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Conflict-Risk and Agricultural Portfolios: Evidence from Northern Uganda

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ABSTRACT *Although the impact of insecurity on agricultural decisions is widely discussed, it remains largely unstudied empirically. This study estimates the effect of risk of violence on livestock and crop portfolios using spatially disaggregated risk measures and data from over 690,000 households, approximately 75 per cent of all rural households in Northern Uganda. As the risk of violence increases, households decrease their livestock holdings while shifting its composition towards smaller, less risky animals that can be kept within villages. The similarly strong shifts in the choice of crops, however, are not always consistent with a shift towards less risky crops. Since households remain reliant on agriculture, these ex ante behavioural responses to insecurity suggest important consequences for welfare.*

1. Introduction

Recent years have seen increased interest on the links between violence and agriculture.¹ Studies reveal a complex relationship with some viewing agriculture as a ‘spoils of war’ and, hence, a potential driver for violence (Crost & Felter, 2019; Dube & Vargas, 2013; Jaafar & Woertz, 2016; Nunn & Qian, 2014) while others consider the effect of the violence on agriculture. I focus on a particularly understudied aspect of the latter, the effect of insecurity (that is the risk of exposure to violence). Although both the development and (albeit to a lesser degree) micro-conflict literatures highlight the importance of *ex ante* responses to risk, the effects of insecurity on agricultural decision-making are rarely studied empirically; the existing studies almost invariably do not directly measure risk.

Studies on the impact of violence on agriculture are hampered by two challenges. First, violence has both direct and indirect effects including through insecurity. The distinction between the two is important as it reveals the extent to which the effects are focused on the directly exposed and the timing of these losses (that is *ex ante* vs. *ex post*) (Rockmore, 2016). However, since measures of indirect exposure are typically not available, studies typically focus on the overall effects of violence. The resultant estimates therefore necessarily combine the effects of both types of exposure. Furthermore, by focusing only on exposed households/areas, these studies ignore the effects on insecurity in areas not exposed to violence. The absence of measures of risk may also affect the identification.²

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Selection into violence at the geographic and individual levels presents a second challenge since it is typically not random. That is, if the factors that drive the selection are correlated with the outcomes studied then the resultant estimates will be biased. This can be resolved by addressing this selection at both levels but this is rarely done. Taken together, the literature suggests significant household responses to insecurity as households try to minimise conflict-related risk by shifting away from profitable crops and livestock that become ‘risky’ during times of conflict (Bozzoli & Brück, 2009; Bundervoet, 2007; Lautze & Raven-Roberts, 2006; McKay & Loveridge, 2005; Tschirley & Weber, 1994; Vlassenroot, 2008; Vlassenroot & Raeymaekers, 2008).

The particular context in Northern Uganda³ allows this study to overcome these challenges and examine the effects of insecurity on agricultural portfolios. In particular, substantial qualitative and quantitative evidence suggests that the violence in attacked communities was largely indiscriminate (Allen & Schomerus, 2006; Blattman & Annan, 2010; Branch, 2010; Finnström, 2003; Titeca, 2010). Consequently, once attacked, everyone in the area was equally at risk. Therefore, the disaggregated geographic measures of risk are sufficient to address the selection into violence. Consequently, I follow Rockmore (2016) by creating geographically disaggregated risk measures based on the distance of parishes from previous attacks.

The study primarily relies on a sample of more than 690,000 households from the 2002 Uganda Census, roughly 75 per cent of all rural households in Northern Uganda. Due to the size of the sample, it is possible to use (198) sub-county fixed effects and therefore control for a variety of unobserved sub-county invariant factors, many of which may be correlated with the placement of violence or local livestock/agricultural practices.

Both the size and composition of livestock portfolios strongly respond to the risk of violence as households shift from large to small livestock. Similar results emerge in a separate dataset that also includes controls for individual and community exposure, remoteness, and the availability of inputs and output markets. The decrease in livestock holdings is approximately 65 per cent of the average value of livestock holdings and 25.5 per cent of the mean annual consumption. Despite only measuring changes in the extensive margins, there are strong changes in cropping. These are, however, more sensitive to model specification.

This study most closely resembles and builds upon Rockmore (2016) and Arias, Ibanez, and Zambrano (2018). The former finds that the aggregate effects of conflict-risk exceed those of direct exposure to violence, suggesting strong *ex-ante* household responses to insecurity. This study extends Rockmore (2016) by focusing on agriculture, the primary livelihood in Northern Uganda and many developing countries, to understand whether changes in crop and livestock portfolios may help to explain the large risk-related losses.

This study strongly complements Arias et al. (2018), the only study to directly estimate the effects of insecurity on agricultural decision-making. Arias et al. (2018) focuses on a context where the uncertainty arises from the shift of territory from an armed group to another. In contrast, in the conflict in Northern Uganda, the Lord’s Resistance Army, the main rebel group, was unable to hold territory and therefore raided communities for supplies and forced recruits. This occurs most frequently in conflicts with asymmetric power. The differences in contexts lead to different responses. In Arias et al. (2018), the uncertainty affects the willingness to make investments that only pay off after a prolonged period, particularly those with sunk costs, such as perennial crops or leaving land fallow. In Northern Uganda, households shift portfolios to livestock and crops to try to reduce the likelihood of being raided or which are easier to manage in such conditions. Lastly, due to data constraints, Arias et al. (2018) focuses on the type of land use (perennial, seasonal, or mixed crops, cattle ranching or idle land). The data available for Northern Uganda provide information on the specific choice of crops and livestock as well as the statistical power (due to the sample size) to identify any changes.

The analysis suggests that households partially responded to insecurity through the size and composition of their portfolios, particularly by shifting from profitable opportunities to low-risk low returns activities. More broadly, these results are consistent with Dabalén and Paul (2014) which

finds that the civil conflict in the Côte d'Ivoire led to lower dietary diversity. Due to the nature of their data, they could not investigate the underlying reasons. This study suggests that this may reflect endogenous agricultural responses (especially since the actual violence in the Côte d'Ivoire was low). Insofar as these endogenous responses and the resultant lower dietary diversity imply shifts in the availability of calories and nutrients, these responses may also explain some of the important adverse health consequences associated with growing up during conflicts (Akresh, Lucchetti, & Thirumurthy, 2012; Akresh, Verwimp, & Bundervoet, 2011; Bundervoet, Verwimp, & Akresh, 2009; Minoiu & Shemyakina, 2014).

The remainder of this article is organised as follows. [Section 2](#) provides a detailed description of the context and the data. [Sections 3](#) and [4](#) presents the methodology and the estimation results, respectively. [Section 5](#) considers additional pathways and [Section 6](#) concludes.

2. Northern Uganda: background and data

2.1. Background

The conflict with the Lord's Resistance Army (LRA) in Northern Uganda persisted largely uninterrupted from 1986 until 2008. The LRA was formed by Joseph Kony from the remnants of Alice Lakwena's Holy Spirit Movement, which had sought to replace the national government in Kampala, along with elements of other insurgent groups. Although the LRA initially sought support from the Acholi, one of the main ethnic groups in Northern Uganda, the local population did not support them. As a result, the LRA raided local communities for supplies and forced recruits: representative data suggests that 19, 25 and 25 per cent of Northern Uganda communities were attacked in 1992, 1999, and 2004 respectively (Ssewanyana, Younger, & Kasirye, 2007). The violence intensified about Uganda raids on LRA bases in southern Sudan in 2002. The LRA expanded both intensity and geographical scope (Supplementary Material Table 1). The data in this study come from this period and therefore represent responses at the height of the violence.

While the conflict led to voluntary migration, the number of internally displaced persons (IDP) increased substantially beginning in 1996 when the government forced the populations of the most affected regions into IDP camps (Fiala, 2015). The period following the 2002 offensive saw the IDP population rise from an estimated 400,000 to close to two million (Norwegian Refugee Council [NRC], 2004). As is subsequently described, the data used in the analysis include both areas with and without large concentrations of IDP camps and the results are robust to the inclusion of IDP camp-fixed effects.

2.2. Data for the primary analysis

The analysis primary relies on the 2002 Uganda Census.⁴ The Census provides basic information on households, including their demographics, livestock holdings at the time of the Census and the crops grown in the planting season immediately prior to the Census, as well as on the infrastructure in communities.

LRA activity is directly measured in the Census through a question regarding rebel activity within the past 12 months prior to the Census.⁵ Since the Census covers every village and community, the answers generate a complete map of violence over the preceding year. In contrast, survey data or collections of reports only provide information on a (presumably representative) subset of violence. Since the methodology relies on geospatial data, the answers are aggregated to the parish level, the lowest level with geospatial coordinates.⁶

While the Census contains information on the full population, the final sample is limited to 690,836 households, roughly 75 per cent of all rural households. The remaining 25 per cent are dropped for three reasons, none of which are related to the violence or its placement. First, the analysis relies on the distance of geo-location of communities and one parish could not be matched

the to the geo-referenced map, resulting in the loss of its 41,002 households (5.2%). Second, 139,299 households (15.1%) could not be matched with their agricultural module. This is primarily due to inconsistencies in the coding of parish identifiers. For instance, the identifier might be for the fourth parish in a district with only three parishes. Lastly, the Census also collected information at the community level. For a further 49,891 households (5.4%), information is missing from the community portion of the Census.

These data are supplement by geospatial environmental data from Lang, Barrett, and Naschold (2013). These include parish level measures of the per cent of the parish land in different land types and agro-ecological zones. These data were created by the International Livestock Research Institute (ILRI). Appendix [Tables 1](#) and [2](#) present descriptive statistics for the data.

2.3. Data for robustness check

The robustness of the livestock results is examined using the Northern Uganda Survey (NUS) 2004, a geo-referenced representative survey of Northern Uganda. The NUS contains detailed information on livestock but unfortunately does not contain information on cropping decisions. The community questionnaire contains information on LRA attacks in the current year, 2004, and in 1999 and 1992. The sample is limited to 2,300 households in 230 rural communities.⁷

Since the data on violence in NUS is not as comprehensive as in the Census, it is supplemented by data from the Armed Conflict Location and Event Data (ACLED) for Uganda (Raleigh & Hegre, 2005). The ACLED data are drawn from a variety of sources including press accounts, books, and humanitarian worker accounts and classified by event type, year, participants, and geographical coordinates. The analysis is limited to violent events that involve the LRA and which occurred prior to 2004. Since the precision of the coordinates varies in ACLED, I limit the data to those coded at the village or sub-regional levels.

3. Empirical strategy

Since the Census data do not contain measures of insecurity, I follow Rockmore (2016) and construct spatially disaggregated risk measures based on the geospatial variation in the location of violence. I begin by describing the local context and how this influences the estimation of risk. I then specify how the disaggregated measures of the risk of violence are created for the main analysis with the Census data and then for the robustness tests with NUS data. Lastly, I specify the equations for the analysis of livestock and cropping behaviour for the main analysis and robustness tests.

3.1. Conflict risk in Northern Uganda

Selection into violence can be conceptualised as a two-stage process. The first stage relates to selection at the geographical level⁸ – that is, why is this area attacked (as opposed to another)? In the context of conflict, the characteristics of an area, such as the physical geography or its ethnic homogeneity, may influence the likelihood of being attacked (as well as the observed outcomes).

The ‘geographic placement’ of attacks by the LRA was not random. Although the LRA operated throughout Northern Uganda, it primarily operated in the Acholi districts especially before 2002. While the tactics and motivations of the LRA are unclear, there are several plausible explanations for this targeting including linguistic differences throughout Northern Uganda. Since the original LRA members primarily came from the Acholi districts, it was easier for the LRA to operate in these areas and to communicate with abducted individuals from these districts. Moreover, although the main bases for the LRA were in Southern Sudan, there were smaller bases in the Acholi districts (Fiala, 2015). Within these areas, proximity to previous attacks is highly relevant. The LRA primarily moved by foot, carrying their supplies and supervising their abductees (Finnström, 2003). Over time, especially after 2002, LRA attacks became more frequent in other parts of the country

(Ssewanyana et al., 2007). This is partially due to the forced displacement within the Acholi districts by the government which deprived the LRA of potential targets for supplies and abductees, thereby forcing the LRA to shift their attacks.

The second stage relates to the within community heterogeneity in exposure as households may face very different risks of experiencing violence. For instance, in ethnic or religious conflicts, such as the genocide in Rwanda or inter-communal violence in India, this risk may vary greatly between households within a community. This would result in different household responses.⁹

In the context of Northern Uganda, there was relatively little within community heterogeneity in the exposure to violence (and hence in the risk of violence). The ideology of the LRA was to ‘purify’ Northern Uganda of corruption and witchcraft through violence (Allen & Schomerus, 2006; Branch, 2010; Finnström, 2003; Titeca, 2010). This resulted in the relatively indiscriminate use of violence and widespread looting and abductions.¹⁰ In the most affected areas, close to 40 per cent of males and 20 per cent of females aged between 14 and 30 were abducted (Beber & Blattman, 2013).

Due to non-random attrition from migration and survival bias, it is not possible to directly verify whether households that suffered damage to crops and/or livestock differed from other households. In the context of Uganda, however, attacks and looting were almost invariably associated with abductions. Consequently, analyses of abductions are likely very relevant. Using data representative of the pre-violence population for two of the most affected districts in Uganda, Blattman and Annan (2010) largely finds no significant differences in the mean characteristics of abducted and non-abducted youths (and their families).¹¹

This suggests that once an area was attacked, abductions (and presumably, therefore, exposure to violence and/or looting) by the LRA were largely exogenous of individual and household characteristics (after controlling for the age of individuals and household composition). Therefore, selection into violence can be modelled as only occurring at the geographical level. While there is surely some intra-community heterogeneity in beliefs, as is subsequently discussed, the regression controls for many of the arguably most important factors – prior exposure to violence, the demographic structure of the household, having a female head of household – so that any remaining heterogeneity is likely small and random.

Formally, the risk of violence in the Census data is estimated using the predicted value from the following equation:

$$\ln \left[\frac{\Pr(\text{Rebel}_i = 1)}{1 - \Pr(\text{Rebel} = 1)} \right] = A + \pi_i \text{Distance}_i + E_i \quad (1)$$

where the dependent variable, Rebel_i , refers to whether there were any incidents of rebel activity within any enumeration area of parish i . Distance measures the ‘straight-line’ distance (in decimal degrees) from parish i to the nearest parish (excluding parish i) with rebel activity during the preceding 12 months. The estimated coefficient, π_i , is the relative weight placed on the attack in predicting the likelihood of an attack in the current period. The constant term, A , denotes the level of conflict risk within a parish if the distance to rebel activity was 0. E_i is an error term that is assumed to have mean 0.

The disaggregated risk measures in the NUS data are created in a similar fashion. However, since the NUS does not contain as much information regarding the placement of LRA attacks, it is supplemented by information from the ACLED data. In particular, the following logistic regression is estimated:

$$\ln \left[\frac{\Pr(\text{Insecurity}_n = 1)}{1 - \Pr(\text{Insecurity}_n = 1)} \right] = \delta + \sum_{t=1992}^{2003} \gamma_{nt} \text{distance}_{nt} + \epsilon_{nt} \quad (2)$$

where the dependent variable, Insecurity_n , is a binary variable for whether any section of the community n found it hard to cultivate their land in 2004 because of insecurity. The vector, distance ,

represents the distance (in decimal degrees) of community n from the closest LRA attacks (excluding community n) in each of the previous years (t). Nine distance measures are created using both the NUS and ACLED data: two from the NUS (1992 and 1999 community attacks) and seven from the ACLED data (yearly measures for 1997 until 2003). The γ coefficients represents the relative weights placed on the various distance measures. Finally, δ and ϵ_{nt} are the constant and error terms, respectively.

3.2. Agricultural portfolios

Having created disaggregated risk measures, the relationship between the risk and agricultural portfolios is estimated using the following model:

$$Outcome_{ijlmn} = \alpha + b_1 \widehat{Risk}_i + b_2 \widehat{Risk}_i^2 + \theta Violence_i + X'_{ijn} \delta + \gamma_m + \epsilon_{ijlmn} \quad (3)$$

For outcome type l household j in community n in parish i located in sub-country m .

In the analysis of livestock, the outcomes measured (l) are the total household livestock holdings in each of the five most prevalent types: goats, sheep, pigs, cattle, and poultry. Atypically large holdings of livestock are omitted.¹² For the analysis of cropping behaviour, the outcome variables are binary indicators for whether or not the household cultivated cassava, sweet pea, groundnuts, sorghum, maize, beans, millet or sesame.

\widehat{Risk}_i and \widehat{Risk}_i^2 are the predicted disaggregated risk measures for parish i from Equation (1) and its square. The choice of a quadratic relationship allows the relationship between responses and risk to vary as risk levels change. Risk is expected to have a diminishing effect since there may be a limited number of viable *ex ante* risk mitigation strategies.¹³ Consequently, as risk levels increase, households may no longer have strategies to adopt. Similarly, households may require a minimum amount of consumption (thereby weakening the effect of high levels of risk). Conversely, the effect could be increasing if households do not respond to low levels of risk. The quadratic specification allows for either of these possibilities while also allowing for a constant relationship if the quadratic term is insignificant. More broadly, the quadratic specification follows Rockmore (2016) thereby allowing for a direct comparison.

Violence is a binary variable for whether there was any LRA activity within the parish during the past 12 months. Consequently, b_1 and b_2 capture the effect of *ex ante* risk mitigation while θ reflects the combined effect of the exposure to violence, *ex post* coping and any external aid. The *ex ante* risk mitigation captures the 'cost' of uncertainty, here insecurity.

The identifying assumption is that in the absence of violence, the households in violent/insecure parishes would have the same crop and livestock portfolios as the households in non-affected parishes. It is therefore important to control for factors that could invalidate this assumption. X'_{ijn} is a vector of controls for household, community and parish characteristics that potentially affect the choice of portfolio such as the demographic profile of the household,¹⁴ the proportion of literate adults and characteristics of the head of the household,¹⁵ and the availability of household assets¹⁶ likely to influence the choice of livelihoods and the availability of labour. The community variables are binary indicators for a human disease epidemic, the presence of micro-finance institutions and for the presence of an all-weather road, and for the presence of seasonal roads in any of the enumeration areas. Since some of these factors are potentially endogenous to the insecurity and violence, the estimation results are subsequently reported with and without these controls.

The parish controls include a measure of the ethnic diversity of the parish and agroecological measures. This measure parallels Easterly and Levine (1997) and represents the probability that two people of different ethnicities would meet if randomly matched. This addresses concerns about livelihoods varying across ethnic groups. In practice, however, there is relatively little ethnic heterogeneity within rural northern Uganda (although urban areas are more somewhat more homogeneous) (mean 0.09). The agroecological controls are measures for the per cent of land area in the

parish in each of 13 land covers types and the 4 agroecological zone measures.¹⁷ These agroecological factors would directly affect the returns to particular portfolios allocations.

Lastly, the model includes sub-county fixed effects, γ_m . The sub-county is the geographical level immediately above the parish and adds 198 additional fixed effects. These control for a variety of unobserved sub-county invariant factors, many of which may be correlated with the placement of violence or local livestock/agricultural practices. Consequently, the estimation relies on the variation in the risk of violence between the roughly 5.3 parishes within each sub-county. α is an intercept. ε_{ijklmn} , is an error term.

To test the robustness of the livestock results with the NUS data, a modified version of Equation (3) is estimated that include additional control variables. In particular, the following Tobit regression is estimated:

$$Livestock_{ijkln} = \pi + b_1 \widehat{Risk}_n + b_2 \widehat{Risk}_n^2 + Exposure'_{jn} b_3 + X'_{jn} b_4 + District_k + e_{ijkln} \quad (4)$$

where the subscripts refer to community n , household j and livestock type l , and district k . \widehat{Risk}_n and \widehat{Risk}_n^2 are the predicted risk values for community n from Equation (2) and its square, respectfully. The estimated coefficients, b_1 and b_2 , represent the causal effect of risk of violence (after controlling for exposure and so forth) on the number of each livestock type.

Current and historical exposure to violence are captured at both the household and community levels. Whereas community level attacks may affect the broader economy and public goods, household attacks may lead to the destruction or theft of personal assets, the abduction or death of household members or psychological trauma. Consequently, the vector, $Exposure'_{jn}$, contains separate measures for community and household exposure to violence.

At the household level, it is not possible to distinguish the timing of attacks and therefore the binary indicator measures whether a household has been attacked since 1992. At the community level, it is possible to distinguish between attacks since 1992 and attacks in the year of the survey. Consequently, two separate binary indicators are included. Similarly, binary variables are created for abductions within the household. The estimated coefficients, b_3 , reflect both the effects of the shocks and any *ex post* coping or external aid.

The vector, X_{jn} , contains a variety of household and community-level controls including the demographic structure of the household and characteristics of the head of household, household assets and variables for working-age individuals who are temporary away.¹⁸

In an alternate specification, I include additional community characteristics which may influence decisions: the type and availability of local roads, agricultural and non-agricultural markets, availability of electricity, availability of credit, food distribution, proximity to an urban centre or other major source of employment (<10 km), proximity to an IDP camp (<5 km), and army and police bases. Due to their potential endogeneity, these are not included in the base specification.

$District$ is a district level fixed-effect and e_{ijkln} is an error term clustered at the community level.¹⁹

4. Estimation results

This section has three parts. It first presents the estimates of the disaggregated measures of risk. It then discusses the estimation of the effects of rising insecurity on livestock and crop portfolios before addressing potentially concerns regarding the robustness of these results.

4.1. Disaggregated measures of risk

The estimation results of Equation (1) are presented in Table 1. The sign of the estimated coefficient matches expectations; communities which are more distant to attacks in the past 12 months are less likely to be attacked. Since the purpose of Equation (1) is to estimate a measure of conflict risk, its

Table 1. Logit estimating objective risk for the census data

	Attack
Distance to nearest activity	-0.18*** [0.02]
Constant	1.12*** [0.13]
Observations	1174
Pseudo R ²	0.14
Percent of LRA attacks in 2004 correctly classified	69.0%

Notes: The dependent variable is a binary variable whether there were any incidents of rebel activity within any enumeration area of the parish. Robust standard errors in brackets. ***Statistically significant at the 1 per cent level.

Data source: 2002 Uganda Census.

'effectiveness' is not reflected in the significance of the estimated coefficient for the *Distance* variable. It is rather reflected in whether the measure of risk (that is the predicted value) matches the actual geospatial variation in the data? Despite having only one explanatory variable, the fit is strong as 69 per cent of the data are predicted correctly.²⁰ The values of the predicted risk (mean of 0.39) underline the high levels of uncertainty in the sample. The estimated risk parameters with the NUS data are even accurate predictors of attacks (slightly over 80% of 2004 attacks). (Estimation results presented in Supplementary Material Table 3).

Since the Census did not occur simultaneously throughout the country, rebel activity in one area may have occurred after data collection in another area. In practice, the entire Census was administered within 1 week so reported rebel activity likely preceded the data collection. However, to err on the side of caution, the risk parameters created from the Census data are not interpreted in the same casual manner as those from the NUS data.

4.2. Livestock holdings

The literature suggests that as the risk of violence increases, households shift from maximising profit to minimising exposure to risk. This results in a shift away from 'risky' livestock and crops. Within the context of violence, smaller livestock are often preferred since they can be kept within villages or individual compounds. In contrast, larger livestock need to graze which may place household members are a greater risk. For instance, the LRA frequently hid in the tall grasses and ambushed people wandering outside of villages and IDP camps. Moreover, since the monetary value of larger livestock can strongly decrease during times of violence, their desirability is likely much lower in times of insecurity and violence (Verpoorten, 2009). Within the context of Uganda, this suggests a relative shift away from cattle and, to a lesser extent, sheep, towards goats and poultry and, potentially, pigs.

Table 2 presents the results for the estimation of Equation (2) for livestock. Each column presents a separate Tobit regression (left-censored at 0).²¹ Due to the number of outcomes, it is important to account for the multiple outcomes (hypotheses) in this and subsequent estimations. The thresholds for statistical significance are therefore adjusted using the Bonferroni correction based on the number of different outcomes. For Table 2, there are five different outcomes so the threshold for significance at the 5 per cent level changes from a t-value of 0.05 to 0.01.

The estimated risk coefficients are all significant at the 1 per cent level and reveal a clear quadratic relationship. At the mean levels of risk in the sample (0.39), the number of each type of livestock decreases with the exception of pigs. The implied losses at the mean levels of risk are quite large; relative to mean positive holdings, there are over 25 per cent for sheep and over 15 per cent for goats

Table 2. Relationship between livestock holdings and the risk of violence

Estimated coefficients	Goats	Sheep	Pigs	Cattle	Chicken
Risk	-5.38*** (0.43)	-12.49*** (1.13)	2.54*** (0.53)	-11.69*** (0.91)	-2.55*** (0.36)
Risk ²	6.01*** (0.54)	13.13*** (1.52)	-2.36*** (0.64)	16.16*** (1.17)	2.45*** (0.46)
As % of positive holdings (at mean risk)	-15.8%***	-26.8%***	21.5%***	-17.2%***	-7.8%***
Mean holdings	2.4	0.9	0.1	1.6	3.3
Mean positive holdings	5.8	8.6	2.4	8.2	6.5
Pseudo R ²	0.05	0.13	0.10	0.11	0.04
Sample Size	6,90,615	6,90,658	6,90,764	6,90,514	6,90,714

Notes: The dependent variable is the number of each type of livestock. The control variables are measures of the demographic profile of the household, the proportion of literate adults and characteristics of the head of the household, and the availability of household assets likely to influence the choice of livelihoods and the availability of labour, binary indicators for a human disease epidemic, the presence of micro-finance institutions and for the presence of an all-weather road, and for the presence of seasonal roads in any of the enumeration areas, measure of the ethnic diversity of the parish, agroecological measures, and sub-country fixed effects. The standard errors are in parentheses and are not corrected for multiple hypothesis testing. The thresholds for significance are corrected using a Bonferroni correction based on the total number of different outcomes. ***Statistically significant at the 1 percent level.

Primary data source: 2002 Uganda Census.

and cattle. Poultry, the least affected of the livestock, decreased by roughly 8 per cent. As I subsequently calculate using the NUS data, these are economically important decreases.

The only exception are the numbers of pigs which increase. However, these do not offset the overall decrease in other types of livestock as mean pig holdings are quite small. The increase in the number of pigs may be due to the lack of interest in pigs by the LRA and Karamajong, a neighbouring ethnic group who raided livestock. However, as is subsequently discussed, the results for pigs are not robust.

Crucially, the decrease in the number of livestock is accompanied by a clear shift in the composition of livestock holdings. That is, the decrease in the larger livestock (cattle and sheep) is larger than and statistically different from the decrease in the smaller livestock (chicken, goats, and pigs). For instance, comparing the average livestock holdings of the households with the lowest risk with those of the highest risk, holdings of cattle and sheep fell by roughly 80 per cent. In contrast, holdings of goats and poultry decreased by roughly 60 and 10 per cent respectively (Table 2 in the Supplementary Material). Consequently, as risk levels increased, households decreased their overall livestock holdings (which are risky in themselves) and, within livestock, shifted towards the least risky animals.

4.3. Cropping behaviour

The literature on the effects of (the risk of) violence on cropping decisions underlines the value of so-called 'conflict-resistant crops' (Kibriya, Savio, Price, & King, 2016; Zilverberg, 2007). Households may prefer crops whose harvest can be delayed (for example root crops), which require little attention (for example calabashes) or which are difficult to loot (for example rice) (Finnström, 2003). Similarly, farmers may shift from intensive cultivation and perennial crops to low-risk and seasonal crops such as green peas and bananas (Vlassenroot, 2008). In contrast, more lucrative crops, such as fruits or vegetables, which need to be harvested within a short period of time (and which are easily looted) may force households to choose between venturing to exposed fields to harvest and remaining in the relative safety of their village. In the context of Uganda, the LRA was reported to steal groundnuts, sesame and maize (Stites, Mazurana, & Carlson, 2006) leading households to switch towards root crops and crops that were difficult to loot, such as rice (Finnström, 2003).

Table 3. Relationship between cropping and the risk of violence

Marginal effect at mean risk level	Cassava	Sweet pea	Groundnut	Sorghum	Maize	Beans	Millet	Sesame
Risk	0.17*** (0.02)	0.06*** (0.01)	-0.01 (0.01)	0.05*** (0.01)	-0.05*** (0.01)	0.21*** (0.02)	-0.19*** (0.01)	-0.36*** (0.01)
Risk ²	-0.24*** (0.02)	-0.07*** (0.02)	-0.04** (0.01)	-0.06*** (0.01)	0.02 (0.02)	-0.30*** (0.02)	0.21*** (0.02)	0.35*** (0.02)
Total effect	-6.9%***	-1.5%**	-4.5%***	-0.7%	-2.3%***	-8.5%***	2.2%***	-0.3%
Percent planting	32.6%	17.9%	8.5%	17.3%	22.1%	30.1%	15.2%	16.9%
Pseudo R ²	0.18	0.18	0.14	0.16	0.16	0.28	0.18	0.20
Sample size	6,73,870	6,89,737	6,89,737	6,89,737	6,90,836	6,89,737	6,89,737	6,72,694

Notes: The dependent variable is a binary variable for whether or not the household cultivated each of crop. The control variables are measures of the demographic profile of the household, the proportion of literature adults and characteristics of the head of the household, and the availability of household assets likely to influence the choice of livelihoods and the availability of labour, binary indicators for a human disease epidemic, the presence of micro-finance institutions and for the presence of an all-weather road, and for the presence of seasonal roads in any of the enumeration areas, measure of the ethnic diversity of the parish, agroecological measures, and sub-country fixed effects. The standard errors are in parentheses and are not corrected for multiple hypothesis testing. The thresholds for significance are corrected using a Bonferroni correction based on the total number of different outcomes. ***, **Significant at the (adjusted) 1 and 5 per cent levels, respectively.

Primary data source: 2002 Uganda Census.

Due to the data available, it is only possible to estimate changes in the extensive margin (that is whether a crop was cultivated). Insofar as households respond to risk along both the extensive and intensive (i.e. how much is cultivated) margins, Table 3 necessarily underestimates the degree to which cropping decisions change. Despite this limitation, there are clear changes in the cropping behaviour: with the exception of millet (which increases), and sorghum and sesame (which are not significant and have near-zero coefficients), households are less likely to grow most of the crops. These changes are extremely large. In particular, relative to the sample means, the decreases in cassava (-21%), groundnut (-52%) and sorghum (-28%) are notable. The decreases in the likelihood of planting sweet peas (-8.4%) and maize (-10.4%) are smaller but still meaningful. In contrast, there is a clear increase in the cropping of millet (14%). Since the estimated coefficient for the squared risk term is consistently negative (with the exception of maize), the decreases should increase with risk.

Difficulty in accessing land may play a role (Stites et al., 2006) although it does not necessarily explain the patterns observed. For instance, as a root crop, the cultivation of cassava might be expected to increase or at least to decrease by a smaller margin than other crops. More broadly, the increase in the cultivation of millet may reflect the effort required to harvest (relative to other many other crops. Since the results do not necessarily match those from the literature, this suggests a need for further research to better understand the changes in cropping behaviour.

4.4. Robustness

This section explores the robustness of the results along several dimensions: the functional form of the risk variables, the potential endogeneity of control variables, and the limited number of controls variables, particularly relative to exposure, in the Census.

I begin by examining the specification of the risk variables and the choice of control variables. Consequently, the main results from Tables 2 and 3 are re-estimated in Tables 4 and 5 respectively. The top panel in the tables uses only a linear risk term while the bottom panel includes both the linear and squared term. For each livestock/crop type, I present the estimated effects of risk for three different sets of control variables. First, I include no control variable or fixed effects (that is with just the risk and attack variables). This almost surely makes the identifying assumption untenable.

Table 4. Robustness of livestock results

Linear specification					
Estimated coefficients	Goats	Sheep	Pigs	Cattle	Chicken
No controls	-5.06***	-20.72***	1.66***	-14.59***	-0.78***
Fixed effects + Environmental	-1.14***	-3.53***	0.87***	-1.10***	-0.56***
All	-0.96***	-3.32***	0.67***	-0.02	-0.71***
As percent of positive holdings	Goats	Sheep	Pigs	Cattle	Chicken
No controls	-33.6%***	-93.3%***	26.2%***	-68.9%***	-4.6%***
Fixed effects + Environmental	-7.5%***	-15.9%***	13.8%***	-5.2%***	-3.3%***
All	-6.4%***	-14.9%***	10.6%***	-0.1%	-4.2%***
Quadratic specification					
Estimated coefficients: Linear term	Goats	Sheep	Pigs	Cattle	Chicken
No controls	-8.64***	-5.49***	3.57***	-25.01***	-5.77***
Fixed effects + Environmental	-4.81***	-11.05***	3.66***	-12.21***	-1.71***
All	-5.38***	-12.49***	2.54***	-11.69***	-2.55***
Estimated coefficients: Quadratic term	Goats	Sheep	Pigs	Cattle	Chicken
No controls	5.28***	-23.52***	-2.72***	15.63***	7.29***
Fixed effects + Environmental	5.10***	11.11***	-3.55***	15.82***	1.55***
All	6.01***	13.13***	-2.36***	16.16***	2.454***
As percent of positive holdings	Goats	Sheep	Pigs	Cattle	Chicken
No control	-39.8%***	-77.5%***	35.0%***	-81.4%***	-12.7%***
FE + Environ	-15.0%***	-24.8%***	29.8%***	-20.5%***	-5.5%***
All	-15.8%***	-26.8%***	21.5%***	-17.2%***	-7.8%***
Mean holdings	2.4	0.9	0.1	1.6	3.3
Mean positive holdings	5.8	8.6	2.4	8.2	6.5

Notes: The dependent variable is the number of each type of livestock. Each entry represents the coefficient estimate for a different estimation. These are estimated with (1) no controls; (2) with the agroecological measures, and sub-country fixed effects; (3) and with the full set of controls: measures of the demographic profile of the household, the proportion of literate adults and characteristics of the head of the household, and the availability of household assets likely to influence the choice of livelihoods and the availability of labour, binary indicators for a human disease epidemic, the presence of micro-finance institutions and for the presence of an all-weather road, and for the presence of seasonal roads in any of the enumeration areas, measure of the ethnic diversity of the parish, agroecological measures, and sub-country fixed effects. The standard errors are in parentheses and are not corrected for multiple hypothesis testing. The thresholds for significance are corrected using a Bonferroni correction based on the total number of different outcomes. ***Statistically significant at the 1 percent level.

Primary data source: 2002 Uganda Census.

The second specification adds the variables for land type and agroecological zones as well as the sub-country fixed effects since these are exogenous to violence. Lastly, the third specification uses the full model (that is Equation 2). Consequently, the estimation results using the quadratic risk specification and the full model correspond to the earlier estimates.

Table 4 presents the estimation results for livestock. Each number represents the estimated effect of one Tobit regression estimated at the sample mean for risk or as a per cent of non-zero mean holdings. The overall decrease in livestock holdings and the relative shift from large to small livestock are evident across all of the quadratic risk specifications in irrespective of the choice of control variables. In the linear risk specifications, the same patterns emerge with the exception of the estimated effect on cattle. The estimated effect strongly declines with the inclusion of the land type and agrological variables and the sub-country fixed effects. The estimated coefficient is roughly zero and statistically insignificant in the full model. The evidence, however, strongly points to the quadratic model for the specification of risk. First, the squared risk term is statistically significant in every specification indicating the non-linear underlying relationship of risk to livestock holdings. Second, the average number of cattle in each household clearly declines as risk levels increase (Table 2 in the Supplementary Material). There is, however, a small increase at very low levels of risk. This suggests the linear specification is not sufficiently flexible to account for this.

Table 5. Robustness of cropping results, the marginal effect at mean risk levels

Linear specification	Cassava	Sweet pea	Groundnut	Sorghum	Maize	Beans	Millet	Sesame
Linear term	12.6%	21.6%	3.1%	-10.5%	-12.5%	30.2%	7.4%	-10.3%
No controls	-1.3%	0.4%	-2.8%***	0.9%	-2.2%***	1.1%	-2.4%***	-8.9%***
Fixed effects + Environmental	-1.5%***	-0.1%	-3.6%***	0.6%	-2.9%***	-1.2%	-2.3%***	-8.4%***
All								
Quadratic specification								
Linear term	Cassava	Sweet pea	Groundnut	Sorghum	Maize	Beans	Millet	Sesame
No controls	20.3%***	28.7%***	23.0%***	24.3%***	-3.6%***	40.0%***	-23.9%***	-9.3%***
Fixed effects + environmental	18.1%***	9.8%***	2.1%	4.4%***	2.5%	31.3%	-16.4%***	-36.8%***
All	16.7%***	5.8%***	-0.6%	5.0%***	-4.6%***	21.3%***	-18.8%***	-35.6%***
Quadratic term	Cassava	Sweet pea	Groundnut	Sorghum	Maize	Beans	Millet	Sesame
No control	-11.2%***	-10.0%***	-28.7%***	-50.9%***	-13.1%***	-14.3%***	45.0%***	-1.5%
FE + Environ	-25.4%***	-11.7%***	-6.4%***	-4.6%**	0.4%	-40.7%	18.0%***	36.7%***
All	-23.7%***	-7.3%***	-3.9%**	-5.8%***	2.3%	-29.8%***	21.0%***	35.2%***
Combined effect	Cassava	Sweet pea	Groundnut	Sorghum	Maize	Beans	Millet	Sesame
No controls	9.0%***	18.8%***	-5.6%***	-26.6%***	-16.7%***	25.7%***	21.1%***	-10.8%***
Fixed effects + environmental	-7.3%***	-1.9%***	-4.3%***	-0.2%	-2.1%***	-9.4%	1.6%**	-0.1%
All	-6.9%***	-1.5%**	-4.5%***	-0.7%	-2.3%***	-8.5%***	2.2%***	-0.3%
Percent cropping	32.6%	17.9%	8.5%	17.3%	22.1%	30.1%	15.2%	16.9%

Notes: The dependent variable is a binary variable for whether or not the household cultivated a particular crop. Each entry represents the coefficient estimate for a different estimation. These are estimated with (1) no controls; (2) with the agroecological measures, and sub-country fixed effects; (3) and with the full set of controls: measures of the demographic profile of the household, the proportion of literature adults and characteristics of the head of the household, and the availability of household assets likely to influence the choice of livelihoods and the availability of labour, binary indicators for a human disease epidemic, the presence of micro-finance institutions and for the presence of an all-weather road, and for the presence of seasonal roads in any of the enumeration areas, measure of the ethnic diversity of the parish, agroecological measures, and sub-country fixed effects. The standard errors are in parentheses and are not corrected for multiple hypothesis testing. The thresholds for significance are corrected using a Bonferroni correction based on the total number of different outcomes. ***, **Significant at the (adjusted) 1 and 5 per cent levels, respectively.

Primary data source: 2002 Uganda Census.

The estimation results for crops are presented in [Table 5](#). Similar to [Table 4](#), each number represents the results from one probit regression. Unlike the livestock results, there are some differences in the magnitude and significance levels between the linear and quadratic risk models. In particular, the estimated coefficients for sweet peas, sorghum, and beans are not statistically in the linear model (once any controls are added). Since the quadratic terms are consistently significant (with the exception of maize), this suggests that imposing a linear relationship causes the risk term to be insignificant. That said, some of the cropping results are sensitive to the specification of risk in the (reduced form) model. Similar to the earlier results for livestock, the addition of the household and community variables does not have a large effect.

A second set of concerns revolves around limitations in the Census data in terms of control variables especially those related to prior exposure to violence. For instance, in addition to the mental health literature, a growing economics literature finds important and lasting behavioural effects from prior exposure to shocks, including violence.²² The NUS data allow for more fine-grained controls for exposure to violence (at the individual and community levels and current vs. historical).

Similarly, there may be concerns related to migration insofar as there was substantial migration during this time period. Whether the migration was voluntary or mandatory, it is likely related to the incidence or potential for violence. For instance, since the forced relocations were part of a strategy to deprive the LRA of abductees and loot, these were most likely focused in areas that were likely to be attacked. In order to avoid panic sales, households in these areas might have anticipated the relocation and decreased their livestock herds and shift towards livestock that fit better in an IDP camp context.

The NUS data allow us to control for these issues. Since the majority of the migration was to IDP camps or their proximity (for protection or due to forced relocation), controls for IDP camp residence and proximity to an IDP camp address this. Moreover, the household characteristics include variables for whether or not the head of household migrated due to insecurity in the year of the survey (2004), or since 1992. More broadly, the results are qualitatively very similar across years and datasets suggesting that selective migration is not driving the results.

Since the violence used to estimate risk for the NUS data strictly occurs prior to the survey, it is possible to estimate a causal relationship between the risk of violence and livestock holdings. Finally, it addresses concerns related to potential quantity-quality tradeoffs in the Census data.

The estimation results for Equation (4) are presented as a percent of positive livestock holdings at mean risk levels in [Table 6](#). Columns (1) and (2) present the estimation results for the NUS with the base specification and with the addition of the potentially endogenous community variables. These estimation results are extremely similar between the two columns suggesting that the results are not impacted by the inclusion (omission) of the community and market characteristics.

For comparison, columns (3) and (4) present the comparable results from the Census (from [Table 3](#)) with just the geographic-fixed effects and environmental controls, and with the full set of controls, respectively.²³ Despite the difference in data and years of collection, the results are remarkably consistent: there is a sharp decrease in the number of livestock and a shift in the composition towards small livestock.

The notable difference between the estimation results for pigs in the NUS and Census are difficult to explain as they are significant at the 1 per cent level but have opposite signs. One possibility is that the decrease in attacks, overall and, especially, from the Karamajong cattle raiders between 2002 and 2004 explains the decreased premium placed on pigs.

4.5. *Magnitudes of responses*

The NUS data also provide evidence as to the magnitude of the response to insecurity. First, I examine it as a fraction of the value of livestock holdings. While the Census does not contain information on the prices of livestock nor on household income/consumption, this information is available in the NUS data. Using the median 2004 prices,²⁴ at the mean risk levels, the value of the average livestock portfolio

Table 6. Comparison of NUS and census estimations

	NUS		Census	
	Base	w/Added controls	FE ± Environ	All controls
Goats	-16.1%***	-16.8%***	-15.0%***	-15.8%***
Sheep	-14.9%***	-19.1%***	-24.8%***	-26.8%***
Pigs	-66.9%***	-69.4%***	29.8%***	21.5%***
Cattle	-22.3%***	-15.8%***	-20.5%***	-17.2%***
Chicken	-8.3%***	-8.3%***	-5.5%***	-7.8%***

Notes: The dependent variable is the number of each type of livestock. For the NUS estimations, the base control variables are measures of the demographic structure of the household and characteristics of the head of household, household assets and variables for working-age individuals who are temporary away. The added controls are measures of the type and availability of local roads, agricultural and non-agricultural markets, availability of electricity, availability of credit, food distribution, proximity to an urban centre or other major source of employment (<10 km), proximity to an IDP camp (<5 km), and army and police bases.

For the Census estimations, the fixed effects (FE) and controls are agroecological measures, and sub-country fixed effects, and the full set of controls are measures of the demographic profile of the household, the proportion of literate adults and characteristics of the head of the household, and the availability of household assets likely to influence the choice of livelihoods and the availability of labour, binary indicators for a human disease epidemic, the presence of micro-finance institutions and for the presence of an all-weather road, and for the presence of seasonal roads in any of the enumeration areas, measure of the ethnic diversity of the parish, agroecological measures, and sub-country fixed effects. The standard errors are in parentheses and are not corrected for multiple hypothesis testing. The thresholds for significance are corrected using a Bonferroni correction based on the total number of different outcomes. ***Statistically significant at the 1 percent level.

Primary data sources: 2004 Northern Uganda Survey; 2002 Uganda Census.

declined by roughly 260,746 shillings (\$150), which represents roughly 65 per cent of the average value of livestock holdings and 25.5 per cent of the mean annual consumption.

Second, it is possible to compare the effect of conflict risk to those of exposure to violence. The estimated effects of exposure to violence, however, need to be interpreted with caution as they reflect the combined effect of the exposure to violence as well as any *ex post* coping, external aid, and so forth. Consequently, Table 7 is simply suggestive. It contains the estimated effects (relative to average positive holdings) from the NUS specification with additional controls (for example remoteness, access to markets, roads, security forces, and so forth) (column 2, Table 6). In general, the effects of insecurity are roughly 50–100 per cent of those of prior exposure to violence.

5. Broader household responses

The adverse estimated effects on agricultural may be mitigated if households are able to shift away from the sector. I comparing changes in the self-reported main sources of income for households in the communities that experienced the greatest change in predicted levels of conflict-risk²⁵ between 1999 and 2004.²⁶ Since these households experience the greatest changes between the two periods, they would presumably be the most likely to exhibit changes. Moreover, by comparing changes in income sources within locations across time, it is possible to eliminate the effects of any time-invariant location-specific effects.

While the 1st and 5th quintile have statistically indistinguishable levels of risk in 1999 (Supplementary Material Table 4), there is a substantial difference (0.60) by 2004. In contrast, despite some initial differences in the reported sources of income, the changes in income sources in responses to risk levels are broadly similar. Only permanent wage employment is

Table 7. Relative magnitude of response to insecurity

	Goats	Sheep	Pigs	Cattle	Chicken
Insecurity	-16.8%***	-19.1%***	-69.4%***	-15.8%***	-8.3%***
Community attacked in past year	-13.9%***	70.6%***	25.0%***	-3.0%	-24.8%***
Community attacked since 1992	-28.8%***	-20.3%***	-52.7%***	-33.8%***	-3.4%***
Household attacked since 1992	2.3%***	-17.0%***	-58.3%***	0.8%	-8.4%***

Notes: These are the estimated coefficients from the estimations that generated Column 2 of Table 6. The coefficients for the different measures of exposure were suppressed in Table 6. The standard errors are in parentheses and are not corrected for multiple hypothesis testing. The thresholds for significance are corrected using a Bonferroni correction based on the total number of different outcomes. ***Statistically significant at the 1 percent level.

Primary data sources: 2004 Northern Uganda Survey.

(weakly) significant. This suggests that the adverse effects of conflict risk on agriculture were not offset by changing income sources, potentially reflection the limited options for income diversification.

6. Conclusion

Conflict-risk leads to significant changes in agriculture in rural northern Uganda. For agriculture, the results largely support the widely held belief that household shift away from profitable but risky (in terms of exposure to violence) activities towards less risky, lower return activities. In particular, there is a strong shift away from large, grazing livestock, despite the positive marginal returns, to smaller livestock which can be kept within compounds. Moreover, the overall value of livestock herds, which are typically targeted during conflicts, declined by roughly two-thirds. While the analysis of cropping finds equally strong responses, they do not necessarily match expectations suggesting the need for further analysis.

Insecurity's effect on the composition of livestock and crops may explain the reduced dietary diversity observed by Dabalen and Paul (2014). Since local food markets may cease functioning during conflicts, the effects of endogenous changes may be magnified and therefore have potentially important effects especially on the long-run human capital of adolescents (and therefore on the intergenerational transfer of poverty).

The large decreases size and value of the livestock herds (approximately one-quarter of annual mean consumption) should results in significant monetary inflows. Household may conserve the income to insure themselves against potential attacks and to have capital in case of forced migration due to insecurity or the government. At the same time, the saving levels may be higher than desired as the insecurity likely reduces the opportunities for households to productively invest; many peace-time opportunities may not be available while others only payoff over prolonged periods of time making them very risky during periods of conflict. Consequently, insecurity may lead households to decrease investment in a productive activity, livestock, without providing opportunities to reinvest the funds.

As a whole, the results suggest that the households (in Northern Uganda) primarily responded to the risk of violence through shifts in the livestock and crop portfolios. This suggests the need for future research investigating the link between insecurity and adverse post-conflict nutritional and health outcomes through the shifts in the agricultural portfolios. Similarly, policy interventions can attempt to help household cope by offering less costly ways to respond to insecurity such as crops which are both nutritional and having qualities which are desirable in uncertain times or by helping households diversify into smaller livestock without resorting in widespread forced sales of larger livestock.

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Notes

1. See Koren (2018) for a recent review of the literature.
2. Studies that compare directly exposed households (regions) with those who do not suffer violence implicitly assume that the violence-affected households would resemble the non-violence affected in the absence of the exposure. However, these households may also suffer losses from the risk of violence and, insofar as the risk varies across households, the losses from the risk of violence may vary between the two groups.
3. The effects of violence in Uganda have been relatively widely studied: per capita expenditure (Rockmore, 2016), labour markets (Blattman & Annan, 2010), social capital and trust (Bauer, Fiala, & Lively, 2017; De Luca & Verpoorten, 2015a, 2015b), and risk preferences (Rockmore, Barrett, & Annan, 2016).
4. As with other Censuses in developing countries, the Uganda Census was collected in a very short period (1 week). While this is standard practice, this raises potential concern regarding a trade-off between quantity and quality. To mitigate these concerns, the questionnaires for Census are typically significantly shorter than those in standard surveys which makes it easier to train enumerators and to collect data rapidly. Moreover, the results of the Uganda Census generally match those from surveys.
5. 'Rebel activity' could potentially refer to violence by non-LRA groups. It almost certainly refers to the LRA insofar as 90 per cent of the violence recording in Northern Uganda in 2002 were associated with the LRA according to ACLED data. More broadly, since the research estimates the risk of violence, it is not essential that the violence be perpetrated by the LRA.
6. Parishes are the geographical region immediately above villages and typically contain 3-9 villages. This does lead to an unavoidable loss of precision.
7. I drop communities that are incorrectly coded as being outside of Uganda as well as households without food consumption or with abnormally high landholding (200 or more acres relative to the mean holding of 3.7 acres).
8. See Jacoby (2000) for a general discussion of placement effects.
9. Consequently, geographic instrument variables do not necessarily account of the endogeneity of violence.
10. Interviews of rebel commanders reveal a strategy of attacking and capturing as many people as possible before subsequently sorting them (Blattman & Annan, 2010).
11. The only exceptions were the age of the individual and the size of the household. The former reflects the preference of the LRA for children old enough to be militarily useful but also sufficiently young to be controlled. The importance of the size of the household is due to households with 25 or members, a rare occurrence in Northern Uganda (only 0.1% of rural households in the Census). As is subsequently discussed, the controls include household demographic characteristics.
12. A conservative measure of outliers is used; an outlier is any observation that is more than 6 standard deviations away from the mean of individuals who have positive holdings.
13. Table 2 in the Supplementary Material shows the relationship between different risk deciles and outcomes. In general (but not always), the responses seem to slowdown or stop in the top deciles.
14. Household demographics are disaggregated by gender and by the total number of individuals aged 0-5, 6-16, 17-50 and 51 and older in each household.
15. These are the gender, age, literacy, marital status, disabled and disaggregated educational attainment of the head of the household.

16. The binary asset variables measure ownership of land, house, motor vehicle, motorcycle, bicycle, and mobile phone.
17. The agro-ecological controls include measures for the per cent of the parish area that is populated, shrub or tree leaf, herbaceous, broadleaf, coniferous, tropical, woodland, bushland, grassland, or wetland cover. These also include the per cent of land in humid, sub-humid, semi-humid or transition agroecological zones, respectively.
18. The household variables are the total number of disabled individuals, total number in different age groups (<14, 14–60, 60+), number of absent working-age household members, and non-regular household members, indicator variables for asset ownership (hoe, plough, boat, vehicle, motorbike, bicycle, generator), total amount of land in three largest plots). The head of household variables are disaggregated education measures and gender.
19. As discussed in Abadie, Athey, Imbens, and Woolridge (2017), a clustering adjustment is only necessary to address sampling, specifically that certain segments of the population are not observed. This is not the case in the Census data. However, the NUS data are clustered to address the sampling at the community level.
20. To do this, I classify predicted values of over 0.5 to 1 and values at 0.5 or below to 0. I then see what per cent are predicted correctly. Note that the recoding of the predicted variable is only for the purposes of looking at the fit. For the subsequent analysis, it is a continuous variable bounded by 0 and 1. The results are available upon request.
21. The full estimation results for livestock and crops are available in the Supplementary Material II.
22. Mental health literature: Hubbard, Realmuto, Northwood, and Masten (1995); Kulka et al. (1990); McSharry and Kinney (1992); Schnurr, Lunney, and Sengupta (2004); recent review of shocks and risk preferences: Schildberg-Hörisch (2018); violence and behavioural preferences: Callen, Isaqzadeh, Long, and Sprenger (2014); De Luca and Verpoorten (2015a, 2015b); Nasir, Rockmore, and Tan (2017); Rockmore et al. (2016); Voors et al. (2012).
23. The full results are available upon request.
24. Since the price data contain clear outliers, the price data were purged of prices that were more than six standard deviations above the non-zero price mean for the specific type of livestock.
25. It is not possible to estimate whether any section of the community found it hard to cultivate land in previous years. Consequently, conflict risk is re-estimated using a dependent variable for whether or not a community was attacked. This is done for both 1999 and 2004. The relative fit is close to 80 per cent. The estimation are available upon request.
26. This analysis relies only on the non-IDP NUS sample due to the substantial differences in income sources in IDP camps and the increased reliance on food aid (Allen & Schomerus, 2006). The number of internally displaced individuals greatly increased during this period, particularly in late 2002 after Operation 'Iron Fist' with reported increases of 100,000 internally displaced individuals in 7 months in 2002 (NRC, 2004).

References

- Abadie, A., Athey, S., Imbens, G. W., & Woolridge, J. (2017). *When should you adjust standard errors for clustering?* (NBER Working Paper. No. 24003). NBER.
- Akresh, R., Lucchetti, L., & Thirumurthy, H. (2012). Wars and child health: Evidence from the Eritrean-Ethiopian conflict. *Journal of Development Economics*, 99(2), 330–340.
- Akresh, R., Verwimp, P., & Bundervoet, T. (2011). Civil war, crop failure and stunting in Rwanda. *Economic Development and Cultural Change*, 61(1), 157–186.
- Allen, T., & Schomerus, M. (2006). *A hard homecoming: Lessons learned from the reception center process in Northern Uganda: An independent study*. Washington, DC: United States Agency for International Development/United Nations Children's Fund.
- Arias, M. A., Ibanez, A. M., & Zambrano, A. (2018). Agricultural production amid conflict: Separating the effects of conflict into shocks and uncertainty. *World Development*, 119, 165–184.
- Bauer, M., Fiala, N., & Levely, I. (2017). Trusting former rebels: An experimental approach to understanding reintegration after civil war. *The Economic Journal*, 128(613), 1786–1819.
- Beber, B., & Blattman, C. (2013). The industrial organization of rebellion: The logic of forced labor and child soldiering. *International Organization*, 67(1), 65–104.
- Blattman, C., & Annan, J. (2010). The consequences of child soldiering. *Review of Economics and Statistics*, 92(4), 882–898.
- Bozzoli, C., & Brück, T. (2009). Agriculture, poverty and post-war reconstruction: Micro-level evidence from Northern Mozambique. *Journal of Peace Research*, 46(3), 377–397.
- Branch, A. (2010). Exploring the roots of LRA violence: Political crises and ethnic politics in Acholiland. In T. Allen & K. Vlassenroot (Eds.), *The Lord's resistance army: Myth and reality* (pp. 25–44). London: Zed Books Ltd.
- Bundervoet, T. (2007). *Livestock, activity choices and conflict: Evidence from Burundi households in conflict network* (Working Paper No. 24). Brighton: Households in Conflict Network, The Institute of Development Studies – at the University of Sussex.
- Bundervoet, T., Verwimp, P., & Akresh, R. (2009). Health and civil war in rural Burundi. *Journal of Human Resources*, 44(2), 536–563.
- Callen, M., Isaqzadeh, M., Long, J. D., & Sprenger, C. (2014). Violence and risk preference: Experimental evidence from Afghanistan. *American Economic Review*, 104(1), 123–148.
- Crost, B., & Felter, J. H. (2019). Export crops and civil conflict. *Journal of the European Economic Association*. doi:10.1093/jeaa/jvz025

- Dabalén, A., & Paul, S. (2014). Effect of conflict on dietary energy supply: Evidence from Cote d'Ivoire. *World Development*, 58, 143–158.
- De Luca, G., & Verpoorten, M. (2015a). Civil war and political participation: Evidence from Uganda. *Economic Development and Cultural Change*, 64, 113–141.
- De Luca, G., & Verpoorten, M. (2015b). Civil war, social capital and resilience in Uganda. *Oxford Economic Papers*, 67, 661–686.
- Dube, O., & Vargas, J. (2013). Commodity price shocks and civil conflict: Evidence from Colombia. *The Review of Economic Studies*, 80(4), 1384–1421. Retrieved from www.jstor.org/stable/43551562
- Easterly, W., & Levine, R. (1997). Africa's growth tragedy: Policies and ethnic divisions. *The Quarterly Journal of Economics*, 112(4), 1203–1250.
- Fiala, N. (2015). Economic consequences of forced displacement. *The Journal of Development Studies*, 51(10), 1275–1293.
- Finnström, S. (2003). *Living with bad surroundings: War & existential uncertainty in Acholiland, Northern Uganda*. Uppsala: Uppsala University Press.
- Hubbard, J., Realmuto, G. M., Northwood, A. K., & Masten, A. S. (1995). Comorbidity of psychiatric diagnoses with posttraumatic stress disorder in survivors of childhood trauma. *Journal of the American Academy of Child and Adolescent Psychiatry*, 34(9), 1167–1173.
- Jaafar, H. H., & Woertz, E. (2016). Agriculture as a funding source of ISIS: A GIS and remote sensing analysis. *Food Policy*, 64, 14–25.
- Jacoby, H. (2000). Access to markets and the benefits of rural roads. *Economic Journal*, 110, 713–737.
- Kibriya, S., Savio, G., Price, E., & King, J. (2016). The role of conflict in farmers' crop choices in North Kivu, Democratic Republic of the Congo. *International Food and Agribusiness Management Review*, 19(3), 99–118.
- Koren, O. (2018). Food abundance and violent conflict in Africa. *American Journal of Agricultural Economics*, 100(4), 981–1006.
- Kulka, R. A., Schlenger, W. E., Fairbanks, J. A., Hough, R. L., Jordan, B. K., Marmar, C. R., ... Senator Cranston, A. (1990). *Trauma and the Vietnam war generation: Report of findings from the National Vietnam Veterans Readjustment Study*. New York, NY: Brunner/Mazel Publishers.
- Lang, C., Barrett, C. B., & Naschold, F. (2013). Targeting maps: An asset-based approach to geographic targeting. *World Development*, 41(1), 232–244.
- Lautze, S., & Raven-Roberts, A. (2006). Violence and complex humanitarian emergencies: Implications for livelihoods models. *Disasters*, 30, 383–401.
- McKay, A., & Loveridge, S. (2005). *Exploring the paradox of Rwandan agricultural household income and nutritional outcomes in 1990 and 2002* (MSU Staff Paper 2005-6). East Lansing, MI: Michigan State University.
- McSharry, S., & Kinney, R. (1992). *Prevalence of psychiatric disorders in Cambodian refugees: A community random sample*. Unpublished Manuscript, Social Research Institute, Graduate School of Social Work, University of Utah, Salt Lake City, Utah.
- Minoiu, C., & Shemyakina, O. (2014). Armed conflict, household victimization, and child health in Cote d'Ivoire. *Journal of Development Economics*, 108, 237–255.
- Nasir, M., Rockmore, M., & Tan, C. M. (2017). Do the lessons from micro-conflict literature transfer to high crime areas?: Examining Mexico's war on drugs. *The Journal of Development Studies*. doi:10.1080/00220388.2017.1400016
- Norwegian Refugee Council (NRC). (2004). *Profile of internal displacement*. Uganda: Norwegian Refugee Council/Global IDP Project.
- Nunn, N., & Qian, N. (2014). US food aid and civil conflict. *The American Economic Review*, 104(6), 1630–1666.
- Raleigh, C., & Hegre, H. (2005, March 7–8). *Introducing ACLED: An armed conflict location and event dataset*. Paper presented to the conference on 'Disaggregating the Study of Civil War and Transnational Violence', University of California Institute of Global Conflict and Cooperation, San Diego, CA.
- Rockmore, M. (2016). The cost of fear: The welfare effect of the risk of violence in Northern Uganda. *The World Bank Economic Review*, 31(3), 650–669.
- Rockmore, M., Barrett, C. B., & Annan, J. (2016). *An empirical exploration of the near-term and persistent effects of conflict on risk preferences households in conflict network* (Working Paper No. 239). Brighton: Households in Conflict Network, The Institute of Development Studies – at the University of Sussex.
- Schildberg-Hörisch, H. (2018). Are risk preferences stable? *Journal of Economic Perspectives*, 32(2), 135–154.
- Schnurr, P. P., Lunney, C. A., & Sengupta, A. (2004). Risk factors for the development versus maintenance of posttraumatic stress disorder. *Journal of Traumatic Stress*, 17(2), 85–95.
- Sewanyana, S., Younger, S., & Kasirye, I. (2007, March 18–20). *Poverty under conflict: The case for Northern Uganda*. Paper presented to the conference on "Economic Development in Africa", Centre for the Study of African Economies, Oxford, UK.
- Stites, E., Mazurana, D., & Carlson, K. (2006). *Movement on the margins: Livelihoods and security in Kitgum District, Northern Uganda*. Medford, MA: Feinstein International Center, Tufts University.
- Titeca, K. (2010). The spiritual order of the LRA. In T. Allen & K. Vlassenroot (Eds.), *The Lord's resistance army: Myth and reality* (pp. 59–73). London: Zed Books Ltd.
- Tschirley, D. L., & Weber, M. T. (1994). Food security strategies under extremely adverse conditions: The determinants of households income and consumption in Rural Mozambique. *World Development*, 22(2), 159–173.

- Verpoorten, M. (2009). Household coping in war- and peacetime: Cattle sales in Rwanda, 1991-2001. *Journal of Development Economics*, 88, 67–86.
- Vlassenroot, K., & Raeymaekers, T. (2008). Crisis and food security profile: The Democratic Republic of the Congo. In L. Alinovi, G. Hemrich, & L. Russo (Eds.), *Food security in protracted crises* (pp. 157–168). Rome: FAO.
- Vlassenroot, K. (2008). Land tenure, conflict and household strategies in the Eastern Democratic Republic of the Congo. In L. Alinovi, G. Hemrich, & L. Russo (Eds.), *Food security in protracted crises* (pp. 197–221). Rome: FAO.
- Voors, M. J., Eleonora, E. M. N., Philip, V., Erwin, H. B., Robert, L., & Daan, P. V. S. (2012). Violent conflict and behavior: A field experiment in Burundi. *American Economic Review*, 102(2), 941–964.
- Zilverberg, C. (2007). *Agriculture, technology and conflict* (Unpublished MS Thesis). College Station: Texas A&M University.

Appendix

Appendix Table 1. Data for main analysis

Variable	Mean	Std. Dev	Min	Max	Obs.
Estimated Risk (Logit)	0.39	0.21	0.00	0.75	690836
Estimated Risk*Estimated Risk (Logit)	0.19	0.15	0.00	0.57	690836
Cassava, grown in last season (Jan–Jun 2002)	0.33	0.47	0.00	1.00	690836
Sweetpeas, grown in last season (Jan–Jun 2002)	0.18	0.38	0.00	1.00	690836
Groundnuts, grown in last season (Jan–Jun 2002)	0.08	0.28	0.00	1.00	690836
Sorghum, grown in last season (Jan–Jun 2002)	0.17	0.37	0.00	1.00	690836
Maize, grown in last season (Jan–Jun 2002)	0.22	0.41	0.00	1.00	690836
Beans, grown in last season (Jan–Jun 2002)	0.31	0.46	0.00	1.00	690836
Millet, grown in last season (Jan–Jun 2002)	0.15	0.36	0.00	1.00	690836
Sesame, grown in last season (Jan–Jun 2002)	0.17	0.37	0.00	1.00	690836
Goats, owned (total)	2.37	5.87	0.00	133.00	690615
Sheep, owned (total)	0.94	5.28	0.00	196.00	690658
Pigs, owned (total)	0.11	0.77	0.00	29.00	690764
Cattle, owned (total)	1.64	7.36	0.00	190.00	690514
Chicken, owned (total)	3.27	5.57	0.00	104.00	690714
Ethnic diversity, Easterly–Levine measure	0.09	0.15	0.00	0.91	690836
Male household members, aged 0–5	0.61	0.79	0.00	10.00	690836
Male household members, aged 6–16	0.88	1.08	0.00	15.00	690836
Male household members, aged 17–50	1.00	0.84	0.00	48.00	690836
Male household members, aged 51 or older	0.19	0.40	0.00	10.00	690836
Female household members, aged 0–5	0.61	0.79	0.00	10.00	690836
Female household members, aged 6–16	0.84	1.02	0.00	18.00	690836
Female household members, aged 17–50	1.12	0.79	0.00	19.00	690836
Female household members, aged 51 or older	0.18	0.41	0.00	11.00	690836
Proportion of household members aged 10 or older who are literate	0.36	0.29	0.00	1.00	690836
Head of the household male, (0=no, 1=yes)	0.78	0.41	0.00	1.00	690836
Head of the household married, (0=no, 1=yes)	0.84	0.36	0.00	1.00	690836
Head of the household, no education	0.33	0.47	0.00	1.00	690836
Head of the household, some education	0.38	0.48	0.00	1.00	690836
Head of the Household, completed P7	0.16	0.37	0.00	1.00	690836
Head of the Household, completed J3	0.09	0.29	0.00	1.00	690836
Head of the Household, completed S6	0.01	0.08	0.00	1.00	690836
Head of the Household, completed a certificate	0.02	0.14	0.00	1.00	690836
Head of the Household, completed diploma training	0.01	0.10	0.00	1.00	690836
Head of the Household, completed a degree	0.00	0.04	0.00	1.00	690836
Age of the head of the household	41.16	14.95	10.00	95.00	690836
Is the head of the household literate?	0.60	0.49	0.00	1.00	690836
Own a house, (0=no, 1=yes)	0.95	0.21	0.00	1.00	690836
Own land, (0=no, 1=yes)	0.04	0.19	0.00	1.00	690836
Own at least one motorvehicle, (0=no, 1=yes)	0.00	0.04	0.00	1.00	690836
Own at least one motorcycle, (0=no, 1=yes)	0.01	0.10	0.00	1.00	690836

(continued)

Appendix Table 1. (Continued)

Variable	Mean	Std. Dev	Min	Max	Obs.
Own at least one bicycle, (0=no, 1=yes)	0.40	0.49	0.00	1.00	690836
One at least one mobile phone, (0=no, 1=yes)	0.01	0.07	0.00	1.00	690836
Any cattle rustling in the past 12 months? (0=no, 1=yes)	0.15	0.36	0.00	1.00	690836
Any incidence of rebel activity in the past 12 months? (0=no, 1=yes)	0.27	0.44	0.00	1.00	690836
Did the LC1 experience any drought in the past 12 months? (0=no, 1=yes)	0.76	0.43	0.00	1.00	690836
Is there a market place for crops in the LC1? (0=no, 1=yes)	0.21	0.41	0.00	1.00	690836
Is there a market place for animals/poultry in the LC1? (0=no, 1=yes)	0.05	0.22	0.00	1.00	690836
Any major disease affecting crops in the past 12 months? (0=no, 1=yes)	0.90	0.30	0.00	1.00	690836
Any major disease affecting livestock in the past 12 months? (0=no, 1=yes)	0.95	0.21	0.00	1.00	690836
Any human epidemic in the past 12 months? (0=no, 1=yes)	0.86	0.35	0.00	1.00	690836
Do you have any formal micro-credit institutions in the LC1? (0=no, 1=yes)	0.10	0.30	0.00	1.00	690836
Is there an all weather road in or bordering the LC1? (0=no, 1=yes)	0.42	0.49	0.00	1.00	690836
Is there a seasonal road in or bordering the LC1? (0=no, 1=yes)	0.56	0.50	0.00	1.00	690836
Distance of the parish to an urban center	21.30	12.91	0.40	68.90	690836
Fraction of the parish which is populated	0.99	0.06	0.24	1.00	690836
Fraction of the parish covered by water	0.01	0.06	0.00	0.76	690836
Fraction of the parish covered by trees/shrub	0.00	0.01	0.00	0.27	690836
Fraction of the parish covered by herbaceous	0.36	0.27	0.00	1.02	690836
Fraction of the parish in the humid agro-ecological zone	0.01	0.09	0.00	1.00	690836
Fraction of the parish in the sub-humid agro-ecological zone	0.13	0.33	0.00	1.01	690836
Fraction of the parish in the semi-humid agro-ecological zone	0.84	0.35	0.00	1.01	690836
Fraction of the parish in the transition agro-ecological zone	0.01	0.07	0.00	1.00	690836
Fraction of the parish covered by coniferous plantation	0.00	0.01	0.00	0.30	690836
Fraction of the parish covered by woodland	0.15	0.24	0.00	1.01	690836
Fraction of the parish covered by bushland	0.05	0.16	0.00	1.00	690836
Fraction of the parish covered by grassland	0.13	0.20	0.00	1.00	690836
Fraction of the parish with wetland cover	0.00	0.03	0.00	0.36	690836

Data from the 2002 Uganda Census. Used in Tables 1 to 6.

Appendix Table 2. Data for robustness

Variable	Mean	Std. Dev	Min	Max	Obs.
Community attacked in 2004	0.29	0.45	0.00	1.00	3520
Estimated subjective risk	0.27	0.26	0.00	0.97	3520
Estimated subjective risk, squared	0.14	0.22	0.00	0.94	3520
Total number of goats	1.88	3.32	0.00	26.00	3489
Total number of sheep	0.48	1.73	0.00	15.00	3489
Total number of sheep	0.19	0.61	0.00	5.00	3499
Total number of cattle	1.21	3.43	0.00	36.00	3501
Total number of chicken	3.16	5.17	0.00	38.00	3508
Community attacked since 1992	0.48	0.50	0.00	1.00	3520
Household attacked since 1992	0.51	0.50	0.00	1.00	3520
Any abduction in 2004 (0=no, 1=yes)	0.00	0.04	0.00	1.00	3520
Any abduction since 1992 (0=no, 1=yes)	0.05	0.22	0.00	1.00	3520
Number of disabled individuals in household	0.29	0.55	0.00	6.00	3520
Female head of household	0.31	0.46	0.00	1.00	3520
Total number in household younger than 14	2.63	1.94	0.00	12.00	3520
Total number in household between 14-60	2.26	1.30	0.00	9.00	3520

(continued)

Appendix Table 2. (*Continued*)

Variable	Mean	Std. Dev	Min	Max	Obs.
Total number in household older than 60	0.19	0.45	0.00	3.00	3520
Number of absent working age household members, 14-60	0.07	0.29	0.00	3.00	3520
Number of absent working age non-regular household members, 14-60	0.02	0.15	0.00	4.00	3520
Some schooling but did not finish primary, head of household	0.53	0.50	0.00	1.00	3520
Finished primary, head of household	0.13	0.34	0.00	1.00	3520
Finished primary, head of household	0.16	0.37	0.00	1.00	3520
Finished secondary, head of household	0.01	0.09	0.00	1.00	3520
Specialized degree or diploma, head of household	0.05	0.22	0.00	1.00	3520
Finished tertiary, head of household	0.00	0.06	0.00	1.00	3520
No answer for schooling, head of household	0.00	0.05	0.00	1.00	3520
Head of household migrated due to insecurity, 2004 (0=no, 1=yes)	0.02	0.15	0.00	1.00	3520
Head of household migrate due to insecurity, ever (0=no, 1=yes)	0.23	0.42	0.00	1.00	3520
Residing in an IDP camp	0.18	0.39	0.00	1.00	3520
Presence of NGO assisting former combatants within 5km of LC1 center	1.84	0.37	1.00	2.00	3510
Own at least one hoe (1=yes)	0.13	0.33	0.00	1.00	3520
Own at least one plough (1=yes)	0.24	0.43	0.00	1.00	3520
Own at least one boat (1=yes)	0.00	0.07	0.00	1.00	3520
Own at least one vehicle (1=yes)	0.00	0.03	0.00	1.00	3520
Own at least one motorbike (1=yes)	0.00	0.07	0.00	1.00	3520
Own at least one bicycle (1=yes)	0.37	0.48	0.00	1.00	3520
Own at least one generator (1=yes)	0.00	0.04	0.00	1.00	3520
Sum of acres of land in 3 largest plots	3.94	15.22	0.00	700.00	3520
Tarmac road in community	0.04	0.20	0.00	1.00	3500
Gravel road in community	0.34	0.47	0.00	1.00	3490
Feeder road in community	0.66	0.47	0.00	1.00	3510
Community road in community	0.87	0.34	0.00	1.00	3510
Market which sells agricultural inputs with LC1 (0=no, 1=yes)	0.05	0.21	0.00	1.00	3510
Market which sells agricultural produce with LC1 (0=no, 1=yes)	0.14	0.35	0.00	1.00	3510
Market which sells non-agriculture production with LC1 (0=no, 1=yes)	0.24	0.42	0.00	1.00	3510
publically generated electricity w/in 5km	0.15	0.36	0.00	1.00	3510
privately generated electricity w/in 5km	0.19	0.39	0.00	1.00	3510
Credit source not requiring credit w/in 10km	0.29	0.45	0.00	1.00	3510
Presence of WFP or other food distribution within 5km of LC1 center	0.12	0.33	0.00	1.00	3510
IDP camp w/in 5km	0.36	0.48	0.00	1.00	3500
Army detachment/barrack in LCI	0.14	0.34	0.00	1.00	3500
Police station/post in LCI	0.05	0.23	0.00	1.00	3500
Distance to nearest attack 1999, NUS	0.35	0.31	0.00	1.37	353
Distance to nearest attack 1992, NUS	0.33	0.30	0.00	1.25	353
Distance to nearest attack 1997, ACLED	0.94	0.54	0.02	2.43	353
Distance to nearest attack 1998, ACLED	0.45	0.34	0.00	1.36	353
Distance to nearest attack 1999, ACLED	0.95	0.51	0.01	2.22	353
Distance to nearest attack 2000, ACLED	1.00	0.64	0.00	2.49	353
Distance to nearest attack 2001, ACLED	0.73	0.53	0.01	2.11	353
Distance to nearest attack 2002, ACLED	0.43	0.38	0.00	1.60	353
Distance to nearest attack 2003, ACLED	0.25	0.23	0.00	0.95	353

Data from the 2004 Northern Uganda Census. Used in Tables 6 and 7