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Can we fight drugs using communication campaigns? A framed field experiment

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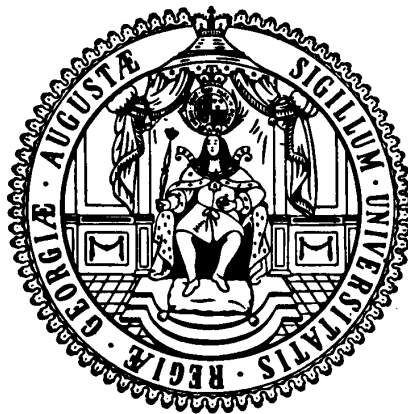
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**Can we fight drugs using communication campaigns?
A framed field experiment**

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February 2016

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Can we fight drugs using communication campaigns? A framed field experiment

Marcela Ibanez and Juanita Vasquez

February 27, 2016

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Abstract

This paper uses a framed field experiment to test the effect of persuasive communication as a strategy in the fight against drugs in Colombia. Our design varies the salience and the degree of informativeness of the messages that participants receive, while highlighting particular negative effects of growing coca in the community. We find that messages that make the relation of coca cultivation with violence salient are the most effective at reducing coca investments. Our results suggest that the main mechanism at play is attitudinal change rather than a change in beliefs. Interestingly, we find that exposure to persuasive messages translates into lower intentions to cultivate coca in the future. We conclude that interventions that aim at increasing “awareness” of the negative effects that coca has in the community are a promising policy instrument in the fight against drugs.

JEL codes: A13, G11, D03, D83, K42, Z13

Keywords: Field experiment, attitudinal change, communication campaigns, illegal behavior.

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1 Introduction

Extensive empirical evidence supports monetary incentives as an instrument to deter crime (Andreoni et al., 1998; Cameron, 1988). However, behavioral economic models of crime have recognized that economic behavior also depends on ethical and normative considerations (Elster, 1989; Axelrod, 1986; Akerlof and Yellen, 1986, Glaeser et al., 1996; Manski, 2000; Garoupa, 2003; Calvó-Armengol and Zenou, 2004). In this paper we investigate the efficiency of persuasive messages that “trigger” normative factors as a strategy to reduce crime.

The context of our analysis is the war on drugs in Colombia, the largest supplier of cocaine to the US and European markets (UNODC, 2010). Colombia’s economic and social structures have been affected by drug production. Empirical evidence shows that the cultivation of coca is associated with violence, presence of illicit armed groups, deforestation and health problems (Angrist and Kugler, 2008; Mejia and Restrepo, 2013; Rincón-Ruiz and Kallis, 2013, UNODC, 2014).

In response to the drug problem, Colombia has engaged in an aggressive campaign to eradicate illegal crops. About 1.1% of the annual GDP was invested annually in the military component of the fight against drugs between 2000 and 2008 (Mejia et al., 2013). Yet, the results of this policy are rather disappointing. For every 100 hectares sprayed, coca cultivation is reduced in only 13 hectares (Ibanez, 2013; Rozo, 2013; Mejía et al., 2013). In this context, it seems necessary to identify alternative policy instruments to decrease the supply of illicit drugs.

Authorities proposed that in order to eradicate coca it was necessary to create a culture of lawfulness that succeeds in “eradicating coca from people’s minds and hearts.” In 2008, the DNE (Colombia’s agency against illegal drugs), the Ministry of Justice and the United Nations Office on Drugs and Crime (UNODC) implemented a mass communication campaign by radio and television, seeking to persuade producers not to cultivate coca.¹ Using a simple message, a girl said “don’t grow coca, the plant that kills.”² The message further explains that coca cultivation is illicit and generates losses at the personal, family and community level. Although the campaign was criticized on the grounds of disregarding diversity of cultural values of indigenous populations that use coca for religious and traditional purposes, this was the first time a large-scale intervention was carried out in the country, with the objective of increasing awareness of the problems that drug production brings to the community.

¹Previous campaigns have addressed consumption problems or trafficking without making reference to problems of production.

²The original messages in spanish was “No cultives coca, la mata que mata.”

Highlighting the negative consequences of illicit drug production generates seems to be a sensitive approach to persuade illicit crop producers to voluntarily abandon coca cultivation. Coca farmers seem to recognize that the consumption of drugs has negative health consequences. Therefore, they perceive the problem of drugs as a problem that occurs far away in consumer countries. Nonetheless, with this intervention, producers could understand that the problem of drugs is also affecting their own communities and that their own children are suffering the consequences of drug production.

As communication campaigns are part of the strategy that the government is setting up to recover territories that have been hardly hit by conflict and illegality, a relevant question is how effective they are in changing people's attitudes and which type of messages are more effective in persuading producers to stop working with illegal crops. Can persuasive messages promote a decrease of coca cultivation? If so, which type of messages would be more effective in persuading producers? Who would be persuaded by these messages? Which would be the mechanisms to explain such behavioral change? Understanding the effects that communication campaigns can have on legality opens up a whole new avenue of interventions that are able to reach more people at lower costs, and complement the efforts of other government interventions. Additionally, if communications do in fact change attitudes towards illegality, the sustainability of other strategies in the fight against drugs is likely to increase.

To test the effect of persuasive communication messages on illegal crop cultivation we conducted a framed field experiment with farmers living in Putumayo, a region with one of the longest coca cultivation traditions in the world. The use of an experiment to measure the effect of communication campaigns has many advantages over observational data. The comparison of participants' decisions in a controlled environment allows us to identify the channels that lead to behavioral changes. Moreover, using survey data we are able to investigate the short term effects of messages on attitudes. The lab in the field also offers the possibility to observe illegal behavior, something that is harder to achieve with observational data. Since the experiment is conducted with participants who face similar investment decisions in their daily life, we can capture reactions to communication messages in the population that would be targeted by this policy. Testing this intervention in the lab provides a first impression on the likely effectiveness of communication campaigns in changing behavior.

Our experimental design builds on Ibanez and Martinsson (2013) coca investment game. Participants have to decide how to allocate an endowment between a secure but low-return legal activity – cattle raising – and a the more profitable but legal product – coca cultivation. To mimick the problem of drugs, coca investments generate a negative externality. Using a between subject design, we vary the framing used to highlight the

various negative consequences of coca cultivation. The different degrees of informativeness and salience of the frames allow us to explore the potential channels driving investment decisions. Moreover, using a post-experimental survey we test whether making the negative consequences of coca salient influences the opinions and attitudes of farmers toward coca cultivation and the intention to cultivate coca in the future.

We find that persuasive messages that stress the negative consequences of coca on the community are effective in reducing farmers' willingness to invest in coca, generate changes in people's attitudes towards coca and alter the intentions to cultivate coca in the future. Particularly, we find that messages that communicate the violence that coca generates are the most effective.

This paper contributes to different areas of research. The first area we contribute to is the economic analysis of persuasion. There is extensive empirical research on the effectiveness of persuasive communication to increase desirable behaviors such as inter-group prejudice and conflict, racial prejudice, use of contraceptives, HIV prevention, saving for the old age, loan take-up, obesity and recycling, among others (Paluck, 2009; Paluck and Green, 2009; DellaVigna et al., 2012; Kellstedt, 2000; Mesina, 2005; Palmgreen et al., 2008; Karlan et al., 2010; Choi et al., 2012; Bertrand, 2009; Carlson, 2001; Burn and Oskamp, 1986; Chong et al., 2013). Also recent papers have considered the use of persuasive communication to increase political participation and shape political attitudes and attitudes towards candidates (Gerber et al., 2008; Gerber et al., 2009; Oberholzer-Gee and Waldfogel, 2009; DellaVigna and Kaplan, 2007; DellaVigna and Gentzkow, 2009; Gentzkow and Shapiro, 2010; Gamson, 1992; Nelson et al., 1997; Wood, 2000). While most of these studies find that communication leads to behavioral change, they do not investigate the effect of communication campaigns on law compliance as we do in this paper.

The second strand to which we contribute is the economic models of law compliance. There is a relatively long tradition in economics trying to understand why individuals comply with the law (Cameron, 1988; Freeman, 1999; Witte and Witt, 2000; Levitt, 2004). Behavioral economic models of crime recognize the role of moral factors in law compliance (Etzioni, 1986; Sen, 1986; Vanberg, 1988). We contribute to this research by investigating whether it is possible to persuade individuals to comply with the law by using non-monetary interventions that aim at triggering normative factors.

Moral suasion – defined as a persuasive tactic used by an authority to influence agents to adhere to a policy – has been used to increase tax compliance (Schwartz and Orleans, 1967; McGraw and Scholz, 1991; Blumenthal et al., 2001; Hasseldine et al., 2007; Fellner et al., 2013), decreasing late book returns in the public library (Apesteguia et al., 2013) and increasing honesty in payments for newspapers sold in unguarded newspaper boxes

(Pruckner and Sausgruber, 2013). Our intervention differs from previous work in many dimensions. Unlike previous interventions we do not use explicit normative appeals. Instead of telling participants what the “correct” behavior is, we provide participants with an example on the social consequences of investing in coca. Second, our intervention does not consider social interaction effects and we do not refer to the behavior of others. Instead, we are interested in testing whether the intervention affects belief formation by changing what people expect that others will do. Similarly as DalBo and DalBo (2013), we are interested in understanding the mechanisms that lead to behavioral change. Hence we use a controlled lab experiment to investigate how information frames affect beliefs and attitudes.

The last strand of literature we contribute to is the empirical analysis of the effectiveness of anti-drug policies (Moreno-Sanchez et al., 2003; Ibanez and Carlsson, 2010; Reyes, 2011; Ibanez and Martinsson, 2013; Ibanez, 2013; Rozo, 2013; Mejia et al., 2013). We build on this literature testing whether alternative policies can be used in the fight against drugs. While the effect of communication campaigns on drug use has been investigated before (Derzon and Lipsey, 2002; Palmgreen, 2006), this is the first paper that considers the effect of communication campaigns on drug production.

The paper is organized in seven sections. Section 2 presents the background of the war on drugs in Colombia and provides a motivation for the intervention used. Section 3 presents the experimental design and discusses the main hypothesis of the study. Section 4 presents the experimental procedures. Section 5 presents the results. Section 6 discusses the external validity of the experiment and the last section concludes.

2 Background

The war on drugs

The fight against drugs has been critical for Colombia in the last two decades when the country became a major cocaine producer and started suffering the consequences of this problem. Empirical evidence suggests that in areas with coca crops, the number of violent deaths among the young male population is higher than in comparable areas (Angrist and Kugler, 2008). Mejia and Restrepo (2013) find that a 10% increase in the price of coca is associated with a 1.25% increase in homicides, a 3% increase in displacement, a 2% increase in attacks by insurgent groups and a 1% increase in incidents involving land mine explosions. Besides, the production and processing of coca is associated with negative effects on the environment (UNODC, 2006; Davalos et al., 2011). It is estimated that between 2001 and 2013, 275,588 hectares of forest were cut down

in Colombia exclusively to grow coca (UNODC, 2014). Rincón-Ruiz and Kallis (2013) estimate that about 110 thousand hectares of primary forests were cleared to establish coca fields between 2001 and 2008. Additionally, large amounts of agrochemicals are used in the cultivation and processing of coca base (Bernal, 2007). The transformation of the leaf to coca paste also generates pollution. The gasoline, sulfuric acid, ammoniac and other chemicals used to produce one kilo of coca paste are freely disposed in the environment, contaminating water sources and potentially generating health problems to the local population.

Two main strategies are used to control drug supply: eradication and alternative development. Eradication focuses on the detection and destruction of the crops. The second strategy aims at raising the opportunity cost of coca growing by establishing alternative legal opportunities, although has been used to a lesser degree compared with the first. Between 2008 and 2010, the Colombian government spent about US\$1,1 billion per year on military component of the war against drug production and trafficking, with additional US subsidies of US\$406 million per year (Mejia et al., 2013).¹

The efficiency of anti-drug policies is however highly contested. Rydell, Caulkings and Everingham (1996) conclude that it is more cost-effective to implement demand control (treatment) than enforcement. Grossman and Mejia (2008) and Mejia and Restrepo (2013) use micro simulation models to estimate the cost-effectiveness of different anti-drug strategies in Colombia, and conclude that it is more effective to control trafficking than production. Using micro data, Ibanez (2013) shows that coca cultivation is very inelastic to eradication efforts and that a one percent increase in eradication decreases coca cultivation in only 0.22 percentage points. Mejia et al. (2013) consider exogenous variation in restrictions to aerial spraying along the Ecuadorian border imposed in 2006 to identify the local effects of this policy. They find that spraying an additional hectare reduces coca cultivation between 0.02 and 0.065 hectares in a given year. Rozo (2013) gets similar results exploring restrictions to spraying inside national parks. Aerial spraying has also been criticized on the grounds of the side effects that it generates on human health. Camacho and Mejia (2013) show that spraying is associated with increased dermatological problems and miscarriages.

The low effectiveness of current anti-drug policies and the side effects that it has generated call for an alternative intervention. Inspired by the campaign “Coca, la mata que mata”, we investigate the effectiveness of persuasive communication to change attitudes towards coca and coca cultivation.

¹This represented 1.1% of the annual GDP. In the subsequent period the economy grew so the expenditure of the war on drugs had a lower share of GDP.

Attitudes towards coca

To persuade producers to abandon coca, the first step is to understand why they cultivate it and what they think about this activity. With this objective in mind, in cooperation with UNODC Colombia, we organized two focus group sessions with around 25 cocoa producers that lived in coca areas and who were beneficiaries of alternative development programs.

We asked participants: “In the region many people cultivate coca. Why do you think they do it?” Not surprisingly, the most voted reason was coca’s higher profitability with respect to other crops. However, in the subsequent discussion many participants disagreed with this statement and argued that in the past coca was a better option but that “now” producers were just receiving enough to cover production costs. The high risk of eradication, lower prices of coca base and high production costs make this activity no longer attractive. Easier transportation of coca compared with other products² and market security emerged as key factors explaining farmers preference to grow coca. Workshop participants pointed out that the “coca boom” had not brought progress to the region. Throughout the workshop the relation of illicit armed groups, coca cultivation and violence was often mentioned. One respondent said: “After the coca boom no money was left. The only legacy was death and poverty.”

When we asked participants for the reasons why many people were not cultivating coca in the region, the most voted reason was that they had other productive options, for example cocoa, oil palm, avocado, and that these options could be as profitable as coca. Moral aspects were also cited as a reason for not cultivating coca. One participants said: “My parents did not cultivate due to scrupulousness.” Other said: “People realize that it harms others in the USA and Europe.” Another participant added: “Experience with coca in the family allowed us to think about the problems with coca. The youth are being damaged, they went to work with coca (raspar) and left their studies. They got used to the easy money without much effort. The good habits were lost.” Finally, a preference for living in legality and avoiding problems with the authorities and other community members, was commonly cited. One participant said: “People like to live in legality.” Another one added: “For many, living in peace is important and therefore they do not cultivate,” “without coca people can live in peace. Leaving the illicit crops decreased violence.”

Finally, we asked what was needed for people to stop cultivating coca. One respondent said “An infusion of scrupulousness.” Participants considered that people need to un-

²Coca leaves are usually collected at the producer’s farm. In case farmers need to carry the harvested leaves out of their farm, its weight is much lower than other products such as cacao, plantain, etc., making transportation easier and cheaper.

derstand the damage that they generate to their communities and become conscious of the damage that they cause the younger generations. Interestingly, participants considered that campaigns should focus on the impact on the consumer more than the impact on their own communities. Another group considered that people needed productive options to see the advantages of living in legality. A respondent said “Some people have the consciousness to stop cultivating, but do not have the resources to do it.” These answers suggest that persuasion campaigns, accompanied by alternative development projects could have the potential to decrease coca cultivation.

Based on the focus group sessions, we selected three sets of arguments on the consequences of coca cultivation to build our treatments. These argument can be classified according to how often they were mentioned in the workshop and hence how informative they are. Table 1 presents some examples of the type of arguments used by participants in the workshop when pointing at the negative consequences of coca and the reasons to stop cultivating it. We find that the argument that is most commonly used is related with violence. Participants associate coca cultivation with the arrival of illegal armed groups, increased weapon possession, disputes over coca proceeds and with “death.” People noticed that there was an increase in domestic violence and a lack of trust in others. Given that people are aware of the link between coca and violence, messages that stress this relation would carry low information value.

The second most common argument was related to what we denominate “change in values.” People mention that the good traditions were lost, that children abandoned school to work with coca, that people wanted easy money. Messages that relate coca with the impact on new generations and lost of traditional values can then consider to carry a middle degree of informativeness. The third set of arguments are related with the environment. These arguments are less frequently mentioned, with few participants recognizing the impacts on deforestation of natural protected areas, forests and pollution. Therefore, an intervention that focuses on the environmental impact of coca cultivation can be considered to carry high informative value. Another set of arguments was related to consumption problems. In this case, the consumers were thought of mainly outside their communities, and participants recognized it as a global problem. Finally, indirect effects like higher risks of legal crop damage due to aerial spraying were also mentioned.

Table 1: Arguments used to explain why coca is bad for the community

Argument	With coca...	Total
Violence	Social leaders who disagreed were killed	16
	Armed groups support coca cultivation	
	Violence, displacement and extortion increased	
	Life without coca is safer, more time with the family	
Values	Those who did not cultivate did not want problems	9
	Good traditions were lost	
	Coca brings more bars and prostitution	
	The children dropped out of school (No coca in order to be) a good example for the youth	
Environment	Natural parks are invaded with coca	5
	Eradication has negative effects on the environment	
Consumption	Drug consumption among adolescents is higher	6
	People do not understand consequences on consumption	

Note: The arguments are taken from discussions with people living in coca growing areas who are beneficiaries of an alternative development program. We classify the arguments based on the statements used. We select only a few examples based on the statements used. Total refers to the simple count of the number of times that arguments were used. We cannot measure the intensity of emotions that the arguments evoke.

3 Experimental design

Our experimental design builds on Ibanez and Martinsson (2013). Participants were randomly and anonymously matched in groups of five. Each participant received ten experimental units ($E = 10$) that represent the amount of land, labor and capital available to them for investments in agricultural activities. Their task was to decide how to distribute the endowment between investments in coca and cattle farming. They could invest any amount, but investments had to be done in whole units (0, 1, 2, etc.).

The experiment mimics the three main features of coca cultivation. First, coca is more profitable than cattle. Hence, each unit allocated to coca receives one point in return, whereas each unit allocated to cattle receives $a < 1$. Second, coca cultivation is illegal and with probability p , authorities will inspect investments. If coca investments are positive, participants are fined $f = 1.2$ units for each point unit of endowment invested. Otherwise, no fine applies. The fine punishes only those who invested part of the endowment in coca. Third, coca production generates negative externalities. For each unit invested in coca in the group, all participants in that group lose $b = 0.17$ units, independently on whether they individually invested in coca or not.

The pay-off for subject i when he is not discovered, which happens with probability $(1 - p)$, can be expressed as

$$\pi_i = c_i + a \times (10 - c_i) - b \sum c_i, \quad (1)$$

where c_i is the amount invested in coca and a is the relative profit between coca and cattle. On the other hand, the expected pay-off for subject i when they are discovered, which happens with probability p , can then be expressed as

$$\pi_i = c_i + a \times (10 - c_i) - b \sum c_i - f \times c_i \quad (2)$$

The experimental design uses a between-within subject design that combines i) five different frames to persuade producers and ii) nine different marginal incentives to cultivate coca (three different levels of a and p , respectively). We randomized the persuasion treatments over sessions so each participant was exposed to only one persuasive message. Yet, we allow participants to make decisions under nine scenarios that vary the relative return to the legal activity, a , and the probability of inspection, p , so we can compare how each participant behaves under different scenarios of risk and relative profitability between a legal activity and illegal coca. The order in which a and p was presented did not vary across individuals.

Persuasion Treatments

Persuasion messages are introduced in a subtle way. To illustrate the negative consequences associated with coca cultivation we used four different frames that emphasized different potential consequences of coca cultivation. The frames serve only as cues and are not consequential for the payments in the experiment. In other words, the size of the negative effect of coca investments is kept constant ($b = 0.17$) over treatments. These messages are not deceptive as they are based on actual facts collected from secondary sources and coca growers' opinions.¹ In the **Control treatment** we explained:

“Coca cultivation generates negative effects in the community. Hence, for each point invested in coca every participant in the group will lose b points.”

¹The participants in our experiment are not the same as those in the focus groups.

The persuasion messages were selected according to information that we collected in the two above-mentioned focus groups. We use persuasive messages that vary i) the degree of new information conveyed and ii) the salience of the information. The degree of informativeness is assessed according to how often people use the arguments as a justification for not cultivating coca.² We use four different frames to illustrate the negative consequences that coca has on the community. The first frame considers the effects of coca on violence. The number of attacks by illicit armed groups, the number of accidents by land mines and the homicide rate is higher in coca than in non coca areas (Angrist and Kugler, 2008 and Mejia and Restrepo, 2013). People from coca growing areas seem to be aware about it. Violence was the most commonly cited reason for arguing against coca cultivation in our focus groups. Since association between coca and violence was clear to most participants, the **Violence treatment** can be considered to carry a low informative value. Participants in this treatment were told:

“Coca cultivation generates negative effects on the community as it increases violence. In coca growing areas people buy weapons and often get killed in quarrels. Criminals arrive and illegal armed groups fight to gain control of the territory. Hence, for each point invested in coca every participant in the group will lose b points.”

The second frame used to persuade producers was related with the change in values due to coca cultivation. In coca growing areas school attendance is lower than in non-coca growing areas (Angrist and Kugler, 2008). Children abandon school to work in coca fields. The proceeds of coca are not invested in better living conditions but instead are used to buy sex, alcohol and status goods. Some farmers told us that during the coca boom people stopped consuming rum and beer (the common drinks) and turned to whiskey (which is typically not even found in Colombian rural areas and is consumed by the wealthy), and that the “best” girls from a famous region came and were available. The women mentioned that the men were barely home, because of the presence of new bars and prostitution. Even though some participants mentioned the above reasons, they were not the most commonly mentioned to justify why coca is bad. Therefore we consider that this treatment has a middle informative value. Participants in the **Value treatment** were told:

“Coca cultivation generates a change in values. The money from coca is carelessly spent and people do not save. The young get used to earning money easily and do not study. They become lazy and get into bad habits.”

²This measure could also reflect the importance that this criteria has for the people.

The proceeds from coca are spent in partying, alcohol, drugs and sex. Hence, for each point invested in coca every participant in the group will lose b points.”

The third frame illustrated the negative environmental impacts of coca cultivation. It is estimated that since 2001 at least 275,588 hectares of forest have been lost to coca (UNODC, 2014). This does not take into account the loss before 2001, which is hard to estimate without the satellite pictures available since 2001, and also does not include the hectares eradicated in order for coca farmers to establish survival crops around the coca crops.³ In addition, the production and processing of coca is intense in the use of chemicals that are freely disposed into the environment, polluting the soil and water sources (Bernal, 2006). As people do not associate coca with environmental problems we consider that this treatment carries a high informative value. Participants in the **Environment** treatment were told:

“Coca cultivation generates negative effects on the environment. Planting coca fields generates deforestation. The chemicals used to process coca pollute the soil and the water and affect human health. Hence, for each point invested in coca every participant in the group will lose b points.”

The last frame used is similar to the violence frame, except that it makes the relation between coca and violence more salient. When illustrating the negative effects of coca, we provide actual figures on violence in coca-growing areas versus non-coca-growing areas. This information is made salient by showing the order of magnitudes compared with other regions. For example, experiencing twice the number of violent deaths, being three times more likely to have illegal armed groups, etc. We consider that this frame has a low informative value as violence is commonly associated with coca. However, compared to the violence treatment, this treatment has a high level of salience. Participants in the treatment **Quantified Violence** were told:

“Coca cultivation generates negative effects in the community, as it increases violence. In coca growing areas, homicide rates are twice as high as those in non-coca areas. While in non-coca growing regions 33.35 out of a thousand people are killed, in coca growing areas this rate is 63.13. Coca growing areas are three times more likely to have a massacre. In coca

³An additional very serious issue is that this deforestation does not follow deforestation by urban expansion, but happens in places that environmentally strategic, as in the deep forest. Additionally, farmers use a slash-and-burn technique that depletes the land of its soils, making it much harder for it to recover (UNODC, 2006).

growing areas there are over five combats per year, vis-a-vis less than one in non-coca areas. In coca growing areas there are over five land mine accidents per year, while in non-coca areas the average is less than one. Hence, for each point invested in coca every participant in the group will lose b points.”

Table 2 presents the summary of the persuasion treatments used. We compare the effect of frames with different informative values (low, middle and high information value) and with different degrees of salience (no salience or salience) with the control treatment.

Table 2: Between subject design: Persuasion treatments

		Salience	
		No	Yes
No Information		Control	-
	Low	Violence	Violence Data
Information Value	Middle	Values	-
	High	Environment	-

Note: The frames are randomly allocated across sessions. Each participant is exposed to only one frame.

3.1 Hypothesis

The main hypothesis that we test in our experiment is that persuasion treatments can decrease coca investments compared to the control group that receives no messages.

Hypothesis 1.

Coca investments will be lower in treatments that emphasize a particular consequence of coca cultivation on the community compared to the control treatment.

Second, we expect that the effectiveness of the messages on decreasing coca investments, depends on the informative value and salience of the message. However, the direction of the effect would depend on the channel at play. If persuasion messages affect beliefs, then messages that have high information value would result in a larger decrease of coca

investments compared to messages with low informative value. Changes in beliefs would be reflected on changes in the expected coca investments of other group members. We expect that messages that are more informative would result in a larger change in the beliefs regarding how much money would be invested in coca by other group members.

On the other hand, if persuasion messages operate via changes in attitudes, we expect that the behavioral change would not necessarily be correlated with the value of the information. Messages with low information value might result in a high change in coca investments as they could lead to less favorable attitudes towards coca. We test this hypothesis by comparing responses to a post-experimental survey on attitudes towards coca. Changes in attitudes would lead to a change in behavior, even when beliefs about the expected investment of others is fixed. This leads us to the next hypotheses:

Hypothesis 2.

Changes in behavior will depend on the information value of the message if the mechanism at play is belief formation. Persuasion treatments with a higher informative value would also result in larger changes in beliefs regarding what others will invest in coca. More informative messages will result in a larger behavioral response than low information message.

The alternative hypothesis is:

Hypothesis 2a

Changes in behavior will not depend on the informative value of the message if the mechanism at play is attitudinal change. Persuasion treatments with a lower informative value would result in larger changes in the investment in coca crops.

Relative payoff of the alternative and risk of eradication

The second feature of the experimental design is that each participant is exposed to nine different scenarios that combine three relative profits of the alternative activity (cattle farming) and three levels of risk. Based on observations from real-life and likely future levels, we included the following three levels of relative profits between cattle farming and coca growing: $a = [0.2; 0.44; 0.68]$ and three levels of plausible successful eradication $p = [0; 0.1; 0.3]$.

The parameters included in the experiment reflect historical values. For example, Ibanez (2007) estimates that in 2007 the relative mean return of the second best alternative to coca was about 0.28 while the risk of eradication was about 0.1. The selected parameters ensure a social dilemma situation as the social cost related to the negative externalities ($0.17 * 5 = 0.85$) is larger than the private benefit from investing in coca ($1 - a$) in all nine scenarios. It is expected that a risk-neutral, self-interested utility maximizer would make a non-zero investment in coca if $1 - a - b - 1.2p > 0$.

Table 3 presents the marginal incentive to cultivate coca in each of the nine scenarios presented to participants, which are denoted by letters according to the order in which the decisions were presented in the experiment. All but one of the scenarios imply a positive marginal incentive to cultivate in coca and imply that risk-neutral participants should invest all their endowment in coca. In the ninth scenario the optimal response would be to not invest in coca.

Table 3: Within subject design: Marginal incentive to cultivate coca

a	p		
	0	0.1	0.3
0.2	A=0.63	D=0.51	G=0.27
0.44	B=0.39	E=0.27	H=0.03
0.68	C=0.15	F=0.03	I=-0.21

Note: Estimated as $\pi' = 1 - a - b - pf$. Each participant was exposed to all nine scenarios.

We expect that participants would respond to economic incentives by reducing coca investments as the marginal return of the alternative, a , and the probability, p , increase. Yet, the empirical question that we want to test is the magnitude of the elasticity of investments to these two policies. Another hypothesis that we want to explore is whether the effectiveness of the persuasion messages increases as the marginal net return of the alternative activity is larger and as the risk of eradication is higher.

Hypothesis 4.

The effectiveness of persuasion treatments increases as the marginal incentives to cultivate coca are lower.

4 Experimental procedures

The experiment was conducted with farmers living in the region of Putumayo, Colombia, between March and May 2012. Putumayo is one of the regions in Colombia with longest tradition in the cultivation of coca, where it started to be cultivated as early as the 1980's. By 2000 it was estimated that 66 thousand hectares were cultivated with coca only in this region, representing forty percent of all area with coca in the country. As a consequence, Putumayo has been targeted by different anti-drug programs such as aerial spraying, forced manual eradication and alternative development.

Four municipalities were included in the study: Puerto Asis, Valle del Guamuez, San Miguel and Puerto Leguizamo. UNODC (2012) estimated that about six thousand hectares were cultivated in coca in these four municipalities in 2011. This represents almost ten percent of the total area cultivated with coca in the country.

Participants in the experiment were recruited using a two step procedure. In the first step, within each municipality we selected communities (veredas) that had a medium or high density of coca crops and that were safe enough to visit. Local contacts who knew the areas helped us with this selection. In the second step, community leaders (veredal presidents) helped us with recruiting the participants. In order to avoid self-selection, they were instructed to use a random selection mechanism. After writing a numbered list of all head of households living in the neighborhood, the leader was asked to draw 30 to 40 numbers.¹ The households identified with those numbers were invited to a one-day workshop with university researchers. No further information was given on the purpose of the workshop, and no more than one person per household was invited to participate. Community leaders controlled that only the randomly selected participants came to the activity.

In the morning session we conducted the experiment and after a lunch break participants were interviewed individually. We conducted 21 sessions with a total of 652 participants. The experimental sessions consisted of four stages. First, the experiment instructions were read out loud to the subjects. This was followed by several examples and individual exercises. To check for subjects' understanding of the experiment we used control questions that were checked by an enumerator before continuing the activity.

In the second stage participants simultaneously decided how much they wanted to invest in coca in each of the nine scenarios. The scenarios were presented in the same order

¹We had to use this procedure as there is no central registration of the population. The experimenter team verified that the selection process was conducted as instructed but did not have access to the list of inhabitants. This procedure was used to maintain anonymity of the participants, as explained below.

to all participants and involved increasing relative returns of the alternative activity (cattle) and of risk of inspection. Participant could however decide if they wanted to complete the decisions in a different order. We also asked participants to report their expectations on how much would other group members invest in coca in each of the scenarios.

In the third stage, a lottery randomly selected one of the nine scenarios for payment. If the selected scenario involved a positive probability of inspection, then a second lottery determined whether they were caught or not.² The selected scenarios and outcome of the lottery applied to all participants in the session. The outcomes from these two lotteries are common to everyone. This mimics real life since both relative profits and successful eradication are normally the same for people living close to each other.

Finally, in the last stage, all subjects were paid privately in cash. Earnings amounted to 9 USD on average, a little more than a full working day's wage. While the payouts were calculated, we had a group discussion and heard comments from the participants.

In order to encourage honest answers we did not ask names, addresses or any other information that would have allowed us to identify the participants. To match survey and experimental information we used participation numbers that were given to participants upon their arrival to the workshop. The participation number was composed of the date when the experimental session was conducted, followed by consecutive numbers to identify each participant. We instructed participants that payments would be done according to that identification number so they had to keep it with them. The survey consisted of 14 sections that asked rather standard questions on socioeconomic characteristics, land use, attitudes towards the state, experience cultivating coca, attitudes towards coca, and intentions to cultivate coca in the future.

5 Results

5.1 Descriptive statistics and randomization checks

In the post-experimental survey we included a series of questions on the socioeconomic characteristics of the participants. Definitions of the variables used in the analysis can be found in Table A.1 in the Appendix.

²We represented probabilities using colored balls. We filled a non-transparent bag with nine or seven green balls, and one or three red balls depending on the scenario. If a red ball was selected, participants with positive investments in coca were fined. Otherwise they escaped without being discovered and no fine applied.

Table 4: Randomization checks at a community level

	Control			Violence			Values			Environment			Quantified Violence		
	Mean	Std.Err		Mean	Std.Err		Mean	Std.Err		Mean	Std.Err		Mean	Std.Err	
Number of inhabitants	532.81	165.38		-215.75	173.20		-87.51	179.90		-324.99	167.45		-264.64	170.67	
Proportion of Sisben Population	0.24	0.09		0.18	0.16		0.01	0.11		0.46	0.46	*	0.35	0.21	
Number of teachers per-capita (a)	0.02	0.01		0.00	0.01		-0.01	0.01		0.00	0.01		-0.01	0.01	*
Has a library in the school	0.18	0.17		0.11	0.27		-0.18	0.17		-0.18	0.17		0.00	0.25	
Has computers in the school	0.74	0.21		-0.39	0.32		-0.07	0.31		-0.35	0.37		-0.29	0.32	
Computers in the school per-capita	0.01	0.00		-0.01	0.00	**	0.00	0.01		-0.01	0.01	*	-0.01	**	0.00
Distance to the urban center in Km	19.82	4.60		7.87	13.68		52.59	50.05		0.16	10.93		42.67	**	7.71
Time to the urban center in minutes	33.64	7.25		14.16	16.54		47.91	48.14		-2.66	14.68		39.61	**	18.75
Has electricity	0.59	0.21		-0.24	0.32		0.16	0.29		-0.59	**	0.21	-0.59	**	0.21
Has public light	0.34	0.23		0.01	0.33		-0.10	0.31		-0.34	0.23		-0.34	0.23	
Coca density (b)	3.07	0.74		1.32	0.81		0.70	1.00		0.62	1.33		1.28	0.86	
Beneficiary of Alternative Development	0.43	0.23		0.38	0.27		0.07	0.33		0.17	0.38		0.05	0.33	
Number of observations	180			184			170			122			155		
Number of veredas	9			5			6			3			5		

Note: This table reports the results of the randomization check on community characteristics for the 28 veredas in our analysis. We test for differences between the control and treatment groups by OLS regressions clustered at a vereda level. a. Estimated as the ratio over the total number of inhabitants.

b. Coca density is measured in a zero to five scale where zero indicates no coca and 5 indicates high density. * $p < 0.1$ ** $p < .05$ *** $p < .01$.

To test whether the randomization process worked and whether the socioeconomic characteristics of participants are comparable across treatments, we ran the following regression model:

$$Y_{ik} = \beta_0 + \beta_1 \textit{Violence}_i + \beta_2 \textit{Values}_i + \beta_3 \textit{Environment}_i + \beta_4 \textit{QuantifiedViolence}_i + e_i \quad (3)$$

where Y_{ik} refers to a characteristic k of individual i , and *Violence*, *Values*, *Environment* and *QuantifiedViolence* are dummy variables that take the value equal to one for participants assigned to the corresponding persuasion treatment. β_0 indicates the average value of characteristic k for the control treatment, whereas β_1 to β_4 indicate the difference in each characteristic of persuasion treatment j compared with the control. Table 5 presents the estimated results. In the control treatment participants were on average 43 years old, have a low education achievements with only 1.4 years of education completed. One tenth of the participants were women. About one half of the population was classified as poor using the standard of living index. While most of the population is catholic, one third of the respondents report being evangelic. About half of the participants have a land title and owned on average 14 hectares of land. One fourth of the respondents self-reported having cultivated coca the year before the survey was administered.

Table 5: Coca investments by treatment

Panel A: Socioeconomic Characteristics	Age HH head	Female head HH	Education	Evangelical	Poverty
Violence	1.628 (2.100)	-0.030 (0.042)	0.119 (0.144)	0.112 (0.210)	1.830 (2.417)
Environment	-1.632 (1.545)	0.037 (0.038)	0.311** (0.138)	-0.117 (0.089)	1.862 (2.530)
Values	0.361 (2.624)	0.134* (0.076)	0.249 (0.267)	0.073 (0.147)	6.266** (2.471)
Quantified Violence	1.347 (2.304)	-0.021 (0.030)	0.062 (0.179)	-0.109 (0.133)	0.167 (2.848)
Control	43.959*** (1.442)	0.123*** (0.026)	1.428*** (0.126)	0.329*** (0.078)	52.064*** (1.923)
<i>N</i>	652	652	649	655	623
Panel B: Land Use					
	Land Title 1991	Land Title 2011	Land Size 1991 (HA)	Land Size 2011 (HA)	Coca 2011
Violence	-0.114** (0.041)	-0.122 (0.085)	3.397 (4.885)	0.316 (4.050)	0.008 (0.108)
Environment	-0.061 (0.043)	-0.122** (0.051)	5.133 (9.057)	-3.101 (2.566)	0.076 (0.130)
Values	0.066 (0.080)	0.054 (0.075)	-5.928* (2.868)	- (1.650)	-0.163* (0.084)
Quantified Violence	-0.130** (0.059)	- (0.045)	4.824 (9.419)	-1.762 (4.454)	0.146 (0.153)
Control	0.364*** (0.034)	0.493*** (0.042)	14.509*** (2.248)	13.553*** (1.341)	0.248*** (0.067)
<i>N</i>	624	651	653	635	646
Panel C: Social Capital					
	Participation	Trust in the State	Trust Neigh- bors	Risk Eradica- tion	FGB
Violence	-0.021 (0.063)	0.079 (0.185)	0.277 (0.201)	-1.218 (0.710)	-0.105 (0.087)
Environment	0.031 (0.059)	0.216 (0.170)	0.192 (0.194)	-0.429 (0.649)	-0.044 (0.106)
Values	-0.024 (0.065)	0.301 (0.197)	0.351* (0.171)	0.527 (0.672)	0.110 (0.180)
Quantified Violence	-0.010 (0.075)	0.124 (0.232)	0.246 (0.268)	-0.302 (0.361)	-0.111 (0.087)
Control	0.869*** (0.052)	2.616*** (0.144)	2.834*** (0.169)	6.535*** (0.286)	0.111 (0.087)
<i>N</i>	649	653	653	652	645
Panel D: Exposure to Violence					
	Displacemen	Homicides	Landmines	Extorsion	Accidents with Weapons
Violence	0.075 (0.068)	0.065 (0.043)	0.010 (0.014)	0.023 (0.016)	0.022 (0.026)
Environment	0.059 (0.134)	0.076 (0.048)	-0.021** (0.007)	0.012 (0.029)	0.012 (0.019)
Values	0.073 (0.100)	0.028 (0.048)	-0.007 (0.008)	0.024 (0.031)	0.007 (0.024)
Quantified Violence	0.052 (0.070)	0.044 (0.049)	-0.007 (0.015)	-0.007 (0.016)	-0.024 (0.018)
Control	0.288*** (0.059)	0.116*** (0.034)	0.027*** (0.005)	0.027*** (0.009)	0.034** (0.015)
<i>N</i>	653	654	653	653	653

Note: This table reports the results of the post-experimental survey. We test for differences estimating an independent regressions for each variable. Standard Errors are presented in parentheses and are clustered at the neighborhood level. * $p < 0.1$ ** $p < .05$ *** $p < .01$ indicate significant differences with respect to the control

Participants in the survey have also been severely affected by violence and a significant fraction has had family members displaced by violence, murdered, killed in massacres, had accidents with land mines and had accidents with fire arms. Trust in institutions was relatively low with an average of 2.6 in a one to five scale. The perceived risk of eradication, measured in a one to ten scale was 6.5. About one tenth of the participants were beneficiaries of the Forest Warden Families alternative development program.¹

We find that there are significant differences between participants in the control treatment and participant in the persuasion treatments. In the treatment *Values* a larger proportion of the respondents is female, classified as poor, has higher levels of trust, less land and is less likely to cultivate coca than in the *Control* treatment. Similarly, in the treatment *Environment*, participants are more educated, less likely to have land titles and less likely to be affected by land mines than those in the control treatment. We control for these variables in the analysis.

To test for potential channels affecting changes in behavior, in the post experimental survey we asked participants to rate in a 1 to 5 scale the degree of acceptance to a series of statement regarding coca cultivation. Table ?? below presents the descriptive statistics of the answer to these questions. We find that participants have a quite negative attitude towards coca: 95 percent of the respondents consider that cultivating coca is not correct, 69 percent consider that it is never justifiable to cultivate coca and 65 percent disagree that coca cultivation should be legal. Participants recognize the problems associated with coca cultivation: the majority disagree with the statement that coca brings progress to the region, consider that coca generates violence within the families and generates violence in the community. Besides, most of the participants recognize that coca promotes disrespect to the law and drug consumption habits. The majority of participants consider that coca should not be cultivated (76 percent).

5.2 Impact of persuasion messages on investments

Participants in the experiment made decisions under nine different scenarios. To account for possible correlation of the decisions over the different scenarios we estimate a panel random effects model. Due to the random assignment of the participants into treatment and control groups, the identification of the causal effect of the persuasion treatment on investment in coca is straightforward. The impact of the persuasion treatments on coca investments is estimated using the following model with clustered standard errors at the community level:

¹This program gives a monetary subsidy to communities who accept to keep their land free of coca and received workshops on social capital, culture of legality and technical issues. The agreement is verified by UNODC and in case of default all farmers lose the subsidy.

Table 6: Attitudes towards coca: Descriptive statistics

Panel A: All Areas										
	Correct	Need	Legal	Family	Violence	Legitimacy	Consumption	Trust	ShouldNot	
Violence	-0.040 (0.032)	0.223** (0.084)	-0.185 (0.269)	0.076 (0.131)	-0.198 (0.229)	0.122 (0.126)	0.099 (0.069)	0.100 (0.187)	0.036 (0.238)	
Environment	-0.020 (0.031)	0.300*** (0.084)	-0.320 (0.233)	0.381** (0.145)	-0.107 (0.216)	0.088 (0.134)	0.076 (0.073)	0.081 (0.197)	-0.167 (0.209)	
Values	-0.005 (0.032)	0.356*** (0.071)	-0.760*** (0.161)	0.075 (0.076)	-0.018 (0.144)	0.205 (0.157)	0.132* (0.064)	0.252 (0.182)	0.308 (0.205)	
Quantified Violence	-0.032 (0.032)	0.407*** (0.080)	-0.141 (0.303)	0.149 (0.200)	-0.165 (0.202)	0.283** (0.133)	-0.002 (0.108)	-0.122 (0.200)	0.152 (0.282)	
Control	0.206* (0.102)	4.344*** (0.255)	2.815*** (0.557)	3.409*** (0.534)	4.391*** (0.492)	4.203*** (0.353)	4.355*** (0.275)	4.187*** (0.463)	3.735*** (0.417)	
<i>N</i>	524	525	525	522	525	525	525	521	525	525
Panel B: Low Density										
	Correct	Need	Legal	Family	Violence	Legitimacy	Consumption	Trust	ShouldNot	
Violence	0.015 (0.068)	0.419 (0.509)	-0.945 (0.867)	0.660 (0.584)	0.452 (0.451)	0.200 (0.482)	-0.019 (0.325)	0.266 (0.541)	0.818 (0.602)	
Environment	0.091 (0.067)	0.426 (0.502)	-0.813 (0.854)	0.560 (0.575)	-0.311 (0.444)	-0.068 (0.475)	-0.144 (0.320)	0.182 (0.532)	0.688 (0.593)	
Values	0.013 (0.053)	0.656* (0.391)	-1.497** (0.666)	0.466 (0.447)	0.077 (0.346)	0.744** (0.371)	-0.017 (0.250)	0.478 (0.415)	1.054** (0.463)	
Quantified Violence	0.073 (0.071)	0.441 (0.527)	-0.938 (0.896)	1.008* (0.603)	0.193 (0.466)	0.103 (0.499)	-0.020 (0.336)	0.003 (0.559)	0.912 (0.622)	
Control	-0.079 (0.098)	4.197*** (0.732)	2.936** (1.247)	3.036*** (0.838)	4.135*** (0.648)	3.776*** (0.694)	4.854*** (0.468)	3.601*** (0.779)	2.721*** (0.866)	
<i>N</i>	256	256	256	254	256	256	256	254	256	256
Panel C: High Density										
	Correct	Need	Legal	Family	Violence	Legitimacy	Consumption	Trust	ShouldNot	
Violence	-0.077 (0.098)	-0.063 (0.292)	-1.516** (0.693)	-0.714 (0.470)	0.657 (0.531)	-0.452 (0.388)	0.186 (0.379)	0.549 (0.626)	0.692 (0.603)	
Environment	-0.114 (0.076)	0.004 (0.226)	-1.002* (0.537)	0.128 (0.364)	0.799* (0.411)	-0.040 (0.301)	0.213 (0.293)	0.903* (0.484)	0.029 (0.467)	
Quantified Violence	-0.090 (0.108)	0.116 (0.321)	0.096 (0.762)	-0.189 (0.517)	0.056 (0.584)	-0.060 (0.427)	-0.225 (0.416)	0.331 (0.698)	1.055 (0.663)	
Control	0.458*** (0.141)	4.229*** (0.417)	3.380*** (0.992)	3.169*** (0.672)	4.161*** (0.760)	4.095*** (0.555)	3.955*** (0.542)	4.013*** (0.895)	3.578*** (0.863)	
<i>N</i>	268	269	269	268	269	269	269	267	269	269

Note: Responses to post-experimental survey. a. The possible responses were: yes, no, no response. b. We asked: please indicate how much you agree with the following statements. The options of response were 1. Disagree, 2. Do not agree or disagree, 3. Agree. * p<0.1, ** p<.05, *** p<.01.

$$Y_{it} = \alpha + \beta_1 \text{Violence}_i + \beta_2 \text{Values}_i + \beta_3 \text{Environment}_i + \beta_4 \text{QuantifiedViolence}_i + \beta_5 X_{it} + \beta_6 Z_i + u_i + \epsilon_{it}, \quad (4)$$

where Y refers the following outcome variables for person i in scenario t : the likelihood of investing in coca, the amount invested in coca conditional on a non-zero investment, or the unconditional amount invested in coca. *Violence*, *Values*, *Environment* and *QuantifiedViolence* are defined as dummy variables equal to one for participants allocated to each of the different persuasion treatments, which are fixed throughout all scenarios. X is a vector of incentives to invest in coca in the experiment that varies over the nice scenarios, while Z is a vector of controls that include individual socioeconomic characteristics and municipality and fixed effects. The parameter u_i is an individual time invariant unobserved effect that is assumed to be uncorrelated with other variables, while ϵ_{it} is the error term.

We estimate a random effects probit model for the likelihood of investing in coca and report the estimated marginal effects at the means of the independent variables. The conditional and unconditional investments in coca are estimated using a random effects linear model. In all models, standard errors are clustered at the vereda level to account for correlation between decisions within sessions.

Table 7 presents the results of the estimated models using three different specifications. The first specification controls only for persuasion treatments and municipality fixed effects. The second specification is similar to the first specification but also controls for the marginal incentives to invest in coca in the experiment (vector X). The last specification includes a vector of controls Z . We present the results for our three outcome variables: the likelihood to invest in coca, the conditional investment in coca and the unconditional amount invested in three separate columns for each specification.

The estimated models suggest that compared to the *Control* treatment, persuasion messages that emphasize the relation of coca with violence and that make this relationship salient by providing data on violence result in a lower likelihood to invest in coca in the experiment. Exposure to these messages reduce the likelihood of investing in coca by about 20 percent. Messages that emphasize the effect of coca on the environment or in changes in values have no significant effect on the likelihood to invest in coca.

Contrary to what we expected, we find that the persuasion treatments have no effect on the total amount invested in coca. While treatment Violence deterred farmers from investing in coca, conditional on a non-zero investment, participants invested a larger fraction of the endowment in coca under this treatment. The treatment Values also

resulted in higher conditional investments by about 0.3 to 0.7 points.

These results are robust for all three estimated models once we include additional controls and corroborate Hypothesis 1.

Result 1

Persuasion treatments that emphasize the negative relation between coca cultivation and violence deter farmers from investing in coca. Yet these treatments can also increase the amount of endowment invested in coca conditional on a non-zero investment.

Surprisingly, we find that participants react more to treatments that have low information value (treatments that make salient the relation between coca and violence). As previously discussed, this information is not new for participants. They often discuss the consequences that coca has on violence and are aware of this relationship. Hence, this finding suggests that persuasion messages operate not via changes in beliefs but via changes in attitudes. We further explore this potential mechanism below.

Regarding other control variables we find that participants do react to economic incentives as expected, by decreasing the likelihood to invest in coca and the conditional and unconditional amounts invested, when the risk of being sanctioned if discovered cultivating, p , and the marginal return of the alternative, a , increase. Consistent with results from Ibanez and Martinsson (2013), the elasticity of coca investments is higher to sticks (changes in the risk of sanction) than to carrots (changes in the marginal return of the alternative).

The regression results of the specification that includes controls on socioeconomic characteristics uncover other interesting relations. Participants who self-reported having cultivated coca one year prior to the experiment are also more likely to invest in coca in the experiment. This seems to suggest that participants bring to the game their past real life experiences with coca. Interestingly, we find that those who belong to an Evangelic church, who are older or who had a title over their land in 1991 are less likely to invest in coca in the experiment and also invest less. This result suggests that investments in coca are partly driven by norms of what is correct and by poverty. Similar results are obtained by Ibanez (2010) who finds a negative correlation between the likelihood of cultivating coca and belonging to a Evangelic church.

Table 7: Treatment effects on coca investments

	No Controls			Experimental Controls			Socioeconomic Controls		
	(1) dcoca	(2) coca dcoca=1	(3) coca	(4) dcoca	(5) coca dcoca=1	(6) coca	(7) dcoca	(8) coca dcoca=1	(9) coca
Violence	-0.204* (0.113)	0.343* (0.193)	-0.242 (0.404)	-0.156 (0.106)	0.388* (0.198)	-0.244 (0.403)	-0.135 (0.100)	0.462** (0.206)	-0.040 (0.307)
Environment	-0.086 (0.132)	0.089 (0.214)	0.064 (0.333)	-0.080 (0.125)	0.142 (0.214)	0.061 (0.333)	-0.087 (0.086)	0.276 (0.245)	0.056 (0.310)
Values	-0.152 (0.129)	0.572** (0.238)	-0.079 (0.333)	-0.116 (0.119)	0.611*** (0.228)	-0.080 (0.333)	-0.117 (0.128)	0.704** (0.277)	-0.060 (0.302)
Quantified Violence	-0.229** (0.110)	-0.088 (0.303)	-0.417 (0.457)	-0.173* (0.104)	-0.057 (0.294)	-0.418 (0.457)	-0.252** (0.099)	0.009 (0.394)	-0.513 (0.428)
Risk Sanction				-0.533*** (0.096)	-2.219*** (0.583)	-2.554*** (0.452)	-0.565*** (0.054)	-2.116*** (0.620)	-2.362*** (0.497)
Profit Alternative				-0.090*** (0.016)	-0.717*** (0.178)	-0.546*** (0.084)	-0.095*** (0.011)	-0.678*** (0.178)	-0.481*** (0.108)
Coca Farmer							0.221*** (0.039)	0.353* (0.191)	0.691*** (0.126)
Poverty Index							0.000 (0.001)	0.019* (0.011)	0.009 (0.007)
Female HH							0.041* (0.024)	0.248 (0.326)	0.286 (0.193)
Catholic							0.021 (0.080)	-0.835* (0.466)	-0.309 (0.462)
Evangelic							-0.177** (0.074)	-0.800 (0.559)	-0.672 (0.468)
Age HH							-0.003*** (0.001)	-0.004 (0.009)	-0.010* (0.005)
Trust Institutions							-0.014 (0.009)	0.081 (0.092)	0.028 (0.061)
Title 1991							-0.005*** (0.002)	0.007 (0.014)	-0.007* (0.004)
Experience Coca							-0.000 (0.002)	-0.026 (0.016)	-0.011 (0.013)
Control		3.211*** (0.245)	1.405*** (0.314)		3.788*** (0.276)	2.070*** (0.318)		3.414*** (0.911)	2.149*** (0.655)
Municipal effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6241	2568	6241	6241	2568	6241	4691	1943	4691
People	699	405	699	699	405	699	525	302	525
Clusters	21	21	21	21	21	21	21	21	21

Note: Standard errors presented in parenthesis are clustered at the vereda level. For models on dcoca: Likelihood to invest in coca, the marginal effects at the means of a Random Effects Probit Model are reported in the Table. For unconditional (coca|dcoca==1) and conditional investment in coca coca (coca) we estimate Random Effects Generalized Least Squares. c. Probability of being sanctioned in the experiment. d. Marginal return of the alternative product in the experiment. e. Self-Reported measure of having cultivated coca in 2011. Results of t-test indicated at following significance levels * p<0.1, ** p<0.05, *** p<0.01.

Heterogeneous effects

From a policy perspective it is important to understand if the effect of the persuasion messages is reaching those who are intended to be affected by a policy. In other words, we are interested in testing whether the message affects those who live in communities with high density of coca to a higher degree than those in low density communities. To explore this relation, we classified veredas as low or high density according to the fraction of participants who self-reported having cultivated coca the year before the survey. This measure is positively correlated with secondary information on coca density (Spearman Correlation Coefficient=0.25, p-value<0.001). Neighborhoods with a density score above the median level of density (more than 19 percent of the respondents reported having cultivated coca) are classified as high-density while those with lower scores are classified as low-density.²

Table 8 presents the results of the estimation of Equation 4. Models one to three refer to neighborhoods with low coca density, while models four to six present the results for neighborhoods with high coca density. We find that in areas with low density the treatment *QuantifiedViolence* resulted in significantly lower likelihood to invest in coca than the control. However, this treatment and the treatment *Values* result in larger conditional coca investments and an insignificant effect on unconditional investments. Surprisingly, the treatment *Violence* results in significantly larger unconditional investments in coca.

In areas with high coca density, all persuasion treatments used decrease the likelihood of investing in coca significantly. Participants who hear a persuasive message are between 40 to 60 percent less likely to invest in coca than the control group. Yet, conditional on investing, participants invest about five points more in coca than the controls. The net effect of the persuasion treatments is negative and significant in all treatments with an average reduction in investments of about 0.8 points.

Result 2

*Our results suggest that the effectiveness of persuasion treatments is higher in areas with high density of coca than in areas with low density. In areas with high density, persuasion messages have a larger deterring effect and significantly decrease unconditional coca investments. The treatments *Violence* and *QuantifiedViolence* are the most effective in deterring coca investments.*

²Due to confidentiality agreements with respondents in the survey, we do not report this information.

Table 8: Heterogeneous treatment effects by density of coca in the neighborhood.

	Low Density			High Density		
	(1) dcoca	(2) coca dcoca=1	(3) coca	(4) dcoca	(5) coca dcoca=1	(6) coca
Violence	-0.224 (0.190)	0.728 (0.676)	0.764*** (0.247)	-0.421*** (0.107)	5.311*** (1.229)	-0.878*** (0.066)
Environment	-0.097 (0.221)	0.378 (0.683)	0.000 (.)	-0.458*** (0.080)	5.213*** (1.159)	-0.691*** (0.093)
Values	-0.028 (0.202)	0.404* (0.229)	-0.046 (0.113)		0.000 (.)	0.000 (.)
Quantified Violence	-0.275* (0.162)	2.681*** (0.750)	-0.373 (0.266)	-0.622*** (0.140)	4.734*** (1.228)	-0.709*** (0.090)
Risk	-0.631*** (0.107)	-3.560*** (0.978)	-2.918*** (0.878)	-0.571*** (0.081)	-1.315* (0.681)	-1.833*** (0.517)
Alternative Profit	-0.103*** (0.018)	-0.904*** (0.145)	-0.484*** (0.122)	-0.101*** (0.022)	-0.553** (0.276)	-0.480*** (0.183)
Municipal effects	Yes	Yes	Yes	Yes	Yes	Yes
Socioeconomic Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2287	688	2287	2404	1255	2404
People	256	118	256	269	184	269
Clusters	10	10	10	11	11	11

Note: Standard errors presented in parentheses are clustered at the neighborhood level. For models on likelihood to invest in coca (dcoca), marginal effects at the means of a Random Effects Probit Model are reported in the Table. For conditional (coca|dcoca=1) and unconditional investments in coca (coca), we estimate Random Effects Generalized Least Squares. c. Probability of being sanctioned in the experiment. d. Marginal return of the alternative product in the experiment. e. Not enough observations in the Values treatment in order to estimate high density coefficients. f. We include the following controls: dummy on having cultivated coca one year before the experiment, dummy for female respondents, age, religion, indicator of poverty according to living conditions, trust in local institutions, number of years cultivating coca, title over the land in 1991, session fixed effects. Results of t-test indicated at following significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

5.3 Mechanisms

If persuasion treatments are effective at decreasing investment decisions and affect those who live in areas with higher density of coca more, which are the channels that lead to the behavioral change? Our hypothesis is that the informative value of the message would determine the channel at play. One potential mechanism is that persuasion messages affect beliefs and change the expectations on how much others invest. To assess the importance of persuasion messages at affecting expectations on the behavior of others, we estimate Equation 4 with expected behavior of others as the dependent variable and with session fixed effects. Table 9 presents the results. We present the results for three different samples. The first column presents the results for all participants while the second and third columns present the results for participants living in low and high density coca areas respectively. We find that the persuasion treatments have no significant negative effects on beliefs on coca investments by others in any of the three

samples considered. Yet, the treatment Environment actually increases the expected coca investments by others, indicating that the channel goes in the opposite direction than intended. It could be that people do not see the environment as a problem that affects them directly and may think that once others hear this argument, they may be less likely to reduce their coca investments. This result suggests that the mechanism associated with behavioral change is not related with beliefs. This result is also consistent with the finding that messages with a higher informative value do not result in a larger change in coca investments. We reject Hypothesis 2, and conclude:

Result 3

Persuasion treatments do not affect the beliefs on coca investments by others in the group.

Table 9: Treatment effects on beliefs of what others invest in coca

	Beliefs Others' Investments		
	(1) All	(2) Low Density	(3) High Density
<i>Treatments</i>			
Violence	-0.269 (1.729)	-0.001 (1.292)	1.913 (1.643)
Environment	0.100 (1.942)	0.130 (1.273)	2.133* (1.273)
Values	0.117 (1.348)	0.286 (0.992)	0.000 (.)
Quantified Violence	-0.256 (2.070)	-0.656 (1.336)	1.809 (1.809)
Economic Incentive	Yes	Yes	Yes
Municipal effects	Yes	Yes	Yes
Socioeconomic Controls	Yes	Yes	Yes
Observations	4710	2297	2413

Note: Standard errors presented in parentheses. We estimate Ordinary Least Squares models. c. We include the following controls: dummy on having cultivated coca one year before the experiment, dummy for female respondents, age, religion, indicator of poverty according to living conditions, trust in local institutions, number of years cultivating coca, title over the land in 1991, economic incentives in the experiment, session fixed effects. d. Not enough observations in Values treatment in high-density areas to estimate the coefficient. Results of t-test indicated at following significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Another potential channel that could explain investment decisions is attitudinal change. Cues on the effects of coca on the community could have generated more negative attitudes towards coca. Hence, anti-coca attitudes should be higher in treatments

where participants invest less than in the control treatment. To test this hypothesis, we regress the post experimental attitudinal questions on the same set of controls included in Equation 4 and include session fixed effects. Columns 4 to 6 in Table 9 present the results. Panel A presents the results for the complete sample whereas Panels B and C present the results by areas of low and high density respectively. We find that the persuasion treatments have ambiguous effects on attitudes towards coca compared with the control treatment. All treatments result in a larger fraction of respondents who agree with the statement that people cultivate coca due to need. Yet, depending on the message received, participants exhibit more negative attitudes towards coca in different questions. For instance, participants in the treatment *Environment* agree to a larger extent that coca brings problems to the family. Participants in the treatment *Values* disagree that coca should be legal and point at the problem of increased consumption. Participants in the treatment *QuantifiedViolence* agree to a larger extent that coca cultivation promotes disrespect for the law.

The results of the treatments by coca density in the region, as presented in Panels B and C, confirm similar tendencies. Out of nine questions on attitudes towards coca, participants in persuasion treatments from low density areas expressed a more negative attitude in four questions and those in high density areas in three. Yet, for one question the attitudes towards coca were less negative. These findings lead us to believe that a change in attitudes is taking place.

Result 4

Persuasion treatments operate via changes in attitudes. Treatments that lead to lower coca investments are also associated with more negative attitudes towards coca.

5.4 Impact of the message on intentions to cultivate coca in the future

An interesting question is whether persuasion treatments have indirect effects beyond the laboratory conditions. To assess this question, in the post experimental survey we asked: How likely is it that you will cultivate coca next year? Participants could answer in a one to five scale where one indicated not likely at all and five indicated very likely. Not surprisingly, we find that there is a significant and positive correlation between the intention to cultivate coca and the self-declared coca cultivation. The large majority of those cultivating coca declared that they would not cultivate coca next year (85 percent). Yet, only half of those who declared having cultivated in 2011, one year

Table 10: Treatment effects on attitudes towards coca

Panel A: All Areas										
	Correct	Need	Legal	Family	Violence	Legitimacy	Consumption	Trust	ShouldNot	
Violence	-0.040 (0.032)	0.223** (0.084)	-0.185 (0.269)	0.076 (0.131)	-0.198 (0.229)	0.122 (0.126)	0.099 (0.069)	0.100 (0.187)	0.036 (0.238)	
Environment	-0.020 (0.031)	0.300*** (0.084)	-0.320 (0.233)	0.381** (0.145)	-0.107 (0.216)	0.088 (0.134)	0.076 (0.073)	0.081 (0.197)	-0.167 (0.209)	
Values	-0.005 (0.032)	0.356*** (0.071)	-0.760*** (0.161)	0.075 (0.076)	-0.018 (0.144)	0.205 (0.157)	0.132* (0.064)	0.252 (0.182)	0.308 (0.205)	
Quantified Violence	-0.032 (0.032)	0.407*** (0.080)	-0.141 (0.303)	0.149 (0.200)	-0.165 (0.202)	0.283** (0.133)	-0.002 (0.108)	-0.122 (0.200)	0.152 (0.282)	
Control	0.206* (0.102)	4.344*** (0.255)	2.815*** (0.557)	3.409*** (0.534)	4.391*** (0.492)	4.203*** (0.353)	4.355*** (0.275)	4.187*** (0.463)	3.735*** (0.417)	
<i>N</i>	524	525	525	522	525	525	525	521	525	525
Panel B: Low Density										
	Correct	Need	Legal	Family	Violence	Legitimacy	Consumption	Trust	ShouldNot	
Violence	0.015 (0.068)	0.419 (0.509)	-0.945 (0.867)	0.660 (0.584)	0.452 (0.451)	0.200 (0.482)	-0.019 (0.325)	0.266 (0.541)	0.818 (0.602)	
Environment	0.091 (0.067)	0.426 (0.502)	-0.813 (0.854)	0.560 (0.575)	-0.311 (0.444)	-0.068 (0.475)	-0.144 (0.320)	0.182 (0.532)	0.688 (0.593)	
Values	0.013 (0.053)	0.656* (0.391)	-1.497** (0.666)	0.466 (0.447)	0.077 (0.346)	0.744** (0.371)	-0.017 (0.250)	0.478 (0.415)	1.054** (0.463)	
Quantified Violence	0.073 (0.071)	0.441 (0.527)	-0.938 (0.896)	1.008* (0.603)	0.193 (0.466)	0.103 (0.499)	-0.020 (0.336)	0.003 (0.559)	0.912 (0.622)	
Control	-0.079 (0.098)	4.197*** (0.732)	2.936** (1.247)	3.036*** (0.838)	4.135*** (0.648)	3.776*** (0.694)	4.854*** (0.468)	3.601*** (0.779)	2.721*** (0.866)	
<i>N</i>	256	256	256	254	256	256	256	254	256	256
Panel C: High Density										
	Correct	Need	Legal	Family	Violence	Legitimacy	Consumption	Trust	ShouldNot	
Violence	-0.077 (0.098)	-0.063 (0.292)	-1.516** (0.693)	-0.714 (0.470)	0.657 (0.531)	-0.452 (0.388)	0.186 (0.379)	0.549 (0.626)	0.692 (0.603)	
Environment	-0.114 (0.076)	0.004 (0.226)	-1.002* (0.537)	0.128 (0.364)	0.799* (0.411)	-0.040 (0.301)	0.213 (0.293)	0.903* (0.484)	0.029 (0.467)	
Quantified Violence	-0.090 (0.108)	0.116 (0.321)	0.096 (0.762)	-0.189 (0.517)	0.056 (0.584)	-0.060 (0.427)	-0.225 (0.416)	0.331 (0.698)	1.055 (0.663)	
Control	0.458*** (0.141)	4.229*** (0.417)	3.380*** (0.992)	3.169*** (0.672)	4.161*** (0.760)	4.095*** (0.555)	3.955*** (0.542)	4.013*** (0.895)	3.578*** (0.863)	
<i>N</i>	268	269	269	268	269	269	269	267	269	269

Note: Standard errors presented in parentheses. OLS models. e. We include the following controls: dummy on having cultivated coca one year before the experiment, dummy for female respondents, age, religion, indicator of poverty according to living conditions, trust in local institutions, number of years cultivating coca, title over the land in 1991, and session fixed effects. Results of t-test indicated at following significance levels * p<0.1, ** p<0.05, *** p<0.01.

before the survey, declared that they would probably cultivate or be very likely to cultivate (49 percent) in the next year.

To establish the impact of the persuasion treatments on intentions to cultivate coca we run a model as expressed in Equation 4. Table 11 presents the results of this estimation for the whole sample and for areas with low and high density of coca. We find that the treatment *QuantifiedViolence* significantly reduces the probability to have intentions to cultivate coca for all areas. In regions with low coca density, the probability to be willing to cultivate coca in the next year is significantly higher in the *Value* treatment. For areas with high coca density, two of the treatments increased the declared likelihood to cultivate coca in the future (*Violence* and *Environment*), while the treatment *QuantifiedViolence* had a negative effect. This result confirms the previous observation that in areas with high density of coca, participants react more to low information and to more salient information than in areas with low coca density.

Table 11: Treatment effects on probability to cultivate next year

	(1)	(2)	(3)
Intention to Cultivate	All	Low Dens	High Dens
Violence	-0.039 (0.105)	-0.072 (0.062)	0.242** (0.087)
Environment	-0.172 (0.146)	-0.015 (0.065)	0.116** (0.050)
Values	-0.025 (0.043)	-0.147*** (0.039)	
Quant.Violence	-0.505*** (0.137)	-0.034 (0.094)	-0.295*** (0.048)
Constant	1.926*** (0.382)	1.819** (0.592)	2.388*** (0.371)
Observations	522	254	268
Num.Clusters	21	10	11

Note: Standard errors presented in parenthesis and clustered at the neighborhood level. If 19 percent or less of the population declared to be cultivating coca, the area was classified as low density. Otherwise it was classified as high density. We include the following socioeconomic controls: dummy on having cultivated coca one year before the experiment, dummy for female respondents, age, religion, indicator of poverty according to living conditions, trust in local institutions, number of years cultivating coca, title over the land in 1991. Not enough observations in the Values treatment in High Density areas to estimate the coefficient. We also control for session fixed effects. Results of t-test indicated at following significance levels * $p < 0.1$, ** $p < .05$, *** $p < .01$.

6 External validity

One potential concern with the experimental results is that they might have low external validity. We think that this is not the case.

First, our framed field experiment increases the external validity of the results by i) conducting the experiment with participants (coca farmers) who face similar decisions in their daily life; ii) using a frame that represents the decision context. Decisions were framed as investments in coca production or cattle farming. This feature of the experiment allows us to make salient both monetary and non-monetary dimensions affecting investment decisions in the game; iii) simulating the decision context by using parameters that capture real life values. Some evidence that supports our claim of achieving external validity is reflected by the the positive correlation between decisions in the experiment and in real life. About 90 percent of those who invested any positive amounts of coca during the experiment reported having grown coca at some point in their lives in the survey, and the longer the person had been growing coca, the more likely he/she was to invest in coca in the experiment. This shows that participants brought their own experiences to the game and is further strengthened by qualitative work with participant farmers which indicates that people considered that the game captured pretty well their decision to cultivate coca or not. When speaking about the experiment, people instantly equated their decisions in the experiment to their decisions in their daily life. Statements such as "I did not invest in coca (in the game) because I realized how bad it is for our family and we stopped growing coca last year" or "it's impossible not to invest in coca because how else can I send my children to school or feed them?" say a lot about the close link that people saw between their experimental decisions and their real life actions.

Second, one could think that the investment decision in the persuasion treatments change not because people have internalized the message, but because they want to please the experimenter with their answers. In other words, the results of the experiment could be subject to experimenter demand effects. Yet, if participants wanted to please the experimenter, we would have seen a decrease in coca investments across all treatments compared to the control group. However, the results show that the likelihood to invest in coca varies according to the treatment (and region). Moreover, we also find significant treatment effects on responses to the likelihood of investing in the future. If people wanted to please the experimenter, reductions would not have been differential across treatments (or regions) compared to the control.

Moreover, if participants had been seeking to please the experimenter, they would have expressed more anti-coca attitudes that go in the same direction as the intervention. Hence treatments that give an example on the negative effects of coca on violence, would have also lead to higher acceptance of statements that coca is associated with increased violence in the family or increased violence in the community compared to the control group. Statistical analysis shows that this is not the case. As discussed previously,

responses to the attitudinal question are influenced by each treatment in different directions. Participants change attitudes towards questions that are not directly related with the argument used or that go in an opposite direction (pro-coca attitudes).

7 Discussion and conclusions

Our work shows that persuasion messages that make salient the adverse consequences of coca on violence are the most effective in preventing people from investing in coca in the experiment. The results indicate that this type of intervention is more effective in areas where illegality is higher. The main mechanism behind behavioral change seems to be changes in attitudes rather than changes in beliefs.

One limitation of this study is that we are only able to capture short term effects of the type of persuasive communications used. In the future, it would be interesting to test the effectiveness of alternative interventions. For instance, it would be interesting to test the effect of interventions that highlight the positive effects of working in legality and that give hope by making the achievements of those that have switched to legality more salient. Also, since our intervention was introduced in a subtle way, it would be interesting to see what would happen if the persuasive messages were sent in a much powerful way (in songs, billboards, radio spots, for example). Similarly, it would be interesting to see how people react to the experience of others similar to them.

Another question that we cannot address in our analysis is whether short term interventions, like the ones tested in this paper, have longer term effects in coca investments. Is it enough to tell people once about the consequences of their behavior, or is it necessary to continuously bring up the same message? Could there be depreciation effects of these interventions, so that the effectiveness of using the same type of message falls over time?

The result of our lab in the field experiment cannot predict how persuasion messages will affect coca growing decisions outside the experiment. Yet, the results of this paper are encouraging, since they confirm that persuasion messages are in fact capable of affecting behavior at least in a controlled environment. This finding suggests that alternative policies, different from carrots and sticks that are solely based on monetary incentives, can be used in the fight against drugs. Future research should focus on evaluating the effect of large-scale persuasive communications in the field.

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Appendix

A1. Instructions

The following instructions were read out loud to all participants. These are the instructions for the control group; those for the other groups are exactly the same, except that when group externalities of coca growing are explained, each treatment message is mentioned. The following instructions were translated by the authors. The original Spanish instructions can be found in the online version of this document.

Start

Good morning, welcome to this workshop.

Before we begin we want to thank you for your participation. This workshop has been financed by a group of University Professors, and everything we do is an academic matter. Throughout the exercise we will not ask your name, where you live nor any other question that allows us to identify you or your family. We will carry out this workshop in different communities. For the exercise to be comparable between communities we have prepared the instructions that we will now read.

You will receive 15.000 pesos (8 USD). There are two conditions for you to receive this money. The first one is that you participate in this workshop. The second is that you complete the survey that we will have in the afternoon. Although participating in both activities entitles you to these 15.000 pesos, you can end up with more or less than this amount depending on the decisions that you make during the workshop, as well as on the decision on other participants from your group.

We will start by randomly forming groups of 5. The groups will remain the same during the workshop. You will not know during or after the workshop who was part of your group.

How long is the workshop?

This workshop will last approximately 2 hours. You will have to make 9 different decisions. The decisions seem very similar at first, but they are different. This is why it is important that you carefully think about each one of them and consider what you would do if in reality you had to make these decisions.

Which type of decisions will you have to make?

In each decision you have 1 million pesos (526 USD approx.) to invest in coca or cattle. For each 100.000 pesos that you invest in coca you obtain 1.250.000 pesos. For each 100.000 pesos that you invest in cattle raising you will get 250.000, 550.000 or 850.000

pesos depending of which of the 9 decisions is taking place. You have to decide how much you want to invest in coca and how much you want to invest in cattle. You can invest any amount between 0 and 1 million pesos. You are free to decide how you want to invest, but at the end the whole million has to be invested. Your investment has to happen in units of 100.000. For example, you can invest 0, 100.000, 200.000, 300.000 pesos, etc., but you can't invest 10.000, 50.000, etc.

[THIS IS WHERE THE TREATMENT MESSAGES ARE MENTIONED DEPENDING ON THE TREATMENT FOR EACH SESSION]. Coca generates negative effects on society. To represent the damage that coca generates on the community, we will discount 212.5 pesos for every 100.000 pesos invested in coca in the group. This discount applies to all the persons in the group, regardless of whether each grew coca or not.

Since coca is illegal, there is a risk that authorities find out that you are growing coca. If your investment is discovered, for each 100.000 that you invest in coca you will have to pay a fine of 1.500.000 pesos. However, like in real life, authorities not always discover you. To determine whether you are discovered or not, we will take a ball from a bag. If the ball is green you are not discovered. If the ball is red you are discovered and fined. In some decisions all balls will be green, so there will be no risk of being caught. In other decisions there will be two red balls and 8 green balls, meaning that the risk of being caught is 20%. In other decisions there will be three red balls and 7 green balls, so that the risk is 30%.

Correct guess

Your second assignment is to guess how much others from your group are investing in coca. You can increase your income by guessing correctly how much the others invested in coca. The closer your guess is to what others did, the higher your payment. If you guess the exact value that others are investing, you get 1000 pesos more. If your guess is more or less 100.000 pesos difference, you receive 500 pesos and if your guess is between 100.000-200.000 pesos different than the real value you get 200 pesos. If you are off by more than 200.000 pesos you don't receive anything. Do you believe others will do the same as you? Do you think they invest more than you in coca? Do you think they invest less than you in coca?

Procedure

You will receive 9 decision sheets like the one on the board.

DECISION A

You have 1.000.000 pesos that you can invest in coca or in cattle.

For every 100.000 pesos invested in coca you get 1.250.000 pesos.

For every 100.000 pesos invested in cattle you get 250.000 pesos.

The impact that coca generated is so that for every 100 thousand pesos invested in coca each person in the group loses 212.500 pesos.

Coca is illegal. If you are discovered investing in coca you will have to pay a fine of 1.5000.000 pesos for each 100.000 pesos invested in coca.

In this decision there is no risk of being discovered.

1. How much do you want to invest in coca?
2. How much do you want to invest in cattle?
3. How much do you think others will invest in coca?

The heading of the decision sheet explains the payment conditions for each activity. [In our example, read the first three lines.] Then the sheet explains the negative effects that coca has and the cost that this entails [read treatment] The next line explains how risky it is to grow coca. [Read line on coca is illegal] Next you see the questions that you need to answer. The first is how much you want to invest in coca. Let's say that I invest 700.000 in coca. Write 700.000 in the box. The second question is how much you want to invest in cattle. If I invested 700.000 in coca, how much do I have left for cattle? 300.000 pesos. Write 300.000 in the box. The total sum of your investment in coca and cattle should be 1.000.000 pesos. It's not necessary that you write down the sum, but you need to do it in your head. The last line asks how much you think others will invest in coca on average. This is the value that you have to guess! For instance, I think others will invest the same as me, then I write 700.000, or more, or less. In other words, I think on average they will invest 700.000.

How are your payments calculated?

In our example I invested 700 thousand in coca, and 300 thousand in cattle. How do we calculate the return of our investment in coca? How many times is 100 in 700? 7 times, so that income for coca investment is 7 times 1.250.000, which is: 7 times 0? -0, 7 times five?- 35 [write down and calculate together on the board and say each step out loud] 5 and 3 remain. 7 times 2? 14, and 3? 17, seven and we keep 1. 7 times 1, seven, plus 1, 8. This means that for every 700.000 pesos invested in coca you receive \$8.550.000 pesos. What is my income for my investment in cattle? How many times is 100 in 300? 3. Then, my income would be 3 times 250.000 pesos. How much is this? 750.000 pesos. The total amount of my investment is 9.500.000 pesos. Let's suppose others invest in average 700.000, like I thought. Given the negative effects of coca, there is a reduction for all group members. In our example, I invested 700.000 pesos in coca and the others on average 700.000. How much was invested in total in the group? 5 people in the group

times 700 thousand is 3.500.000. For each thousand pesos invested in coca there is a discount of 212.5 thousand. How many times is 100 thousand in 3.500.000? 35 times. So the reduction for investing in coca for each group member is 35 times 212.500. This amounts to \$7.437.500 pesos [Taking off 3 zeros], or approximately 7.438. My total income is thus 9500 (9.500.000 pesos) minus 7.438 (7.438.000 pesos) , for a total of 2.062 (2.062.000) pesos. Since we come from a university, in the workshop we will not pay you 2 million. Instead, we will pay you the 1 per thousand of what you got for your investments. This means that in this example we would pay you 2.062 pesos. With an approximation, you would receive 2.100 pesos. In this example I guessed the exact value of what others invested, so as a prize I receive 1000 more. Additionally, I had received 15.000 for taking part in the workshop, so in total I receive 18.100 pesos (9.8 USD). Coca 100 thousand pesos give 1.250 (one million two hundred fifty thousand pesos). Invest 700 $700/100=7$ Receive: $7 \times 1.250 = 8.750$ Cattle 100 thousand pesos give 250 thousand pesos. Invest 300 $300/100=3$ Receive $3 \times 250 = 750$ Income for Investments 9.500 Reduction for coca 100 thousand pesos in coca reduce income in 212.5 700 in coca on average $700 \times 5 = 35$ $35 \times 212.5 = -7.438$ Net investment 2.062 ~ 2.100 Correct guess 1.000 Payment for participation 15.000 Total payoff 18.100

Let's now suppose that we are dealing with a decision where we can get caught by the authorities. Let's suppose I did the same investment as before, this is, that I invested 700 thousand in coca and 300 thousand in cattle. What happens if I get a green ball? I get the same income that we calculated. What happens if I get a red ball? For each 1 thousand invested in coca, the authorities fine me with 1.500 pesos. This means that if I am caught I need to pay a fine of $1500 \times 7 = 10.500$. My payoff when I was not caught was 18.100. If I take out what I had to pay as a fine, I am left with 7.600 pesos. Total payoff if not caught 18.100 Coca fine 100 thousand pesos in coca give a fine of 1.500 (one million five hundred) if caught 700 thousand in coca $700/100=7$ $7 \times 1.500 = -10.500$ Total payoff if caught 7.600

Let's see another example. Let's suppose that you invest 400 thousand pesos in coca. How much is left for investing in cattle? 600 thousand pesos. How much do you receive for your coca investment? How many times is 100 in 400? 4. Your income is then 4 times 1250=5000 (5 million). How much do you get for cattle? 100 is 6 times in 600, so 6 times 250=1.500 (1.500.000 pesos). In total you receive 6.500 (six million 500 thousand pesos) for your investments. If others invest on average 700 thousand in coca, total investment in coca is $700 \times 4 + 400 = 3200$. (3 million 200 thousand pesos). The reduction for investing in coca is 32 (100 is 32 times in 3200) times 212,5=6.800 (six million 800 thousand pesos). Your income is 6.500 (six million 500 thousand pesos), minus 6.800 (six million 800 thousand pesos), for a negative balance of 300 (300 thousand pesos).

But don't worry, you don't have to pay from your pocket. As we had already explained we will only pay the one in one thousand so you will lose 300 pesos. These 300 pesos we will take from the 15.000 that we gave you for participating in the workshop and survey. So, in the end you will receive 14.700 pesos. This is if you are not caught by the authorities. Coca 100 thousand pesos give 1.250 (one million two hundred fifty thousand pesos). Invest 400 $400/100=4$ Receive: $4 \times 1.250 = 5000$. Cattle 100 thousand pesos give 250 thousand pesos. Invest 600 $600/100=6$ Receive $6 \times 250 = 1500$. Income for Investments 6.500. Reduction for coca 100 thousand pesos in coca reduce income in 212.5 700 in coca on average $700 \times 4 = 28$ $28 + 4 = 32$ $32 \times 212.5 = -6.800$ Net investment -300. Correct guess 0. Payment for participation 15.000. Total payoff 14.700

What if authorities discover you-a red ball appears? You are fined. And what is the amount of the fine? 4 times 1.500=6.000 (six million pesos). From this amount you only need to pay the 1 per thousand, which is 6.000 pesos. If you are discovered you will receive 8.700. If your guess is incorrect you don't receive any payment. Total payoff if not caught 14.700. Coca fine 100 thousand pesos in coca give a fine of 1.500 (one million five hundred). If caught 400 thousand in coca $400/100=4$ $4 \times 1.500 = -6.000$. Total payoff if caught 8.700.

Implementation

During the workshop you will have to make 9 decisions, but only one will be paid at the end. To determine which decision will be paid we will select one of the 9 cards marked with letters A through I. The letter that is randomly selected will determine which decision to pay. The decision will be the same for all participants. So that we keep everything confidential, you will receive your payment in an envelope marked with your participant number.

Procedure

We will begin by assigning seats to everyone in the room. Once you all have a seat we will pass around an id number. This is the number we will use in the survey. If for any reason you lose it, we won't be able to pay you. Do you have any questions until now? Once we start you can't talk to anyone in the room. If someone starts talking he/she won't be able to participate in the workshop or in the payments anymore. If you have a question please raise your hand and one of us will go to your seat and assist you. If you want to change any of your decisions, please cross out with a line what you want to change and give your new answer next to it. Once you complete all your decisions we will pick up your sheets and we will proceed to determine which decision will be paid by taking out a card at random. This decision holds the same for everyone in the group. If necessary, we will decide whether you get caught or not by taking a ball out

of the bag. Whether or not there is control applies to everyone in the group.

Workshop starts

Now we are going to begin the workshop. We are you to please come to the front so we can assign the seats. {Assign seats and hand out practice round} Practice Round Before we start with the investment decisions, we want to do a practice round. The idea is to be sure that we have explained to you clearly what you have to do. These decisions will not affect your payment.

A2. Variable definitions

Table A.1: Variable definitions at a community and household level

Variable	Definition
Risk Sanction	Experimental risk of being caught (0, 0.1, 0.3)
Profit Alternative	Experimental profit of alternative product (0.2, 0.44, 0.68)
Coca farmer	Mentioned growing coca in 2011
Poverty index	ICV Livelihoods index built with household data
Female HH	Female head of household
Catholic	Head of household claimed being catholic
Evangelic	Head of household claimed being evangelic
Age HH	Age of household head
Trust institutions	Self-declared trust in rural and educational institutions, local authorities, scale (1 very low-5 very much)
Trust neighbors	Trust in neighbors. Scale (1 very low-5 very much)
Participation	Participates in at least one local group/association/organization
FGB	Has been/or currently is beneficiary of the Forest Warden Families Program
Risk eradication	Perceived risk of coca being eradicated 1(lowest)-10 (highest) scale
Land size 1991/2011	Size of land in 1991 and 2011 in hectares
Title 1991/2011	Had title over land in 1991 and in 2011
Experience coca	Has experience working with coca, has worked with coca before
Coca 2011	Was growing coca in 2011
Displacement	Member of household has been victim of forced displacement
Homicides	Member of household has been victim of homicide
Landmines	Member of household has been victim of landmines
Extortion	Member of household has been victim of extortion
Accidents with weapons	Member of household has been victim of an accident with weapons