farm income, non-farm income and total annual income showed that differences exist between the likely earned incomes of the highly and less affected households as evidenced by the plausibility of their respective chow test F-statistics at 10% probability level.

Impact of Conflict on Households' Annual Income

Presented in Table 4 are the results of the impact of farmers-herders conflict on the households' livelihood. Between the highly and less affected households, the Average treatment effect (ATE) estimations viz. propensity-score matching and regression adjustment show that conflict has significant negative impact on the farm income of highly affected households as indicated by their respective ATE estimated coefficients which were different from zero at 10% probability level. Thus, the ATE coefficients of propensity-score matching and regression adjustment respectively, been -177 303 and -204 431 imply that highly affected households had their farm incomes less than their counterparts which are less affected by ₦177 303 and ₦204 431 in the case of the former and latter respectively. However, the nearest-neighbor matching reveals that the conflict has no significant impact on the farm income of the affected households as evidenced by its ATE estimated coefficient which is not different from zero at 10% degree of freedom. Furthermore, within each stratum, the regression adjustment showed conflict to have significant impact on the farm income of both the highly affected and less affected households as indicated by the plausibility of their respective Average treatment effect on treated/untreated (ATET/U) at 10% probability level while the propensity-score matching showed the impact to be significant only in the less affected stratum as evidenced by the plausibility of its ATEU coefficient at 5% probability level. In the case of nearest-neighbor matching it shows that within each group the extent of the conflict has no significant impact on the households' farm income as indicated by its ATET and ATEU coefficients which were not within the plausible margin of 10% probability level. Therefore, the significant of the ATET and ATEU coefficients been -222 717 and 197 344 respectively, imply that the conflict made the highly affected households lost ₦222 717 while the less affected households have their farm income increased by ₦197 344, otherwise it will have been lost if they were highly affected by the conflict. Besides, the propensity-score matching reveals that the households that are less affected by the conflict had an average increase in their farm income by ₦214488. The potential increase over the actual increase for the less affected households viz. regression adjustment mean estimation are 2.91% [ln(648993.40)-ln(444562)/ln(444562)] and 2.72% [ln(640134)-ln(449135.80)/ln(449135.80)] respectively. Thus, it can be concluded that the potential increase of the farm income of the less affected households is slightly higher than the actual increase in their farm income by 0.187%.

For the non-farm income, the regression adjustment and the nearest-neighbor matching showed that the extent of conflict has significant negative impact on the non-farm income of the highly affected households as indicated by their respective ATE coefficients which were within the acceptable margin of 10% probability level while the propensity-score matching reveals that the conflict has no significant negative impact on the non-farm income of the highly affected households as evidenced by the non-plausibility of its estimated ATE coefficient at 10% significance level. Therefore, it can be inferred that the extent of conflict makes the non-farm income of the highly affected households to be significantly different from that of the less affected households. The ATE coefficients of regression adjustment and nearest-neighbor matching been -81 114 and -63 479 respectively imply that due to the conflict, the households that were highly affected had their non-farm incomes to be lower than the households that were less affected by ₦81 114 and ₦63 479 respectively. Furthermore, within each stratum, the nearest-neighbor matching showed the impact of the conflict to be significant among only the less affected households as evidenced by its ATEU which is different from zero at 10% degree of freedom while the regression adjustment showed the impact of the conflict to be signif-

Table 3: Effect of conflict households' annual income

Items	ESS	DF	Test	F-stat
Farm income				
Highly affected	75.70286	80		
Less affected	127.0805	208	I	35.11451***
Pooled	227.5078	289	II	11.25919***
Pooled with dummy	214.6372	289	III	17.32972***
Non-farm income				
Highly affected	32.15027	54		
Less affected	161.9917	166	I	10.15535***
Pooled	203.1037	221	II	6.802379***
Pooled with dummy	201.416	289	III	2.421582***
Total annual income				
Highly affected	49.41665	80		
Less affected	118.9478	208	I	28.54325***
Pooled	185.0508	289	II	9.194371***
Pooled with dummy	175.8498	289	III	15.12136***

Source: Field survey, 2020

Note: ESS, DF, I, II & III respectively mean Error sum of square, Degree of freedom, Test for Effect of conflict, Test for Homogeneity of slope and Test for differences in intercepts.

Note: *** means significant at 1%.

icant in both groups as indicated by its ATET and ATEU which are different from zero at 10% degree of freedom. Therefore, households that were less affected had their non-farm income increased by ₦75 072 and ₦86 616 viz. nearest-neighbor matching and regression adjustment respectively; while those that were highly affected lost ₦66 919 in their non-farm income. It was observed that the potential increase [ln(209956.7)-ln(128842.3)/ ln(128842.3)=4.15%]in the non-farm income of the less affected households is higher than their actual increase [ln(204827.80)-ln(156271.60)/ln(156271)=2.26%] by 1.89%.

For the total income, all the ATE estimations showed the extent of conflict to have significant negative impact on the overall annual income of the highly affected households as indicated by their respective ATE estimated coefficients which were different from zero at 10% degree of freedom. Thus, it can be inferred that the extent of the conflict made the annual income of the highly affected households to be significantly different from that of the less affected households. The implications of the ATE estimated coefficients of -147 024, -220 372 and -285546 viz. nearest-neighbor matching, propensity score matching and regression adjustment respectively, indicate that the highly affected households lost ₦147 024; ₦220 372; and, ₦285 546. Furthermore, the empirical evidence showed that within each group, both the nearest-neighbor matching and propensity-score matching show only the less affected stratum to be significantly impacted by conflict as indicated by their respective ATET estimated coefficients which were within the acceptable margin of 10% probability level. While in the case of regression adjustment estimation, the conflict has significant impact on both strata as indicated by their respective ATET and ATEU which were different from zero at 10% degree of freedom. Thus, the nearest-neighbor matching and propensity-score matching show that the households that were less affected have an increase in their average annual income by ₦292 813 and ₦269 177 respectively;

Table 4: Impact of conflict on households' annual income

Items	Coefficient	t-stat	Coefficient	t-stat
	Farm income			
	Regression adjustment		**Nearest-neighbor matching**	
ATE	-204431.4(85049.78)	2.40**	-188613.8(119789.7)	1.57^{NS}
ATET (H)	-222717.1(101551.9)	2.19**	-113456.8(97597.97)	1.16^{NS}
ATEU (L)	197344.6(89016.04)	2.22**	217741.6(146353.3)	1.49^{NS}
Mean (H)	444562(62636.5)	7.10***		
Mean (L)	648993.4(58390.06)	11.11***		
	Propensity-score matching			
ATE	-177303.4(70942.13)	2.50**		
ATET (H)	-81358.02(96887.53)	0.84^{NS}		
ATEU (L)	214488(74368.71)	2.88***		
	Non-farm income			
	Regression adjustment		**Nearest-neighbor matching**	
ATE	-81114.43(27102.28)	2.99***	-63479.31(30387.59)	2.09**
ATET (H)	-66919.03(32000.56)	2.09**	-33567.9(44065.53)	0.76^{NS}
ATEU (L)	86616(28333.12)	3.06***	75071.77(31254.81)	2.40**
Mean (H)	128842.3(21385.95)	6.02***		
Mean (L)	209956.7(17716.18)	11.85***		
	Propensity-score matching			
ATE	-43068.97(37209.34)	1.16^{NS}		
ATET (H)	-13086.42(61674.31)	0.21^{NS}		
ATEU (L)	54689(39554.04)	1.38^{NS}		
	Total annual income			
	Regression adjustment		**Nearest-neighbor matching**	
ATE	-285545.8(89894.42)	3.18***	-252093.1(125208.7)	2.01**
ATET (H)	-289636.1(108747.7)	2.66***	-147024.7(112230)	1.31^{NS}
ATEU (L)	283960.6(92876.25)	3.06***	292813.4(150314.7)	1.95*
Mean (H)	573404.2(65720.31)	8.72***		
Mean (L)	858950.1(63387.31)	13.55***		
	Propensity-score matching			
ATE	-220372.4(80413.99)	2.74***		
ATET (H)	-94444.44(103846.5)	0.91^{NS}		
ATEU (L)	269177(86473.63)	3.11***		

Source: Field survey, 2020

Note: ATE, ATET and ATEU respectively mean Average treatment effect, Average treatment effect on treated and Average treatment effect on untreated. Note: *** ** * & ^{NS} means significant at 1%, 5%, 10% & Non-significant, respectively. Figure in ( ) is standard error; H = highly affected; L = less affected

while based on regression adjustment, they have their annual income increased by ₦283960.6. However, based on the regression adjustment, those households that were highly affected lost an average of ₦289636.10 in their total annual income. The empirical evidence showed the potential increase [ln(858950.10)-ln(573404.20)/ ln(573404.20)=3.05%] in the annual income of the less affected households to be marginally higher than their actual increase [ln(844961.70)-ln(605407.40)/ ln(605407.40)=2.50%]by 0.54%.

Generally, it can be inferred that farmers-herders clashes impacted negatively on the incomes of highly affected households in the studied area.

Annual income Gap due to Conflict

A cursory review of the result for the discrimination effect on farm income due to conflict between the highly affected and less affected households show that endowed related factors-age, marital status, farm size and co-operative membership contributed favourably to the farm income of the highly affected households while the endowed characteristics- gender, household size, experience, education, extension contact and access to credit favored the less affected households (Table 5). In the case of the non-farm income, it was observed that endowed related factors viz. gender, household size, experience and access to credit favoured the highly affected households whereas age, marital status, education, farm size, extension contact and co-operative membership favoured the less affected households (Table 6). Besides, for the overall income, evidences show that the highly affected households were favoured by the contributions of the endowed related factors viz. household size and access to credit while endowed related characteristics viz. gender, age, marital status, experience, education, farm size, extension contact and co-operative membership contributed favourably to the less affected households (Table 7). Furthermore, the empirical evidences show that the farm income, non-farm income and the total annual income differentials between the two groups arises due to the differences in the coefficients of the contributed explanatory variables of the two-income equations in each income categories. The estimated results show that 79.3%, 55.5% and 94.9% of the farm income, non-farm income and the overall total annual income differentials respectively between the highly affected and less affected households were due to structural difference called conflict while endowed characteristics based on the aforementioned income categories respectively, accounted for 20.7%, 44.5% and 5.06%.

The average annual farm income, non-farm income and the gross annual income of the highly affected and less affected households were ₦449 136 and ₦640 134; ₦156 271 and ₦204 828; and, ₦605 407 and ₦844 962 respectively. Out of the farm income gap of ₦190 998, the difference due to superior endowment of the less affected households accounts for ₦39 469 while the difference due to conflict accounted for ₦151 529. Out of the non-farm income gap of ₦48 556, the difference due to superior endowment characteristics of the less affected households is ₦21 601 while discrimination due to conflict accounts for ₦26 995. Besides, for the overall annual income, out of the gross income gap of ₦239 554, superior endowment and conflict discrimination effects of the less affected households account for ₦12 110 and ₦227 444 respectively. Therefore, it can be inferred that due to discrimination in the extent of conflict, the highly affected households lost approximately ₦151 529 farm income annually; and, received ₦26 995 and ₦227 444 less in term of their real annual non-farm income and

Table 5: Farm income gap by conflict

Items	H	L	$\bar{X}_H$	$\bar{X}_L$	$\beta_H(\bar{X}_H - \bar{X}_L)$	$\bar{X}_L(\beta_H - \beta_L)$
Intercept	13.16647	12.57306				0.59341
Gender	-1.18448	0.249924	0.962963	0.952153	-0.0128	-1.36577
Age	0.011156	-0.00941	43.45679	40.12919	0.037123	0.825409
Marital status	0.19848	0.369338	0.925926	0.894737	0.00619	-0.15287
Household size	-0.01905	-0.01757	10.69136	7.856459	-0.054	-0.0116
Experience	-0.00969	0.011536	20.79012	18.03589	-0.0267	-0.38292
Education	-0.0061	-0.01368	12.67901	10.52632	-0.01313	0.079769
Farm size	0.003114	0.021919	5.244444	4.017703	0.003821	-0.07555
Extension	-0.06183	0.121265	0.814815	0.641148	-0.01074	-0.11739
co-operative membership	0.580097	0.234904	0.62963	0.626794	0.001645	0.216365
Access to credit	-0.3837	0.149687	0.197531	0.08134	-0.04458	-0.04339
Average income	**449135.8**	**640134**				
Income gap		**190998**				
Endowment effect					**-0.11318**	
Discrimination effect						**-0.43452**
Overall effect						**-0.54771**
% from overall effect					**20.66479**	**79.33521**
Contribution to Gap					**39469.4**	**151529**
Without Discrimination					**600664.6**	**600664.6**
% of Disc. in income						**33.74**

Source: Field survey, 2020

gross income respectively. On the average, the discrimination values represent 33.7%, 17.2% and 37.6% of the actual annual farm income, non-farm income and the gross income respectively of the highly affected households. Thus, without discrimination effect, the highly affected group annual farm income, non-farm income cum the overall income should be ₦600 664 , ₦183 227 and ₦832 852 respectively.

For the farm income, evidence shows that the highly affected households have more characteristics that are associated with high income earning while in the case of non-farm income and gross annual income, the less affected households have more characteristics that are associated with high income earning as indicated by the negative sign of the endowment effect for the former and positive sign of the endowment effect for the latter. Furthermore, in absolute term, the unexplained difference of the non-farm income (0.393) is less than that of the farm income (0.435) as evidenced by the gap of -0.041 (Figure 1). Thus, it can be concluded that

Table 6: Non-farm income gap by conflict

Items	H	L	$\bar{X}_H$	$\bar{X}_L$	$\beta_H(\bar{X}_H - \bar{X}_L)$	$\bar{X}_L(\beta_H - \beta_L)$
Intercept	8.686736	10.276				-1.58926
Gender	-0.108	0.142289	0.962963	0.952153	-0.00117	-0.23831
Age	0.02814	0.012317	43.45679	40.12919	0.093639	0.634976
Marital status	0.644523	0.105485	0.925926	0.894737	0.020102	0.482297
Household size	-0.01486	-0.03845	10.69136	7.856459	-0.04212	0.185376
Experience	-0.01607	0.005459	20.79012	18.03589	-0.04426	-0.38829
Education	0.08196	0.076026	12.67901	10.52632	0.176434	0.062462
Farm size	0.020638	0.017082	5.244444	4.017703	0.025318	0.01429
Extension	0.754904	0.172885	0.814815	0.641148	0.131101	0.37316
Co-operative membership	0.425985	0.266575	0.62963	0.626794	0.001208	0.099917
Access to credit	-0.38871	-0.02218	0.197531	0.08134	-0.04517	-0.02981
Average income	**156271.6**	**204827.80**				
Income gap		**48556.10**				
Endowment effect					**0.31509**	
Discrimination effect						**0.3932**
Overall effect						**0.708292**
% from overall effect					**44.48593**	**55.51407**
Contribution to Gap					**21600.70**	**26955.50**
Without Discrimination					**183227.10**	**183227.10**
% of Disc. in income						**17.25**

Source: Field survey, 2020

Table 7: Total income gap by conflict

Items	H	L	$\bar{X}_H$	$\bar{X}_L$	$\beta_H(\bar{X}_H - \bar{X}_L)$	$\bar{X}_L(\beta_H - \beta_L)$
Intercept	12.41696	12.63915				-0.22219
Gender	0.842126	0.124188	0.962963	0.952153	0.009103	0.683587
Age	0.012966	-0.00048	43.45679	40.12919	0.043145	0.539573
Marital status	0.421758	0.309437	0.925926	0.894737	0.013154	0.100498
Household size	-0.01541	-0.02647	10.69136	7.856459	-0.04368	0.086884
Experience	0.007382	0.01026	20.79012	18.03589	0.020332	-0.05191
Education	0.017012	-0.0003	12.67901	10.52632	0.036622	0.182211
Farm size	0.006873	0.020914	5.244444	4.017703	0.008431	-0.05642
Extension	0.163485	0.064644	0.814815	0.641148	0.028392	0.063371
co-operative membership	0.581835	0.334189	0.62963	0.626794	0.00165	0.155223
Access to credit	-0.34831	0.152412	0.197531	0.08134	-0.04047	-0.04073
Average income	**605407.4**	**844961.7**				
Income gap		**239554**				
Endowment effect					**0.076676**	
Discrimination effect						**1.440107**
Overall effect						**1.516783**
% from overall effect					**5.055152**	**94.94485**
Contribution to Gap					**12109.8**	**227444**
Without Discrimination					**832851.9**	**832851.9**
% of Disc. in income						**37.5688**

Source: Field survey, 2020

non-farm income suffered from both income status and discrimination due to conflict while farm income is only affected by discrimination due to the conflict.

Generally, it can be inferred that the conflict affected households' farm income mostly and this did not come as a surprise as pressure on the limited available arable land for crop cultivation by the farmers against search for pasture by the nomads/pastoralists has led to incessant bloodbath, thus causing loss of lives and properties, and food insecurity in the studied area in particular and the country in general.

CONCLUSION

Based on the findings it can be inferred that conflict had both effect and impact on the various kinds of incomes earned by households in the studied area. Besides, the negative impact of conflict was more pronounced on farm income which owes majorly to invasion of farm lands by pastoralists/nomads. Furthermore, conflict has induced significant discrimination into the various incomes earned by the households vis-à-vis between the highly and less affected households. Succinctly, it can be inferred that farmers-herders conflict has not only threatened the livelihood of the rural economy but also that of the general economy, thus, causing food insecurity, depletion of valuable able-bodied farming population, increase in the number of destitute, government expenditure wastage viz. establishment of displacement camps, loss of properties; over-bloating the labour market- high rate of unemployment etc. Therefore, the study advised all the stakeholders involved viz. the states and the farmers/pastoralists to embrace the federal government initiatives of modern ranching viz. establishment of cattle routes, grazing reserves, and arable cropping area demarcation. Doing this will go a long way in averting the unnecessary bloodletting-loss of lives, loss of properties and food insecurity which has introduced inflation into the economy due to production scarcity.

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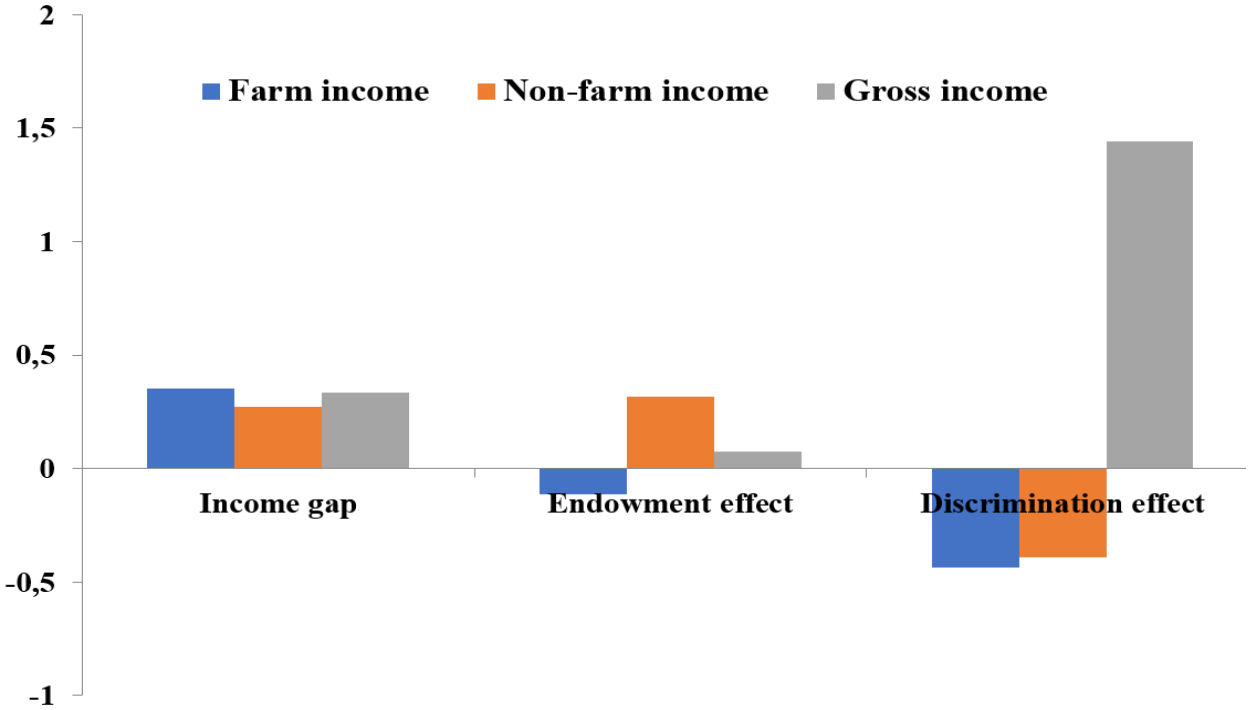

Figure 1: Income decomposition gap

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