SUBJECTIVE INSECURITY AND COOPERATION:

EVIDENCE FROM FIELD EXPERIMENTS

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Abstract

Violence may elicit heterogeneous responses among people due to subjective differences in the way they experience such situations. Specifically, individuals experiencing similar conditions of violence in their environment may develop different perceptions of insecurity. Although the literature contains studies on subjective perceptions of insecurity as a variable that could affect different aspects of well-being and associativity, the influence of subjective insecurity on pro-social preferences has not been examined. Recent studies have explored a direct relationship between exposure to violent acts and pro-social behaviors, yet conclusions are divergent. We argue that subjective insecurity is a key determinant of cooperative behavior. We investigated how individual perceptions of insecurity affect cooperation using public good field experiments with 320 farmers in rural Colombian municipalities exposed to different levels of violence over recent years. To do this, we developed a cognitive-affective measure of subjective insecurity. We found that subjective insecurity has a negative effect on cooperation. This result persisted when we controlled for objective violence level and community effects. In fact, we found that objective violence level is positively associated to participation. These research findings pose new challenges for social interventions aimed at recovering individual agency and fostering community cooperation to overcome collective action problems. Our results suggest that when violence is relatively low, the potential of a community to engage in collective action still depends on subjective insecurity. Consequently, peace and crime reduction programs should consider an eventual lag between actual violence reduction and effective decrease of subjective insecurity, and implement policies ensuring that perceptions of threats to security and safety, both present and future, are reduced.

Introduction

Extant knowledge portrays human beings as possessing complex and endogenous preferences that can be affected by external factors such as markets (e.g. Bowles, 1998), government intervention (e.g. Cardenas et al., 2000), natural disasters (e.g. Carter & Castillo, 2005), and violence. Experimental studies have recently paid attention to the relationship between objective violence, measured by intensity indicators (e.g., victimization, homicides rates, number of kidnappings, attacks, displacement), and pro-social preferences such as trust, altruism and cooperation. To date, however, the evidence on the direction and nature of the relationship between exposure to violence and pro-social behaviors is not conclusive. The sign and direction of causality is still a matter of disagreement (see for example Voors et al., 2012; Gilligan et al., 2013; Cassar et al., 2013; Hopfensitz & Miquel-Florens, 2014; Bauer et al., 2014; Moya, 2013; Callen et al., 2014). As summarized by Gilligan et al. (2013), these studies put forward different explanations of their results: a) a preference-based hypothesis, which posits that individuals actually change their preferences due to exposure to violence; b) an institutional explanation, which suggests that individuals develop and adopt new social norms to cope with violence, without changing their preferences; and c) a purging hypothesis, which proposes that individuals with certain preferences or conditions leave the community as a consequence of violence, changing the distribution of social preferences in a given community but causing no change in individual preferences.

The above works attempt to trace a direct link between actual violence levels observed either at the community or the individual level (e.g. victimization) and the behavior of individuals. In so doing, they do not incorporate the heterogeneity of subjective individual

responses to violence. As the experience of a violent act interacts with a myriad of individual psychological conditions, each person should react in a unique way to the same objective violent act or threat (e.g., witnessing a murder). Our research expands the hypothesis that preferences are modified by examining a perception-based mechanism and, in particular, by linking subjective insecurity to pro-social behavior.

The focus on subjective perception of insecurity is useful for at least two reasons. First, the distinction between objective violence and subjective (perceived) measures of insecurity is needed because objective conditions and subjective perceptions may differ. As Bar Tal and Jacobson (1998) explained, "individuals perceive external events and conditions, evaluate them, and subsequently form beliefs about the state of security. Estimation of security is thus a cognitive process based on the repertoire of personal beliefs that make up people's subjective view of reality. This implies that external events are subjectively identified, interpreted, and understood" (p. 60). Thus the same external event might elicit different insecurity beliefs (Bar Tal & Jacobson, 1998) or, as Owen (2008) suggests, a person may *feel* insecure even when objective indicators appear to be favorable. Such perceptions of insecurity, like any other belief, are dynamic and hence are affected and updated by evolving events and the actions of the individual (e.g., Hogarth & Einhorn, 1989). In consequence, a static indicator of violence will not necessarily coincide with subjective perceptions that are the outcome of complex dynamic processes of belief updating.

Second, measures of subjective perceptions of insecurity reflect a wide psychological mindset that may exert an influence on choices and behaviors (Diprose, 2007; Tadjbakhsh & Chenoy, 2007). As Diprose (2007) explains, "the threat of violence is an important aspect of security and safety; however, threats can be real and perceived, incorporating many other psychological elements" (p. 9). For this reason, the focus on individual

perceptions of insecurity allows us to analyze individual-level variables, which solves methodological problems faced by previous works on violence and pro-social behaviors. One such problem is that aggregate measures of objective violence are calculated for geographic regions or, alternatively, use individual measures of victimization that are often underreported[2] (Czaja & Blair, 1990; Cantor & Lynch, 2000). Furthermore, it is difficult to determine a causal direction of the relationship between violence and pro-social preferences.[3] However, as suggested by psychological theory (e.g. Theory of Reasoned Action by Ajzen & Fishbein, 2005), attitudes similar to subjective insecurity are composed of cognitions and affective associations that precede observable behaviors and behavioral intentions. As Tadjbakhsh and Chenoy (2007) express it, "people's perceptions of security impact on their optimism and pessimism and influence their choices and courses of action, and ultimately impact on their lives" (p. 115). This supports the notion that subjective insecurity influences behavior and this relationship remains true even when cooperation and actual violence display two-way causality, as discussed in previous studies.

In this paper we develop a measure of subjective insecurity and explore its relationship to the individual willingness to cooperate, while controlling for community and contexts of violence. Our measure of subjective insecurity is based on developments of the human security concept (UNDP 1994) and in particular on Tadjbakhsh's (2014) definition: "Insecurity can refer to the loss of the guarantee of access to jobs, health care, social welfare, education, etc. as much as to the fear that arises from domestic violence, political

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[2] In that regard, Cantor and Lynch (2000) explain: "Victims may be reluctant to report incidents that are a source of pain, fear, shame, or embarrassment. One way of coping with a painful experience, in fact, is to try to forget it. Reporting the incident in a survey forces the victim to re-experience it and, perhaps, disclose information that could become known to other household members. Of particular concern is the gross underreporting of domestic violence on household victimization surveys" (p.112).
[3] Most of the studies exploring violence and pro-social behavior or social capital face a causality problem, because it is not clear whether communities developed higher levels of pro-social behavior because of their exposure to violence, or whether they experienced more violence because of higher levels of social capital; indeed, in the context of civil war, armed groups might target specific communities with higher levels of social capital (Kalyvas, 2006).

instability, crime, displacement, etc." (p. 2). As such, our insecurity measure, explained further in the methods section, captures an individual-centered concept in which "threats depend invariably on the context and can be anything from a sudden clear and present danger to a chronic violation of human dignity" (p. 2). To measure cooperation, we conducted public good field experiments with farmers in rural areas of Antioquia, Colombia, who have been exposed to different levels and forms of violence.

We found that subjective insecurity has a negative effect on cooperation. Furthermore, we found that the result held and objective violence was positively associated with cooperation when controlling for violence levels and community effects on cooperation.

Our results have implications for social interventions aimed at recovering individual agency and fostering community cooperation to overcome collective action problems.

Background: Violence, Cooperation and Social Capital

In recent years, there has been renewed interest in examining both the link between exposure to violence and social capital and the possible impacts of conflict on development. Recent studies have suggested a positive relationship between violence exposure and individual economic performance, political participation and pro-social behaviors, but the evidence remains inconclusive. Survey-based evidence suggests that in post-war periods, individuals who were exposed to violence are more likely to attend community meetings, participate in political meeting groups, and vote (Bellows & Miguel, 2009), while ex-combatants are more likely to vote and mobilize politically (Blatmann, 2009). In contrast, specific forms of victimization, such as displacement, may reduce participation in community organization, at least in the short term (Ibáñez & Moya, 2006).

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These studies have relied on objective measures of violence and victimization, while the subjective perceptions of insecurity remain largely unexplored in spite of potentially different results (Owen, 2003; Bar Tal & Jacobson, 1998). For instance, there is evidence of a positive association between subjective insecurity and relevant variables of well-being and social capital (Wills et al., 2011; Forero et al., 2014; Rockmore, 2011, 2012).

Experimental evidence has provided additional elements to understand the relation between exposure to violence, subjective insecurity, and pro-social behavior. Voors et al. (2012) aimed to establish the causal impact of objective indicators of civil-war victimization on social, time and risk preferences. They found that individuals self-reporting higher levels of exposure to violence display more altruistic behavior, are more willing to take risks, and exhibit a higher discount rate, but victims and non-victims don't differ much in their perceptions of insecurity. Similarly, Gilligan et al. (2013) found that subjects from *villages* exposed to violent conflict were more likely to contribute in public good games and more trusting than subjects from villages not exposed. However, subjects from victimized *households*, in spite of being more altruistic, were not more likely to contribute to public goods, nor were they more trusting than subjects from non-victimized households. Explanations of these results based on psychological recovery during post-conflict have not been conclusive. Victims' pro-social behavior has been also found to be somewhat contradictory as they participate more in community activities but are less trusting (Cassar et al., 2013). In addition, victims display increased risk aversion (Moya, 2014) but higher contribution in public good games (Hopfensitz & Miquel Florens, 2013). Further evidence shows that victims' increased involvement in community activities is accompanied by decreased cooperation in public good games (Giraldo et al., 2013; Eslava

& Zapata, 2014). Some explanations point to different types of victimization as responsible for different aspects of pro-social behaviors.

In the present work, we contribute to this discussion by focusing on subjective insecurity as a potential variable to solve this puzzle. Subjective insecurity captures the way victims or non-victims encode violence within their beliefs and affective associations, which in turn influences pro-social behavior, in particular cooperation.

Method

To analyze the relationship between subjective insecurity and cooperation, we conducted a series of public good experiments with farmers in rural areas of Colombia. In this region, violence and conflict are of different kinds and intensities, and for this reason it is an appropriate sampling space to obtain significant variability in subjective insecurity. The experiments were complemented by a survey collecting our measure of subjective insecurity and other relevant socioeconomic information.

Participants and sample.

We conducted our experiment with farmers in rural areas of Antioquia, one of the main coffee-producing regions in Colombia. Antioquia is a region of $63,612 \, \text{km}^2$ where people have experienced extreme situations of violence.[4] We selected four municipalities in this region with different average levels of objective violence over the last 10 years.[5] Violence data were available at the municipality level. We used indicators of homicide

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[4] Similar in size to Norway and twice the area of Belgium.
[5] Two of these municipalities were part of a larger group where the National Federation of Coffee Growers (FNC) intended to conduct a peace and development intervention, funded by the Spanish Agency for International Development Cooperation.

rates, number of kidnappings, number of displaced individuals (expulsion) and number of armed clashes (such as attacks on police and army facilities, ambushes, and harassments) to construct a municipal violence index.[6] This index was calculated using an average of the normalized indicators for each year and the "peak-end rule" (Kahneman et al., 1993; Fredrickson, 2000), a psychological heuristic according to which the subjective judgment of an experience that occurs over time depends mainly on the maximum and final levels of that experience. Thus, for the "peak-end rule," we used the average of these two values to capture the salience of extreme and recent events within a long- but low-intensity conflict, as is the case in Colombia and Antioquia (Palacios, 2012; Pizarro, 2004).

We calculated these indexes for all municipalities in Antioquia (n=125) and finally selected two municipalities with relatively low violence indexes, Sopetrán and San Jerónimo, and two municipalities with relatively high violence indexes, Abejorral and Betulia. The classification of these four municipalities was consistent when using the average violence and the peak-end rule.[7] Final selection of municipalities took into consideration similar characteristics of population size, distribution of ethnic groups, average farm size, income, and municipal expenditure. In addition, one year after the experimental sessions, we conducted community workshops with leaders and participants of the experiments to gather information about the context of these municipalities, and to gain understanding about the differences in their perceptions of insecurity and the way violent events in the past might have shaped them. A summary of this information for the four municipalities is reported in Appendix A.

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[6] We used official data for the period 1998-2010 from the Presidential Observatory for Human Rights.
[7] High-violence municipalities displayed an index above the 60 centile and low violence municipalities below the 20 centile for both methods: For Betulia the average based index (AVE) is 1.98 and the peak-end rule based index (PER) is 4.02. For Abejorral, AVE is 1.15 and PER is 1.65; for San Jerónimo, AVE is 0.28 and PER is 0.17; and for Sopetrán, AVE is 0.21 and PER is 0.48.

We gathered 80 farmers from different rural districts in each of the four municipalities for a total of 320 participants. The Colombian National Federation of Coffee-Growers (FNC) helped with recruitment using public announcements and its local networks. Recruitment targeted adult peasants in the rural districts of the four municipalities. We deliberately sought a balanced representation of coffee and non-coffee producers in order to reduce biases resulting from affiliation to the FNC. Table 1 shows participants' descriptive statistics of age, income, gender, level of education, FNC affiliation[8], and average of known people by session.

Across municipalities, there were significant differences in age ($F = 12.29; p < .001$) and income ($F = 8.31; p < .001$), but not in education. Abejorral had significantly more FNC affiliation than Betulia and Sopetrán ($z = 3.04; p < .001$), and San Jerónimo ($z = 2.68; p < .001$). Betulia and San Jerónimo did not differ significantly in their percentage of FNC affiliation. In terms of participation by gender, the samples in Betulia, San Jerónimo, and Sopetrán did not differ significantly, while Abejorral had significantly more male participants than Betulia ($z = 2.94; p < .01$) and San Jerónimo ($z = 2.5; p < .05$), but not more than Sopetrán. We controlled for these differences in our estimations.

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8 FNC affiliation implies that the individual or someone at his household was affiliated to FNC, since the benefits of FNC affiliation are beyond the individual.

Table 1 Sample characteristics

Municipality	Violence index	% Males	Age	Number of years of education	Monthly income	FNC Affiliation	Average Known people by Session
Abejorral	High	0,54	49,6	5,1	US$140	0,68	16
Betulia	High	0,38	37,8	5,1	$280	0,51	10
Sopetran	Low	0,48	45,2	5,2	$210	0,51	15
San Jeronimo	Low	0,40	38,3	5,5	$165	0,53	15
Total		**0,54**	**42,8**	**4,99**	**$215**	**0,54**	**14**

Procedure

During November and December of 2011, we implemented a standard public good game to measure cooperation. The public good game is a versatile, well-established experiment that has been used in many contexts and for varied purposes (See for example Ledyard, 1995; and Holt et al., 1997).

In our experiment, we followed the procedure reported by López et. al. (2012). Participants were randomly assigned to groups of five individuals. Each person received an endowment from the experimenter (USD 80 cents in our study) and then, within each group, they were asked to contribute to a community project. The total of contributions to the project was multiplied by two and the total amount was then distributed in equal parts to the five members of the group. Individual earnings corresponded to the endowment

minus the contribution plus the amount returned to each participant after the "project" took place. This game was played twice for practice, to facilitate understanding of the procedure, and 15 times for money. Communication was not allowed. Participants were fully informed of the whole procedure and were provided with materials to keep track of their individual decisions and earnings. Total gains were the lump sum of the gains from each of the game's 15 rounds. After the experiment, we conducted a survey with subjective insecurity measures and socio-economic information. Finally, total payments were calculated and participants were paid and dismissed. Earnings were calculated so that the opportunity cost of attending the experiment was covered.

The individual contributions to the community project during the game were used as the measure of cooperation. Thus, we obtained 15 decisions-to-contribute per individual, yielding a panel of 4800 observed individual contributions. In the experimental economics literature, contributions to the public good are considered a measure of cooperation, a behavior that might be very difficult to measure otherwise (Carpenter, 2002). Although this measure of cooperation does not discriminate the motives or preferences that precede cooperation, it is often considered as a proxy of social capital (see for example Poteete et al., 2010; and Karlan, 2005).

Subjective insecurity.

To measure subjective insecurity we developed a questionnaire capturing affective and cognitive aspects of the construct. We adapted questions from Diprose (2007), the Wills et al. (2011), Forero et al. (2014), and the National Survey of Victimization (DANE, 2009). Questions were designed to capture variations in the intensity of perceptions independently of their causes (e.g. armed conflict, domestic violence or crime). That is, we

did not inquire about the source of the perception of insecurity because we were interested in an overall sense of insecurity.[9]

Our basic questionnaire was composed of eight questions that captured feelings of fear related to different general aspects of threats and vulnerabilities (affective side), as well as subjective estimates of the possibility of experiencing violence (cognitive side).

Table 2 contains the eight base questions. We also wanted to capture variations of subjective insecurity as a function of social distance. Accordingly, the questions were framed by three social-distance-related dimensions of insecurity from an egocentric perspective (i.e., distance from the self) (Trope & Liberman, 2010): personal, family and community. Social distance is related to other psychological distance judgments such as hypotheticality of events (Waslak, Trope, Liberman, & Alony, 2006). Hence, underlying estimates (i.e. subjective probabilities) of being targeted by violence may vary as a function of social distance, affecting subjective insecurity. In addition, estimations of security anchored at different egocentric distances may also be affected by other well-known subjective biases and judgment miscalibrations like over-confidence (Liechtenstein, 1982), specifically in terms of excessive precision in beliefs about insecurity (Moore & Healy 2008); illusory correlations between the occurrence of violent acts and social contexts (Chapman & Chapman, 1971); and the illusion of control (Langer, 1975), as many people may believe that they have a certain control of threats within their own life and family as opposed to the community. In order to capture community-specific items of insecurity we replaced two of the base questions ("robbed by day" and "aggressions by day") with concerns on "children playing safely" and the presence of a "protective authority".

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[9] Understanding the sources of vulnerability is an additional research question. See for example Kostovicova's (2014) suggestions on human security operationalization and Bar Tal and Jacobson (1998) on the sources of insecurity feeling as psychological process.

Table 2. Personal subjective insecurity questions

	1 Totally disagree	2 Partially disagree	3 Partially Agree	4 Totally agree
1. I do not feel safe when walking after dark				
2. I feel I could face threats to my life				
3. I fear for my life				
4. I feel I face risks when participating in social, economic and political meetings				
5. I fear being robbed by day				
6. I fear being robbed by night				
7. I fear personal aggressions by day				
8. I fear personal aggressions by night				

The survey used a 4-point bipolar Likert scale to capture variations on the intensity of perceptions of insecurity. The scale is symmetric, ranging from 1 (totally disagree) to 4 (totally agree), and does not have a neutral point to force respondents to go in one direction or the other. Thus, we avoided the risk of an overestimated middle focal point in responses.

In addition to questions on the perceptions of insecurity and victimization, the survey included a wide array of questions intended to collect socio-demographic information on gender, income, education level, and economic activities. These are covariates in the following analyses.

Results

    Descriptives.

Average cooperation across all rounds and groups was 46%, which is within the range of 40% to 60% reported in the literature (López et al., 2012) and in recent public good games conducted in the same region (Giraldo et al., 2013; Eslava & Zapata, 2014). Furthermore, there were no significant differences between municipalities in the average levels of cooperation (*F = 1.07; p > .35*).

No evidence was found either of learning or behavioral change as rounds progressed.[10] Figure 1 shows the average cooperation per round by municipality. On average, cooperation in round 1 was 48%, slightly decreasing to 45% in round 15. However, no significant trend was observed (*t (mean contribution rounds 1 and 15) = 1.7; p > .08*). A closer look at contribution distribution reveals a bimodality located in the 45th and 75th percentiles, corresponding roughly to contributing one third or two thirds of the endowment. Figure 2 shows the overall distribution. This result persisted across municipalities (see Appendix B).[11]

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[10] López et al. (2012) report that public good lab experiments tend to start at around 40–60% of the initial endowment, but individuals reduce their contributions over time to 10–30%. However, for public good experiments in the field and for common pool field experiments there is no evidence of behavioral change over time (Vélez et al., 2008; López et al., 2012; Cárdenas et al., 2013).

[11] The endowment was $1,500 (Colombian pesos) for each round. Although local currency is available in coins of 50, 100, 200, 500 and 1,000, and bills of 1,000, 2,000 and higher, during the experiment, subjects were not constrained by these units (i.e. coins and bills of certain denominations). We therefore do not think that the two focal points can be attributed to an artifact of the experiment. Explaining focal points is outside the scope of this paper, but we adjust our statistical methods to account for this empirical situation.

Figure 1. Average contribution by municipality.
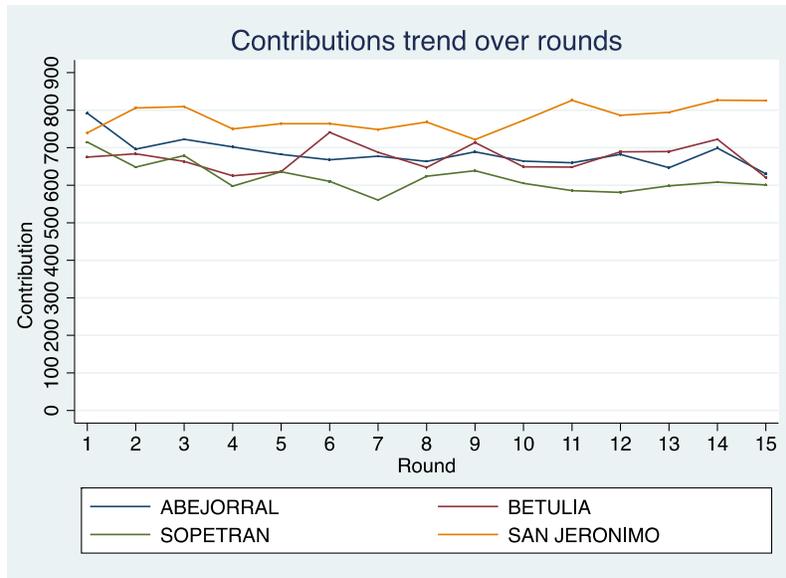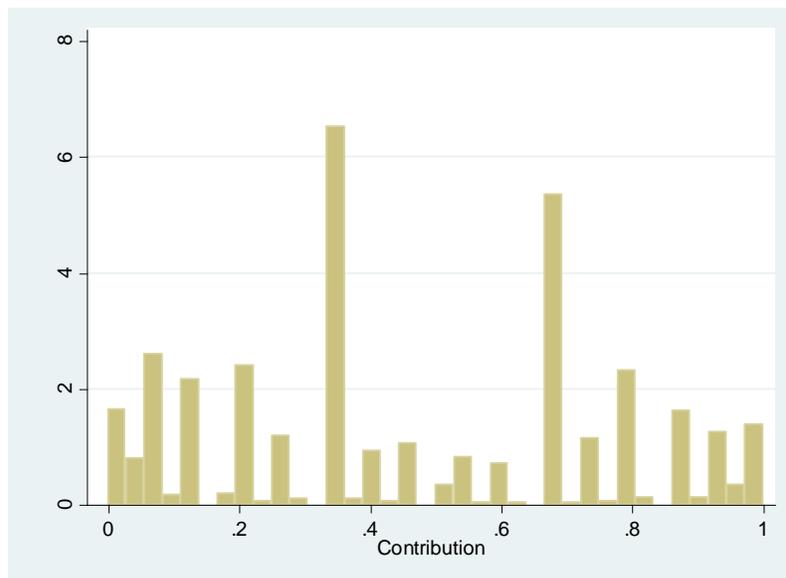

Figure 2. Distribution of contributions (all 15 rounds together)

In regards to the measure of subjective insecurity, factor analyses and Cronbach's alpha revealed that for each dimension of insecurity (i.e., personal, family and community), the eight questions loaded on a single factor (see Appendix C) with high reliability for each insecurity dimension. For this reason, an aggregated index of perceived insecurity was calculated as the average of the three ($\alpha_{personal}$ = .81; α_{family} = .86; $\alpha_{community}$ = .82; α_{total} = .93). These reliability coefficients are above the cut-off points suggested by Hair, Black, Babin, Anderson, & Tatham (2006). One item (related to the presence of a protecting authority) was removed from community insecurity due to very low factor loading (less than 0.05). We conclude that we obtained a reliable overall measure of subjective insecurity.

The difference in overall subjective insecurity between municipalities of relatively high and low violence was significant (M_{high} = 1.90, M_{low} = 1.49, t = -5.44; p < .001). Between the two municipalities with relatively low violence, the difference in subjective insecurity was insignificant (p > .15), but between municipalities of relatively high violence a significant difference was observed (p < .05). This result persisted for each dimension of insecurity, reinforcing the external validity of our measure. Also worth noting is that, as shown in Figure 3, the distribution of insecurity was highly skewed. Table 3 displays descriptive statistics of perception of insecurity. Overall, the insecurity levels across insecurity dimensions are not significantly different.

Table 3. Summary statistics of perceptions of insecurity
by municipality and insecurity dimension

Municipality	N	Personal Insecurity Index	Family Insecurity Index	Community Insecurity Index	Overall Insecurity Index
Abejorral (high)	80	1.83	1.80	1.69	1.78 (.68)
Betulia (high)	80	2.04	1.96	2.05	2.02 (.74)
Sopetrán (low)	80	1.63	1.54	1.53	1,56 (.61)
San Jerónimo (low)	80	1.46	1.48	1.34	1.43 (.59)
Overall	320	1,74	1.69	1,65	1.70 (.69)

Standard deviation in parentheses.

Figure 3. Distribution of total insecurity index
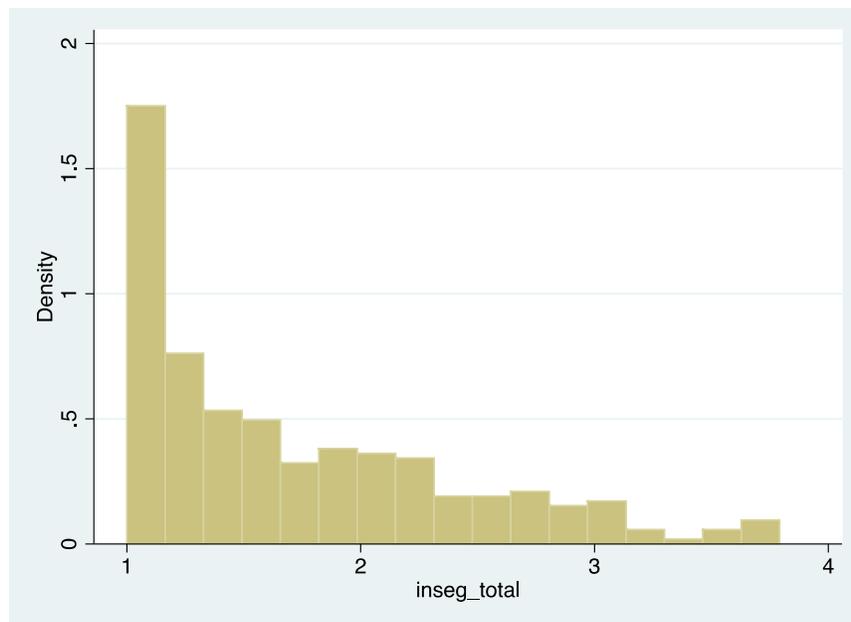
Results and discussion

We conducted quantile regressions analysis in order to account for the bimodality of contributions (the dependent variable) to the public good game (Koenker, 2005). In the first model, we estimated the main effects of subjective insecurity on cooperation, using the

aggregated index of perceived insecurity as the main independent variable, several socio-demographic covariates, and dummy variables for rural districts, in order to control for local fixed effects of community on cooperation.[12] In addition, we used bootstrapped (2000 repetitions) estimation of standard errors and robust clustered errors to account for the repeated nature of our data (in our experiment, each participant made 15 decisions about contributions). We estimated the regression for quantiles 45 and 75, since preliminary analyses revealed that these were the two most probable values in the distribution of cooperation (See Table 4).

In our base model, we found a significant negative main effect of subjective insecurity on cooperation for both quantiles. That is, higher levels of subjective insecurity constrict cooperative choices, suggesting that fear and perception of threat impose cognitive and affective costs, thus driving individuals away from contributing to the public good. However, this effect could be confounded with the interplay of violence levels and cooperation, as reported in the reviewed studies. Therefore, to isolate the effect of subjective insecurity from that of violence per se, we conducted an additional regression analysis including an objective violence dummy (coded 1 for high relative violence and 0 for low relative violence). In model 2 we also added the interaction between objective violence and subjective insecurity to obtain a reliable estimation under potential multicolinearity (see Hayes, 2013, for details on how interaction terms reduce multicolinearity problems).

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[12] As Arjona (2014) argues, different local institutional arrangements emerge in war zones, that is, "a set of rules that structure human interaction" and thus shape decision-making. The local institutions reveal different forms of armed presence in the territory, even within the same municipality. Thus, by including dummy variables for rural districts we hoped to capture the effects of local war institutions (e.g. type of armed presence) or other idiosyncratic community-level phenomena on cooperation.

In this model, the significant negative effect of subjective insecurity persists. Interestingly, in the model in which violence was included, the effect of violence was positive. These results show that individual and contextual variables do not affect cooperation in the same direction. While increased insecurity negatively affects cooperation, contextual variables have the opposite effect. Communities exposed to high levels of violence increase cooperation and this effect partially counteracts the effect of insecurity. Our results suggest that while individual-based measures such as emotions and beliefs negatively affect cooperation (perhaps due to fear and mistrust), the context increases cooperation, possibly as an adaptation strategy.

Other results worth discussing are the covariates that significantly explain cooperation in both quantiles and in the three models. Being affiliated to the National Federation of Coffee Growers (FNC) increases contribution to the public good. This is an important result because it reveals the long-standing tradition and work of the FNC and its committees that link virtually all coffee producers in the region. Although coffee producers don't have to sell to the FNC, the organization encourages producers' economic organizations, and provides a price floor as well as technical assistance and other types of social interventions, all of which may have created a network between coffee producers who understand the importance of cooperation in pursuing collective projects. However, cooperation decreased when people in a game session knew each other, which might reflect local conflicts or mistrust among inhabitants of the same community. Having one more year of formal education significantly reduces contribution for levels of low cooperation (Q45), and males contribute more in levels of high cooperation (Q75). Age is not significant.

Conclusion

Cooperative behavior is desirable for many reasons. It is a component of social capital and, as such, an antecedent of collective action (e.g. Ostrom et al., 2003; Poteete et al., 2010; Karlan, 2005) and a determinant of social and economic development (Ostrom et al., 2003; Fukuyama, 1995, 2001; Putman, 1993). This research taps into the classical problem of collective action by centering the analysis on individuals' subjective affective and cognitive assessments of insecurity. Consistent with the model of cognitive institutionalism proposed by Mantzavinos et al. (2004), in which outcomes alter reality through a process of feedback that goes through the mind, we argue that individuals experiencing similar conditions of violence in their environment may develop different perceptions of insecurity, which in turn affect cooperative behavior.

Our results contribute to the literature discussing the effect of exposure to violence and pro-social behaviors (see for example Gilligan et al., 2013; Voors et al., 2012; Cassar et al., 2013; Hopfensitz & Miquel-Florens, 2013; Bauer et al., 2014; Moya, 2012; Callen et al., 2014) and the argument that subjective experience of insecurity is an important driver of cooperative behavior. When moving away from objective, aggregate and sometimes narrow measures of violence toward subjective, individual-level measures of insecurity that are wider in scope, we find a negative relationship between perceptions of insecurity and cooperative preferences. Furthermore, when controlling for objective violence levels and community effects, subjective insecurity continues to be relevant in explaining cooperative behavior. Thus, the negative effect on cooperative behavior reveals a behavioral pattern whereby the subjective experience of the individual overrides collective or social considerations.

This empirical result is in line with theoretical developments on human security literature, in which feeling secure is a pre-condition for human development, understood as the expansion and realization of choices (Sen, 1999). As mentioned by Tadjbakhsh and Chenoy (2007), "in societies where the minimum conditions for human security are not met, human development is difficult to achieve and to sustain" (p. 114). Our results show that, as a necessary component of human development, social capital would be difficult to improve under conditions of increased subjective insecurity. When people feel insecure, it could be difficult to overcome this feeling and cooperate in pursuit of collective objectives. Instead, people who feel insecure may tend to reduce their contributions to collective efforts as they might feel their vulnerability is increasing, given that feelings of insecurity are based on "appraisal of threat and coping capability" (Bar-Tal & Jacobson, 1998, p. 68).

Subjective insecurity represents a powerful tool to better understand what is constricting people's choices and community development. In this sense, our results suggest a new puzzle that requires further research. While individual-centered measures such as emotions and beliefs negatively affect cooperation, the violent context increases it. Thus, communities exposed to higher levels of objective violence cooperate more than communities exposed to lower levels. New research designs need to explore this relationship, because two opposing forces may be at play in the aftermath of violent events and it is important to identify the underlying mechanisms. Is the link between subjective perceptions of insecurity and cooperation related to fear and mistrust? Is cooperative behavior driven by an adaptation strategy when objective violence is high? Future field and laboratory studies could be designed to reveal these mechanisms and their interactions, controlling by exposure and time after violent events.

Our results provide a comprehensive view of the determinants of cooperation and offer new insights for successful social interventions aimed at recovering individual agency and fostering community cooperation to overcome collective action problems in different contexts of violence. Peace and crime reduction as well as post-war intervention programs should consider a potential lag between reduction of violence and changes to subjective insecurity. Actions should be taken to ensure that the perceptions of threats to security and safety, both present and future, are reduced. This is even more important in contexts that are relatively less violent, since individuals may have fewer incentives to cooperate for the provision of public goods.

Failure to reduce perceptions of insecurity might have profound effects at the society level. If perceptions of insecurity increase in a given population, less cooperative behavior is expected. Thus, negative feedback from the environment might create a belief system (Mantzavinos et al., 2004) in which an informal norm such as freeriding is promoted. If this occurs, costly institutions would be required to facilitate exchange and interaction, and promote efficient outcomes. Decreased perceptions of insecurity, on the other hand, could prevent these problems, and increase subjective well-being.

Table 4 Two models including subjective insecurity, violence, and interaction

VARIABLES	Model 1: base		Model 2: with interaction	
	q45	q75	q45	q75
Subjective insecurity	-87.89***	-63.33**	-105.2***	-76.71***
	(20.55)	(25.65)	(30.67)	(26.93)
Gender (male=1)	-1.066	93.56***	-12.11	96.69***
	(25.70)	(24.37)	(31.70)	(25.39)
Age	0.977	0.940	0.854	0.817
	(0.955)	(1.401)	(0.844)	(1.154)
Education (years)	-15.45***	0.182	-15.24***	-0.161
	(4.246)	(4.901)	(4.306)	(4.570)
Monthly income	3.10e-05	7.17e-05**	3.75e-05	6.98e-05**
	(4.24e-05)	(3.52e-05)	(4.73e-05)	(3.09e-05)
Cofee producer (dummy)	95.18***	130.1***	90.13***	130.6***
	(26.07)	(34.52)	(25.32)	(40.90)
Known people in the game	-7.593***	-14.00***	-7.883***	-14.42***
	(2.759)	(2.876)	(2.626)	(2.321)
Round	-0	0	0	0
	(0.215)	(9.12e-08)	(0.341)	(9.14e-08)
Violence (1=high)			272.4***	730.6***
			(78.59)	(185.2)
Violence*Insecurity			15.98	25.60
			(39.82)	(38.00)
Constant	700.7***	1,161***	450.4***	413.2***
	(86.22)	(180.4)	(106.2)	(103.4)
N	4,425	4,425	4,425	4,425

Standard errors in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

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Appendix A

As mentioned above, we conducted community workshops with leaders and participants of the experiments to gather information about the context of these municipalities, and to gain an understanding of the differences in their perceptions of insecurity and the way violent events in the past might have shaped them. Each workshop consisted of three activities. First, a timeline was constructed to identify the most important stages in the community history. Second, a historical graph was plotted in order to recognize the existence and development of social and economic organizations. And third, a rules matrix was designed to establish changes in social norms over time. The methodology of these workshops was based on Arjona (2008, 2010).

Abejorral

Workshops were carried out in three rural settlements or *veredas*: Pantanillo, Mata de Guadua and Guayabal. According to the information obtained in these workshops, the dominant illegal armed group in the area since the beginning of 2000 and until 2003 was the paramilitary group United Self-Defense Forces of Colombia (or AUC, from the name in Spanish), especially the Cacique Nutibara and Metro armed blocks. According to workshop participants, livestock farmers brought the AUC due to problems with petty crime. The presence of these groups was continuous due to the high strategic value of the area and the opportunity to extract rents from farmers. Between 2000 and 2002 there were confrontations between the paramilitary blocks, the FARC and Colombian National Army, leading to massive displacement.

During their time in the area, paramilitary groups instituted social and environmental rules. For instance, they made it mandatory to attend meetings of the Community Action Board (or JAC from the name in Spanish), and prohibited nightlife, drugs and the use of shotguns to hunt animals. According to workshop participants, the trust among community members decreased while these groups were present in the territory. Community leadership also deteriorated in comparison to the community order before the arrival of the AUC. For example, the Community Action Boards were split by ideological differences and the inhabitants resorted to the paramilitaries to solve everyday problems. The paramilitaries became the rulers of social and economic life, and the authorities for conflict resolution.

In 2003 there was a change of AUC control in the area (the Metro block lost its dominance to the Cacique block). In March, the IV Brigade (National Army) intensified military operations, and then in December of that year, the demobilization of the Bloque Cacique took place. Workshop participants reported that, after the demobilization of the AUC, petty crime increased. Participants also reported that despite the demobilization process, the paramilitary presence continued until 2005.

In 2011, Abejorral had the lowest number of homicides since 2007, and when the experiments were conducted, these communities were receiving state-driven aid for education and housing to mitigate the disastrous effects of the wet season.

Betulia

We conducted three workshops in the *veredas* of Cibeles, La Valdivia and La Florida. According to information obtained, the FARC was the first armed group present in the area, arriving in 1980, and the paramilitaries arrived in the mid 1990s in order to gain

territorial control. Unlike Abejorral, where the dominant armed group was the AUC, in Betulia constant violent encounters took place between the guerrillas and the Southwest and Metro paramilitary blocks until 2005, when the guerrillas withdrew from the area.

The strategic value of the area (its suitability for coca planting) was the main reason for the presence of different groups. In this process, the roles of the "informants" or "collaborators" were created on both sides. According to participants, this generated an atmosphere of uncertainty, distrust and terror.

According to workshop participants, before the presence of illegal armed groups, the Community Action Board and its president were a legitimate authority and they had a recognized regulatory function in social interactions within the community. However, with the arrival of armed actors, this social capacity to intervene was reduced through massacres, mass displacement, disappearances, targeted killings of peasants, accusations that leaders sympathized with the opposite side, and other coercion strategies.

According to workshop results, the Southwest block demobilized in 2008 and the following year the participants reported increases in petty crime until police arrival in the *veredas* in 2010.

In 2010, Betulia experienced a boom in coffee production, which was followed by a drastic drop in international coffee prices. At that time the FNC was setting up a support system to work with the farmers to deal with the emergency caused by low prices. When the experiments were carried out in late 2011, based upon participants' reports and also official data, the level of violence had reached relatively low levels: the number of homicides was the lowest since the 1990s and the cases of mass displacement the lowest since 1997.

San Jerónimo

We conducted workshops in the *veredas* of Buenos Aires, La Clarita and Alto Colorado. In Alto Colorado, the community identified the sporadic presence of paramilitary groups (including targeted killings and social cleansing for petty crime) during 1998 and until 2005-2006, when demobilization occurred. Nevertheless, according to workshop participants in that *vereda*, the community knew about those isolated cases when the paramilitaries came and went, but they never saw them again. In the other two *veredas*, presence or control by illegal armed groups was never identified at any moment in time.

In 2005, more projects were created, for example community organizations such as La Escuela Campesina (Rural School), the elderly group and also infrastructure projects like the shared irrigation system, the communal house and the road to La Mina.

In general and until 2011, San Jerónimo had achieved relatively low levels of violence. However, in 2010 the community experienced an isolated violent incident caused by the return of a family that had had problems years ago.

Sopetrán

Here the workshops were held in Guayabal-Rojas and Guayabal-Los Pomos. Both *veredas* had a paramilitary presence from the mid 1990s until 2008. There are places within the municipality where these groups still remain.

According to participants, in the 1980s, gangs were created in town. Later, in 1995, police inspectors were removed and then the rumors of a paramilitary presence in Sopetrán started in 1998. According to some, paramilitaries arrived in the area brought by commercial traders to provide security. During this time, the JAC were weak and were not recognized as an authority. There were even rumors that some of the *vereda*'s leaders asked

these groups for help because people were not participating in their meetings. With the arrival of the armed actors, a social purge took place. The paramilitaries gathered the community to warn them and tell them that they had certain rules, especially against theft and rape. The information obtained in the workshops suggests that paramilitary groups sought to create a social contract with the community by providing public goods such as roads and security against theft, and also by building a close relationship with the presidents of the Community Action Boards. In 2007, for example, paramilitary groups met with six or seven presidents of the JAC and they give away a cow for each *vereda*.

Even today, this armed group is recognized as an authority in town, to the point that they have an "office" in downtown Sopetrán where they solve the problems of the community. They reportedly act as rulers that provide security to the inhabitants.

Appendix B Distribution of contributions by municipality (all 15 rounds together)

Graphs by municipio
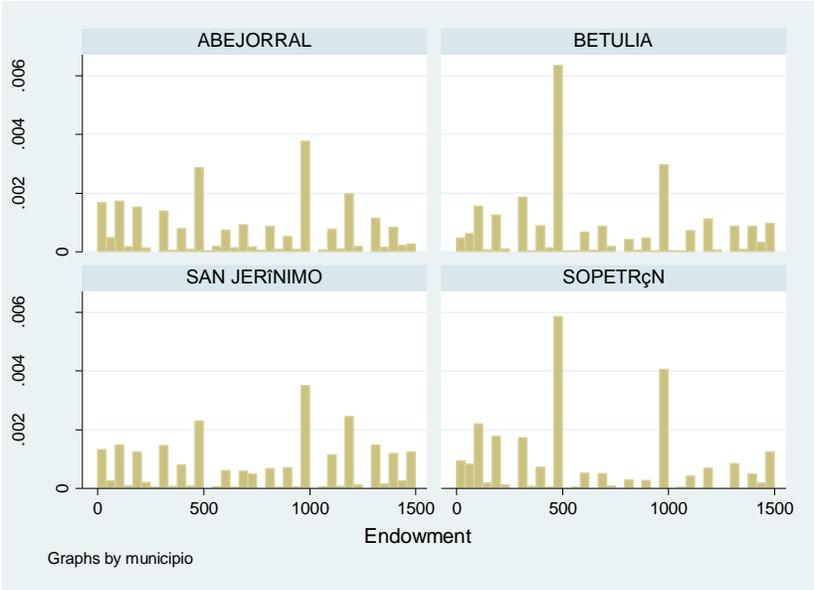
Appendix C Factor analysis for insecurity dimensions

Scree plot of eigenvalues after factor