

Web Appendix

Violent Conflict and Behavior: a Field Experiment in Burundi

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I. Surveys

We use panel data from two waves of household and community surveys. The first wave of data was collected in 1998, the second in 2007. In 1998 the World Bank and the Burundi Institute of Statistics and Economic Studies (ISTEEBU) conducted a general-purpose household survey to assess living standards in rural Burundi, using a two-stage clustered and stratified sampling approach. Stratification was based on the four agro-ecological zones that are present in Burundi. The first stage comprised the random selection of 391 villages (called *sous-collines* in Burundi; the lowest administrative unit) from a list that featured all villages in Burundi. Villages were chosen with a probability proportional to their population. Subsequently, within each village 10 households were randomly selected from a list of all households residing in the village (Enquête Prioritaire 1998).

In 2007, we designed the Priority Survey as a follow-up to the 1998 survey. We randomly drew 100 of the 391 baseline sites with the purpose to track and re-survey all 1000 original (1998) rural households in these sites. We located and re-interviewed 874 out of the 1000 selected households. In addition we interviewed on average three village officials in our community questionnaire. They would collectively discuss and answer our questions.

Our Burundian partner ISTEEBU informed the village chief of our upcoming visit and our survey team met with him one day beforehand. Enumerators were instructed to conduct

the interview with preferably the household head, or spouse if the household head was unavailable. The enumerators would obtain oral informed consent to conduct the interview, and emphasized that the respondent could opt out of the interview at all times. Non-response rates to the surveys were very low; less than 3% in 1998 and less than 1% in 2007.

II. Experiments

For the experiments we drew a stratified random sample from our list of villages (interviewed in 1998 and 2007). We based our stratification on the incidence of war-related violence at the village level. In our 2007 survey we obtained information from the village officials about the incidence of violent attacks in their villages, between 1993 and 2003. We ended up with a sample of 36 villages: 25 experienced violence and 11 did not. In one of these villages we were unable to conclude the experiments. Of the 306 household heads that were invited to the experiment 26 did not show up. The most important reasons were a move to a different location (19%), illness (15%), other businesses (11.5%), unable to find them when the village official came round to their house (11.5%), or for reasons unknown (43%).

The experiments were conducted during March-April 2009 in collaboration with Ligue Iteka, a Burundian non-governmental human rights organization. The organization has a long history of operation as well as nationwide coverage in Burundi and has a solid reputation of being trustworthy amongst Burundians.

We organized an extensive training of our local experimenters and ran several pilot tests to ensure that our typical participant was able to understand our experiments without much effort. A day before the experiments, research coordinators contacted local government officials in each research site, and asked them to invite the household heads of the 2007 survey participants. The experiments started at approximately 9 a.m., and lasted about three hours. Each session started with a general introduction in which the participants were

informed, among other things, that upon completion of the session they would receive a show-up fee of 2000 FBU plus or minus the amount of money they would gain or lose as a result of their decisions during the session. The games were implemented by three teams, each with one instructor and two research assistants. Subjects who had difficulty completing record sheets by themselves were helped by research assistants who carefully avoided giving specific instructions about how to answer.

As many of our participants had received little or no education, we followed a relatively simple design and our experimenters used clear and visual instructions to make it easier for illiterate subjects to understand the consequences of any decisions they made in the games.¹ In each session the social preference experiment was implemented first, followed by the risk and time preference experiments. After subjects completed all experiments we randomly determined which pairwise choice was to be paid in the risk and time preference experiment. The average experimental earnings for three games were about 6000 FBU² (roughly 5 days wages for unskilled labor), including the 2000 FBU show-up fee. The subjects were not informed about their earnings in each experiment until all experiments had been completed.

A. Social Preference Experiment

To measure social preferences we used a modified version of the social value orientation experiment devised by Wim B.G. Liebrand (1984). In this experiment, subjects (denoted as i , j) are presented with 6 pairwise choices between two own-other payoff combinations. The pairs of allocations lie on a circle in the positive quadrant, where the amount of money the decision maker allocates to himself (S_i) is measured along the horizontal axis and the amount

¹ We tested comprehension by asking test questions before the start of each experiment. To enhance understanding we also limited the group size to 10 participants and if needed experiments were conducted in two groups. Also, instructors went through the experiments question by question. All experiments were conducted in the local language Kirundi.



² USD 1 = 1,210 FBU (20 May 2009), which is roughly equal to a full day's wage rate for unskilled labor.

of money allocated to the other participant is measured along the vertical axis (O_i).³ The radius of the circle is 250 FBU, so that $S^2+O^2 = (250)^2$. As a result, the total amount of money to be allocated (S_i+O_i) is not constant across combinations. A subject's i 's earnings are equal to the amount of money allocated to himself (the sum of S_i 's over the six choices), plus the amount of money allocated to him by his partner j in the experiment (the sum of O_j over the six choices); see Table A1

Table A1 Choice Pairs Social Preference Experiment

Question	A		B	
	Self	Other	Self	Other
1	0	250	60	240
2	60	240	120	220
3	120	220	180	180
4	180	180	220	120
5	220	120	240	60
6	240	60	250	0

Example Record Sheet Social Preference Experiment

2	WEWE 					UWUNDI 				
	A	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
B	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

B. Risk Preference Experiment

³ Originating in the social psychology literature this experiment is now frequently applied in the economics literature as well (Theo Offerman, Joep Sonnemans and Arthur Schram 1996). In these versions subjects are offered 24 pair wise allocations, covering all four quadrants of the circle. Pretesting revealed that the cognitive burden of making all 24 choices was too large for our (largely illiterate) subject pool. We decided to just offer subjects pair-wise choices in the “first quadrant” of the social orientation circle—corresponding to positive amounts for both the giver and receiver. We thus reduced the cognitive burden imposed on our illiterate subjects at the cost of reduced precision with which pro-social preferences can be measured.

Risk preferences were measured using a game based on William T. Harbaugh, Kate Krause and Lise Vesterlund (2002). Subjects were presented with 6 choice cards, each of which presented them a choice between A: receiving (or losing) an amount of money with certainty (y , that varied between the 6 choice cards), and B: participating in a game where they may either gain (lose) 2000 FBU with probability 0.3, or gain (lose) nothing with probability 0.7. Hence, the expected absolute value of the gamble was always the same (600 FBU. This was an expected gain for three cards and an expected loss for the other three cards), whereas we varied the amount of money to be received with certainty (y); see Table A2. For both gains and losses the certain bid (y) was lower, equal to, and higher than the expected value of the gamble. As the certain payoff (y) in A increases, the gamble in B becomes less attractive. The point at which a subject switches from the risky to the safe alternative allows us to determine her degree of risk aversion.

Table A2 Choice Pairs Risk Preference Experiment

Question	Certain	Gamble	
	gain/loss	p	gain/loss
1	500	0.3	2000
2	600	0.3	2000
3	700	0.3	2000
1	-500	0.3	-2000
2	-600	0.3	-2000
3	-700	0.3	-2000

Example Record Sheet Risk Preference Experiment

	A					B									
						●●●					○○○○○○				
3	2000 + 500					2000 + 2000					2000 + 0				
	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU
	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU
	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU
	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU
	+					+									
	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU					
	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU					
	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU					
	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU	100 FBU					

The probabilities of the gamble (0.3 of winning/losing 2000 FBU, and 0.7 of receiving nothing) were represented visually using three black and seven white balls. To illustrate the chances of winning/losing money, the ten balls were put into a bag in the presence of all participants in the session. We would then shake the bag with the balls to convince the audience that the balls were all mixed. Next, we drew one ball from the bag about ten times – with replacement – to show the participants that the likelihood of drawing a black ball (implying winning/losing money) was less than half the likelihood of drawing a white ball (resulting in zero payoffs). The choice cards displayed the options both numerically and graphically with each change in money stock represented by an equivalent number of banknotes. Payoffs for this second experiment were not determined until after the third experiment had been completed. Then, payoffs were determined by first selecting which of the six cards was to be implemented. Six numbered balls were put into a bag to randomly select one card to be played for payment. Those subjects who had chosen the safe option A were informed about the amount of money y , as stated on that card, they were to receive (or had to pay). For those who had chosen the gamble, option B, the seven white balls and the three black balls were put into the bag again to determine whether they would receive (have to pay) 2000 FBU (when any of the three black balls were drawn), or whether they received nothing (if one of the seven white balls was drawn). Note that we made sure that at the end of the experiment all subjects had non-negative earnings because of the 2000 FBU show-up fee.

C. Time Preference Experiment

To measure time preferences, we follow Glenn W. Harrison, Morten I. Lau and Melonie B. Williams (2002) and presented subjects with a set of nine simple pairwise choices between two options: receiving an amount of money at some date in the near future, and receiving a larger sum at a later time. The amounts of money were to be delivered by the same

trustworthy local NGO, Ligue Iteka. However future money is always less certain than instantaneous money. Consequently, we provided subjects with a choice between two future options – receiving money tomorrow, or in 15 days – rather than one “instant” versus one future income option. The two options to choose from were A: receive 1000 FBU in one day, and B: receive $1000(1 + d)$ FBU in two weeks plus one day, with d equal to 0.00, 0.01, 0.02, 0.05, 0.10, 0.40, 0.70, and 1.00; see Table A3. Thus, at the highest interest rate subjects earned an additional 1000 FBU by waiting two weeks. In the experiment subjects were asked to identify their switching point from preferring A to preferring B. Increasing the interest rate d over the nine decisions allows us to observe the point at which a subject switches from preferring 1000 FBU tomorrow to preferring $1000(1 + d)$ FBU in two weeks plus one day. The switching point serves as a measure of the subject’s discount rate; the earlier people switch from A to B the more patient they are.

Table A3 Choice Pairs Time Preference Experiment

Question	Tomorrow	In two weeks and one day	d
1	1000	1000	0
2	1000	1010	0.01
3	1000	1020	0.02
4	1000	1050	0.05
5	1000	1100	0.1
6	1000	1400	0.4
7	1000	1700	0.7
8	1000	2000	1

Participants were not shown (d).

Example Record Sheet Time Preference Experiment

	A	B
	Ejo	Mu ndwi zibiri
2	1000 1000 FBU	1010 1000 FBU 10 FBU

After subjects completed all questions (and after having determined the payoffs for the social orientation game and the risk preference game), we randomly determined which pairwise choice was to be paid in the time preference experiment. To do so, we put 9 numbered balls into a bag, and picked one randomly. The choice made for that question (i.e. A or B) then determined how much money was delivered, and when.

Upon completion of this third game participants were informed about their revenues in the social orientation game, the payments for the risk preference game were determined according to the procedure explained above, and they received the associated earnings, plus their show-up fee.

The pay-off of the time preference game was placed in a sealed envelope and handed over to a representative of the regional office of the local non-governmental organization. All participants received a receipt stating the amount of money they were entitled to. At the relevant date (either the next day, or 15 days later), the representative went back to the community to deliver envelopes to the respective participants, in return for their receipts. To ascertain that the money envelopes were indeed delivered by our local organization, we checked whether all receipts were collected – which was indeed the case. The participants were informed about this procedure in advance.

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Online Appendix B: Data Description

Experimental variables

- *Social preferences*: degree of altruism resulting from 6 choices between participant (S) and randomly chosen community member (O), for each question holds $S^2 + O^2 = (250)^2$, the resulting degree of altruism is $\alpha = \tan(O/S)$, with $37.5 < \alpha < 52.5$. Items were rescaled to $0 < \alpha < 100$. In community level regressions, variable for j -th community is created by averaging over all community households.
- *Risk preferences*: switch point [0 (risk averse), ... , 3 (risk loving)] between risky gain (or loss) with a probability $p = 0.3$, and certain (y) gain (or loss). In community level regression, variable for j -th community is created by averaging over all community households.
- *Time preferences*: discount rate is switch point between receiving 1000 FBU in one day and receiving $(1 + d)1000$ FBU in two weeks and one day, $d = [0, \dots, 100]$. In community level regression, variable for j -th community is created by averaging over all community households.

Conflict variables

- *Rel. number of dead in attacks 1993-2003*: Number of dead in community attacks relative tot population size. Reports total number of dead on the *colline* as a consequence of

confrontations between rebels and army as well as one sided violence between 1993-2003 divided by population size, as stated by local administrators (BCS 2007).

- *Household level victimization index*: is an additive index of physical (death of household member, forced labor, torture, ambush) and non-physical (theft of assets, crops and money) exposure of any household member. Since the absolute scale of this variable is arbitrary it is normalized to have a mean of zero and standard variation of one (BPHS 2007).
- *Household level victimization index – physical attack*: is dummy variable taking unity if any household member was exposed to a physical attack (death of household member, forced labor, torture, ambush) (BPHS 2007).
- *Household level victimization index – no physical attack*: is dummy variable taking unity if any household member was exposed to a non-physical attack (theft of assets, crops and money) (BPHS 2007).
- *Attack during 1993-2003*: is a dummy variable taking unity if community was attacked between 1993-1998 (BCS 2007).

Household and community variables

- *Age of head of household*: measured in years (BPHS 1998 and 2007 and ESD-SR) .
- *Gender of head of household*: in household level regressions variable is dummy variable taking unity if head of household is male, zero else. In community level regressions, variable household dummy's are averaged over number of households per community (BPHS 1998 and 2007 and ESD-SR).
- *Literacy of head of household*: in household level regressions variable is dummy variable taking unity if head of household is literate, zero elsewhere. In community level regressions, variable household dummy's are averaged over number of households per community (BPHS 1998 and 2007 and ESD-SR).
- *Total land holdings per capita (m²)*: total land size of household *i* in square meters, divided by number of adult equivalents present in household *i* (BPHS 2007).
- *Per capita total expenditure*: variable is the aggregated income of per capita expenditure for all goods purchased over a 15 day period valued at local market prices and divided by the adult equivalents of household *i* (BPHS 2007).
- *Perceived trust level in 1998*: measurement of trust in community members, rated on a 10 point scale 1 (very low)-10 (very high) (BPHS 1998).

- *Livestock farmer in 1993*: in household level regressions variable is dummy taking unity if household owned livestock in 1993, zero elsewhere. In community level regression, variable for j -th community is created by averaging over all community households (BEES 2009 and ESD-SR). Both variables are based on recall questions in the BEES 2009 and ESD-SR surveys respectively.
- *Share of cash crops in total production in 1998 and 2007*: share of cash crops (coffee, tea, tobacco and cotton) produced relative to total production (BPHS 2007).
- *Expenditures farm improvement in 1998 and 2007*: Expenditures on farm improvements (construction, repairs and purchase of equipment) in 2006-2007 (BPHS 1998 and 2007)
- *Land Gini coefficient*: variable based on household land holdings. Community level Gini coefficient is created by $G = 1 - 2 \int_0^1 L(X) dX$ (BPHS 2007).
- *Social capital*: index comprising a weighted (and normalized) scale of respondents' participation in community organizations and the degree of membership (BPHS 2007).
- *Distance to market*: Average distance to main agricultural market where food and non-food items are traded, measured in time intervals of 15 minutes, where $t = 1, \dots, 5$ (BCS 2007).
- *Density (1990 and 2008)*: number of people in community per square kilometer (MPDRN 2006 and RNPH 2008).
- *Percentage of votes for Ndadaye*: percentage of votes in favor of Ndadaye at the commune level during the presidential elections in 1993
- *Distance to Bujumbura*: distance of j -th community to capital in kilometers.
- *Altitude (log)*: average altitude of j -th community (MPDRN 2006).
- *Conflict over land*: percentage households which report to have conflicts over land in community (BPHS 2007).
- *Ethnic homogeneity*: percentage of Hutu population in community (BEES 2009).
- *Social homogeneity*: measure of perceived within village socio-economic inequality rated on a five-point scale 1 (no inequality)-5 (high degree of inequality). (BCS 1998 and 2007).
- *Severe draught*: dummy taking unity if household was exposed to severe draught in past three years (2007-2009) (BEES 2009).
- *Excess rain*: dummy taking unity if household was exposed to excessive rain in past three years (2007-2009) (BEES 2009).

- *Manioc crop disease*: dummy taking unity if community was exposed to cassava crop disease in 2006 (FAO 2006).
- *Upcoming ceremony*: dummy taking unity if household was expecting a ceremony in the near future (BEES 2009).
- *Present in village in 1993 and 1998*: dummy taking unity if household was present in village in 1993 and 1998 (ESD-SR).
- *Present in village in 1998 and 2009*: dummy taking unity if household was present in village in 1998 and 2009 (BPHS 2007, BEES 2009).

Data sources

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BCS. Burundi Community Survey 1998 and 2007

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