Armed Conflict on Risk and Time Preferences: Evidence from Northern Uganda

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ABSTRACT

This study investigates the effect of exposure to armed violence on individual risk and time preferences, as elicited from incentivized lab-in-the-field experiments with randomly sampled subjects in rural northern Uganda. Combining the results of a series of field experiments with household survey information, the study also examines the effect of exposure to armed conflict on real-life behavior in terms of risk and time preferences. Controlling for a rich set of determinants of risk and time preferences, the study provides suggestive evidence that exposure to armed conflict induces higher risk aversion and loss aversion but does not affect time discount rate and present bias. With regard to real-life behavior, the results show that exposure to conflict is associated with higher investment in child education but does not affect engagement in high-value crops, investment in child health, and alcohol consumption. On the one hand, the findings present fundamental evidence indicating that significant shock from exposure to armed conflict might have persistent undesirable impacts on individuals' attitudes, which might adversely influence their decision making in terms of investment and consumption patterns. On the other hand, the study provides suggestive evidence against the pessimistic view on the costs and destructive nature of conflicts. These findings have important implications for public policy efforts to address post-conflict reconstruction programs.

Keywords: Conflict, Risk aversion, Time preference, Field experiment, Northern Uganda

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1. Introduction

The occurrence of violent armed conflicts since the early 1980s has been concentrated in low-income countries and remains a primary development challenge for developing countries (Collier et al. 2003). It is known that violent conflicts affect countries' economic development negatively because of loss of human life, institutional decay, threats to human capital development, destruction of physical capital, capital flight, and discouragement of investment (Blattman and Miguel 2010). In addition, recent studies have found that armed conflict also affect individual preferences such as risk aversion and impatience though the results are mixed and inconclusive (Bauer et al. 2016).[1] Callen et al. (2014) and Moya (2018) found that exposure to violent conflict increases risk aversion, while Voors et al. (2012) found that such exposure induces risk-seeking behavior. The impact on time preference has been examined only by Voors et al. (2012) who find that exposure to violence induces impatience. Since individuals with higher risk aversion and discount rate tend not to save adequately or invest in income-generating activities (Cardenas and Carpenter 2013) that would enhance their economic and social wellbeing, it is important to accumulate the evidence whether exposure to armed conflict affects risk and time preferences.

The northern region of Uganda experienced a devastating armed incursion by the Lord's Resistance Army (LRA) between 1987 and 2006 (Nannyonjo 2005). The rebels were responsible for atrocities, including brutal murders, abductions, sexual enslavement, burning of houses, and looting of camp settlements (International Criminal Court 2005). Even after the conflict ended and a lot of reconstruction programs were undertaken in the northern region, the northern individuals have been suffering from a range of serious difficulties, including social and psychological problems (Annan et al. 2011; Rohner et al. 2013) and the northern region is still the poorest in Uganda. This enduring negative effect can be partially because conflict exposure indeed affected individual preferences, which makes it

[1] Since the conflict disrupted the wealth and economic opportunities, the affected individuals' location on the utility function and the shape of the function might have changed. Those who suffer from psychological distress may react to negative shocks with greater degree, which increases risk aversion. Time discount rate can be increased when the uncertainty in the future is high.

difficult for the affected people to take risk and invest in more profitable activities. If so, post-conflict reconstruction programs need to take individual preferences into consideration in order not to hinder progress of reconstruction and trigger long-term consequences for their welfare.

By undertaking incentivized lab-in-the-field experiments with randomly selected subjects who were exposed to armed conflict over an extended period of time, we examine whether exposure to armed conflict affects risk and time preferences, and whether the behavior of the subjects in the economic experiments translates into systematic differences in real-life behavior. We use several variables of conflict exposure to examine the effect of different intensity of exposure. As Annan and Blattman (2009) show, formerly abducted youth report more symptoms of emotional distress because of exposure to more extreme violence than non-abductees in the war zones where they had been displaced and attacked during the war. Adelman (2013) and others state that many households in war zones were forced to move to camps where infrastructure and food were not adequate and the displacement was not a choice of households. Our identification relies on the assumption that the exposure to the conflict, specifically the child abduction by LRA and displacement status was not confounded with subjects' preferences before the war after controlling for age and residential location, following Blattman and Annan (2009).

Although our main analyses are based on the non-confoundedness assumption, we also adopt the instrumental variable (IV) estimation approach since a few studies that examine the effect of northern Uganda conflict on trust consider exposure to conflict to be endogenous. We use distance from home to South Sudan and the interaction term with the distance to the nearest army barracks as IVs for conflict exposure measured by the number of deaths aggregated at county level.[2]

We find evidence that exposure to conflict induces higher risk aversion and loss aversion, but has no effect on time discount and present bias. In terms of real-life behavior, we do not find any negative evidence that conflict exposure may have influence on. Exposure to conflict increases investment in child

[2] The validity of these exclusion variables is discussed in Section 3.

education and there are no impacts on health investment (mosquito net use), alcohol consumption (temptation goods), and engagement of high-value crops which are considered to be more risky.

The rest of the paper is organized as follows. Section 2 provides background to the northern Uganda conflict. Section 3 discusses the data, experimental design, and experimental results. Section 4 presents the estimation model while Section 5 shows the estimation results. Section 6 concludes with policy implications.

2. Background to the Armed Conflict in Uganda

Northern Uganda was long plagued by a brutal, ruthless, and relentless violent armed conflict and insecurity between the government of Uganda and the rebel LRA for close to 20 years between 1987 and 2006 (Nannyonjo 2005). The LRA was listed as a terrorist group by the international community such as African Union and US government and its members were accused of widespread human rights violations, including murder, abduction, mutilation, child-sex slavery, and forcing children to participate in hostilities. There is a complex historic background to the conflict, which mainly transpired in the Acholi and Lango sub-regions of northern Uganda, resulting from ethnic hostilities, colonial-era marginalization of the northern region, weak institutional frameworks, and an unstable political environment during the post-independence period from 1962 (Nannyonjo 2005; Rohner et al. 2013).

Ethnic division is thought to have been promoted mainly by British colonialists as part of their divide-and-rule strategy (Rohner et al. 2013). Nannyonjo (2005) argued that a vast majority of the Acholi were generally discriminated against, as they were over-represented in the army but under-represented in the administration and white-collar jobs during British colonial rule. According to Blattman (2009), the LRA's drive was fueled by longstanding political grievances and wide economic inequality between the northern ethnic groups of the Nilotics, dominated by the Acholi, and the southern-central ethnic groups, dominated by the Bantu. The LRA began life in 1987 and traces its beginnings to 1986, when anti-government movements after the President, General Yoweri Kaguta Museveni, overthrew the regime of

President Tito Okello, an ethnic Acholi, by a military coup d'état; President Museveni has been in power for the last 3 decades. The vast majority of the LRA rebels originated from the northern districts of Gulu, Kitgum, and Pader, which are dominated by the Acholi ethnic group. Led by the reclusive Joseph Kony, the LRA started its own military movement by recruiting former Acholi soldiers who had deserted the army forces (Nannyonjo 2005). At the height of the conflict, the LRA was responsible for one of Africa's longest-running armed conflicts, in which more than 1.8 million people were displaced from their homes and forced to enter internally displaced peoples (IDP) camps.

According to Finnstrom (2008), the government of Sudan played a crucial role in the LRA conflict. First, it provided logistical support and military equipment to the LRA rebels. Second, it allowed the LRA to accommodate its base camps in South Sudan. In exchange for this support, the LRA worked with the Sudanese army to fight the South Sudanese rebels, the Sudan People's Liberation Army (SPLA). The Ugandan government retaliated by supporting the SPLA with logistical support and military equipment (Blattman 2009; Dolan 2009; Finnstrom 2008; Rohner et al. 2013). Most of the LRA raids into northern Uganda were initiated from the LRA bases in South Sudan, from where LRA rebels attacked households, eventually retreating to South Sudan.

According to Rohner et al. (2013), in 2002, in a bid to restore diplomatic relations and foster reconciliation, the governments of Uganda and Sudan signed a protocol that gave the Ugandan army the right to penetrate South Sudan to pursue the LRA rebels. The military operation to oust the LRA rebels, code-named "Operation Iron Fist," destroyed LRA bases and many rebels were killed (Dolan, 2009). However, the military operation was considered a failure because the LRA rebels, despite coming under intense attack, managed to oust the Ugandan army and penetrated more neighboring districts in northern Uganda, where they carried out more atrocities (Allen 2005; De Luca and Verpoorten 2015; Dolan 2009). The bulk of the LRA violence fully unraveled within this period of 2002–2005 (Rohner et al. 2013). Children kidnapped by the LRA were trained to fight and forced to kill family members so they would think they had no home to which to escape. During this period, the government of Uganda forced northern households to vacate their villages and move to IDP camps.

In 2006, with the assistance of US forces, the Ugandan army forcefully entered South Sudan and destroyed the majority of the LRA bases, forcing the rebels to retreat to the jungles of the Democratic Republic of Congo, and later, further west to the Central African Republic. Traces of war effects can still be observed in northern Uganda and many villagers are still traumatized by the conflict even 10 years after the cessation of the conflict. The poverty incidence in the northern region is the highest in Uganda, accounting for 43.7% of the country's poverty levels (World Bank 2016). The northern region has been undergoing post-conflict reconstruction since the conflict ended. However, despite the numerous targeted interventions of post-conflict reconstruction programs, poverty and under-development have remained significantly high in the northern region. The current situation in the northern region has continued to pose challenges for reducing regional inequality in Uganda.

3. Data and Experiments

3.1 Data

This study utilizes data collected in rural northern Uganda as part of the Research on Poverty, Environment and Agricultural Technology (RePEAT) project conducted by Makerere University (Uganda) and Japan's National Graduate Institute for Policy Studies. Although the RePEAT survey has been collecting panel data in Uganda since 2003, the northern region was not covered for security reasons. However, in 2015, a new sample of 345 households in 23 communities (Local Council 1, LC1, which is the smallest administrative unit in Uganda) from 10 districts in the northern region were added to make the data more representative of the whole of Uganda.[3] This study uses only this new sample

[3] The survey communities (LC1s) in the northern region are selected consistently with the original RePEAT sampling scheme. The RePEAT sample is a subset of the sample used in the study of Policies for Improved Land Management in Uganda by IFPRI (Yamano et al. 2004). Since one of the main research objectives for both studies was to investigate agricultural productivity and welfare, the stratification was based on the following four factors, including those affecting agricultural potential: population density, elevation (whether 1500 meters or more above sea level, which delineates the southwestern and eastern highlands), market access (travel time to the nearest market location, weighted by the population of each market location) and agricultural potential (Ruecker et al. 2003). First, we classify all the sub-

from the northern region. In the 2015 survey, all the sampled 345 households were interviewed but incentivized lab-in-the-field experiments were conducted only in about half of the sample communities owing to budget shortages.[4] To obtain data from field experiments in the remaining half of the communities as well as those who did not participate in experiments in communities where field experiments were conducted in 2015, an additional survey was conducted at the beginning of 2017. In the 2017 survey, an additional 198 households participated in the field experiments, making a combined total of 312 households (90% of the whole sample). In addition to the field experiments, additional information was collected from 327 households in 2017.[5]

The study also utilizes conflict intensity data from the Uppsala Conflict Data Program (UCDP, which provides precise geo-referenced numbers of deaths from the LRA insurgency aggregated at the district and county level as well as from areas within a certain distance from conflict events, and is used as a measure of conflict exposure. The UCDP data have recorded ongoing violent conflicts throughout the world since the 1970s and constitute one of the most accurate and well-established data sources on global armed conflicts.

The third data source is a 10-year rainfall precipitation and temperature dataset obtained from the National Aeronautics and Space Administration. Subjects in our sample are mainly rural farmers with high dependence on rain-fed agriculture for their crop and animal production. Therefore, rainfall intensity

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counties of the two sub-regions in the northern region into the development domains that are defined and used in the IFPRI study. The northern region covered by this wave consists of 4 development domains out of 18. Then, strata are constructed based on the development domains and sub-regions. Subsequently, sub-counties are randomly selected at each stratum. The probability of a sub-county being selected is set so that it becomes proportional to the sampling weight of the sub-county, which is set for the number of households in general. In order to increase the sample size of the most seriously affected areas by the war, we double the sampling weight of sub-counties from Acholi sub-region, except sub-counties from Gulu and Nwoya districts, where the influence of the war was relatively weaker. Finally, after selecting the sub-counties, we randomly select one LC1 from each selected sub-county.

[4] In the 2015 survey, couples were invited to the field experiments, and the participation rate was 114 households out of 345 households. In 2017, the main decision maker in each household (198 households) was invited to participate in the field experiments to increase the participation rate. For the main analyses, we use only one subject from each household (household head or main decision maker).

[5] Households that were not included in the 2017 survey had either lost a key family member or migrated, with community leaders not privy to specific details regarding their new locations.

and temperature are used as exogenous covariates in the estimation specifications.

3.2 Descriptive Statistics

Table 1 presents summary statistics for individual (experiment subjects), household, and community characteristics, categorized by severely affected districts and less severely affected districts.[6] In terms of individual and household head characteristics, the mean age of the subjects is 40.2 years, the household head age is 44.8 years, and 66.3% of the subjects are male. The average years of schooling are about 5.7 years, suggesting that the majority of the subjects attained only some primary-level education. The northern region consists of two main ethnicities, the Acholi and the Lango. Subjects affiliated to the Acholi ethnicity are more likely to be found in districts more severely affected by the LRA conflict than in those less severely affected. During the survey, subjects were asked 12 numeracy and cognitive measurement questions. The correct answers to these questions are counted, and a numeracy score from 0 to 12 is constructed. Numeracy and cognitive measurement is controlled for in the analysis to capture aspects of the subjects' intelligence (Dohmen et al. 2010). The mean numeracy score is 5.3 out of 12 points. Of the subjects, 77% are household heads and about three-fourths are married. The average household size is 6.4 members. Average size of land holding is 7.2 acres, while the asset value is 566,038 Uganda shillings (Ushs), which is approximately 171 US dollars (USD).[7] The average distance from a homestead to the nearest town is 31.9 kilometers. The average distance to South Sudan is 152.4 kilometers while the average distance to the nearest army barracks is 42.9 kilometers. Households in more severely affected districts are farther from the district town and closer to South Sudan than those in less severely affected districts. Besides ethnicity and distance to town, South Sudan, and army barracks, households in more severely affected districts have more members and own larger land than those in less

[6] Based on the share of households who were displaced during the northern conflict, the sample districts are divided into two groups: more severely and less severely affected districts. More severely affected districts are coincided with Acholi districts.

[7] The exchange rate used is 3,311.46 Ushs to 1 USD (Bank of Uganda) as of July 1, 2015.

severely affected districts on average.

Table 2 shows the descriptive statistics of households' conflict exposure, individuals' conflict exposure, other shocks experienced in the 12 months prior to the field experiment, and real-life behavior related with risk and time preference. Consistent with the definition of the severity of the exposure to the conflict at the district level, we find a higher number of deaths aggregated at the county level in more severely affected districts. Household-level conflict exposure is measured by the experience of displacement during the LRA insurgency, duration of displacement, damage to residential houses and non-residential buildings (storage and animal houses), theft of livestock, looting of household items, abduction of household members, panga or axe attacks, threats by rebels of being killed, as well as whether household members are distressed owing to the conflict. In more severely affected districts, 87% of households were displaced for 3 years. About 60% of those also experienced residential house damage, theft of livestock, looting of household items, and threat of being killed by the rebels. About 38% of households in more severely affected districts experienced abduction of a family member as well as attacks on family members by rebels using pangas or axes. Meanwhile, 29% of households in more severely affected districts have a household member who was severely tortured or beaten. Consistent with household conflict exposure, individuals in the more severely affected districts were more exposed to the conflict. About 23% of the subjects in more severely affected districts were abducted while 26% experienced attacks with pangas or axes. Furthermore, 49.1% were threatened with death while 18% were severely beaten or tortured. Subjects who were forced to serve in the rebellion, forced to kill family members or other people, and depressed by the conflict are found in the more severely affected districts.

Since risk and time preferences can be influenced by recent negative events other than armed conflict, we interviewed households on whether they experienced other non-armed conflict shocks, including crop diseases, drought, excessive rainfall, and land-related conflict regarding ownership and borders in the last 12 months. Besides crop diseases, there are no significant differences in recent negative shocks experienced in more and less severely affected districts. This partially confirms that exposure to conflicts and agro-ecological conditions are not closely correlated with each other.

As actual practices of real-life behavior that are considered to be explained by risk and time preferences, this study adopts cultivation of high-value crops, use of mosquito bed nets, alcohol consumption, and investment in child education. The first variable is the crop area on which a high-value crop is grown normalized by the total cultivated land by the household in the last 12 months, where the high-value crops are cotton and tobacco (export crops), and sesame, sunflower, and cashew nuts (oil crops).[8] On average, 18.6% of the cultivated land is under these high-value crops. There is no difference between households in more and less severely affected districts. The second variable measures insufficient use of mosquito bed nets calculated by subtracting the number of children from the total number of mosquito bed nets that a household possesses. Mosquito bed net usage in Uganda is among the most widely used preventive measures of malaria, especially for children, to avoid morbidity and mortality.[9] This variable is negative when the number of mosquito nets owned by a household is less than the number of children. The negative value does not necessarily mean that not all the children in a household slept under the bed net, since it can be used by more than one child, but it is likely that such children face a higher risk of malaria infection. This variable can capture the investment in child health to reduce the risk of infection or to improve future health.

The third variable is quantity of alcohol consumed per month.[10] Since alcohol is considered a temptation good, present-biased individuals are likely to consume more. Avoiding alcohol consumption

[8] During the survey, we interviewed various farmers, community leaders, and agricultural extension officers about which crops they believe are risky for production. They consider crops are risky if finding potential buyers is problematic, since a ready market does not exist and buyers purchase only if certain crop standards are fully met.

[9] Malaria is the leading cause of morbidity and mortality among children aged under 5 years in Uganda and therefore, the use of mosquito bed nets characterizes malaria prevention-related behavior. According to the Ministry of Health of Uganda, malaria prevalence is highly concentrated in the Acholi sub-region; on average, the country records 478 cases per 1000 people per year (New Vision 2016). In fact, use of mosquito bed nets might translate into large reductions in out-of-pocket health spending for the majority of households.

[10] During the survey, subjects were asked how often they consume alcohol with options of never, every day, every week, twice a week, twice a month, every month, four times a year, twice a year, and other (specify). They were also asked how much alcohol in liters they consumed, which enables us to construct a monthly consumption variable for those who indicated they consume alcohol.

can be regarded as investment in individual health. On average, 10.3% of the subjects drink alcohol every day while monthly consumption of alcohol is 2.5 liters, and there is no difference between households in severely affected and less severely affected districts.

In terms of investment in child education, we construct 3 household-level variables: Share of children in school out of children of school-going age (6–19 years), education expenditure in the last 12 months per child in school (age 6–19 years), and total education expenditure in the last 12 months. There is no statistical difference of these variables between more and less severely affected districts.

3.3 Experimental design

The study adopts an experimental design framework to elicit risk preference following the pair-wise choice framework of Holt and Laury (2002). Other studies conducted in Uganda by Tanaka and Munro (2014) and Tanaka and Yamano (2015) have adopted the same experimental design framework. The framework is based on the accept/ reject experimental design (Cardenas and Carpenter 2008). Two risk preference experiments were conducted, one involving payoff gains only (experiment 1) and the other involving both payoff gains and losses (experiment 2). One advantage of the experiments is that they are incentivized and involve real losses, just like real-life investments. The experimental procedure used in this study is comparable to previous experiments on risk-elicitation tasks. The study adapts the procedure used by Tanaka and Munro (2014) for eliciting time preference. Two experiments on time preference were conducted, one involving a front-end delay (experiment 3) and the other involving no front-end delay (experiment 4).

It is worth noting that in all the sampled communities in the northern region, the experimental procedure followed a common procedure with the risk preference experiments conducted first, followed by the time preference experiments, and this order was strictly emphasized and adhered to in all the communities. Tables A1 and A2 in the appendix indicate the different payoff options in the risk preference experiments, while Tables A3 and A4 indicate the different payoff options in the time preference experiments. In all four experiments, subjects were presented with two columns of pair-wise lottery choices (A or B) from which they were to select (accept) one payoff per row and reject the other. Each experiment comprised eight rows in total. The first point at which a subject switches from one column to the other is our main interest in the analysis of the experiments. Subjects' risk aversion is elicited from experiment 1, loss aversion elicited from experiments 2 and 1, time discount rate from experiment 3, and present bias from experiments 3 and 4. A detailed explanation is provided in the Appendix.

Table 3 summarizes the estimated risk aversion, loss aversion, and discount rate parameters of subjects who participated in the experiments. Without accounting for the influence of control variables, there are no differences in preference parameters in severely affected districts versus less severely affected districts on average. The overall mean risk aversion (1.125) is comparable to the estimate of 1.32 found in Tanaka and Munro's (2014) previous study in rural Uganda. Other studies conducted in developing countries that are more comparable include Wik and Holden (1998) in Zambia, who estimated the risk aversion range to be between 0.81 to 2.0, and Jiménez (2003) in Spain, who estimated a risk aversion range from 0.4 to 1.25 (cited in Cardenas and Carpenter 2008). Other studies with estimated risk-aversion ranges that are slightly lower than our estimate include Holt and Laury (2002) in the US (0.68 to 0.97); Barr (2003) in Zimbabwe (0.32 to 0.81), and Harrison and Rutström (2008) in India (0.84).

The overall mean loss aversion parameter (3.43) is comparable to estimates in rural Uganda (3.22) by Tanaka and Yamano (2015). Loss aversion is the notion that the disutility of losses weighs more heavily than does the utility of comparable gains (Kahneman and Tversky 1979; Morrison and Oxoby 2014). The result suggests that, on average, a decrease in utility from losing 1 USD has an equal magnitude to an increase in utility from gaining 3.43 USD.

The overall mean monthly discount rate is about 50%, which is substantially higher than that estimated by Voors et al. (2012) (40.16%), but comparable to other studies conducted in rural Uganda:

Tanaka and Yamano (2015) (49%) and Tanaka and Munro (2014) (47.5%). Individuals in districts that were more severely affected by the conflict exhibit a lower discount rate estimate, suggesting that more affected individuals might be less impatient than less affected individuals are.

The last rows show the proportion of subjects with present bias. According to O'Donoghue and Rabin (1999), the term "present bias" refers to the tendency of individuals to give relatively much more weight to a lesser immediate payoff (e.g., 10,000 Ushs today) than a higher delayed payoff (e.g., 20,000 Ushs in 2 months), yet, in the case that the same payoff option is offered with both payoffs delayed (e.g., 10,000 in 2 months or 20,000 in 4 months), the same individuals are more inclined to wait the extra time to receive the larger payoff. On average, about 62% of the subjects are present biased.

In the risk experiments, some of the subjects chose either all A or all B, which are not rational choices. Although we consider subjects who chose all A (B) as having high (low) risk aversion, it is possible that they might not have understood the risk experiment fully. To differentiate these subjects from those with rational choices in the risk experiments with high (low) risk aversion who switched to B in the last row (second row), we add a dummy variable taking 1 if subjects did not understand the risk experiment fully (selected all A or all B). Table A5 tests for the mean difference of the individual, household, and community characteristics for subjects with rational choices in the risk experiments (experiments 1 and 2), and those that chose all A or all B. Columns 1, 4, and 7 show the mean of subjects who switched (understood the experiment), while columns 2, 5, and 8 indicate the mean of those who chose either all A or all B. Columns 3, 6, and 9 are p-values of the difference in the means. For columns 1 and 2, we find no statistical difference in most of the characteristics. However, subjects who chose all A or all B on average have 2 years less of schooling. Similarly, in terms of household head characteristics, subjects who chose all A or all B have less schooling years and are older. In columns 3 and 4, we test the mean difference of those in severely affected districts. We find that those that chose all A or all B in the experiments have less schooling years. In columns 7 and 8, we test for the mean difference of those in less severely affected districts, and find that subjects who chose all A or all B have less years of schooling. In terms of real-life behavior, subjects who chose all A or all B on average consume more alcohol than those who switched during the experiments.

4. Identification Strategy and Estimation Models

To identify the impact of conflict exposure on risk and time preferences in Northern Uganda, we construct different comparison groups for each conflict exposure. First, as the most serious exposure to violent conflict, we use subject's abduction status. To identify the impact of being abducted on the preferences, the comparison group is selected from non-abductees in the war zone since abduction by LRA was seemingly random within the Acholi districts (Blattman and Annan 2010). The estimated impact is the effect of the abduction in addition to living in unsafe and stressful war environments, not the total effect of the conflict compared with ones in non-war zones. Since we did not collect the pre-war data, we cannot correct for selective attrition and survival.[11] If abductees who did not return (most likely because they were dead) have different preferences from those who returned, the estimated impacts can be biased. The direction of the bias, however, is not clear. If non-survival abductees were more risk averse and that is why they did not try to escape, the impact on risk aversion is under-estimated. It is also possible that non-survival abductees were less risk averse and they tried to escape when the success rate was not high. Thus, the estimated effect needs to be interpreted with caution.

To identify the effect of conflict exposure on risk and time preferences and real-life behavior, we estimate the following model by ordinary least squares (OLS) estimation.

$$y_{ijd} = \beta_0 + \beta_1 D^k{}_i + \beta_2 X_{ij} + \mu_d + e_{ijd} \quad \ldots\ldots (1)$$

where y_{ijd} denotes individual risk and time preference parameters of individual *i* from household *j* in

[11] According to Falaris (2003), attrition rate of 50% has little impact on estimated coefficient in panel survey in developing countries.

community d. $D^k{}_{ijd}$ is the measure of conflict exposure, X is a vector of a set of controls, including individual and household characteristics as shown in Table 1. μ_d is community fixed effects. e_{ijd} denotes the error term. After controlling for subject's age and location, the effect of abduction on risk and time preferences is measured by β_1.

Second, we use household's displacement status during the war as a conflict exposure variable. The LRA's large-scale attack to civilians from 2002 was the principal driver of internal displacement, while both the security forces and other armed groups and bandits took advantage of the LRA attacks to prey on the local population (Bozzoli, et al. 2012). To protect local populations, national security forces deliberately displaced civilians to the IDP camps the government had set up, although they did not have access to basic services (Adelman and Peterman 2014). Unlike other conflicts, the displacement during the northern Uganda conflict applied to all households regardless of socio-economic conditions of the households (Adelman 2013). The majority of the displaced persons were not allowed to move out from the camps by the military despite the lack of access to sufficient social infrastructure and food. This forced displacement stretched up to non-Acholi districts. By 2006, there were a total of 220 registered camps in the northern region (Bozzoli, et al. 2012). Living in the camps resulted in poor health conditions, with high incidence of diseases and fatalities. Thus, displaced households should have been affected from living in severe conditions even when they were not abducted by LRA. Since displacement was forced by the security forces based on the risk of attacks by LRA, and not a decision of each household, household's displacement status during the war can be assumed conditional unconfoundedness after controlling for village fixed effects.[12] For this analysis, we use sample households in both Acholi and non-Acholi districts in the northern region. Similar caveat on selective attrition and survival as abductees' analyses can be applied to this household-level conflict exposure

[12] Duration of displacement was based on the decision of household (Adelman and Peterman 2014, Alderman et al. 2012) and can be confounded with pre-war risk and time preferences even after controlling for village fixed effects. Thus, we do not use the duration of displacement as a conflict exposure variable.

variable since we do not have pre-war data and cannot construct attrition weights and propensity score to rigorously create comparison group from those who were not displaced. For all the regression specifications, robust standard errors are clustered at the village level to account for sampling scheme and possible correlation among game participants in same community.

Although our main identification strategy is based on the conditional unconfoundedness assumption between subject's abduction status and household displacement as described above, De Luca and Verpoorten (2015) and Rohner et al. (2013) considered that conflict exposure in northern Uganda measured by the number of violent events and fatalities was endogenous and adopted two stage least squares (2SLS) estimation with distance to South Sudan as an instrument to estimate the impact on trust. Their argument was premised on the fact that the Sudanese government assisted the LRA with logistics and bases in the South Sudanese territory from where the LRA initiated attacks in northern Uganda. In both studies, the conflict variable is measured at district or county level and all Uganda data are used without controlling for village fixed effects. Their identifying assumption for the validity of the instrument is that distance to South Sudan affects only the distribution of violence, and has no impact on preference. This assumption is contestable, especially with regard to the geographic correlation. However, we also run similar estimation models as theirs by using the measure of number of deaths from the UCDP data aggregated at county level and two instrumental variables, namely distance to South Sudan and the interaction term with distance to the nearest army barrack.[13] We construct distance variables by computing the minimum distance between the geo-referenced location of a household and the geo-referenced border of South Sudan and nearest army barracks. In all the specifications, we control

[13] Army barracks in northern Uganda are exogenously determined, since they all existed before the start of the conflict. Before districts in northern Uganda were partitioned, each district had one army barracks, located near the main district town. Anecdotal evidence shows that the LRA rebels did not hesitate to attack communities that were located nearer to the army barracks, and therefore, many households that were living nearer army barracks faced serious threats and attacks from the rebels, as they tried to take over army barracks. In addition, owing to increased rebel activities, the government responded by embarking on a strategy of forcing people into IDP camps to separate them from rebels who were hiding among the community and disguising themselves as fellow villagers. Even households that lived near the army barracks were forced by the Ugandan army to move to IDP camps for guaranteed protection (Global IDP Database 2003).

for county-level covariates such as rainfall and temperature and village-level characteristics (distance to town and road condition to town), which absorbs any differences that might vary as agro-climatic conditions change with increased latitude (or distance to South Sudan).

5. Estimation Results

The results for risk aversion and loss aversion are shown in Table 4 while the results for time discount rates and present bias are presented in Table 5. Columns 1 and 4 of these tables report the results of individual-level exposure within severely affected districts, while columns 2 and 5 show the results of household-level exposure in all northern districts with village fixed effects. Columns 3 and 6 present the results of county-level conflict exposure estimated by 2SLS. The bottom of columns 3 and 6 report the coefficients of instrumental variables in first-stage model, which show a statistically significant correlation of the instruments, where the conflict exposure variable is number of deaths. For all the estimations, robust standard errors are clustered at the community level.

The first 3 columns of Table 4 report the risk aversion results with the estimated constant relative risk aversion (CRRA) parameter (σ) as the dependent variable. Within the severely affected districts, abduction status does not have an impact on risk aversion. Although it is not significant, the negative coefficient in column 1 may suggest that exposure to severe violence can induce risk-seeking as found in Voors et al. (2012).[14] Turning to the effect of household displacement within the whole northern region in column 2, we find a positive and statistically significant effect on risk aversion. The results indicate that displaced households are more likely to be risk averse. Similarly, the third column shows that conflict exposure measured at county level indicates that subjects in counties with higher number of deaths during the war are likely to be more risk averse.

[14] We also estimate the same models but adopt other conflict exposure measures, including livestock stolen, household items looted, household member tortured, household member attacked by panga or axe, household buildings burned, household main house damaged, non-residential houses damaged, and household member sexually abused. However, the coefficients of these conflict exposure variables are not statistically significant.

Years of education and numeracy are positively and significantly associated with risk aversion. These results suggest that more educated subjects are more risk averse, which is consistent with Tanaka et al. (2010). This finding could imply that more educated subjects are likely to engage in less risky ventures, probably because they are more informed and take precautionary measures before they engage in risky activities. Strikingly, household characteristics, including household size land holding and asset holding, are not associated with risk aversion (previous studies have shown mixed results on the correlation between household wealth and risk aversion). Similarly, agro-climatic conditions of rainfall and temperature are not correlated with risk aversion. Individuals in more populated areas are more risk averse. Landholding is positively associated with risk aversion. Distance to district town is negatively associated with risk aversion. Tanaka and Munro (2014) argued that proximity to district town may be related with less risk aversion, and in our case, it is possible that major markets, health facilities, financial institutions, and non-governmental organizations are located nearer to or in the district towns, which disadvantages individuals living far away from the towns in terms of transportation costs and access to public service delivery. We also observe that road conditions and altitude are not associated with risk aversion. Numeracy is positively and statistically significantly correlated with risk aversion, suggesting that individuals with higher cognitive ability are more risk averse, just like individuals with more schooling years.

The last 3 columns of Table 4 report the estimation results on the loss aversion parameter (λ) as the dependent variable. Column 4 shows that abductees during the war are more loss averse than non-abductees who lived in the war zone. In terms of the effect of household displacement, we do not find any effect on loss aversion. We find that exposure to conflict measured by the number of deaths at county level is positively correlated with loss aversion, implying that conflict exposure induces higher loss aversion.

Table 6 reports the estimation results for the time discount rate parameter (r) and present bias dummy. The results show that exposure to conflict regardless of the conflict measure does not affect subject's time discount rates and present bias both within severely affected districts and in whole northern region. Our results are different from Voors et al. (2012) where those who were exposed to violent conflict tend to be impatient.

Risk and time preferences can be affected by negative shocks other than armed conflict, since almost all the sample households depend on rain-fed agriculture. To assess the robustness of the findings, we estimate our model specification and include other shocks such as crop disease, drought, excessive rainfall, and land conflict experienced in the last 12 months as additional explanatory variables. The results are reported in Table 6. Even after controlling for the other shocks in the last 12 months, exposure to armed conflict significantly affects risk aversion and loss aversion, but has no effect on time discount and present bias.[15]

Next, we examine whether conflict exposure affects the real-life behavior of those who were exposed to armed conflict by using the same model as equation 1. The results are shown in Table 7. As shown in Columns 1–3, conflict exposure does not affect the cultivation of high-value crops. Although we find the conflict exposure increases risk aversion and loss aversion, the engagement in cultivation of crops with higher risk is not determined by the exposure to conflict. This finding is consistent with Verschoor et al. (2016) where those who are risk takers in an experiment are not associated with cultivation decision of cash crops with greater variance and expected profit. In our sample, there are other factors explaining the crop choice. Female-headed households and ethnicity turn out to be negatively correlated with the cultivation of high-value crops. Wealthier households are associated with the cultivation of high-value crops, which is in line with our expectation. When we control for county-level characteristics in column 3 (coefficients are not shown in table), individuals in areas with more rainfall are more likely to engage in growing high-value crops, while distance from town is negatively correlated

[15] We also include one of the shocks separately as an additional regressor in each specification, and the results still show that exposure to armed conflict significantly affects risk aversion and loss aversion, but does not affect time discount and present bias.

with cultivation of high-value crops. This suggests that proximity to district town and water availability are critical constraints for the cultivation of high-value crops.

In column 4–6 of Table 7, the coefficient of interest is positive, which shows that individuals who were exposed to conflict are more likely to sleep under mosquito bed nets, although they are not statistically significant. Use of mosquito nets is considered to be investment in child health. Since time discount rate was not affected by the conflict exposure, this result is consistent with Table 5. Columns 7–9 show the effect on monthly alcohol consumption. Since alcohol is temptation goods, those who are present biased tend to consume more. In our sample, present bias is not affected by the conflict exposure, which makes us expect that conflict exposure affects the alcohol consumption. The results are consistent with this prediction.

Columns 10–18 report the results of investment in child education. When comparing abductees and non-abductees in the war zone (columns 10, 13, and 16), whether subject was abducted or not does not affect investment in child schooling. The results in column 12 show that the share of children in school aged 6–19 years (primary and secondary school) out of all children in a household is positive and statistically significant, suggesting that those who were exposed to conflict measured by number of deaths aggregated up to county level invest more in child education than those who were not. Columns 13–15 show education expenditure per child in school. The coefficients of the conflict exposure in columns 14 and 15 are positive and significant, suggesting that those who were exposed to conflict are more likely to invest in child education than those who were not in the northern region. Similarly, in columns 17 and 18, we observe a positive and significant correlation of conflict exposure and education expenditure. This result is consistent with the view of the abductees stated in Annan et al. (2008) where the abductees expressed the concerns on the interruption of education which limits them for better employment options just after the ceasefire of the conflict. When they become parents, it is not surprising that they are more serious in regards to investment in child education.

6. Conclusion and Policy Implications

This study estimated the effects of exposure to armed conflict on risk and time preferences in rural households that were exposed to the LRA conflict by utilizing an experimental approach with real payoffs in northern Uganda. After eliciting the risk and time preference measures, we estimated the effect of the conflict exposure on the preference measures. The estimation results indicate that conflict exposure induces higher risk aversion and loss aversion, but has no effect on time preferences. The effect of the violent conflict that ended 10 years prior to the experiment on risk and loss aversion is not mediated by more recent other negative shocks affecting agricultural income and land conflict. This suggests that the effect on risk aversion is explained by the underlying psychological channel shown by Moya (2018): exposure to the violence leads to higher level of psychological trauma and anxiety, which changes risk attitude. The results on real-life behavior show that those who were exposed to conflict are more likely to invest in child education than those who were not exposed, an outcome that may be explained by changes in personal goals, perspectives, and outlook on life after trauma (Blattman 2009; Tedeschi and Calhoun 2004).

The results from the analysis have fundamental implications for policy guidance. On the one hand, exposure to violence might have long-term negative consequences for individuals' attitudes. On the other hand, the study provides suggestive evidence against the pessimistic opinion about the negative costs and destructive nature of conflicts. Specifically, our results indicate that exposed individuals invest more in child education. These positive findings could explain the sequence of partial recovery observed in post-conflict areas (Voors et al. 2012).

In both theoretical and policy-related studies on growth and development, a general assumption is that poverty is persistent because poor individuals are risk averse and/or too impatient to accrue the resources desired to improve and enhance their wellbeing. Such attitudes could deter individuals from making investments they consider uncertain in nature or engaging in activities they regard as involving high risk. Identifying the mechanisms that affect real-life behavior is important for policymakers to design effective policies from an informed viewpoint. It is noteworthy that in many low-income countries, preference data are limited or unavailable (Tanaka and Yamano 2015). Therefore, the recent development of eliciting individual preferences through lab-in-the-field experiments, as this study does, will enable policymakers to take preferences into consideration when formulating post-conflict programs.

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Table 1: Descriptive Statistics

	Combined Mean	Severely Affected Districts	Less Severely Affected Districts	t-stats
Number of observations	312	175	137	
Timing (=1 if experiment was conducted in 2017)	0.635	0.553	0.709	2.898
	(0.482)	(0.499)	(0.455)	
No rational (=1 if chose all A or all B in risk game)	0.138	0.133	0.142	0.221
	(0.345)	(0.341)	(0.350)	
Individual Characteristics				
Age	40.160	39.420	40.846	0.853
	(14.753)	(14.263)	(15.204)	
Schooling	5.721	5.660	5.778	0.300
	(3.457)	(3.498)	(3.428)	
Gender (male=1)	0.663	0.633	0.691	1.082
	(0.481)	(0.484)	(0.463)	
Ethnicity (Acholi=1)	0.468	0.907	0.062	-27.943
	(0.499)	(0.292)	(0.241)	
Numeracy (score out of 12 points)	5.344	5.373	5.317	-0.234
	(2.122)	(2.257)	(1.995)	
Household head (=1)	0.772	0.727	0.815	1.859
	(0.419)	(0.447)	(0.389)	
Household Characteristics				
Head age	44.885	45.140	44.648	-0.289
	(14.965)	(14.497)	(15.427)	
Head schooling	5.692	5.807	5.586	-0.529
	(3.667)	(3.887)	(3.459)	
Marital status (married=1)	0.740	0.747	0.735	-0.243
	(0.439)	(0.436)	(0.443)	
Household size	6.413	6.753	6.099	-2.225
	(2.613)	(2.717)	(2.480)	
Own land size (acre)	7.215	10.000	4.636	-3.169
	(15.152)	(19.507)	(8.798)	
Assets value (Ushs)	566,038	380,188	738,122	1.841
	(1,722,207)	(696,938)	(2,284,261)	
Distance from home to district town (km)	31.929	35.620	28.511	-3.086
	(20.609)	(26.649)	(11.779)	
Distance from home to South Sudan(km)	152.379	132.645	170.651	10.179
	(37.998)	(26.381)	(38.030)	
Distance to nearest army barracks	42.999	42.031	43.895	0.689
	(23.853)	(22.988)	(24.664)	
Community Characteristics				
Average annual rainfall in mm	1123.957	1075.808	1168.54	4.425
(10 years)	(190.387)	(236.856)	(118.063)	
Temperature	26.138	25.963	26.300	3.107
	(0.970)	(1.274)	(0.512)	
Population density (km^2)	219.889	199.389	238.871	1.696
	(206.059)	(228.676)	(181.301)	
Tarmac road to district town (=1)	0.083	0.080	0.086	0.204
(base group is dirt or marram road)	(0.277)	(0.272)	(0.282)	

Note: In parenthesis are standard deviations. t-statistics for testing means between more and less severely affected districts.

Table 2: Conflict Exposure, Other Shocks, and Real-life Behavior

	Combined Mean	Severely Affected Districts	Less Severely Affected Districts	t-stats
UCDP Conflict Exposure	257.035	275.227	240.191	-7.016
No. of dead (county level)	(329.902)	(82.881)	(450.869)	
Household-level Conflict Exposure				
Household was displaced (=1)	0.593	0.873	0.333	-11.570
	(0.492)	(0.334)	(0.473)	
Duration of displacement (years)	2.910	4.433	1.500	-9.003
	(3.224)	(3.153)	(2.593)	
Year household displaced by conflict	2002	2001	2002	2.085
	(2.299)	(2.342)	(2.207)	
Year household returned	2007	2007	2006	3.305
	(1.837)	(2.078)	(1.006)	
Residential house was damaged	0.446	0.607	0.296	-5.782
	(0.498)	(0.490)	(0.458)	
Non-residential building damaged	0.362	0.460	0.272	-3.516
	(0.481)	(0.500)	(0.446)	
Household livestock stolen	0.426	0.567	0.296	-4.999
	(0.495)	(0.497)	(0.458)	
Household items looted by rebels	0.506	0.673	0.352	-5.973
	(0.501)	(0.471)	(0.479)	
Household members abducted	0.240	0.380	0.111	-5.831
	(0.428)	(0.487)	(0.315)	
Household member severely tortured or beaten	0.173	0.293	0.062	-5.657
	(0.378)	(0.457)	(0.241)	
Household members attacked by axe or panga	0.259	0.367	0.160	-4.256
	(0.439)	(0.484)	(0.368)	
Household members threatened with death by rebels	0.452	0.540	0.370	-3.043
	(0.498)	(0.500)	(0.484)	
Individual-level Conflict Exposure				
Subject abducted	0.160	0.233	0.093	-3.439
	(0.367)	(0.424)	(0.291)	
Subject attacked by axe or panga	0.192	0.260	0.129	-2.951
	(0.395)	(0.440)	(0.337)	
Subject severely beaten or tortured	0.115	0.180	0.056	-3.493
	(0.319)	(0.385)	(0.229)	
Subject threatened with death by rebels	0.388	0.467	0.315	-2.775
	(0.488)	(0.501)	(0.466)	
Subject forced to serve in rebellion	0.051	0.073	0.031	-1.702
	(0.221)	(0.262)	(0.173)	
Subject forced to kill family member	0.003	0.000	0.006	0.962
	(0.057)	(0.000)	(0.079)	
Subject forced to kill other people	0.019	0.027	0.012	-0.919
	(0.138)	(0.162)	(0.111)	
Subject depressed by conflict	0.032	0.040	0.025	-0.765
	(0.176)	(0.197)	(0.156)	
Victimization index	0.173	0.239	0.111	-6.200
	(0.193)	(0.196)	(0.168)	

Table 2: Conflict Exposure, Other Shocks, and Real-life Behavior (*cont…*)

	Combined Mean	Severely Affected Districts (1)	Less Severely Affected Districts (2)	t-stats
Other Shocks in last 12 months				
Crop diseases	0.436	0.360	0.506	2.622
	(0.482)	(0.482)	(0.502)	
Drought	0.769	0.733	0.802	1.448
	(0.442)	(0.444)	(0.399)	
Excessive rainfall	0.202	0.207	0.198	-0.200
	(0.402)	(0.406)	(0.399)	
Land conflict	0.324	0.347	0.302	-0.832
	(0.468)	(0.478)	(0.461)	
Real Life Behavior				
High value crops cultivation	0.186	0.184	0.187	0.162
	(0.168)	(0.162)	(0.174)	
Mosquito bed net ownership *[number owned – number of children]*	-1.481	-2.133	-0.877	4.327
	(2.635)	(2.618)	(2.512)	
Daily alcohol consumption	0.103	0.120	0.086	-0.975
	(0.304)	(0.326)	(0.282)	
Alcohol consumption per month (liters)	2.555	2.588	2.525	-0.089
	(6.186)	(6.261)	(6.135)	
Share of children in school (age 6-19)	0.692	0.688	0.696	0.185
[out of households with children aged 6-19]	(0.332)	(0.323)	(0.343)	
Education expenditure per child in school (age 6-19)	1.865	2.064	1.659	-0.882
	(3.558)	(4.058)	(2.963)	
Total education expenditure	4.253	4.975	3.584	-1.066
	(11.524)	(13.560)	(9.242)	

Note: Education expenditure is per 100,000 Ushs. Standard deviations are in parentheses. t-statistics for testing means between more and less severely affected districts. Number of households with children aged 6-19 is 274 while that of households with children aged 6-19 in school is 241. The victimization index is constructed by taking the average of nine conflict exposure variables (eight individual level conflict exposure variables and displacement of household).

Table 3: Risk Aversion, Loss Aversion and Discount Rate Estimates Categorized by Severely Affected and Less Severely Affected Districts

	District				
	Mean	Severely Affected	Less Severely Affected	t-stat	Number of Observations
Risk aversion (σ)	1.125 (1.685)	1.113 (1.704)	1.137 (1.673)	0.117	289
Loss aversion (λ)	3.427 (3.211)	3.167 (2.880)	3.671 (3.484)	1.297	273
Discount rate (r)	0.503 (0.391)	0.496 (0.386)	0.509 (0.395)	0.318	302
Present bias dummy	0.617 (0.487)	0.609 (0.489)	0.623 (0.486)	0.237	295

Notes: Standard deviations are in parenthesis. T-statistics for the test of mean difference between two groups.

Table 4: Effect of Conflict Exposure on Risk and Loss Aversion

	Risk aversion			Loss aversion		
Conflict exposure:	Subject abducted	Household displaced	Log(number of death) at county level	Subject abducted	Household displaced	Log(number of death) at county level
	OLS	OLS	2SLS	OLS	OLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
Conflict exposure	-0.571	0.809**	0.353**	1.094**	-1.537	0.840***
	(0.610)	(0.370)	(0.154)	(0.380)	(1.005)	(0.284)
Age	-0.018	-0.009	-0.012	-0.047	-0.025	-0.036**
	(0.012)	(0.008)	(0.009)	(0.028)	(0.017)	(0.017)
Household head	-0.293	-0.504*	-0.502*	0.293	-0.069	-0.153
	(0.266)	(0.292)	(0.278)	(0.469)	(0.633)	(0.606)
Male	0.318	0.099	0.231	-0.200	0.151	-0.091
	(0.259)	(0.203)	(0.190)	(0.639)	(0.607)	(0.592)
Years of schooling	0.085*	0.101***	0.072***	-0.079	-0.034	-0.050
	(0.039)	(0.032)	(0.028)	(0.090)	(0.076)	(0.069)
Acholi tribe		-0.513	-0.767*		2.854**	-1.626*
		(0.346)	(0.442)		(1.049)	(0.850)
Household size (log)	-0.142	-0.061	0.023	-0.710*	-0.210	-0.328
	(0.383)	(0.252)	(0.247)	(0.331)	(0.260)	(0.360)
Landholding in acre (log)	0.021	0.021	0.091*	0.331	0.155	0.029
Log(land + 0.01)	(0.127)	(0.071)	(0.052)	(0.313)	(0.157)	(0.134)
Value of assets (log)	-0.053	-0.081	-0.047	0.047	-0.023	0.054
	(0.147)	(0.077)	(0.076)	(0.239)	(0.178)	(0.178)
Numeracy	0.082	0.101**	0.079**	-0.186	-0.117	-0.055
	(0.048)	(0.038)	(0.037)	(0.126)	(0.125)	(0.126)
Observations	139	289	289	132	273	273
R-squared	0.186	0.126	0.152	0.111	0.098	0.137
Village fixed effects	Yes	Yes	No	Yes	Yes	No
1st stage						
log(dist. to S. Sudan) ×log(dist. to barracks)			-0.098**			-0.094**
Dist. Sudan (log)			-1.779*			-1.798**
Stock–Yogo			19.93			19.93
F-statistic			49.552			49.137
Hansen J			0.224			0.101

Notes: LC1 fixed effects included. Community robust clustered standard errors are in parenthesis. Significance levels are ***p<0.01, **p<0.05, and *p<0.1. Conflict exposure variable in column 1 and 4 is dummy taking 1 if subject abducted, forced to serve in rebellion, kill family member or kill other people and the sample used is severely affected districts. Conflict exposure variable in column 2 and 5 is dummy taking 1 if household was displaced and the sample used is all districts in the northern region. Other controls are altitude, year of experiment, dummy variable taking 1 if subject selected all A or B. Conflict exposure variable in column 3 and 6 is log of number of total number of deaths aggregated at county level and additional controls are 10-year average annual rainfall, and temperature, population density, distance to town, and whether road to town is tarmac.

Table 5: Effect of Conflict Exposure on Discount Rate and Present Bias

	Discount rate			Present bias		
	Subject abducted	Household displaced	Log(number of death) at county level	Subject abducted	Household displaced	Log(number of death) at county level
	OLS	OLS	2SLS	OLS	OLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
Conflict Exposure	0.008	0.154	0.096	0.008	0.066	0.057
	(0.068)	(0.089)	(0.059)	(0.098)	(0.089)	(0.079)
Age	-0.003**	0.000	-0.001	-0.001	-0.000	-0.001
	(0.001)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
Household head	-0.122	-0.115*	-0.107*	-0.086	-0.102	-0.100
	(0.077)	(0.060)	(0.061)	(0.119)	(0.069)	(0.067)
Male	0.214**	0.128*	0.172**	0.021	0.062	0.112*
	(0.076)	(0.070)	(0.067)	(0.094)	(0.068)	(0.066)
Years of schooling	-0.020	-0.001	-0.007	-0.000	0.017	0.008
	(0.011)	(0.011)	(0.010)	(0.010)	(0.010)	(0.010)
Acholi tribe		0.452***	-0.208		0.281***	-0.105
		(0.083)	(0.146)		(0.086)	(0.192)
Household Size (log)	0.054	0.009	0.008	0.078	-0.089	-0.099
	(0.058)	(0.056)	(0.054)	(0.096)	(0.069)	(0.063)
Landholding in acre (log)	0.013	0.011	0.014	-0.007	-0.022	-0.020
Log(land + 0.01)	(0.028)	(0.016)	(0.015)	(0.037)	(0.020)	(0.017)
Value of assets (log)	-0.032	-0.014	-0.015	-0.027	-0.026	-0.025
	(0.023)	(0.032)	(0.028)	(0.034)	(0.030)	(0.027)
Numeracy	0.012	0.003	-0.003	0.024	0.002	-0.002
	(0.011)	(0.009)	(0.010)	(0.023)	(0.015)	(0.013)
Observations	145	302	302	141	295	295
R-squared	0.119	0.049	0.012	0.047	0.058	0.062
Village fixed effects	Yes	Yes	No	Yes	Yes	No
1st stage						
log(dist. to S.Sudan) ×log(dist. to barracks)			-0.105**			-0.104**
Dist. Sudan (log)			-1.649*			-1.708*
Stock–Yogo			19.93			19.93
F-statistic			52.227			51.995
Hansen J			0.924			0.848

Notes: LC1 fixed effects included. Community robust clustered standard errors are in parenthesis. Significance levels are ***p<0.01, **p<0.05, and *p<0.1. Conflict exposure variable in column 1 and 4 is dummy taking 1 if subject abducted, forced to serve in rebellion, kill family member or kill other people and the sample used is severely affected districts. Conflict exposure variable in column 2 and 5 is dummy taking 1 if household was displaced and the sample used is all districts in the northern region. Other controls are altitude, year of experiment, dummy variable taking 1 if subject selected all A or B. Conflict exposure variable in column 3 and 6 is log of number of total number of deaths aggregated at county level and additional controls are 10-year average annual rainfall, and temperature, population density, distance to town, and whether road to town is tarmac.

Table 6: Effect of Conflict Exposure on Behavior [Includes All Other Shocks per Specification]

	Risk Aversion			Loss Aversion			Discount Rate			Present Bias Dummy		
Conflict Exposure	Subject abducted	Household displaced	log (no. of deaths)	Subject abducted	Household displaced	Log(no. of deaths)	Subject abducted	Household displaced	Log(no. of deaths)	Subject abducted	Household displaced	Log(no. of deaths)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Conflict exposure	-0.455	0.895**	0.340**	1.084**	-1.508	0.814***	0.013	0.164	0.096	0.014	0.083	0.058
	(0.635)	(0.390)	(0.161)	(0.475)	(1.032)	(0.276)	(0.077)	(0.091)	(0.058)	(0.096)	(0.088)	(0.077)
Crop diseases	-0.129	0.084	0.024	0.009	-0.073	-0.061	-0.028	-0.027	-0.016	-0.035	0.015	0.003
	(0.215)	(0.142)	(0.129)	(0.499)	(0.424)	(0.399)	(0.073)	(0.052)	(0.046)	(0.129)	(0.057)	(0.054)
Drought	0.171	0.298	0.313	0.282	0.479	0.548	0.101	0.059	0.081	0.148	0.079	0.087
	(0.270)	(0.257)	(0.222)	(1.001)	(0.637)	(0.575)	(0.089)	(0.070)	(0.064)	(0.161)	(0.088)	(0.075)
Destructive rainfall	0.115	0.036	0.183	0.979	0.916	0.426	0.119	0.026	0.067	0.136	0.053	0.121*
	(0.359)	(0.227)	(0.201)	(1.093)	(0.654)	(0.545)	(0.149)	(0.096)	(0.069)	(0.170)	(0.087)	(0.064)
Land conflict	-0.581	-0.319	-0.234	-0.052	-0.030	-0.395	-0.169	-0.039	-0.038	-0.112**	-0.058	-0.044
	(0.311)	(0.258)	(0.226)	(0.751)	(0.456)	(0.352)	(0.068)	(0.060)	(0.053)	(0.057)	(0.058)	(0.054)
Observations	139	289	289	132	273	273	145	302	302	141	295	295
R-squared	0.339	0.256	0.163	0.315	0.279	0.146	0.348	0.181	0.022	0.226	0.199	0.073
Village fixed effects	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
log(dist. to S.Sudan) ×log(dist. to barracks)			-0.096**			-0.094**			-0.104**			-0.102**
Dist. to Sudan (log)			-1.815**			-1.814**			-1.678*			-1.755*
Stock–Yogo			19.93			19.93			19.93			19.93
F-statistic			48.764			48.252			51.196			51.513

Notes: Robust standard errors are in parenthesis, clustered at community level. Stock–Yogo critical values are reported at 10% maximal IV size. Significance levels are ***p<0.01, **p<0.05, and *p<0.1. Additional regressors include age, head, male, schooling, Acholi, household size (log), land and asset holding (log), altitude, year of experiment, dummy variable taking 1 if subject selected all A or B. Conflict exposure variable in column 1, 4, 7, and 10 is dummy taking 1 if subject abducted, forced to serve in rebellion, kill family member or kill other people and the sample used is severely affected districts. Conflict exposure variable in column 2, 5, 8, and 11 is dummy taking 1 if household was displaced and the sample used is all districts in the northern region. Conflict exposure variable in column 3, 6, 9, and 12 is log of number of total number of deaths aggregated at county level and additional controls are 10-year average annual rainfall, and temperature, population density, distance to town, whether road to town is tarmac.

Table 7: Effect of Conflict Exposure on Real-life Behavior

	High-value Crop Cultivation			Mosquito Bed Net Use			Monthly Alcohol Consumption (liters)		
Conflict exposure var.	Subject abducted OLS	Household displaced OLS	Log(no. of deaths) 2SLS	Subject abducted OLS	Household displaced OLS	Log(no. of deaths) 2SLS	Subject abducted OLS	Household displaced OLS	Log(no. of deaths) 2SLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Conflict exposure	0.006	-0.003	-0.016	0.467	0.052	0.309	-0.204	-3.001	0.105
	(0.024)	(0.024)	(0.016)	(0.349)	(0.262)	(0.197)	(1.247)	(2.083)	(0.514)
Head age	-0.000	-0.000	-0.000	0.040***	0.028***	0.034***	-0.099**	-0.043**	-0.041**
	(0.001)	(0.000)	(0.000)	(0.012)	(0.010)	(0.009)	(0.036)	(0.019)	(0.018)
Female head	-0.122***	-0.115***	-0.116***	-0.775*	-0.426	-0.220	-3.912***	-3.590***	-3.646***
	(0.035)	(0.024)	(0.026)	(0.367)	(0.440)	(0.386)	(0.850)	(0.920)	(0.687)
Head years of schooling	-0.007	-0.006**	-0.009***	-0.017	0.011	0.021	-0.329*	-0.262*	-0.245**
	(0.004)	(0.003)	(0.003)	(0.059)	(0.044)	(0.043)	(0.170)	(0.145)	(0.119)
Head ethnicity	-	-0.043**	-0.003**	-	-1.930***	0.030*	-	-2.848*	0.002
		(0.018)	(0.001)		(0.200)	(0.017)		(1.572)	(0.038)
Household size (log)	-0.027	-0.024	-0.030	-3.588***	-3.159***	-3.055***	1.357	1.260*	1.017*
	(0.040)	(0.022)	(0.020)	(0.332)	(0.277)	(0.270)	(0.877)	(0.646)	(0.564)
Landholding in acres (log)	0.007	0.017**	0.008	0.145**	0.127**	-0.011	0.552*	0.071	-0.006
Log(land + 0.01)	(0.011)	(0.007)	(0.007)	(0.063)	(0.056)	(0.059)	(0.296)	(0.328)	(0.264)
Value of assets (log)	0.012*	0.012*	0.015**	0.390**	0.373***	0.440***	0.044	0.077	0.018
	(0.006)	(0.007)	(0.007)	(0.157)	(0.093)	(0.087)	(0.414)	(0.240)	(0.218)
Observations	150	312	312	150	312	312	150	312	312
R-squared	0.104	0.100	0.176	0.415	0.320	0.406	0.132	0.088	0.076
Village fixed effects	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
log(dist. to S.Sudan) ×log(dist. to barracks)			-0.129**			-0.129**			-0.129**
Dist. Sudan (log)			-1.259			-1.259			-1.259
Stock–Yogo			19.93			19.93			19.93
F-statistic			60.129			60.129			60.129
Hansen J			0.239			0.578			0.425

Notes: Robust standard errors are in parenthesis, clustered at community level. Stock–Yogo critical values are reported at 10% maximal IV size. Significance levels are ***p<0.01, **p<0.05, and *p<0.1. Additional regressor is altitude. Conflict exposure variable in column 1, 4, 7, 10, 13 and 16 is dummy taking 1 if subject abducted, forced to serve in rebellion, kill family member or kill other people and the sample used is severely affected districts. Conflict exposure variable in column 2, 5, 8, 11, 14 and 17 is dummy taking 1 if household was displaced and the sample used is all districts in the northern region. Conflict exposure variable in column 3, 6, 9, 12, 15 and 18 is log of number of total number of deaths aggregated at county level and additional controls are 10-year average annual rainfall, and temperature, population density, distance to town, whether road to town is tarmac.

Table 7: Effect of Conflict Exposure on Behavior *(Contn…)*

Conflict exposure var.	Share of Children in School out of All Children Aged 6–19 Years			Log(Education Expenditure per Child Aged 6–19 Years in School)			Log(Total Education Expenditure)		
	Subject abducted OLS	Household displaced OLS	Log(no. of deaths) 2SLS	Subject abducted OLS	Household displaced OLS	Log(no. of deaths) 2SLS	Subject abducted OLS	Household displaced OLS	Log(no. of deaths) 2SLS
	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Conflict exposure	0.026	-0.033	0.095***	-0.125	0.465***	0.328***	0.167	1.001***	0.711**
	(0.069)	(0.050)	(0.031)	(0.183)	(0.144)	(0.118)	(0.275)	(0.295)	(0.286)
Head age	-0.003	0.001	0.001	0.013*	0.013*	0.016***	-0.013	0.005	0.007
	(0.002)	(0.002)	(0.002)	(0.006)	(0.007)	(0.006)	(0.026)	(0.013)	(0.012)
Female head	0.066	0.095	0.100*	0.418	0.549**	0.670***	1.094	1.075***	1.255***
	(0.093)	(0.059)	(0.052)	(0.408)	(0.252)	(0.256)	(0.742)	(0.333)	(0.328)
Head years of schooling	0.004	0.007	0.004	0.095*	0.110***	0.108***	0.143	0.125**	0.119***
	(0.009)	(0.006)	(0.006)	(0.046)	(0.030)	(0.032)	(0.084)	(0.047)	(0.046)
Head ethnicity	-	-0.136***	0.006**	-	-1.100***	0.025***	-	-0.239	0.062***
		(0.037)	(0.002)		(0.103)	(0.010)		(0.229)	(0.021)
Household size (log)	0.071	0.126**	0.136***	0.225	0.309	0.447	1.448	1.597***	1.772***
	(0.082)	(0.053)	(0.048)	(0.491)	(0.304)	(0.283)	(1.005)	(0.538)	(0.429)
Landholding in acres (log)	0.022	0.001	-0.006	0.397**	0.264**	0.143*	0.757**	0.560*	0.379
Log(land + 0.01)	(0.016)	(0.013)	(0.012)	(0.141)	(0.106)	(0.084)	(0.275)	(0.286)	(0.234)
Value of assets (log)	0.030	0.050**	0.054***	0.172**	0.214***	0.231***	0.198	0.370**	0.377***
	(0.029)	(0.019)	(0.020)	(0.076)	(0.070)	(0.062)	(0.207)	(0.150)	(0.133)
Observations	136	274	274	122	241	241	122	241	241
R-squared	0.056	0.074	0.103	0.243	0.243	0.306	0.199	0.275	0.260
Village fixed effects	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
log(dist. to S.Sudan) ×log(dist. to barracks)			-0.121**			-0.115**			-0.115**
Dist. Sudan (log)			-1.364			-1.379			-1.379
Stock-Yogo			19.93			19.93			19.93
F-statistic			53.936			48.158			48.158
Hansen J			0.741			0.053			0.241

Notes: Robust standard errors are in parenthesis, clustered at community level. Stock–Yogo critical values are reported at 10% maximal IV size. Significance levels are ***p<0.01, **p<0.05, and *p<0.1. Additional regressor is altitude. Conflict exposure variable in column 1, 4, 7, 10, 13 and 16 is dummy taking 1 if subject abducted, forced to serve in rebellion, kill family member or kill other people and the sample used is severely affected districts. Conflict exposure variable in column 2, 5, 8, 11, 14 and 17 is dummy taking 1 if household was displaced and the sample used is all districts in the northern region. Conflict exposure variable in column 3, 6, 9, 12, 15 and 18 is log of number of total number of deaths aggregated at county level and additional controls are 10-year average annual rainfall, and temperature, population density, distance to town, whether road to town is tarmac.

Appendix

1. Additional Details on Experiments

Before the start of the experiments, it was emphasized to the subjects that either one of the risk or time experiments was to be played ex post for actual stakes, and therefore, based on their respective choices in the actual experiments, their monetary payoff would be determined accordingly by the outcome of that lottery. This incentive was in addition to a show-up fee of Ushs 5,000, which was intended to cover the opportunity cost of participating in the experiments and to induce the subjects to participate. Ushs 5,000 is approximately 2 to 3 days' of wages for a typical male farm laborer in the northern region.[16] For both the risk and time preference experiments, subjects were requested to choose column A or column B. All experiments were conducted with all participating subjects duly present to avoid experiencing any cross-talk effects that could potentially bias the experimental outcome.

Given that the level of education attainment of the subjects was low (5.7 years of schooling), it was imperative to make a strong assumption that the subjects would not adequately understand the concept of probabilities used in the experimental design. It is worth mentioning that subjects who had trouble filling out the answer sheets individually during the experiments were carefully helped by the enumerators, who cautiously avoided giving specific instructions to the subjects on how to answer. However, the number of such subjects was almost negligible. Whereas the enumerators were conversant with the local dialect, they had no formal connections with the respective communities, which minimized any bias in responses to the subjects. In addition, while extensive training was offered to the enumerators to fully acquaint them with the research design and experimental procedures, they were ignorant about the experimental hypothesis.

After completion of the two risk and two time preference experiments, one game was randomly selected to be played for real cash using a bingo machine. The procedure involved the subjects choosing one representative to roll the bingo machine for selecting one experimental result for actual payment. Once they had all agreed on who was to represent them, four balls numbered 1, 2, 3, and 4 were put into the bingo machine to decide which game was to be played for real. Balls 1, 2, 3, and 4 represent risk preference experiment 1, risk preference experiment 2, time preference experiment 3, and time preference experiment 4, respectively. Once the experiment to be played for real cash was

[16] Cardenas and Carpenter (2008) argued that payment of 1 to 2 days' wages for a half-day session to subjects participating in economic experiments induces salience among them.

decided based on the first ball to come out of the bingo machine, subjects were again asked to choose among themselves who would roll the bingo machine to decide which row was to be played for real cash. Once they had agreed on who was to represent them in this task, eight balls numbered 1, 2, 3, 4, 5, 6, 7, and 8 were put into the bingo machine to decide which row was to be played for real cash.

2. Measuring Risk and Time Preferences

2.1 Risk Aversion

According to the expected utility theory (EUT), an individual considered rational will maximize his/her expected utility of final wealth. Mathematically, this can be represented by $\sum_{i=1}^{n} p_i u(W_i)$; $u(W_i)$ as the utility level that is derived from final wealth W_i, which occurs with probability p_i for each of the *n* possible states. An individual is regarded as risk averse in the event that the utility function takes a concave shape. Adopting the Arrow–Pratt measure of risk aversion, $r(W) = -u''(W)/u'(W)$, an individual who is risk averse is represented by $r(W) > 0$, a risk-seeking individual is represented by $r(W) < 0$, while a risk-neutral individual is represented by $r(W) = 0$. For risk experiments, $(M) = - M \times u''(M)/u'(M)$. According to Holt and Laury (2002), the relative risk aversion parameter is often estimated to represent the risk aversion degree. *M* in this context represents the change in wealth—rather than final wealth—offered in the economic experiment. Therefore, a CRRA utility function, $u(M) = \frac{M^{1-\sigma}}{1-\sigma}$ is assumed, where σ indicates the curvature of the utility function, $r(M) = \sigma^2$. To compute the risk aversion parameter, σ, risk experiments are designed in such a way that they take the form of pair-wise choices or choices from a series of lotteries that include varying probabilities p_i and payoffs M_i (Holt and Laury 2002). To compute the degree of risk aversion σ reliably, we equate two lotteries that give the same level of expected utility $\sum_{i=1}^{n} p_i \frac{{M_i}^{1-\sigma}}{1-\sigma}$ to the individual and solve them simultaneously. Excerpt 1 (Figure 1) in the appendix is utilized to estimate the subjects' risk aversion parameters.

For risk preference experiment 1, which involved gains only, subjects were asked to choose between column A, which offered a sure payoff of Ushs 4,000 with 100% certainty, or column B, which offered two different payoffs with probabilities of either 25% for payoffs in column 1 and 75% for payoffs in column 2. To ensure that subjects fully understood the notion of probabilities, four balls were used to demonstrate the probability concept. Figures 1 and 2 represent an excerpt of the risk preference experiments in which subjects made their respective payoff choices. The balls were numbered 1, 2, 3, and 4; they can be seen circled below A and B in each of the excerpts. Risk preference experiment 1 was elicited to measure the subject's degree of risk aversion, risk neutrality, or risk seeking based on the point at which the subject switches from option A to option B. For example, if a subject chose option A in rows 1-1, 1-2, 1-3, and 1-4, and chose option B in row 1-5, the subject's risk preference can be represented mathematically as follows:

$$\frac{4000^{1-\sigma}}{1-\sigma} \geq 0.25 \times \frac{13000^{1-\sigma}}{1-\sigma} + 0.75 \times \frac{2000^{1-\sigma}}{1-\sigma}$$ ……………………… (1) from row 1-4

$$\frac{4000^{1-\sigma}}{1-\sigma} \geq 0.25 \times \frac{16000^{1-\sigma}}{1-\sigma} + 0.75 \times \frac{2000^{1-\sigma}}{1-\sigma}$$ ……………………… (2) from row 1-5

Solving for equations (1) and (2) simultaneously, the interval of the risk aversion parameter is $0.41 < \sigma \leq 0.62$, and taking the mid-point, we obtain the risk aversion parameter as $\sigma = 0.52$.

In terms of real payment to the subjects after the experiments, for illustration purposes, suppose risk preference experiment 1, which involved gains only, was chosen to be played for real cash, implying that out of the four balls that were placed in the bingo machine, ball 1 came out of the bingo machine first. Then, when eight balls were inserted in the bingo machine to determine which row would be played for real and ball 5 came out, row 1-5 would be played for real. Subjects who had chosen option A in row 1-5 would be paid Ushs 4,000 with 100% certainty. For subjects who had chosen option B, four balls would be inserted in the bingo machine and one of the subjects representing all the other participants would roll the bingo machine again. If ball 1 came out first, the subjects would earn Ushs 16,000, while if balls 2, 3, or 4 came out first, the subjects would earn Ushs 2,000. Table A1 shows the payoff matrix for risk preference experiment 1. Subjects who chose all A are considered very risk averse and therefore, are assigned $\sigma = 3.04$. Subjects who chose all B are considered very risk seeking and therefore, are assigned $\sigma = -1.15$.

2.2 Loss Aversion

Kahneman and Tversky (1979) in their seminal paper developed an alternative model from the EUT, known as prospect theory. They argued that people knowingly underweight outcomes that are merely probable compared to outcomes that are attained with sure certainty. The loss aversion concept originates from this alternative model of prospect theory. The loss aversion concept has been described as the tendency of the prospect of losses to loom much larger than the prospects of gains of the same magnitude. This can be represented as $u(M) < -u(-M)$. In economics experiments, just like risk aversion, loss aversion is elicited utilizing lottery games. However, lottery games in the context of loss aversion involve negative payoffs as part of the choices (see Appendix Figure 1.2). To estimate the degree of loss aversion, we utilize the value functions $u(M) = M^{\sigma}$ for gains $M > 0$ and $u(M) = -\lambda(-M)^{\sigma}$ for losses $M < 0$, where λ is the loss aversion parameter. The risk aversion parameter σ of each subject elicited in experiment 1 is utilized to estimate the level of loss aversion. Taking into consideration the mean estimated value of σ for each subject and the value function $u(M) = -\lambda\times \frac{(-M)^{1-\sigma}}{1-\sigma}$ for losses ($M < 0$), the range of the loss aversion parameter λ for each switching point is estimated by equating the expected utilities in columns A and B.

Risk preference experiment 2 was undertaken to measure the subjects' degree of loss aversion. The experiment involved gains and losses. Subjects were asked to choose between columns A and B; both columns were sub-divided into two, with each column representing a payoff and probability of 50% chance of winning or losing. For the sub-divided columns, column 1 involved gains while column 2 involved losses. In the event that risk preference experiment 2 was chosen to be played for real cash, this scenario implied that out of the four balls inserted in the bingo machine to determine which game was to be played for real cash, ball 2 came out of the machine first. Then, when eight balls were inserted into the bingo machine to determine which row would be played for real, and ball 2, for example, came out first, row 2-2 would be played for real cash. In this case, subjects would again choose between themselves who would roll the bingo machine. For subjects who had chosen option A in game 2, if either balls 1 or 2 came out of the bingo machine first, the subjects would receive Ushs 4,000, while if the first balls out were either balls 3 or 4, the subjects would lose Ushs500. However, for subjects who had chosen option B, if either ball 1 or 2 came out of the bingo machine first, they would receive Ushs 6,000, while if the first balls out were either balls 3 or 4, the subjects would make a loss of Ushs 4,000. Given that all participants were to receive a participation fee of Ushs 5,000, in the event of a loss by the subject, the money would be deducted from the participation fee. The experimental design was structured in such a way that even if a subject made a loss in risk game 2, he/she would still earn an amount from his/her participation fee. The minimum amount a subject would earn, in the event that he/she made the largest loss in risk preference experiment 2 is Ushs 1,000 (Ushs 5,000–4,000). In fact, the net gain from participating in the risk and time experiments ranged from Ushs 1,000 to Ushs 21,000.

2.3 Discount Rate

The time preference experiments are elicited to estimate the subjects' discount rate and present bias, in addition to comparing the degree of patience of the subjects. To estimate the subjects' discount rate (r), experiment 3 is utilized to obtain the discount rate intervals. We utilize the value function $v(M_0)$ = $\frac{1}{(1+r)^t}$ × $v(M_t)$, where M_0 denotes the present value for the subject who faces payoff M_t, which is offered at time t with discount rate r. It is assumed that $v(M_t) = M_t$. In order to estimate each subject's discount rate, we equate the switching point between two choices and take the midpoint of the interval. For example, to calculate a subject's discount rate (r) taking into consideration experiment 3, suppose a subject switches from column A to column B in row 1-4; the time preference can then be computed as $\frac{1}{(1+r)^4} \times (6{,}000) \leq \frac{1}{(1+r)^6} \times (10{,}000)$. Solving for r, the discount rate becomes $r \leq 0.2909$. Experiment 3 involved a front-end delay while experiment 4 did not. In the time preference experiments that involved future payments, credibility bias was very important and had to be addressed before commencement of the experiments, given that researchers and enumerators are usually strangers to subjects (Cardenas and Carpenter 2008). If credibility bias exists, subjects might willingly opt for present payoffs and intentionally avoid future payoffs, a situation that could make it seem as if they were relatively impatient, yet in fact, this may not be the case. Fernandez-Villaverde and Mukherji (2002) claimed that subjects prefer immediate payoffs when they are uncertain of their future rewards (as cited by Ashraf et al. 2006, p. 652). To mitigate any possible credibility bias and gain subjects' trust about delivery of future payoffs, community leaders were fully engaged in the organization of the subjects and assurance was given to all the subjects that any future payments were to be paid in liaison with the community leaders. Firm arrangements for future payments were discussed with village elders, usually the respective LC1 chairpersons, who assured subjects of guaranteed payments. The engagement of respectable community leaders was uniformly undertaken in all the experiment communities, which assures us that the study did not suffer any credibility bias from the subjects.

For time preference experiment 3, subjects were asked to choose between option A with payoff amounts to be earned in 4 months, and option B with payoff amounts to be earned in 6 months. For time preference experiment 4, subjects were asked to choose between option A with payoff amounts to be earned in 2 months, and option B with payoff amounts to be earned that same day (immediate payment). Suppose time preference experiment 3 was to be played for real cash; eight balls would be put in the bingo machine to determine which row was to be used. A representative from the subjects would roll the bingo machine and the first ball to come out would determine the actual payment row.

If, for example, ball 3 came out of the bingo machine first, then row 1-3 would be played for real cash. Subjects who had chosen option A would be entitled to Ushs 6,000 in 4 months while those that had chosen option B would be entitled to Ushs 9,000 in 6 months.

Present bias is elicited from experiment 3 and 4. The pair-wise choices in both experiments are identical, the only difference being the timing of payment. The timing of experiment 3 is 4 months or 6 months, while that for experiment 4 is today or 2 months. Since experiments 3 and 4 have same structure in terms of time discount, the switching point should be the same in these two experiments if there is no present bias (Tanaka and Munro 2014). The different timeframes allow for the identification of dynamic inconsistency, because subjects deemed dynamically inconsistent demonstrate bias toward future rewards. Following Meier and Sprenger (2010), we compute a present bias dummy and present the bias intensity of each subject. A subject is defined as having present bias when he/she is less patient when a smaller, earlier reward is preferred in the present, where time is today (t=0). Therefore, we classify a subject as having present bias if the discount rate from experiment 4 (t=0 or t=2) is less than the discount rate from experiment 3 (t=4 or t=6). As a measure of present bias intensity of each subject, we take the ratio of the discount rate from experiment 3 over the discount rate from experiment 4. Tables A3 and A4 show the payoff matrix for time preference experiments 3 and 4, respectively. For time preference experiment 3, subjects who chose all A are considered very impatient and therefore, are assigned $\mathrm{r} = 1.039$, while subjects who chose all B are considered very patient and therefore, are assigned $\mathrm{r} = 0.0401$. For time preference experiment 4, subjects who chose all A are considered very patient and therefore, are assigned $\mathrm{r} = 0.0401$, while subjects who chose all B are considered very impatient and therefore, are assigned $\mathrm{r} = 1.039$. It is noteworthy that all subjects in both the risk preference and time preference experiments who had multiple switching were regarded as having irrational answers, and therefore, were dropped from the analysis.

Figure A1: Risk Preference Experiment 1 Answer Sheet

RISK GAME 1

	A	B		Do you prefer A or B?
	① ②③④	①	② ③④	
1–1	4,000	4,000	2,000	
1–2	4,000	7,000	2,000	
1–3	4,000	10,000	2,000	
1–4	4,000	13,000	2,000	
1–5	4,000	16,000	2,000	
1–6	4,000	16,000	3,000	
1–7	4,000	16,000	3,500	
1–8	4,000	16,000	4,000	

Figure A2: Risk Preference Experiment 2 Answer Sheet

RISK GAME2

	A		B		Do you prefer A or B?
	① ②	② ④	①②	③ ④	
2–1	6,000	-500	6,000	-4,000	
2–2	4,000	-500	6,000	-4,000	
2–3	1,000	-500	6,000	-4,000	
2–4	500	-500	6,000	-4,000	
2–5	500	-500	6,000	-3,000	
2–6	500	-1,000	6,000	-3,000	
2–7	500	-1,000	6,000	-2,000	
2–8	500	-1,000	6,000	-1,000	

Figure A3: Time Preference Experiment 3 Answer Sheet

TIME GAME 1

	A	B	Do you prefer A or B?
1–1	6,000 in 4 months	7,000 in 6 months	
1–2	6,000 in 4 months	8,000 in 6 months	
1–3	6,000 in 4 months	9,000 in 6 months	
1–4	6,000 in 4 months	10,000 in 6 months	
1–5	5,000 in 4 months	10,000 in 6 months	
1–6	4,000 in 4 months	10,000 in 6 months	
1–7	3,000 in 4 months	10,000 in 6 months	
1–8	2,000 in 4 months	10,000 in 6 months	

Figure A4: Time Preference Experiment 4 Answer Sheet

TIME GAME 2

	A	B	Do you prefer A or B?
2–1	7,000 in 2 months	6,000 today	
2–2	8,000 in 2 months	6,000 today	
2–3	9,000 in 2 months	6,000 today	
2–4	10,000 in 2 months	6,000 today	
2–5	10,000 in 2 months	5,000 today	
2–6	10,000 in 2 months	4,000 today	
2–7	10,000 in 2 months	3,000 today	
2–8	10,000 in 2 months	2,000 today	

Table A1: Payoff Matrix for Risk Preference Experiment 1 (Gains)

Row	Column A				Column B				EV^A-EV^B	CRRA Interval if Switches to B under EUT	
	Pr (p)	Prize (M)	Pr (1-p)	Prize (M)	Pr (p)	Prize (M)	Pr (1-p)	Prize (M)			
1-1	1.0	4,000			0.25	4,000	0.75	2,000	1,500	n/a	n/a
1-2	1.0	4,000			0.25	7,000	0.75	2,000	750	$-\infty < \sigma \leq -1.15$	-1.15
1-3	1.0	4,000			0.25	10,000	0.75	2,000	0	$-1.15 < \sigma \leq 0.00$	-0.58
1-4	1.0	4,000			0.25	13,000	0.75	2,000	-750	$0.00 < \sigma \leq 0.41$	0.21
1-5	1.0	4,000			0.25	16,000	0.75	2,000	-1,500	$0.41 < \sigma \leq 0.62$	0.52
1-6	1.0	4,000			0.25	16,000	0.75	3,000	-2,250	$0.62 < \sigma \leq 1.60$	1.11
1-7	1.0	4,000			0.25	16,000	0.75	3,500	-2,625	$1.60 < \sigma \leq 3.04$	2.32
1-8	1.0	4,000			0.25	16,000	0.75	4,000	-3,000	$3.04 < \sigma \leq \infty$	3.04

Notes: The table shows all the payoffs (M) and attached probabilities (p, 1-p) for choices A and B in the risk preference experiment 1. EV^A - EV^B is the difference in the expected value between lottery A and lottery B. The range of sigma σ is calculated by equating the expected utilities from lottery A and lottery B assuming a constant relative risk aversion (CRRA) utility function.

Table A2: Payoff Matrix for Risk Preference Experiment 2 (Losses)

Row	Column A				Column B				EV^A-EV^B
	Pr (p)	Prize (M)	Pr (1-p)	Prize (M)	Pr (p)	Prize (M)	Pr (1-p)	Prize (M)	
1-1	0.5	6,000	0.5	-500	0.5	6,000	0.5	-4,000	1,750
1-2	0.5	4,000	0.5	-500	0.5	6,000	0.5	-4,000	750
1-3	0.5	1,000	0.5	-500	0.5	6,000	0.5	-4,000	-750
1-4	0.5	500	0.5	-500	0.5	6,000	0.5	-4,000	-1,000
1-5	0.5	500	0.5	-500	0.5	6,000	0.5	-3,000	-1,500
1-6	0.5	500	0.5	-1,000	0.5	6,000	0.5	-3,000	-1,750
1-7	0.5	500	0.5	-1,000	0.5	6,000	0.5	-2,000	-2,250
1-8	0.5	500	0.5	-1,000	0.5	6,000	0.5	-1,000	-2,750

Notes: The table shows all the payoffs (M) and attached probabilities (p, 1-p) for choices A and B in risk experiment 1. EV^A - EV^B is the difference in the expected value between lottery A and lottery B.

Table A3: Payoff Matrix for Time Preference Experiment 3

Row	Column A		Column B		Front-end Delay	Discount Rate Interval if Switches to B	Mid-point
	Months (t)	Prize (M)	Months (t)	Prize (M)			
1-1	4	6,000	6	7,000	Yes	0 < r ≤ 0.0801	0.0401
1-2	4	6,000	6	8,000	Yes	0.0801 < r ≤ 0.1547	0.1174
1-3	4	6,000	6	9,000	Yes	0.1547 < r ≤ 0.2247	0.1897
1-4	4	6,000	6	10,000	Yes	0.2247 < r ≤ 0.2909	0.2578
1-5	4	5,000	6	10,000	Yes	0.2909 < r ≤ 0.4142	0.3526
1-6	4	4,000	6	10,000	Yes	0.4142 < r ≤ 0.5811	0.4976
1-7	4	3,000	6	10,000	Yes	0.5811 < r ≤ 0.8257	0.7034
1-8	4	2,000	6	10,000	Yes	0.8257 < r ≤ 1.2361	1.0309

Notes: The table shows all the payoffs (M) and timing (t) in months of payment for choices A and B in experiment 3. The range of discount r is calculated by equating the discounted value from lottery A and lottery B.

Table A4: Payoff Matrix for Time Preference Experiment 4

Row	Column A		Column B		Front-end Delay	Discount Rate Interval if Switches to A	Mid-point
	Months (t)	Prize (M)	Months (t)	Prize (M)			
1-1	2	7,000	0	6,000	No	0 < r ≤ 0.0801	0.0401
1-2	2	8,000	0	6,000	No	0.0801 < r ≤ 0.1547	0.1174
1-3	2	9,000	0	6,000	No	0.1547 < r ≤ 0.2247	0.1897
1-4	2	10,000	0	6,000	No	0.2247 < r ≤ 0.2909	0.2578
1-5	2	10,000	0	5,000	No	0.2909 < r ≤ 0.4142	0.3526
1-6	2	10,000	0	4,000	No	0.4142 < r ≤ 0.5811	0.4976
1-7	2	10,000	0	3,000	No	0.5811 < r ≤ 0.8257	0.7034
1-8	2	10,000	0	2,000	No	0.8257 < r ≤ 1.2361	1.0309

Notes: The table shows all the payoffs (M) and timing (t) in months of payment for choices A and B in experiment 4. The range of discount r is calculated by equating the discounted value from lottery A and lottery B.

Table A5: Comparison between Subjects with and without correct understanding of the Experiments

	Subjects who switched during the game	Subjects who chose either all A or all B	p-value on diff. between (1)&(2)	Severely Affected districts			Less Severely Affected districts		
				Subjects who switched during the game	Subjects who chose either all A or all B	p-value on diff. between (4)& (5)	Subjects who switched during the game	Subjects who chose either all A or all B	p-value on diff. between (7) & (8)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Number of observations	208	65		103	29		105	36	
Timing (=1 if experiment conducted in 2017)	0.654	0.856	0.003	0.553	0.759	0.047	0.752	0.917	0.036
	(0.477)	(0.045)		(0.499)	(0.435)		(0.434)	(0.280)	
Individual Characteristics									
Age	39.505	43.662	0.053	38.631	40.862	0.475	40.362	45.917	0.062
	(14.765)	(16.016)		(14.428)	(16.095)		(15.108)	(15.814)	
Schooling	6.106	4.277	0.0003	5.893	4.655	0.046	6.314	3.972	0.0007
	(3.571)	(3.439)		(3.475)	(3.930)		(3.667)	(3.009)	
Gender (Male=1)	0.663	0.585	0.248	0.621	0.552	0.502	0.705	0.611	0.302
	(0.474)	(0.497)		(0.487)	(0.506)		(0.458)	(0.494)	
Ethnicity (Acholi=1)	0.471	0.508	0.608	0.913	0.931	0.754	0.038	0.167	0.009
	(0.500)	(0.504)		(0.284)	(0.258)		(0.192)	(0.378)	
Numeracy	5.439	5.246	0.525	5.427	5.000	0.369	5.451	5.444	0.987
(score out of 12 points)	(2.072)	(2.312)		(2.113)	(2.712)		(2.042)	(1.949)	
Head	0.759	0.738	0.731	0.679	0.655	0.806	0.838	0.806	0.657
	(0.428)	(0.443)		(0.469)	(0.484)		(0.370)	(0.401)	
Household Characteristics									
Head Age	43.678	48.800	0.015	43.699	50.517	0.023	43.657	47.417	0.202
	(14.247)	(15.859)		(13.109)	(17.363)		(15.345)	(14.639)	
Head Schooling	6.063	4.769	0.015	6.049	4.897	0.169	6.076	4.667	0.039
	(3.712)	(3.745)		(3.838)	(4.362)		(3.602)	(3.225)	
Marital Status (Married=1)	0.769	0.692	0.212	0.786	0.621	0.069	0.752	0.750	0.977
	(0.422)	(0.465)		(0.412)	(0.494)		(0.434)	(0.439)	
Household Size	6.490	6.338	0.686	6.913	6.621	0.609	6.076	6.111	0.943
	(2.761)	(2.224)		(2.832)	(2.211)		(2.637)	(2.239)	
Own Land Size (Acre)	7.683	7.540	0.951	10.738	10.605	0.976	4.685	5.072	0.832
	(17.006)	(13.019)		(21.362)	(18.352)		(10.477)	(5.142)	
Assets Value (Uganda Shillings)	713,585	7.540	0.103	458,568	194,169	0.086	963,745	363,666	0.204
	(2,084,069)	(337,891)		(813,563)	(191,964)		(2,805,027)	(407,560)	
Distance from home to	32.164	30.677	0.617	36.421	34.407	0.724	27.987	27.672	0.888

district town (km)	(20.938)	(20.846)		(26.727)	(28.477)		(11.679)	(11.182)	
Distance from home to Southern	152.137	142.502	0.078	130.715	127.458	0.553	173.150	154.621	0.013
Sudan(km)	(36.223)	(44.361)		(23.122)	(34.676)		(34.452)	(47.937)	
Distance to nearest army barracks	42.408	41.738	0.843	39.146	44.779	0.242	45.608	39.288	0.182
	(23.438)	(24.595)		(21.787)	(26.079)		(24.723)	(23.412)	
Community Characteristics									
Average Annual Rainfall in mm	1106.827	1141.690	0.198	1054.815	1106.928	0.295	1157.848	1169.692	0.604
(10 years)	(196.513)	(167.049)		(244.675)	(200.596)		(24.723)	(130.492)	
Temperature	26.144	26.125	0.894	25.894	26.029	0.634	26.389	26.202	0.047
	(1.102)	(0.680)		(1.441)	(0.915)		(0.507)	(0.403)	
Population Density (square km)	216.222	246.712	0.298	189.156	220.590	0.507	242.773	267.755	0.483
	(202.437)	(215.674)		(223.615)	(228.987)		(176.319)	(205.152)	
Road to district town is tarmac=1	0.091	0.077	0.721	0.097	0.000	0.082	0.086	0.139	0.361
(0=dirt or marram road)	(0.289)	(0.269)		(0.298)	(0.000)		(0.281)	(0.351)	
Real Life Behavior									
High Value Crops cultivation	0.187	0.197	0.697	0.194	0.185	0.802	0.181	0.206	0.457
	(0.168)	(0.156)		(0.162)	(0.169)		(0.180)	(0.146)	
Mosquito BedNet ownership	-1.500	-1.338	0.669	-2.184	-2.207	0.969	-0.829	-0.639	0.688
	(2.667)	(2.641)		(2.732)	(2.651)		(2.432)	(2.451)	
Monthly alcohol consumption	1.977	4.385	0.008	2.339	3.869	0.265	1.621	4.800	0.008
(liters)	(4.667)	(9.859)		(5.471)	(9.311)		(3.707)	(10.391)	
Share of children in school (age 6-19)	0.690	0.734	0.389	0.682	0.725	0.535	0.699	0.741	0.570
[out of HHs with children]	(0.349)	(0.294)		(0.336)	(0.258)		(0.363)	(0.324)	
Education expenditure per child in	1.976	1.981	0.994	1.937	2.558	0.505	2.021	1.463	0.426
school (age 6-19)	(3.725)	(3.553)		(4.101)	(4.158)		(3.278)	(2.885)	
Total Education Expenditure	4.609	4.611	0.999	5.359	5.055	0.919	3.874	4.253	0.843
	(12.057)	(12.745)		(15.433)	(9.559)		(7.392)	(14.954)	

Note: Education expenditure is per 100,000 Uganda shillings. In parenthesis are standard deviations.