Inducing Cooperation In Fragmented Societies
Experimental Evidence From Bolivia[*]

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Abstract

This document proposes to use variants of public good games in a laboratory setting to identify: 1) cooperation and trust gaps between high and low cooperation types; and 2) cooperation and trust penalty/premium of ethnically diverse/homogenous teams. Furthermore, it attempts to assess whether it is possible for institutions to overcome both, low propensities to cooperate and out-group biases induced by ethnic fractionalization, by incorporating to the game fixed *weak* and *strong* regulating institutions defined by *low* and *high* acceptable minimum contribution rules and *small* and *high* cheating fines. Finally, it attempts to analyze whether regulating institutions can be self-imposed by individuals to obtain more socially efficient outcomes by introducing voting over the level of both, acceptable minimum contributions and cheating fines. To experiment will be conducted among a convenient sample of a particular cohort of youth people: those who just finished their senior year of high-school living in the cities of La Paz and El Alto, Bolivia. We believe that Bolivia and the cities of La Paz and El Alto, in particular, are perfect locations for our experiment not only because it has an ethnically diverse population easily identified by phenotype markers and typical surnames; but also because it has well documented cleavages associated with and determined by ethnicity.

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Contents

1 Introduction

Trust enables and supports a great variety of relationships; from daily market interactions (Arrow 1974) to the formation of social capital and stable political institutions (Fenno 1978, Bianco 1994). At the same time, market and political institutions ultimately determine who gets what and why (Roth 2016), influencing the levels and trends of societal trust - interpersonal and in institutions. This endogeneity between societal trust and institutions create two distinct development trajectories: **inclusionary** institutions that promote cooperation and growth generating economic and political arrangements; and **exclusionary** institutions that reduce cooperation and encourage extractive economic and political arrangements (Acemoglu and Robinson 2012).

A collection of political economy models suggest that fragmented and polarized societies are more prone to competitive rent-seeking by the different groups and have difficulty agreeing on public goods like infrastructure, education, and good policies (Alesina and Tabellini 1989, Alesina and Drazen 1991, Shleifer and Vishny 1993, Alesina and Rodrik 1994, Alesina and Spoalare 1995). Empirical research suggest that fragmentation in general, and ethnic fragmentation in particular, is directly related to a diverse set of potential causes for the lack of economic growth ranging from society's polarization and degree of social conflict, to under-provision of public goods, to the provision of incentives for growth-reducing policies that create rents for the groups in power at the expense of society at large (Easterly and Levine 1997). Ethnic fragmentation is also related to the quality of the government and the quality of key institutions (Canning and Fay, 1993; Mauro, 1995 and La Porta et al., 1999).

How to establish efficient pro-growth institutions, such as the rule of law or impartial public administration, in low-trust societies is a collective action problem suffering from the standard problem of defection and/or cooperation. Although most agents understand what they would gain from establishing inclusive political and economic institutions, they usually lack appropriate incentives to cooperate unless they trust that most other agents would not defect in the process of creating the institutions meant to facilitate cooperative behavior (Olson 1963). Fragmentation -among ethnicity/race, regions, income/wealth or political views exacerbate the challenge. How fragmented societies, with low social trust endowments, can produce or develop socially efficient institutions is an even harder question.

1.1 Research Objectives

This paper main research question is **whether and how institutions can induce cooperation in ethnically fragmented societies** - which we assume have lower levels of trust of cooperation because of its economic, social and political divisions. In particular, we attempt to answer the following questions:

1. Are there differences in cooperation associated with intra- and inter-ethnic group identities or alienations?

2. Can institutions that regulate behavior increase trust in low-cooperation settings and force better social outcomes? How difficult is for institutions to increase cooperation in low-trust

settings relative to high trust settings? Does ethnic fragmentation makes things harder for institutions?

3. Can these strong and efficient institutions be chosen and maintain by people -even in low-cooperation settings? How long does it take for low trusts agents to choose efficient rules relative to high trust agents? Does ethnic fragmentation hinder the choice relative to more homogenous settings?

In order to answer these questions, we plan to collect **outcomes** of 480 participants playing 1200 variants of the public good game in teams of 4 in a laboratory setting. This would allow us to collect 9,600 data points in a controlled design that will allow us both, to assign individual to teams according to their individual propensity to cooperate, and according to their ethnicity; and to vary the rules of the game in order to answer our research questions. To complement our research we will explore the variability in outcomes using additional information on **socioeconomic characteristics** including age, sex, income class (estimated though an asset index), place of birth, education background (years of schooling and type of institution); **political preferences and partisanship** including satisfaction with incumbent national/regional/local governments, left/right compass, preference for democracy; **elicit trust questions** - interpersonal and in the institutions (armed forces, police, the church, national congress, national/regional/local governments, judiciary branch, political parties, electoral branch); among others.

1.2 Bolivia's background information

Bolivia is a country with a geographical diversity as high as its ethnic and cultural diversity, with 36 officially recognize ethnic groups and a corresponding number of official languages. Its ethnic divisions, intersects with other explicit and implicit divisions of the society, by region, by race, by social class, and by political views. Therefore, Bolivia's relative fragmentation levels depends on the specific characteristic used to define groups and cleavages. Linguistic fragmentation measures based on proportion of people with different mother tongues put Bolivia below the median of the regional and World distribution (with a linguistic fractionalization index of 0.22)[1]. However, measures of ethnic fractionalization that includes racial and linguistic characteristics put it not only on the top of the regional rankings but also among the more fragmented societies in the world (with an ethnic fractionalization index of 0.74)[2]

Ethnic classifications are not set in stone. There is a vast number of ethnic boundary markers that can be used to define ethnicity and race including history, territoriality, language, clothing and race. Figure 1 shows the percentage of indigenous population by cohort according to different markers and definitions available in most household surveys and census data. Individual markers - such as mother tongue, self-identification, language spoken, and the combination of any of these markers, show an accelerated decline in its presence in younger generations. For example, less than

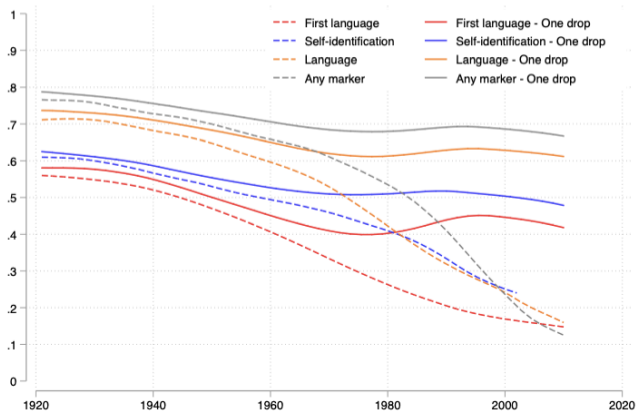
[1]Based on the following distribution of languages spoken as mother tongues: Aymara, 3.84 percent; Guarani, 0.12 percent; Quechua, 8.15 percent; Spanish, 87.65 percent; and Other languages, 0.84 percent

[2]Based on a distribution of the following ethnic groups: Blancos, 10.13 percent; Aymara, 30.38 percent; Quechua, 30.38 percent; Mestizos, 25.32 percent; and Other indigenous groups and afro descendants, 3.80 percent [16]

25 percent of the people born around the year 2000 identifies with an indigenous group, speaks an indigenous language or present any of the available indigenous markers; those with an indigenous mother tongue drop to less than 20 percent.

Does the decline in the presence of individual markers in younger cohort means that indigenous diversities are disappearing? Certainly no. Figure 1 also shows the percentage of indigenous population by cohort according to different definitions and the "one-drop" rule. The one-drop rule is a social and legal principle of racial classification that asserted that any person with even one indigenous ancestor ("one drop" of indigenous blood) is considered indigenous. Under this classification, the percentage of indigenous people in the 2000 cohort jumps to 45 percent by mother tongue, 50 percent by self identification, 62 by language spoken and almost 70 percent by the presence of any marker.

Figure 1: % indigenous population by cohort. Different measurements



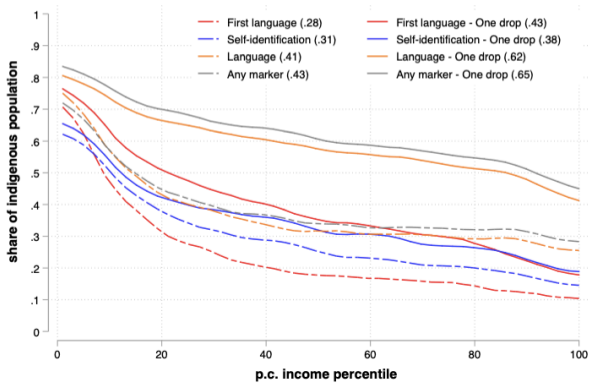
Source: Authors' calculations based on the pooled time series of cross sectional household surveys

Ethnolinguistic fractions are not the only cleavages that matter in Bolivia. Bolivia suffers from "reinforcing cleavages" (Hernani-Limarino, 2006). A central concept in political theory is cross-cuttingness - how groups defined according to one cleavage are identically distributed on a second or more cleavages. A particular cleavage is said to be crosscutting if it is identically distributed among groups defined according to another cleave. If that is not the case, the cleavage is said to be reinforcing, e.g. if one of the ethnic groups is all rich and the other all poor; or one of the ethnic groups support one political party and the other the opposition party.

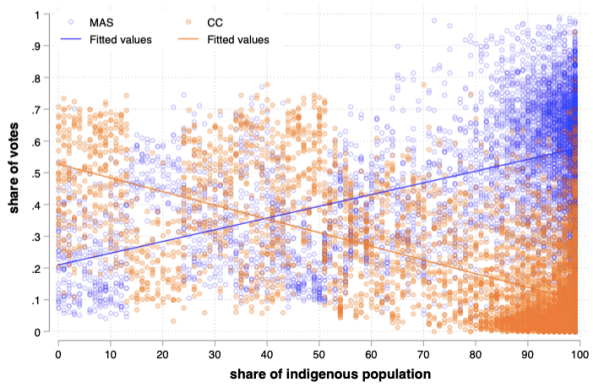
Figure 2 illustrates the self-reinforcing ethnolinguistic, economic and political cleavages in Bolivia. Figure 2a shows the percentage of indigenous population by percentile of the per-capita family income distribution -by alternative definitions of indigenous population. The graph clearly shows that indigenous are overrepresented among the poorest and underrepresented among the richest. For example, while indigenous represent 28 percent of the population according to individual mother tongue, they have a 70 percent (unconditional) probability of being among the poorest five percentiles; and only 11 percent probability of being among the five richest percentiles.

In other words, indigenous are 2.5 times more likely to be among the poorest while they are 2.5 times less likely to be among the richest. Figure 2b shows scatterplots of the percentage of voting shares for Evo Morales' *Movement Toward Socialism* **MAS** and the main opposition party *Civic Community* **CC** by the percentages of indigenous population at the electoral precinct level. The scatter clearly shows a positive relationship between the absolute voting share in favor of **MAS** (and a negative relationship between the absolute voting share in favor of the opposition) and the percentage of indigenous in the elegible population. While expected support for **MAS** increases from 21 to 58 percent of elegible population from non-indigenous segregated areas to indigenous segregated areas; expected support for the opposition **CC** decreases from 53 to 10 percent of elegible population from non-indigenous segregated areas to indigenous segregated areas.

Figure 2: Self-reinforcing ethnolinguistic, economic and political cleavages in Bolivia



(a) % of indigenous population by per-capita family income percentile, 2012-2014



(b) Voting share by % of indigenous eligible population, 2019

Source: Authors' calculations based on official vote count per electoral precinct. Percentage of indigenous population per-precinct corresponds to the percentage of indigenous population among elegible voters in the closest census tracks.

1.3 Ethnic diversity, trust and cooperation

Ethnic identities are often associated with a sense of self that derives from perceived membership into a social group but also with a sense of alienation that derives from perceived exclusion from other social groups. Billig and Tajfel, 1973 use laboratory experiments to study intergroup behavior and showed that, even when the formation of groups is completely random, people have an "in-group bias", i.e. a tendency to put both themselves and others into categories and that this categorization gives rise to favorable treatment of the people in the same social group as oneself -*the in-group* compared to those in other groups -*the out-group* (see also Tajfel, 1982 and Tajfel et al.,1971).

The way the groups are created has been shown to matter for the strength of the in-group bias. Individuals have many characteristics such as nationality, residential location, race, language, occu-

pation, income, wealth, education, membership of a club, and so on. Any of these characteristics, or set of characteristics, can be thought of in purely descriptive terms as a grouping. How important is the indigenous identity and its sense of self

There is plenty of evidence of close networks within ethnic groups, which take on social and economic dimensions.1 The classic text by Horowitz (1985) makes the case that the conventional interpretation of ethnicity as connected only to language or race is much too narrow. Horowitz argues that ascription connection to birth is the primary, if not the only, criterion. Seen this way, religion, caste, tribe, race and language are simply different forms of ethnicity, which is viewed by Horowitz, and many others, as an umbrella term. Though in some societies, religion is a matter of choice, in most societies religious identity is given at birth. Similarly, people can in principle move from one linguistic community The presence of different ethnic groups may be associated with ethnic tension, and a failure of collective action detrimental to the wellbeing of both groups and of society at large. But not necessarily.

Glaeser et al. 2000 use the trust game[3] to analyze trust and trustworthiness in a sample of 196 undergraduates of Harvard University. They found that subjects who are paired with partner of different race and nationality send back less money to their partner. In particular, they found that eleven out of ten times the recipient send back nothing the sender and the recipient were fo different races. Eckel and Grossman, 2001 conduct ultimatum games on a sample of 384 economics students at the Virginia Polytechnic Institute and State University and Wayne State University. They found that black students not only offer more but also reject more often.

Fershtman and Gneezy 2001 use the trust and dictator games to analyze discrimination and in-group/out-group bias between Eastern origin and Ashkenazic origin jews in a sample of 616 Israeli undergraduates from the University of Haifa and the Tel Aviv Academic College using 77 typical ethnic names to induce groups into four relevant ethnic/gender groups.

Hernani-Limarino, 2006 and Hernani-Limarino, 2010 conducted a similar experiment with a sample of more than 1000 undergraduate students in public and private universities of La Paz, Bolivia; inducing grouping using a combination of predetermined pictures and last-names. He found not only significant in-group/out-group biases but also significant decline in trust between 2006 and 2009. Indigenous trust in their non-indigenous counterparts have declined from .34 to .11 while non-indigenous observed trust in their indigenous counterparts have decline from .29 to .096. Interestingly, they found that within group trust have remain constant within indigenous and non-indigenous groups at levels above the national average -above .55 for indigenous and above 50 for non-indigenous (See [15] for further details).

2 Economic system

Social dilemmas are situations in which the optimal behavior of an individual contrast with the optimal outcome for the society. In other words, a social dilemma is a game in which at least

[3]The trust game is a two-player game in which Player A is given a fixed amount of money and asked to decide whether to transfer any of it to Player B, and if so how much. The experimenter then triples the transferred amount and gives it to player B who is asked to chose whether to transfer any money back to Player A

one equilibrium is Pareto inefficient, i.e. at equilibrium no one has an incentive to change their behavior even though an alternative outcome is not only possible but Pareto efficient. Social dilemmas describe situations where individual rationality and efficiency are at odds. Since we are interested in the potential of regulating institutions to induce cooperation in low cooperations settings, we plan to use variants of the classic public good game for our analysis. This section describes it and two variants: a public good game with an imposed regulating institution; and a public good game with voting in a regulating institution.

2.1 Classic public good game

A public good has three main characteristics: it is jointly provided; it is non-excludable, and it is non-rivalrous. Because of them, the classic prediction is a public good game is both: free riding and under-provision.

The simplest possible model to describe the central problem with public goods, called **the voluntary contribution mechanism** (VCM), can be described by the following game structure:

- N players;
- each player, i, has endowment, e_i of tokens;
- chooses a number of tokens, x_i, to contribute to a public account (choices are simultaneous); and
- keeps $e_i - x_i$ to himself;
- Total earnings include whatever he keeps for himself plus the equal distribution of the public account,$ei - xi + m \sum_{j=1}^{N} x_j$, where m is the marginal per capital return (or MPCR).

As long as $\frac{1}{N} < m < 1$ this is a public goods problem. Consider the situation where there $N = 4$ players, everyone endowed with 10 tokens and the MPCR is $m = 0.5$. If everyone keeps tokens to themselves, each player earns 10, while if everyone contributes, each player earns $0.5 \times 4 \times 10 = 20$. Notice that, despite the socially efficient outome is full cooperation, this is not the Nash equilibrium of the VCM game. Why does cooperation fall apart? Suppose everyone else is giving the full amount. If you give the full amount you earn 10 But if you *free ride* and give nothing you earn 25! Therefore, in a Nash equilibrium, everyone should give zero to the public account. Clearly, without any institution that regulates behavior each player has an incentive to keep their full endowment and gain an additional 0.5 units for each additional unit that is contributed by their fellow players. However, the social optimum is attained when each player contribute their full endowment to the pot and receives $E * M = 10 * 2$.

2.2 Parameters

A number of factors affect payoffs in the basic VCM game:

1. The number of repetitions.

2. The number of participants N.

3. The MPCR m.

The number of repetitions

Repetitions of the classic PGG that involve the same players over a series of rounds typically result in a declining proportion of public contribution, from the one-shot PGG. A common explanation for this regularity is related to unfair treatment of conditional cooperators. During repeated games, conditional cooperators observe that not everyone is giving up as much as they do they tend to reduce the amount they share in the next round. If this process is repeated again and again, then contribution are reduced in each additional repetition. Furthermore, free riders in one round, rarely contribute something in later rounds, even after discovering that others do. The amount contributed to the pool rarely drops to zero when rounds of the game are iterated, because a hardcore of always cooperators is always present.

The number of participants

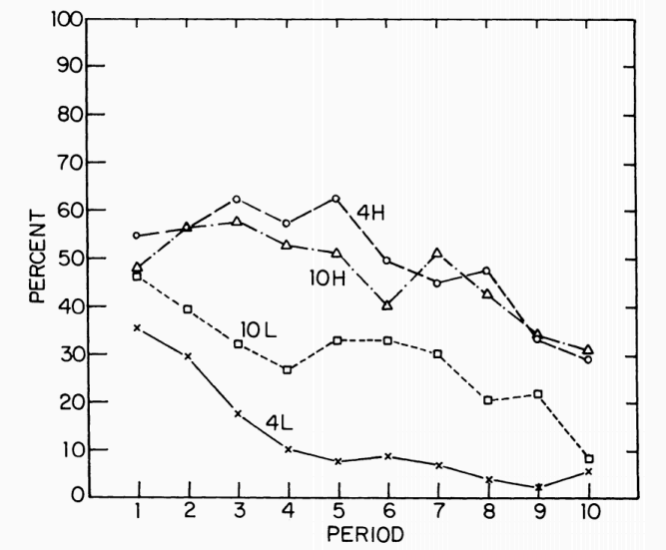
The number of participants have ambiguous effects on the cooperation rates. On the one hand, the number of participants should increase cooperation because it increases the efficiency of cooperating as every token helps more people. On the other hand, a large number of participants can decrease cooperation because it make coordination harder and altruistic motives less salient in a less personal setting. Which force should dominates?

The marginal per capital return

The larger MPCR the more the game induces cooperation, because the less you are deviating from best response by cooperating and the less expensive cooperation is.

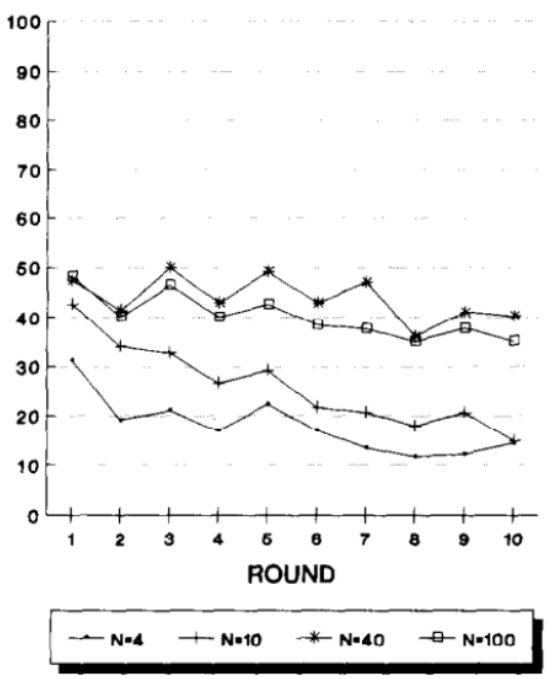
Early research on the effect on cooperation of the number of repetitions, the number of players and the value of the MPCR found that higher MPCR unambiguously induce cooperation. Isaac and Walker, 1988) varied the number of players between 4 and 10, with MPCR between 0.3 (L) and 0.75 (H). Figure 3 reproduce his results. Successive repetition os the PGG reduce cooperation reduces from around 40 percent to less than 10 percent of total tokens with low levels of MPCR (=0.30) while the reduction is significantly lower - from 50 percent to 30 percent of tokens with high levels of MPCR (=.75). The effect of the number of participants was, as expected ambiguous. It reduced cooperation with a lower MPCR and did not seem to matter much with a higher MPCR. Isaac and Walker, 1992 replicated their experiment adding much more players -between 4 and 100, keeping the number of round to 10 and varying the MPCR between 0.3 (L) and 0.75 (H). Figure 4 reproduce their results. On the one hand, with low values of MPCR (=0.30) PGG with fewer players (N=4 and N=10) had less cooperation than those with a larger number of players (N=40 and N=100). On the other hand, with high values of MPCR (0.75) PGG with fewer players had very similar levels of cooperation than those with larger number of players.

Figure 3: Average contribution per round by group size

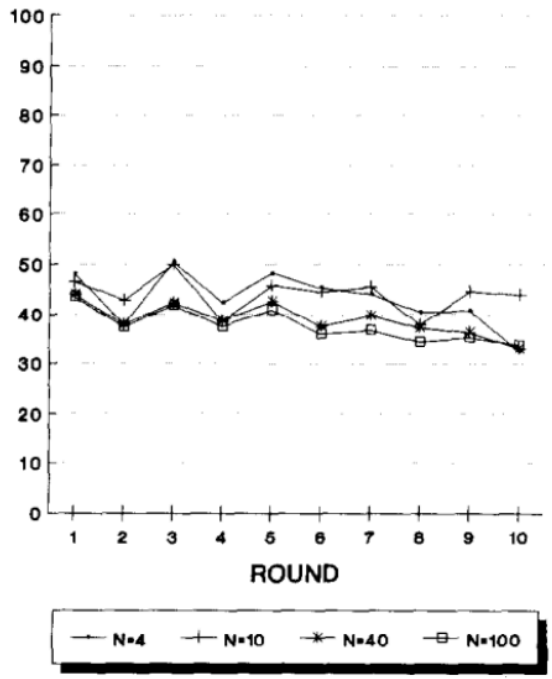


Source: Isaac and Walker (1988)

Figure 4: Average contribution per round by group size



(a) MPCR=0.30



(b) MPCR=0.75

Source: Isaac, Walker and Williams (1992)

2.3 A public good game with institutions

Institutions are humanly-devised rules and arrangements that set constrains and sanctions that shape incentives to behave in a trustworthy (or untrustworthy) manner. They directly affect the incentives for action, therefore, they foster trustworthiness. For example, if I am aware that there that there exists an institution such that I will be severely punished if I cheat in a certain sort of transaction, and if the expected costs of punishment outweigh the expected benefits of cheating, my optimal strategy will be to remain honest. In many situations, I can be considered to be **trustworthy** with regard to this transaction: others who know of the existence of this institutional rule, and of my subjection to it, have good reason to trust me.

Eriksson and Strimling 2012 and Erikson et.al 2013 use a PGG with institutions to identify whether a exogenously imposed institution that regulates behavior through minimum contribution level, monitoring costs an opportunities, and rewards and punishments to successful monitoring and cheating, can increase cooperation among low and high cooperation types. They found that low-cooperation types are less successful than high-cooperation types in building rules -i.e. institutions, even when these types are precisely the ones that need them to generate better societal outcomes.

Consider the introduction of institutions that regulates behavior in our setting. In particular, consider the introduction of:

1. a minimum contribution rule of A units;

2. monitoring, i.e. it allows each agent to monitor a randomly drawn player different than himself at a private cost of $C = 1$ units;

3. punishments, i.e. after checking for compliance, if a player is found cheating, then he is punished with a fine of F units. Punishments are kept by the experimenter so that no other player bears a direct cost or benefit of the punishment; and

4. rewards, i.e. a successful monitor obtains a reward of $R = 3$ units which is taken from the common pot after it has been multiplied, so that rewards redistribute resources to successful monitors.

Equilibrium. Contrary to the *unregulated* PGG that has a unique pure Nash equilibrium with zero contributions, the *regulated* PGGe has a mixed equilibrium where players either attempt to *cheat* by contributing zero, or contribute the lowest acceptable level of A units. To see this, let x_i denote player i's contribution to the common pot and let m_i be the indicator variable of whether agent i invested C units in monitoring another's contribution. A pure strategy in this game is a pair (x_i, m_i) of non-negative integers such that $m_i \leq 1$ and $x_i + Cm_i \leq 10$. From such strategy a compliance indicator variable c_i can be defined by

$$c_i = \begin{cases} 1 & : \text{if } x_i < A \\ 0 & : \text{if } x_i \geq A \end{cases}$$

Payoff to agent i comes from units kept by the agent and from the division of the common pot after multiplication and deduction of rewards, plus any fines and rewards to the player.

Under the standard assumption that $M < N$, only two contribution levels are possible in equilibrium: 0 and A. All positive contributions less than A makes a player a non-complier and put him at risk of fines, so that all contributions between 0 an A are dominated by $x_i = 0$. Conversely, all contributions greater than A makes him a complier and removes the risk of fines, so that all contributions greater than A are dominated by $x_i = A$. Therefore only two strategies need to be analyzed: comply, i.e. $x_i = A$ or non-comply, $x_i = 0$.

Payoffs to a given player can be expressed as:

$$y_i = (10 - Ac_i - Cm_i) + \frac{(MA\sum_j c_j - \sum_j reward_j)}{N} + fine_i + reward_i$$

Let p_i be the probabilities of agent i finding a non-complier (if he monitors) and q_i the probability of being found non-compliant (if cheating). Then the expected fines and rewards to player i will be given by:

$$E[fine_i] = \begin{cases} -Fp_i & : \text{if } c_i = 1 \\ 0 & : \text{if } c_i = 0 \end{cases}$$

$$E[reward_i] = \begin{cases} Rq_i & : \text{if } c_i = 1 \\ 0 & : \text{if } c_i = 0 \end{cases}$$

Notice that, the probability of finding a cheater equals to the frequency of cheating among the other players, so that:

$$p = \frac{\sum_{j \neq i} c_j}{N - 1}$$

and that, the probability of being found cheating equals to the frequency of monitoring among other agents:

$$q = \frac{\sum_{j \neq i} m_j}{N - 1}$$

Equilibrium behavior of player i is described by the following conditions:

$$p - \frac{C}{R(1 - 1/N)} = \begin{cases} < 0 & \to m_i = 1 & i \text{ will monitor} \\ = 0 & \to 0 \leq m_i \leq 1 & i \text{ will monitor} \\ > 0 & \to m_i = 0 & i \text{ will not monitor} \end{cases}$$

$$q - \frac{A(1 - M/N)}{F + R/N)} = \begin{cases} < 0 & \to c_i = 1 & i \text{ will cheat} \\ = 0 & \to 0 \leq c_i \leq 1 & i \text{ will cheat} \\ > 0 & \to c_i = 0 & i \text{ will not cheat} \end{cases}$$

Therefore, as long as $\frac{C}{R(1-1/N)} < 1$ and $\frac{A(1-M/N)}{(F+R/N)} < 1$, then the game has a unique symmetric mixed equilibrium where every player monitor with probability $\frac{C}{R(1-1/N)}$ and cheats with probability $\frac{A(1-M/N)}{F+R/N)}$ and receives expected payoff:

$$10 + A\left[(M-1)\left(1 - \frac{C}{R(1-1/N)}\right) - C\left(1 + \frac{F}{R(1-1/N)}\right)\left(\frac{1 - M/N}{F + R/N}\right)\right] \tag{1}$$

The expected payoff in the symmetric equilibrium is obtain replacing $E[c_i] = 1 - \frac{C}{R(1-1/N}$; $E[m_i] = \frac{A(1-M/N)}{F+R/N}$; $E[\sum_j c_j] = NE[c_i]$; and $E[fine_i] = FE[c_i]E[m_i]$ in the payoff equation. Notice that rewards are just redistribution among agents so that in equilibrium they cancel out.

Given that $N = 4$, $M = 2$, $C = 1$, and $R = 3$; the equilibrium condition simplifies to

2.4 Regulated public good game with voting

Their second experiment impose an additional institution that gives participants the possibility to change the initial rules: voting. After every two rounds, agents get to vote on whether to maintain, reduce or increase the minimum contribution value. They find that, if they are imposed *ex-ante*, even low-trust types are capable of securing and maintaining strong and efficient institutions and attain better social outcomes.

Notice that the equilibrium payoff is increasing in both A and F. Therefore, a rational agent facing the opportunity to change the regulating institution should vote for increasing both, A and F, at each opportunity.

3 Experiment design

3.1 Treatments

We plan to conduct 20 rounds of PG games under different rules with 480 individuals grouped in teams of 4 people. Experiments will be conducted in 4 batches of 120 individuals of which half need to be non-indigenous and half need be indigenous. To isolate the effect of sex/gender discrimination we will divide mean and woman into separate groups.

During the first part of the game, 10 successive rounds of the game will be played according to the following set of rules:

- **Before** assigning individuals to teams, we ask individuals: 1) to elicit individual's contribution preferences in a linear one-shot PGG; and 2) to make contribution choices in a linear PGG.

- Based on their contribution choices and ethnicity (as defined by the registration questionnaire), we assigned individuals to teams. Table 1 explains the sorting of individuals into teams according to their cooperation ranking and ethnicity. Then, we conduct two PGG without revealing any information to the team members, i.e. without revealing neither their type nor their ethnicity.

- Ethnicity of the teams mates is revealed. We revealed ethnicity by matching each subject to the most common surnames of non-indigenous and indigenous origin as described by Bolivia Genealogical Records (Table 2 presents the 12 most common surnames of indigenous and non-indigenous origin we plan to use) and to photograph of indigenous and non-indigenous youth used in previous exercises (See Hernani-Limarino, 2006 for further details) Figure 5

Table 1: Pairing of participants according to trust types

Trust type	Group No					Group No				
Low	1	i_1	i_2	i_3	i_4	2	n_4	n_3	n_2	n_1
	3	i_5	i_6	i_7	n_8	4	n_7	n_6	n_5	i_8
	5	i_9	i_{10}	n_{12}	n_{11}	6	n_{10}	n_9	i_{11}	i_{12}
	7	i_{16}	n_{15}	n_{14}	n_{13}	8	n_{13}	i_{14}	i_{15}	i_{16}
	9	n_{20}	n_{19}	n_{18}	n_{17}	10	i_{17}	i_{18}	i_{19}	i_{20}
Medium	11	i	i	i	i	12	n	n	n	n
	13	i	i	i	n	14	n	n	n	i
	15	i	i	n	n	16	n	n	i	i
	17	i	n	n	n	18	n	i	i	i
	19	n	n	n	n	20	i	i	i	i
High	21	i	i	i	i	22	n	n	n	n
	23	i	i	i	n	24	n	n	n	i
	25	i	i	n	n	26	n	n	i	i
	27	i	n	n	n	28	n	i	i	i
	29	n	n	n	n	30	i	i	i	i

present an example of a screen shoot with team mates for a male player of non-indigenous ascent (upper line) and for a female player of indigenous ascent. After ethnicity is revealed, we conduct two additional PGG two analyze the effect of ethnic fractionalization on cooperation.

- A *weak* regulating institution is imposed -fixing a minimum contribution level of $A = 1$ units and a fine for cheating of $F = 2$ units. Two additional PGG are conducted.

- A *strong* regulating institution is imposed -fixing a minimum contribution level of $A = 8$ units and a fine for cheating of $F = 9$ units. Two additional PGG are conducted.

During the second part of the game, 10 successive rounds of the game will be played according to the following set of rules:

- We allow people to vote on a minimum contribution level A and a fine for cheating F - beginning at minimum contribution level $A = 1$ and fine for cheating $F = 2$. Voting will be allowed every two rounds. Ten rounds of PGG are conducted.

Each round of games is design to answer a particular set of questions. Table 3 present a summary of interventions per-round. This section describes them in more detail.

Table 2: Most common surnames in Bolivia by indigenous origin

Indigenous				Non-indigenous			
Rank	Surname	Incidence	Frequency	Rank	Surname	Incidence	Frequency
1	Mamani	331,923	1:32	2	Flores	224,761	1:47
3	Quispe	210,093	1:51	5	Vargas	138,458	1:77
4	Choque	139,173	1:76	7	Rodriguez	121,503	1:87
6	Condori	126,205	1:84	8	Rojas	111,606	1:95
21	Apaza	58,999	1:180	9	Gutierrez	110,616	1:96
22	Huanca	58,278	1:182	10	Lopez	102,486	1:104
30	Colque	48,436	1:219	11	Fernandez	93,816	1:113
36	Villca	43,593	1:244	12	Gonzales	80,685	1:132
41	Ticona	39,850	1:266	13	Garcia	77,131	1:138
43	Chambi	38,812	1:274	14	Cruz	75,450	1:141
49	Nina	36,369	1:292	15	Perez	72,529	1:146
64	Poma	29,548	1:359	16	Mendoza	66,470	1:160

Source: https://forebears.io/boliviasurnames

Figure 5: Example of male and female assigned ethnicities

(a) Player's name and surname

(b) Julio Flores

(c) Andres Mamani

(d) Juan Quispe

(e) Julia Vargas

(f) Andrea Rodriguez

(g) Ana Choque

(h) Player's name and surname

Note: Permission was granted to use pictures and change names.

Table 3: Baseline game and interventions across rounds

Round	Type	Ethnicity	Regulation	Voting
1	unknown	blind	no	no
2	unknown	blind	no	no
3	unrevealed	blind	no	no
4	unrevealed	blind	no	no
5	unrevealed	revealed	no	no
6	unrevealed	revealed	no	no
7	unrevealed	revealed	A=1, F=2	no
8	unrevealed	revealed	A=1, F=2	no
9	unrevealed	revealed	A=8, F=9	no
10	unrevealed	revealed	A=8, F=9	no
11	unrevealed	revealed	$A_0 = 1, F_0 = 2$	no
12	unrevealed	revealed	$A_0 = 1, F_0 = 2$	yes
13	unrevealed	revealed	$A_1 = A_0 + v, F_1 = F_1 + v$	no
14	unrevealed	revealed	$A_1 = A_0 + v, F_1 = F_1 + v$	yes
15	unrevealed	revealed	$A_2 = A_1 + v, F_2 = F_2 + v$	no
16	unrevealed	revealed	$A_2 = A_1 + v, F_2 = F_2 + v$	yes
17	unrevealed	revealed	$A_3 = A_2 + v, F_3 = F_3 + v$	no
18	unrevealed	revealed	$A_3 = A_2 + v, F_3 = F_3 + v$	yes
19	unrevealed	revealed	$A_4 = A_3 + v, F_4 = F_4 + v$	no
20	unrevealed	revealed	$A_4 = A_3 + v, F_4 = F_4 + v$	yes

3.1.1 Identifying types

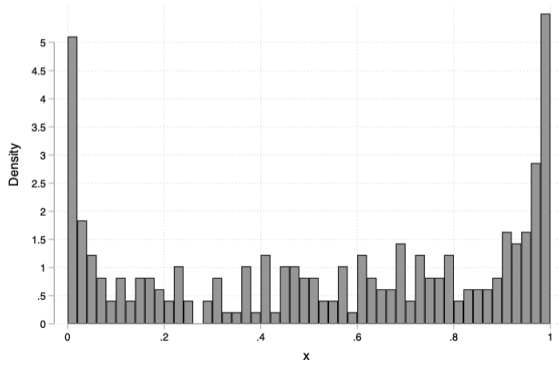
Before assigning individuals to teams, we ask individuals: 1) to elicit individual's contribution preferences in a linear one-shot PGG, the so called **P**-experiment; and 2) to make contribution choices in a linear PGG, the so called **C**-experiment. Participants will play both games in a random sequence, i.e. half participants will first go through the preference elicitation experiment before making their contribution choices (the P-C sessions), and half participants will have the reverse order to control for possible sequence effects (the C-P sessions).

The **P**-experiment will reveal the conditional contribution, i.e. individuals has to indicate how much he wants to contribute to the PG for each rounded average contribution level of other group members. Specifically, participants are shown a contribution table of 11 possible values of the average contribution of the other group members (from 0 to 10) and were asked to state their corresponding contribution for each of the 11 possibilities. Knowledge of individuals' best replies conditional on others' contributions will allow us to identify different *conditional types* such us: 1) *free riders*, those who do not contribute independent of the average contributions of other team members; *unconditional cooperators*, those who contributes all tokens independent of the average contributions of other team members; *perfect conditional cooperators*, those who contribute exactly the amount others team members contribute; *conditional cooperators*, those whose contribution increase as the average contribution of other team members increase; and *triangle contributors* (or *hump-shaped contributions*), those whose contribution increase as the average contribution of other team members increase up to some maximum and decrease thereafter. The experiment is only played once, because we wanted to elicit subjects' preferences, without intermingling preferences with strategic considerations.

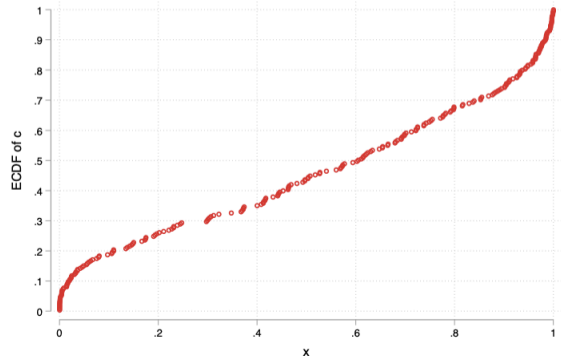
The **C**-experiment will reveal the unconditional contribution given beliefs on the average contribution of other team members, i.e. the individuals' unconditional propensity to cooperate. Figure 6a presents simulated data to illustrate how the density and distribution of the unconditional contributions will allow us to: 1) rank individuals according to their unconditional type

(Figure 6b); 2) Split the sample into low- and high-cooperation types (Figure 6c); and 3) Further split the low and high cooperation sample between indigenous and non-indigenous (Figure 6d).

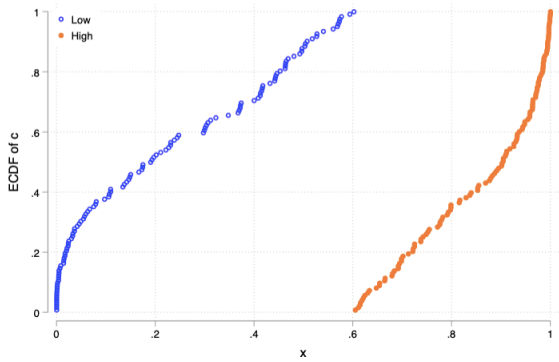
Figure 6: Density and distribution of cooperation (Simulated)



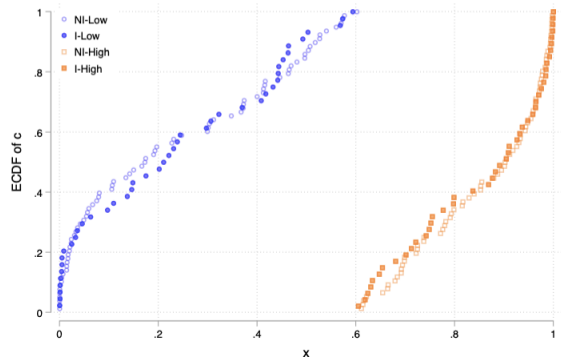
(a) Histogram of contributions



(b) Cumulative distribution of contributions



(c) Histogram of contributions



(d) Cumulative distribution of contributions

Source: Simulated data

How does unconditional trust varies with sociodemographic characteristics? Are there differences between *revealed/experimental* trust and *self-declared/survey* trust? To understand the variation of unconditional propensities to cooperate, we will examine the predictive value of:

- individual predetermined characteristics including age, sex, place of birth, household type, and education background (years of schooling and type of institution);
- income class (estimated though a household asset index),
- political views including left/right compass, preferences for democracy, and satisfaction with incumbent national/regional/local governments, among others;

- elicit trust questions, interpersonal and in the following institutions: armed forces, police, the church, national congress, national/regional/local government, judiciary branch, political parties, electoral branch.

3.1.2 Baseline

Based on their contribution choices and ethnicity, we assigned individuals to teams. We conduct two PGG without revealing any information to the team members, i.e. without revealing neither type nor ethnicity of their team members. No random reshuffled of team mates is applied or announced.

Notice that comparisons of means and distributions between the four groups: low- and high-cooperation types and non-indigenous and indigenous groups will reveal the within- and between-group cooperation gaps. In other words, the cooperation gaps for non-indigenous and indigenous groups by type will be given by:

$$E[x_{ijk}|j = H, k = NI] - E[x_{ijk}|j = L, k = NI]$$
$$E[x_{ijk}|j = H, k = I] - E[x_{ijk}|j = L, k = I]$$

and the cooperation gaps for low- and high- cooperation types by ethnic group will be given by:

$$E[x_{ijk}|j = H, k = NI] - E[x_{ijk}|j = H, k = I]$$
$$E[x_{ijk}|j = L, k = NI] - E[x_{ijk}|j = L, k = I]$$

3.1.3 Does fragmentation matter?

After ethnicity of the team-mates is revealed by photographs and last-names that more closely resembles their ethnic group, individuals cooperation will depend not only on their cooperation type but also on their ethnic composition of their team. The ethnic composition of their team should change behavior if 1) there are preferences for discrimination, i.e. team mates ethnicity change the individual's preferences toward cooperation, i.e. ethnicity triggers in-group and out-group bias; and/or 2) individuals update their beliefs about the cooperation propensity of their team-mates based on their ethnicity.

Notice that, there will be five different possible compositions ("interventions") according to the distribution of ethnicity of participants:

1. a ethnic homogenous team with all indigenous team members, (i, i, i, i), i.e. a non-fragmented indigenous team;

2. a ethnic heterogenous team with a clear indigenous majority, (i, i, i, n), i.e. a fragmented indigenous majority team;

3. a ethnic heterogenous with no majority of any ethnicity, (i, i, n, n), i.e. a ethnically polarized team;

4. heterogenous with a clear non-indigenous majority, (n, n, n, i), i.e. a fragmented non-indigenous majority team; and

5. homogenous with all non-indigenous team members, (n, n, n, n), a non-fragmented non-indigenous team.

Team's ethnic composition corresponds to ethnic fractionalization index of zero in ethnic homogenous teams (cases 1 and 5); .375 in ethnic heterogeneous teams with an ethnic majority (cases 2 and 4); and .50 in ethnic heterogeneous teams with no clear majority (case 3)[4]. Therefore, we would expect to observe a monotonic decrease in cooperation as we move from ethnic homogenous teams to ethnic heterogenous teams to ethnically polarized teams, for all cooperation types, for all ethnic groups, i.e

$$E[x_{ijk}|j = J, k = K, f = 0] > E[x_{ijk}|j = J, k = K, f = 0.375] > E[x_{ijk}|j = J, k = K, f = 0.50] \quad \text{for } j \in \{L, H\}, k \in \{NI, I\}$$

How big are the changes in cooperation outcomes induce by intra- and inter-ethnic group identities or alienations? To answer this question we can make within-group comparisons *before* and *after* the revelation of ethnic identities. Our intuition is that ethnic heterogeneous teams will exhibit less cooperation in ethnically diverse teams after ethnicity is revealed; but ethnically homogenous teams exhibit no significant changes, i.e.

$$E[x_{ijk}|j = \dot{\jmath}, k = \dot{k}, f = \cdot] - E[x_{ijk}|j = \dot{\jmath}, k = \dot{k}, f > 0] > 0 \quad \text{for } \dot{\jmath} \in \{L, H\}, \dot{k} \in \{NI, I\}$$
$$E[x_{ijk}|j = \dot{\jmath}, k = \dot{k}, f = \cdot] - E[x_{ijk}|j = \dot{\jmath}, k = \dot{k}, f = 0] < 0 \quad \text{for } \dot{\jmath} \in \{L, H\}, \dot{k} \in \{NI, I\}$$

3.1.4 Weak vs. strong institutions

Can institutions induce cooperation among low-cooperation types in fragmented teams? Until know, we were interested in identifying cooperation gaps between low- and high-cooperation types, and identifying cooperation premiums/penalties induced by the teams' ethnic homogeneity/heterogeneity. In the last four rounds of games we impose two fixed regulating institutions: a *weak* institution - defined by a *low* acceptable minimum contribution rule, $A = 1$, and a small fine, $F = 2$; and a *strong* institution - defined by a *high* acceptable minimum contribution rule, $A = 8$, and a *high* fine, $F = 9$. To account for potential sequence effects, participants will play both games in a random sequence, i.e. half participants will first go through the *weak* institution

[4]The ethnic fractionalization index measure the probability that two randomly drawn individuals within a country are not from the same ethnic group. More formally, if s_k represents the share of the population of ethnic group k in a society with K ethnic groups, the fractionalization index will be given by:

$$Fract = 1 - \sum_{k=1}^{K} s_k^2$$

game before playing the *strong*institution game (the W-S sessions), and half participants will have the reverse order (the S-W sessions). Again, individuals play two different PGG with the same team mates but with ethnic markers (picture and last-names) reshuffled in each pair of rounds.

The introduction of regulating institutions allow us to identify the extent to which they can (or can not) induce cooperation and close gaps between low- and high-cooperation types, and overcome penalties induced by the teams' ethnic heterogeneity. To see the cooperation gains from *strong* to *weak* institutions; and from *weak* to no institutions at all, we can compare the within group outcomes, i.e.

$$\begin{aligned} E[x^r_{ijk}|j=\dot{\jmath}, k=\dot{k}, f=\dot{f}, r=S] > \\ E[x^r_{ijk}|j=\dot{\jmath}, k=\dot{k}, f=\dot{f}, r=W] > \\ E[x^r_{ijk}|j=\dot{\jmath}, k=\dot{k}, f=\dot{f}, r=\cdot] \\ \text{for } \dot{\jmath} \in \{L,H\}, \dot{k} \in \{NI, I\}, \dot{f} \in \{0, 0.375, 0.50\}, \end{aligned}$$

Will institutions be enough to induce cooperation of low-cooperation types in ethnically fragmented teams? Our intuition is that under a *weak* institution, low cooperation types in ethnically diverse teams will still achieve less efficient outcomes than their high cooperation types in ethnically homogenous teams. However, after a *strong* institution is imposed, even low-cooperation types in ethnically heterogenous teams will produce social efficient outcomes.

3.1.5 Voting

Can *strong* institutions be chosen -and maintained, by people instead of being imposed? Can they be chosen -and maintained, even by low-cooperation types in ethnic heterogenous teams? If a weak institution is not fixed, but free to evolve through voting on changes in minimum contribution A and fines F, How quickly will different types at different teams will achieve a Pareto improvement -if they ever achieve one?. We expect to observe monotonic increasing functions of minimum contributions and fines over rounds; with low-types in ethnic heterogenous teams doing worse than high-types in ethnic homogenous teams at developing strong institutions.

3.2 Implementation

We plan to conduct a computerized lab experiments allow researchers to conduct interactive games with much greater ease and efficiency. We decided to avoid personal contact of field or lab-in-the-field settings because we do not want participants to identify or alienate to other participants before or during the experiment. We are currently negotiating with the *Universidad Catolica Boliviana* and *Universidad Mayor de San Andres* the possibility of using their lab facilities in order to conduct the experiment.

3.2.1 Sampling strategy and subject recruiting

We plan to collect information of the outcomes of the PG game for 480 participants playing 20 rounds of the game under different rules generating a total sample of 9,600 data points. Information

will be collected in four batches of 120 people. An important design feature of our game is that exactly half of our sample in each batch will be non-indigenous and half will be indigenous. Another important design feature is that we will divide mean and woman into 2 different batch of groups. We will arbitrarily restrict the set of participants to those who are 18 to 23 years old.

Recruiting will be conducted using random promotion to all senior high school students in 2019 and first year students in 2020 in the cities of La Paz and El Alto. The main disadvantage of our sampling strategy is that it exclude all students who are not enrolled in school and that it is more likely to exclude students not planning to enrolled in Universities. Interested participants would require to fill up a web registration and complete a small questionnaire about basic demographic characteristics, ethnic markers, subjective inter-personal trust and trust in institutions and social capital. Registration will allow us to guarantee an equal number of indigenous and non indigenous participants. The main incentive for participation should be the five thousand dollars that would be distributed during the sessions.

3.2.2 Power calculations

To be completed.

4 Policy implications

Nothing brings people together more than talking about how far apart they are. Many argue that, since the government of Evo Morales took power in Bolivia in 2006, there has been an increase in inter-group alienation and intra-group cohesion, polarizing the country between those who back up the reforms (and derived gains from it) and those who do not. Whether the new constitution (that gives Bolivia a status of a plurinational state instead of a unitary republic), new legislation that create representation quotas for indigenous nations in the parlament, or anti-discrimination laws (with harsh penalties to a diverse set of actions now regulated as discriminatory) are effectively benefiting a majority of the indigenous populations (who were and still are relatively unskilled and poor) and incorporating them into the economy and polity are hotly debated.

Under this scenario it is important to generate evidence on whether ethnic fragmentation is real, inter-ethnic trust is much lower than intra-ethnic trust; on whether exogenously imposed institutions can solve the collective action problem or they can evolve with time and sequential and successive interactions.

A Questionarie

- What is your birthplace?
- What is the birthplace of your parents?
  1. Father.....
  2. Mother.....
- What is your mother tongue?
- What is the mother tongue of your parents?
  1. Father.....
  2. Mother.....
- With which of the following ethnic groups do you identify yourself?
- To which of the following ethnic groups do you think your parents identify with?
  1. Father.....
  2. Mother.....
- Do you speak any indigenous languages (Aymara/Quechua/Guarani/Other indigenous language)?
- Do/did your parents speak any indigenous language?
  1. Father.....
  2. Mother.....
- Do/did your parents wear any indigenous costume?
  1. Father.....
  2. Mother.....
- Generally speaking, would you say that you can trust most people, or that you can never be too careful in dealing with others? (WAIT FOR ANSWER AND TICK ONLY ONE)

One can trust most people	1
One can never be too careful in dealing with others	2
DNK/DNA	0

- Generally speaking, do you think most people will take advantage of you if they got the chance, or would they try to be fair?

Most people will try to make advantage of you	1
Most people would try to be fair	2
DNK/DNA	0

- Generally speaking, would you say that most of the time people try to be helpful, or that they are mostly looking out for themselves?

People try to be helpful	1
People are mostly looking for themselves	2
DNK/DNA	0

- (SHOW CARD) Please look at this card and tell me how much trust you have in each of the following groups/institutions. Would you say you have a lot (1), some (2), a little (3) or no trust in(4) ...? (READ EACH ITEM AND TICK ONE FOR EACH ONE)

	LOT	SOME	LITTLE	NO	DNK	DNA
A Family	1	2	3	4	9	0
B Friends	1	2	3	4	9	0
C People I work with	1	2	3	4	9	0
D People I study with	1	2	3	4	9	0
E Radio	1	2	3	4	9	0
F Newspaper	1	2	3	4	9	0
G Social networks	1	2	3	4	9	0
H Internet	1	2	3	4	9	0
I Television	1	2	3	4	9	0
J Others	1	2	3	4	9	0
K Anything	1	2	3	4	9	0

- (SHOW CARD) Please look at this card and tell me how much trust you have in each of the following groups/institutions. Would you say you have a lot (1), some (2), a little (3) or no trust in(4) ...? (READ EACH ITEM AND TICK ONE FOR EACH ONE)

	LOT	SOME	LITTLE	NO	DNK	DNA
A Armed forces	1	2	3	4	9	0
B Police	1	2	3	4	9	0
C The Church	1	2	3	4	9	0
D National Congress/Parliament	1	2	3	4	9	0
E The National Government	1	2	3	4	9	0
F Judicial Branch	1	2	3	4	9	0
G Political parties	1	2	3	4	9	0
H Electoral institution	1	2	3	4	9	0
I Teachers	1	2	3	4	9	0
J Doctors	1	2	3	4	9	0
K Unions	1	2	3	4	9	0
L Entrepreneurs	1	2	3	4	9	0

- In politics, people normally speak of "left" and "right". On a scale where 0 is left and 10 is right, where would you place yourself? (WAIT FOR ANSWER AND WRITE DOWN ONLY ONE ANSWER)

LEFT 00 01 02 03 04 05 06 07 08 09 10 RIGHT

- (SHOW CARD) In every country there are differences between social groups. £In your opinion how strong is the conflict between rich and poor, is it very strong, strong, weak or very weak?.(READ EACH ITEM AND TICK ONE FOR EAECH ONE)

	VS	S	W	VW	DN/NA
A Rich and poor	1	2	3	4	0
B Employees and employers	1	2	3	4	0
C Entrepreneurs and workers	1	2	3	4	0
D Young people and society	1	2	3	4	0
E Old people and Society	1	2	3	4	0
F Men and woman	1	2	3	4	0
G Indigenous and non-indigenous	1	2	3	4	0
H Nationals and foreigners	1	2	3	4	0
I Left wing and right wing	1	2	3	4	0

B Instructions for the experiment

This is a translation of the original Spanish version.

Instructions for the P-Experiment You are now taking part in an experiment. If you read the following instructions carefully, you can - depending on your decisions - earn some more money, which you can keep in any case. The entire amount of money which you earned with your decisions will be added up and paid to you in cash at the end of the experiment. These instructions are solely for your private information. You are not allowed to communicate during the experiment. If you have any questions, please ask us. Violation of this rule will lead to the exclusion from the experiment and all payments. If you have questions, please raise your hand. A member of the experimenter team will come to you and answer them in private. We will not speak of *Bolivianos* during the experiment, but rather of points. Your whole income will first be calculated in points. At the end of the experiment, the total amount of points you earned will be converted to *Bolivianos* at the following rate:

1 point = 1.50 *Bolivianos*

All participants will be divided in groups of four members. Except for us - the experimenters - no one knows who is in which group. We describe the exact experiment process below. The decision situation You will learn how the experiment will be conducted later. We first introduce you to the basic decision situation. You will find control questions at the end of the description of the decision situation that help you to understand the decision situation. You will be a member of a group consisting of 4 people. Each group member has to decide on the allocation of 10 points. You can put these 10 points into your private account or you can invest them fully or partially into a project. Each point you do not invest into the project, will automatically remain in your private account.

Your income from the private account:

You will earn one point for each point you put into your private account. For example, if you put 10 points into your private account (and therefore do not invest into the project) your income will amount to exactly 10 points out of your private account. If you put 6 points into your private account, your income from this account will be 6 points. No one except you earns something from your private account.

Your income from the project:

Each group member will profit equally from the amount you invest into the project. On the other hand, you will also get a payoff from the other group members' investments. The income for each group member will be determined as follows: Income from the project = sum of all contributions Œ 0.4 If, for example, the sum of all contributions to the project is 30 points, then you and the other members of your group each earn 30 Œ 0.4 = 12 points out of the project. If four members of the group contribute a total of 10 points to the project, you and the other members of your group each earn 10 Œ 0.4 = 4 points.

Total income:

Your total income is the sum of your income from **your private account** and that from **the project**: Income from your private account (= 10 - contribution to the project) + Income from the project (= 0.4 Œ sum of all contributions to the project) Total income

B.1 Control questions

: Please answer the following control questions. They will help you to gain an understanding of the calculation of your income, which varies with your decision about how you distribute your 10 points. Please answer all the questions and write down your calculations.

1. Each group member has 10 points. Assume that none of the four group members (including you) contributes anything to the project.
   - What will your total income be? .....
   - What will the total income of the other group members be? .....
2. Each group member has 10 points. You invest 10 points in the project. Each of the other three members of the group also contributes 10 points to the project.
   - What will your total income be? .....
   - What will the total income of the other group members be? .....
3. Each group member has 10 points. The other 3 members contribute a total of 10 points to the project.
   - What will your total income be, if you - in addition to the 15 points - invest 0 points into the project?
     Your Income .....
   - What will your total income be, if you - in addition to the 15 points - invest 5 points into the project?
     Your Income .....
   - What will your total income be, if you - in addition to the 15 points - invest 8 points into the project?
     Your Income .....
4. Each group member has 20 points at his or her disposal. Assume that you invest 8 points to the project.
   - What is your total income if the other group members - in addition to your 8 points - contribute another 7 points to the project?
     Your Income .....
   - What is your total income if the other group members - in addition to your 8 points - contribute another 12 points to the project?
     Your Income .....
   - What is your income if the other group members - in addition to your 8 points - contribute another 22 points to the project?
     Your Income .....

B.2 The Experiment

The experiment includes the decision situation just described to you. You will be paid at the end of the experiment based on the decisions you make in this experiment. The experiment will only be conducted once. As you know, you will have 20 points at your disposal. You can put them into a private account or you can invest them into a project. Each subject has to make two types of decisions in this experiment, which we will refer to below as the "unconditional contribution" and "contribution table". You decide how many of the 10 points you want to invest into the project in the unconditional contribution. Please indicate your contribution in the following computer screen:

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