

# What drives the household's pro-environmental behavior? Differences in what people say and do.\*

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## Abstract

Promoting changes in behavior related to natural resources and environmental concerns requires to understand the factors associated. In a context of common pool resources, cooperation is required to overcome social dilemmas, but the understanding of the factors that underlie the behavior is an urgent task. There is considerable evidence on what move the individuals to perform pro-environmental actions. However, since the information about private behaviors is self-reported, produces challenges to analyze in a causal fashion. This paper intends to analyze what intrinsic and extrinsic motivations could explain pro-environmental behaviors. I collect information of households in eight small-urban villages in Colombia and combine it with information from a previous randomized field experiment conducted in these villages. With this data set, there is self-declared behaviors and objective measures of water consumption. I use a propensity score matching to analyze how the motivations affects both. The heterogeneous findings show a contradiction between what the households affirm that they are doing where they are asked and what they are actually doing. Moreover, the anticipated feelings of guilt and anticipated feelings of pride are important drivers to explain pro-environmental behaviors in self-declared behaviors. While the perceived control of behavior and monetary incentives in the observable behavior.

*Keywords:* pro-environmental behavior, motivations, water consumption, propensity score matching

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# 1 Introduction

Nowadays, improve a responsible behaviors in the use of natural resources or in the quality of the environment are urgent tasks. Air pollution, water depletion, and loss of natural forest are becoming more threatening to the sustainability of societies. These situation are characterized by large-scale social dilemmas, that arise when the individuals interests conflict with the collective (Kollock, 1998); ending in a depletion of the resource associated, a tragedy of the commons in the sense of Hardin (1968). Overcome social dilemmas requires cooperation, but the emergence of this behavior is mediated by different motivations. According to , a pro-environmental behavior is simply mean a behavior that consciously seeks to minimize the negative impact of one's actions on the natural and human world. These actions are defining as a voluntary contribution to public's goods because of their low cost of performing them and their not-excludable benefits for the community. A broad part of literature study what drivers influences this behavior and how it is produced, however there are no definitive answers. This paper analyzes the motivations the could influences the decision of the households to perform pro-environmental behaviors. Here I am interested in which and to what extent these motivations underlie the decision-making process.

To do this, I conducted a survey to 371 households in eight small-urban villages in Colombia collecting information about the frequency and the rating of a set of motivations to perform three pro-environmental private sphere actions. For instance, water and energy savings and recycle. With this information, I analyze the effects on two outcomes: self-declare performance and observed pro-environmental behaviors. There are two sets of motivations. i) Intrinsic drivers such as perceived control of behavior, anticipated guilt, and monetary incentive. ii) Extrinsic drivers such as anticipated embarrassment, anticipated pride, valuation of social norms from others, trust in others and in local institutions, and inter-dependency. To analyze the effect of motivations on pro-environmental behaviors there are certain econometric challenges. Due to problem of observability and a lack of exogenous variation, empirical research in the field often proved unable to determine these effects in a causal way. First, the data comes from a survey, hence any model face self-selection problem. Second, the lack of exogenous variation produce correlations instead of causal estimations.

I address these problems using a randomize field experiment conducted on these villages, previous to this survey. Households were exposed to an information normative campaign. They receive messages that promotes water conservation using social comparisons of consumption between the treated and their neighbors of the same socioeconomic level. From the eight villages, six were partially treated (25%, 50% and 75% of the households) and two were controls with no messages. There were 3401 households in the sample, 129 receive the messages, 1489 are neighbors of the treated but with no message (indirectly exposed), and 489 in the control group. In this paper, I combine the sample of the survey with the experimental data. Using propensity score matching to

compare how the motivations affect the response of the treated households.

I find that the effects of motivations on the level of pro-environmental behavior in a traditional approach produces results according to the literature. Negative effects of the perceived control of behavior and the value of monetary payment to perform. Positive effects of anticipated feelings of guilt and embarrassment, and anticipated feelings of pride. The valuation of what other think about not perform PEB is important, both in closest people and neighbors. Finally the intention of behavior is positive and significant. However, when I compared the results with an observed behavior (water consumption), the effects are significant only for the anticipated feelings of guilt, and pride, and for the social norm from closest people. In the last two motivations the sign of the effects are in the opposite direction of the self-declared PEB. This differences describes the bias in the using of surveys. The households could feel the need of censoring when they are asked for private sphere actions. The propensity score matching with the previous randomize intervention show, in the case of the self-declared PEB, that the anticipated feelings of guilt and pride are important drivers to explain the decision of perform in the treated households. In the observable PEB (change in water consumption), the perceived control of behavior and the displacement of the monetary incentives appear significant and according to the literature.

We contribute to the literature providing empirical evidence of incentives and motivation that drives the household's pro-environmental behavior. I extended in the social psychology and economics literature, in particular, intrinsic motivations and collective behavior in social dilemmas. Previous findings about motivation and pro-environmental behaviors are based on correlations and self-declare information.

There are two theoretical frameworks widely used in social psychology. First, the Theory of planned behavior (TPB) ([Ajzen, 1985, 1991](#)). The focus of this framework is the intention to perform a behavior. The intention is determined by attitudes, subjective norms and the perceived control of behavior. The attitudes are defined as the individual's evaluation of performing a behavior based on a rational choice. The subjective norms are related to the perception of the social influences, and the perceived control of behavior with the ability (how easy or difficult) is to perform the behavior. Emotions also play an important role as predictors of behaviors, in particular anticipated guilt and embarrassment ([De Miranda Coelho et al., 2016](#)).

The second is the Norm-Activation (NAT) it includes moral and altruistic considerations. Here an altruistic decision is a behavior where individual leaves its interests for the reach of a collective goal. A pro-environmental action is an altruistic action because the households abandon their benefits for the benefit of all. In this context, reduce the own consumption of water, leaves more available for others or for the ecosystem. Here moral considerations appear since compromise in a pro-environmental behavior is determined in the extent of people feel a personal obligation to act and happens through social interaction ([Schwartz, 1977](#); [Stern, 2000](#)).

Table 1: Distribution of the sample and total population

Village	Total households (#)	Households in the sample	Proportion
1	646	73	11.3%
2	571	57	10%
3	277	31	11.2%
4	222	26	11.7%
5	261	27	10.3%
6	680	76	11.2%
7	388	41	10.6%
8	356	40	11.2%
Total	3,401	371	10.9%

Note: This table describes the total number of households in the villages with the number of households on the survey’s sample. There are eight villages with 3,401 households (Column 1). In column 3 is the proportion of households interviewed. In the column 4 is the number of households in the sample per village.

This paper is presented as follows, the second section introduces the sampling and data collection process, also the previous randomize intervention. In the third section we describe the empirical approach. The fourth section presents the results, followed for a section of final conclusions.

## 2 Data

### 2.1 Survey

We conduct a survey in in eight villages located in the center of Colombia. A collection of 371 households were randomly selected and interviewed. The survey was conducted with the aid of the local government and it was a personal interview to the head of the household (HHH) or the person in charge in her/his absence. The sampling was systematic at geographical level, we determine a sampling interval  $k = (N_m/n_m)$ , where N is the total number of households in the  $m^{th}$  village and n was the minimum sample. Next, we visit every  $k^{th}$  households in each block. The distribution of the sample related to the population is in the Table 1

The questionnaire include information about demographic, social, economics and housing variables. Also, we include a set of measures of intrinsic motivations related to pro-environmental actions, and measures of level of trust in neighbors and local institutions. Using the framework of TPB and NAT (Kaiser et al., 2005; Kaiser, 2006), we define three pro-environmental behaviors (PEB) that households perform at private. The PEB’s were defined and adjusted to the characteristics of the villages in study: small-urban communities mainly with a strong agricultural production dependence. The statements of behaviors were: a) *I unplug the electric appliances when not in use*, b) *I reuse plastic bottles and bags*, and c) *I turn off the faucet while brushing my teeth*. Each

behavior were rated using a Likert scale of frequency.

We explore three groups motivations: i) Intrinsic, including perceived control of behavior (PCB), anticipated guilt (GUI), and monetary payment displacement (MON); ii) extrinsic or social influences, including anticipated embarrassment (EMB), anticipated pride (PRI), valuation of social norms from closest people and from neighbors (SNC/SNN); and iii) trust in others and in local institution. Next I present the questions and the set of answers:

Perceived control of behavior (PCB): *Each of the three behaviors was measured on a Likert scale of five possible responses of difficult (easy/hard), with the statement “I found that...”*

Anticipated Guilt (GUI): *Each of the three behaviors was measured on a Likert scale of five possible responses of agreement (not agree/agree), with the statement “I would feel guilty if I do not ...”*

Monetary Displacement (MON): *Each of the three behaviors was measured on a Likert scale of five possible responses of agreement (not agree/agree), with the statement “I only... if somebody pay me for doing it”*

Subjective norms closest people (SNC): *Each of the three behaviors was measured on a Likert scale of five possible responses of agreement (not agree/agree), with the statement “I think that the people closest to me would be upset if I did not...”*

Subjective norms neighbors (SNN): *Each of the three behaviors was measured on a Likert scale of five possible responses of agreement (not agree/agree), with the statement “I think that my neighbors would criticize me if I did not...”*

Anticipated Embarrassment (EMB): *Each of the three behaviors was measured on a Likert scale of five possible responses of agreement (not agree/agree), with the statement “I would feel embarrassed if my neighbors found out that I did not ...”*

Anticipated Pride (PRI): *Each of the three behaviors was measured on a Likert scale of five possible responses of agreement (not agree/agree), with the statement “I would feel proud if my neighbors found out that I did...”*

Intention of Behavior (INT): *Each of the three behaviors was measured on a Likert scale of five possible responses of intention (not-decided/decided). With the statement “In the next month, I will ...”*

The third part is questions about trust in neighbors. It includes binary response questions on what individuals think about the others in terms of trustworthy, fairness and helpful. Also, questions about trust in local institutions such as water managers, energy companies, regional government and environmental agencies.

Table 2 is a summary of statistics by group by the parts of the survey. On average, the households

have 3.78 inhabitants, 1.47 bathrooms, and an area of 113 square meter. The 87% are houses, and the 56% of the inhabitants are owners. In 31% of the records we found households with mixed uses, mainly commercial activities, such as selling of food, beverages and other goods and services. The head of the household has on average 51 years old. They are men in a 55% of the cases, with a finished secondary level of education in 46%. In terms of frequency of performing PEB's, we found that water saving has the highest frequency, followed by waste recycling. Actions related to energy savings are consider the most difficult to play (PCB\_ES of 1.89). There is more feelings of anticipated guilt of not doing the water saving action (GUI\_WS=4.29). While the three actions have similar responses in terms of the valuation of monetary incentives to act (MON, and in the intention to behavior in the near future (INT). The valuation of the social norms from closest people and from the neighbors are higher for water savings (SNC\_WS=3.38 and SNN\_WS=2.92), as well for anticipated feelings of embarrassment for not doing it (EMB\_WS=3.55), and the anticipated pride of doing it (PRI\_WS=4.34).

The measures of trust in others describe communities with low trust, even though they are small urban villages. Only the 10% consider that the others are trustworthy, 40% that the others act with fairness, and the 29% that the others are helpful. However, I ask them for a number of reliable neighbors (those who you think could take care of your children), the average is 2.61. A high number of neighbors. The perception of trust in local institutions has also low levels. None of the institutions evaluated exceeds 3 on a scale of 4. The best rated is the local environmental agency.

I construct indexes of all the variables to exploit the variability of the three PEB's. Estimating the average and polychoric measures. Table 3 shows the descriptive statistics of these variables. The average indexes vary between 0 and 1, while the polychoric vary between -5 and 5. Trust in others in the villages varies from 0 to 1, and trust in local institutions varies from 1.5 to 4.

## 2.2 Previous Randomize Field Experiment

Between September 2017 and April 2018, a social norm intervention in the field were conducted in 3,041 households from eight villages in Colombia. The intention was to measure the effect of a water consumption report delivered with water bills. The report had two components: i) a descriptive norm, a social comparison of the households consumption versus the average consumption of its neighbors (next we refer to this as the social norm); and ii) an injunctive norm, a message of approval (disapproval) when the consumption was smaller or equal than (greater) the social norm revealed. Two effects were measured: the direct effect on the treated (households that received the report each period) and the indirect effect on the un-treated (households who do not receive any message but were located in villages with treatment). Households were randomly assigned to these three status: directly treated (1429 in 3 villages), indirectly treated (1489 in 3 villages) and control (483 in 2 villages with no messages). The control villages did not overlap with those in treatment.

Table 2: Summary statistics of survey

	Mean	Std. Dev.	Min.	Max.	Obs.
<b>Housing</b>					
Inhabitants (#)	3.78	1.72	1	12	371
Apartment	0.10	0.30	0	1	371
House	0.87	0.34	0	1	371
Other	0.030	0.17	0	1	371
Owner	0.56	0.50	0	1	370
Renter	0.26	0.44	0	1	370
Family	0.18	0.38	0	1	370
Other	0.0081	0.090	0	1	370
Area of housing (m2)	113.6	82.9	10	450	252
Bathrooms (#)	1.47	0.78	1	5	367
Economic activity inside	0.31	0.46	0	1	371
Socioeconomic Strata	2.16	0.54	1	4	351
<b>Head of Household</b>					
HHH was interviewed?	0.56	0.50	0	1	371
HHH Age (years)	51.5	14.8	19	95	369
Female	0.45	0.50	0	1	369
Male	0.55	0.50	0	1	369
Elementary or less	0.40	0.49	0	1	371
High school	0.46	0.50	0	1	371
Tertiary or College	0.15	0.35	0	1	371
<b>Behavior</b>					
Energy saving	3.37	1.45	1	5	371
Waste recycling	3.89	1.42	1	5	371
Water saving	4.61	0.84	1	5	368
<b>Individual Drivers</b>					
PCB ES	1.89	1.30	1	5	371
PCB WS	1.32	0.80	1	5	369
PCB WR	1.77	1.20	1	5	371
A. guilt ES	3.64	1.45	1	5	371
A. guilt WS	4.29	1.17	1	5	370
A. guilt WR	3.71	1.40	1	5	369
Monetary dis. WR	1.96	1.44	1	5	370
Monetary dis. ES	1.85	1.41	1	5	371
Monetary dis. WS	1.81	1.42	1	5	370
Intention ES	4.42	0.95	1	5	370
Intention WR	4.41	1.01	1	5	370
Intention WS	4.78	0.54	1	5	369
<b>Social Drivers</b>					
SN closest ES	2.57	1.60	1	5	371
SN closest WR	2.60	1.59	1	5	371
SN closest WS	3.38	1.67	1	5	370
SN neighbors WS	2.92	1.67	1	5	371
SN neighbors ES	2.44	1.54	1	5	371
SN neighbors WR	2.56	1.59	1	5	371
A. embarrassment WR	3.23	1.65	1	5	371
A. embarrassment WS	3.55	1.59	1	5	371
A. embarrassment ES	3.09	1.65	1	5	370
A. pride ES	4.13	1.32	1	5	371
A. pride WS	4.34	1.16	1	5	369
A. pride WR	4.23	1.24	1	5	370
<b>Trust</b>					
Others are trustworthy	0.10	0.30	0	1	362
Others are fair	0.40	0.49	0	1	340
Others are helpful	0.29	0.45	0	1	356
Reliable neighbors (#)	2.61	2.63	0	15	365
Trust in local government	2.67	0.71	1	4	291
Trust in water utility	2.47	0.68	1	4	359
Trust in energy utility	2.47	0.65	1	4	358
Trust in environmental agency	2.69	0.83	1	4	307

Note: This table describes the information of the 371 households grouped by the components of the survey: i) Information of housing, ii) Information of the head of the household, iii) Pro-environmental behaviors, iv) Intrinsic motivations (includes individuals and social related drivers), and v) Measures of Trust. Authors calculations.

Table 3: Descriptive statistics of the created indexes

	Mean	SD	Min.	Max.	Obs.
PEB Index (avg)	0.79	(0.16)	0.27	1	368
PCB Index (avg)	0.33	(0.17)	0.20	1	369
GUI Index (avg)	0.78	(0.23)	0.20	1	368
EMB Index (avg)	0.66	(0.30)	0.20	1	370
PRI Index (avg)	0.85	(0.23)	0.20	1	368
SNC Index (avg)	0.57	(0.27)	0.20	1	370
SNN Index (avg)	0.53	(0.29)	0.20	1	371
MON Index (avg)	0.38	(0.27)	0.20	1	369
INT Index (avg)	0.91	(0.13)	0.20	1	367
PEB Index (pol)	-0.017	(0.95)	-2.89	1.27	368
PCB Index (pol)	-0.025	(1.02)	-0.89	3.57	369
GUI Index (pol)	-0.018	(1.29)	-2.99	1.39	368
EMB Index (pol)	-0.010	(1.43)	-2.16	1.75	370
PRI Index (pol)	-0.014	(1.33)	-3.19	1.01	368
MON Index (pol)	-0.020	(1.32)	-0.95	2.84	369
INT Index (pol)	-0.017	(1.03)	-4.50	0.79	367
SNC Index (pol)	-0.011	(1.31)	-1.79	2.18	370
SNN Index (pol)	-0.0052	(1.39)	-1.66	2.32	371
Trust Neighbors Index	0.26	(0.30)	0	1	330
Trust Local Inst. Index	2.58	(0.51)	1.50	4	255
Observations	371				

Note: This table describes the statistics of the created indexes. Including average and polychoric measures. Authors calculations.



Table 4: Summary statistics of the RCT results for the survey sample by treatment status

	Mean	Control SD	Obs.	Mean	Indirectly SD	Obs.	Mean	Directly SD	Obs.
Villages (#)	2	(0)	53	6	(0)	147	6	(0)	155
Billing freq.	0.49	(0.50)	53	0.52	(0.50)	147	0.48	(0.50)	155
WC before T	421.1	(305.1)	53	405.5	(291.3)	147	338.1	(217.7)	155
WC after T	475.7	(386.8)	50	416.4	(309.8)	145	355.2	(222.8)	155
Change in WC	44.8	(179.7)	50	7.45	(158.5)	145	17.1	(119.7)	155
Reports (#)	0	(0)	53	0	(0)	147	4.03	(1.00)	155
Observations	53			147			155		

Note: This table shows the summary statistics of the historical information from the field intervention conducted by (Lopez, 2019) between January 2016 and March 2018, matched with the the households in the survey. It is presented in groups of treatment status for ease. Authors calculations.

On average, the findings of the intervention estimated a reduction in water consumption both in directly and indirectly treated households that account for 7.8% and 4.9%, respectively. The effects are higher than those found in similar studies on water use and also in energy.

With information from the intervention, including the treatment status and the outcome for 26 months (before and after), we matched the households in our survey. A summary of this matched information by treatment status is described in Table (4). We have 53 households in the control status, 147 in the directly treated group, and 155 in the indirectly treated. The 50% of the households have a water billing frequency monthly and the rest every two months. On average, The treated households consume less water at baseline. The change in the water consumption during the intervention was about 17.1 L/day in the treated group. All the groups show an increment in the water consumption, but the the increment was lesser in the treated groups.

### 3 Methods

In this paper I estimate the effects of a set of motivations that could explain the decision of the households of perform pro-environmental actions. In particular, actions in the private sphere. We want to estimate to what extent this set of intrinsic and extrinsic motivations underlying the decision-making process. The intrinsic motivations are related to the individual’s perception of performing a PEB. They include a valuation of the effort, emotions of anticipated guilt, the importance of monetary incentives to perform, and the intention of behavior in the future. The extrinsic or social influences, are motivations related to the others in the group or villages. It comprehends social norm valuation of the closest persons and of the neighbors, and emotions of pride and embarrassment about the perception of the others about the own performance.

To identify the effects of interest, the the proposed econometric model is in the Equation 1. Where  $P\hat{E}B_i$  is a variable that indicates the willingness of a household  $i$  to perform a pro-environmental behavior.  $M_{li}$  is a vector that include  $l$  motivations,  $\beta_l$  are the parameters of interest for each motivation, and  $u_i$  is the unobserved component. I construct indexes of the outcomes and motivations. Estimating the average and polychoric measures.

$$P\hat{E}B_i = \alpha + \sum_{l=1}^L \beta_l \hat{M}_{li} + u_i \quad (1)$$

To estimate the effects of the intrinsic and extrinsic drivers on PEB trough Equation 1 there are some identification challenges to address. On the one hand, given that the information comes from a survey, it is not possible to observe the complete set of variables that could affect the individual decision-making process. This produces an omitted variables bias. To solve this, I control in the regression by observable characteristics at the households level. Including demographic, economic and housing characteristics. Also, I include village and socioeconomic stratification fixed effects. On the other hand, given the lack of exogenous variation, empirical research often proved unable to estimate these effects in a causal approach. The use of surveys on behavior-insights research, generates chances for individuals to self-select. It is well known that individuals tend to maximize (minimize) their “good” (“bad”) actions when they are asked. To deal with it, I use the exposition of the households to a randomize field experiment conducted on these villages, previous to survey. The intervention was a normative informational campaign. a part of the population receives messages that promotes water conservation using social comparisons of water consumption (For more details see section xx).

The intervention is an activation of social norms process. Following [Schwartz \(1977\)](#), the revelation of what the others are doing or think it should be done, can influence the individuals behavior. The process involves an activation of the cognitive structure of norms and values, producing feelings of moral obligation to act, and then producing pro-social behavior. Here we exploit the source of variation of the exposition to this informational campaign (treatment). The main assumption is that the kind of information delivered produce an observable PEB. Hence, I use the treatment to estimates comparisons groups. Here, I explore how the motivations affects the the PEB level.

I use a propensity score matching approach to identify the effects. Although, the treatment assignment was pure random, the decision of attend the survey was not. For this reason, the use of this method allows to construct a better . ([Rosenbaum, 2007](#)) proposed a method to reduce the bias in the estimation of treatment effects with observational data sets. They define the propensity score as the conditional probability of receiving a treatment given a set of pre-treatment characteristics:

$$p(x) = Pr(T = 1|X) = E(T|X) \quad (2)$$

where  $T = 0, 1$  is the indicator of the exposure to treatment and  $X$  is the vector of pre-treatment characteristics. The Average effect of Treatment on the Treated (ATT) can be estimated as follows:

$$ATT = E[Y(1)|T = 1] - E[Y(0)|T = 1] \quad (3)$$

The estimation of the ATT requires certain conditions. First, the conditional independence assumption. In its strict version, states that the treatment status is independent of the distributions of potential outcomes once one conditions on all relevant confounders. In other words, once one conditions on confounders  $X$ , it is assumed that, on average, the observed outcomes for the control units can be used to estimate the unobserved potential outcomes of the treated units. This is a form of selection on observables, thus we must also assume that there are no unobserved covariates that determine the selection process, or that those unobservable confounders are sufficiently correlated with the confounders. In this estimation, the main interest is not on the effect on the treatment on the PEB's, but on the interaction of the treatment variable  $T$  with the motivations, as follows:

$$PEB_{ki} = \alpha + \sum_{l=1}^L \beta_{lk} M_{lki} * T + u_i \quad (4)$$

### 3.1 Outcomes

We define the outcomes of interest. First, the  $PEB_{ki}$  is the willingness of the  $i^{th}$  individual to perform the  $k^{th}$  pro-environmental behavior in her/his house, where  $k = \{WS, ES, WR\}$ .  $WS$  is "Water Savings,"  $ES$  is "Energy Savings," and  $WR$  is "Waste Recycling." The information of these PEBs is self-declared in terms of frequency. I construct indexes to exploit the variability of the three components. The second outcome is the observable change of the water consumption previous and after the intervention. This is an objective measure. The water supply systems provide the measure of 26 periods. The use of these variables allows to make a comparative analysis between the self-declared and action performed on real time.

### 3.2 Covariates

The set of covariates to determine the propensity score are observable household characteristics. Include demographics, social and economic variables. Two groups of covariates: i) Housing, include the characteristics of the unit: number of inhabitants, area, number of bathrooms, type (house, apartment...), property, economic activity inside the unit, and level of socioeconomic strata; and

ii) Head of the household, including age, sex, and We use this information as a control variables in The summary statistics can be found in Table (1).

## 4 Results

First I describe the estimations of the motivations on the PEB's using the aggregated variables. In Table 5 are the results for the average index variables. Columns 1-10 are the results for all each motivation separately. All the significant variables are according with the literature. Notice that the PCB is negative, this is the more the households find difficult to perform a PEB, the less they make it. Negative effects is also the monetary incentive, households are less likely to perform a PEB, when they more agree in accepting a payment for it. The emotions have positive signs, GUI, EMB and PRI (Columns 2-4). The social norms from neighbors is important to explain the willing to perform a PEB, the more they value what the others think, the more they perform PEB. The trust measure in neighbors and in local institutions have no significant effects on the performing PEB's. Table ?? presents the estimations using polychoric indexes of the variables. As in the average index, the sign and the significant variables hold.

The results of the regressions on the change on water consumption, and observable PEB, are in Table 7 for the average indexes, and in Table ?? for the polychoric. The data comprehends 26 periods of observations from January of 2016 to August of 2017, and it is provided by local water utilities. In the average indexes, the motivations separately are not significant (Columns 1-10). When all the variables are included, the anticipated guilt (GUI) and the value of social norms from closest people are negative and significant. However, the anticipated feelings of pride and the value of social norms from neighbors are positive and significant. The last two results are against the results showed in Table 5. Implying differences between what the households say they doing and what they actually doing. The results of the polychoric measures maintain the results, except for the anticipated feelings of pride.

Next, I introduce the estimations using the propensity score matching method. Using the Mahalanobis matching procedure, Figure 1 plots the probability score estimated, before and after. Table ?? describe the balance checking comparing before and after the matching. The estimations for the level of PEB are in Figure 2 for average and polychoric indexes. The comparisons is between the households exposed to the treatment and the control group. The results show that on average, the anticipated feelings of guilt is negative and significant in both cases on the treated. The anticipated feelings of pride also show the effect in this sense. The last results is contrary on the expected. Figure 3 describes the results for the change on water consumption after the intervention. All the significant results have a positive impact. In particular, treated households who consider that performing the PEB is highly difficult (PCB) increase the water consumption, compare to the control

Table 5: Naive Estimations using Averaged Index

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
PCB Index (avg)	-0.23*** (-2.93)	-0.44*** (-7.21)									
GUI Index (avg)	0.10** (1.98)		0.20*** (4.72)								
EMB Index (avg)	-0.052 (-1.25)			0.099*** (3.31)							
PRI Index (avg)	0.081** (2.00)				0.17*** (4.50)						
SNC Index (avg)	0.098*** (2.69)					0.11*** (3.17)					
SNN Index (avg)	-0.032 (-0.89)						0.071** (2.20)				
MON Index (avg)	-0.090** (-2.35)							-0.12*** (-3.70)			
INT Index (avg)	0.58*** (6.09)								0.65*** (7.13)		
Trust Neighbors Index	0.043 (1.37)									0.046 (1.39)	
Trust Local Inst. Index	0.016 (0.75)										0.0019 (0.09)
HHs controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Village FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SES FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	206	340	339	341	340	341	342	340	339	302	234
vce	robust	robust	robust	robust	robust	robust	robust	robust	robust	robust	robust

*t* statistics in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

This table reports the OLS estimation of the effects of motivations on pro-environmental behaviors in average indexes. The first column is the estimation including all the motivations, and columns 2-11 is the estimations of the motivations separately. All the regressions were estimated with robust standard errors and include village and socioeconomic strata fixed effects, and controls of observable characteristics of the households. Author calculations.

Table 6: Naive Estimations using Polychoric Index

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
PCB Index (pol)	-0.22*** (-3.13)	-0.44*** (-8.11)									
GUI Index (pol)	0.040 (0.80)		0.18*** (4.36)								
EMB Index (pol)	-0.042 (-0.83)			0.099*** (2.69)							
PRI Index (pol)	0.093* (1.91)				0.17*** (4.48)						
SNC Index (pol)	0.11** (2.47)					0.099** (2.38)					
SNN Index (pol)	-0.046 (-1.03)						0.067* (1.67)				
MON Index (pol)	-0.13*** (-2.82)							-0.21*** (-5.28)			
INT Index (pol)	0.39*** (5.59)								0.45*** (8.46)		
Trust Neighbors Index	0.24 (1.37)									0.29 (1.50)	
Trust Local Inst. Index	0.18 (1.41)										0.075 (0.56)
HHs controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Village FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SES FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	210	340	339	341	340	341	342	340	339	302	234
vce	robust	robust	robust	robust	robust	robust	robust	robust	robust	robust	robust

*t* statistics in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

This table reports the OLS estimation of the effects of motivations on pro-environmental behaviors in polychoric indexes. The first column is the estimation including all the motivations, and columns 2-11 is the estimations of the motivations separately. All the regressions were estimated with robust standard errors and include village and socioeconomic strata fixed effects, and controls of observable characteristics of the households. Author calculations.

Table 7: Regressions of motivations on the change of water consumption ( Average Indexes)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
PCB Index (avg)	-0.16 (-0.48)										0.31 (0.76)
GUI Index (avg)		-0.27 (-1.18)									-0.62* (-1.87)
EMB Index (avg)			-0.12 (-0.70)								-0.087 (-0.28)
PRI Index (avg)				0.13 (0.49)							0.56* (1.75)
SNC Index (avg)					-0.13 (-0.68)						-0.46* (-1.70)
SNN Index (avg)						0.19 (1.09)					0.68*** (2.68)
MON Index (avg)							-0.11 (-0.70)				0.016 (0.08)
INT Index (avg)								0.56 (1.32)			0.064 (0.09)
Trust Neighbors Index									-0.043 (-0.25)		0.018 (0.08)
Trust Local Inst. Index										0.059 (0.46)	0.13 (0.96)
HHs controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Village FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SES FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	337	336	338	337	338	339	337	336	299	231	207
vce	robust	robust	robust	robust	robust	robust	robust	robust	robust	robust	robust

*t* statistics in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

This table reports the OLS estimation of the effects of motivations on an observable pro-environmental behavior. The dependent variable is the normalization of the change of water consumption before/after the intervention. The motivations are average indexes. Columns 1-10 are the estimations of the motivations separately. Column 11 is the estimation including all the motivations. All the regressions were estimated with robust standard errors and include village and socioeconomic strata fixed effects, and controls of observable characteristics of the households. Author calculations.

Table 8: Regressions of motivations on the change of water consumption (Polychoric Indexes)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
PCB Index (pol)	-0.040 (-0.74)										-0.0016 (-0.02)
GUI Index (pol)		-0.046 (-1.10)									-0.11** (-2.03)
EMB Index (pol)			-0.021 (-0.61)								-0.0069 (-0.11)
PRI Index (pol)				0.020 (0.45)							0.089 (1.56)
SNC Index (pol)					-0.031 (-0.78)						-0.093* (-1.71)
SNN Index (pol)						0.036 (0.99)					0.13** (2.60)
MON Index (pol)							-0.023 (-0.74)				0.0020 (0.05)
INT Index (pol)								0.074 (1.34)			0.00086 (0.01)
Trust Neighbors Index									-0.043 (-0.25)		-0.0093 (-0.04)
Trust Local Inst. Index										0.059 (0.46)	0.13 (0.94)
HHs controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Village FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SES FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	337	336	338	337	338	339	337	336	299	231	207
vce	robust	robust	robust	robust	robust	robust	robust	robust	robust	robust	robust

*t* statistics in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Note: This table reports the OLS estimation of the effects of motivations on an observable pro-environmental behavior. The dependent variable is the normalization of the change of water consumption before/after the intervention. The motivations are polychoric indexes. Columns 1-10 are the estimations of the motivations separately. Column 11 is the estimation including all the motivations. All the regressions were estimated with robust standard errors and include village and socioeconomic strata fixed effects, and controls of observable characteristics of the households.



Table 9: Balance checking before and after the matching

Variable		Mean Treated	Mean Control	%bias	% Improvement	t	p-value
Socioeconomic Strata	Unmatched	2.2157	2.1047	20.9		1.91	0.057
	Matched	2.2157	2.2353	-3.7	82.3	-0.33	0.744
Inhabitants (#)	Unmatched	3.7647	3.8848	-7		-0.64	0.523
	Matched	3.7647	3.8105	-2.7	61.9	-0.24	0.811
Type of housing	Unmatched	1.915	1.9372	-6.3		-0.57	0.566
	Matched	1.915	1.9739	-16.7	-165.7	-1.46	0.146
Property of the house	Unmatched	1.5948	1.6597	-8.2		-0.75	0.452
	Matched	1.5948	1.549	5.8	29.5	0.54	0.592
Bathrooms (#)	Unmatched	1.4706	1.4921	-2.7		-0.25	0.804
	Matched	1.4706	1.4183	6.6	-142.5	0.59	0.559
Economic activity	Unmatched	0.33987	0.27225	14.7		1.36	0.176
	Matched	0.33987	0.30719	7.1	51.7	0.61	0.543
HHH Age (years)	Unmatched	52.333	51.209	7.6		0.7	0.485
	Matched	52.333	53.484	-7.8	-2.4	-0.67	0.501
HHH Level of education	Unmatched	1.732	1.9686	-24.7		-2.26	0.024
	Matched	1.732	1.7124	2	91.7	0.19	0.849

Note: This table describes the balance checking on covariates. Including the unmatched and matched sample. Author calculations.

group. This is also the case of those who feel pride when they perform the PEB (PRI), and those who value more what the neighbors think about not performing (SNN). These results confirm the differences founded in what individuals say about the PEB's and what they ctually doing in water consumption.

## 5 Final Discussions

In this paper I estimates the effects of a set of intrinsic and extrinsic motivations on self-declare performing of PEB and an observed behavior. I use a survey to households and the reports of water consumption from the local water utilities in eight small-urban villages in Colombia. To analyze the effects in a casual way, I use a previous randomize field experiment conducted in these villages, previous to survey. Using propensity score matching methods, I compare the effects of the motivations on the treated households. The treatment was a informational campaign deliver messages with social comparisons.

I highlight two main findings:

First, the estimations of the effects of motivations of behavior in a traditional approach produces results according to the literature. Negative effects of the perceived control of behavior and the value of monetary payment to perform. Positive effects of anticipated feelings of guilt and embarrassment, and anticipated feelings of pride. The valuation of what other think about not perform PEB is

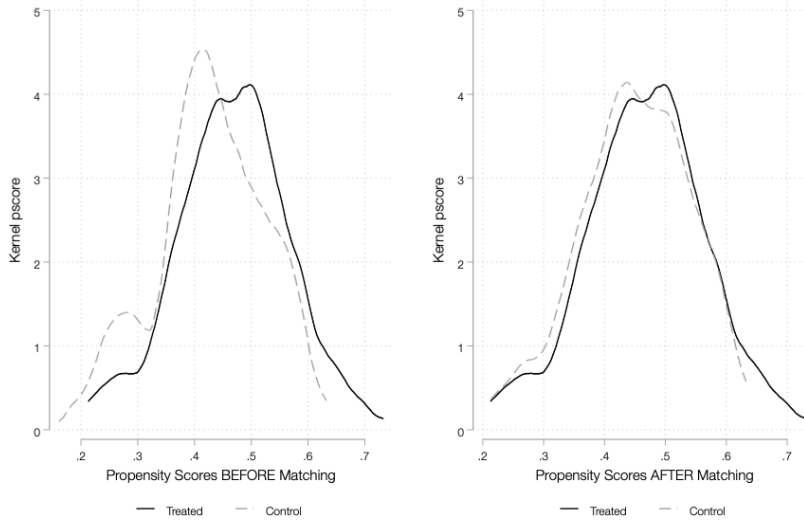


Figure 1: Probability score estimated after and before the matching. The estimation is a probit regression of the observable characteristics of households on the treatment status.

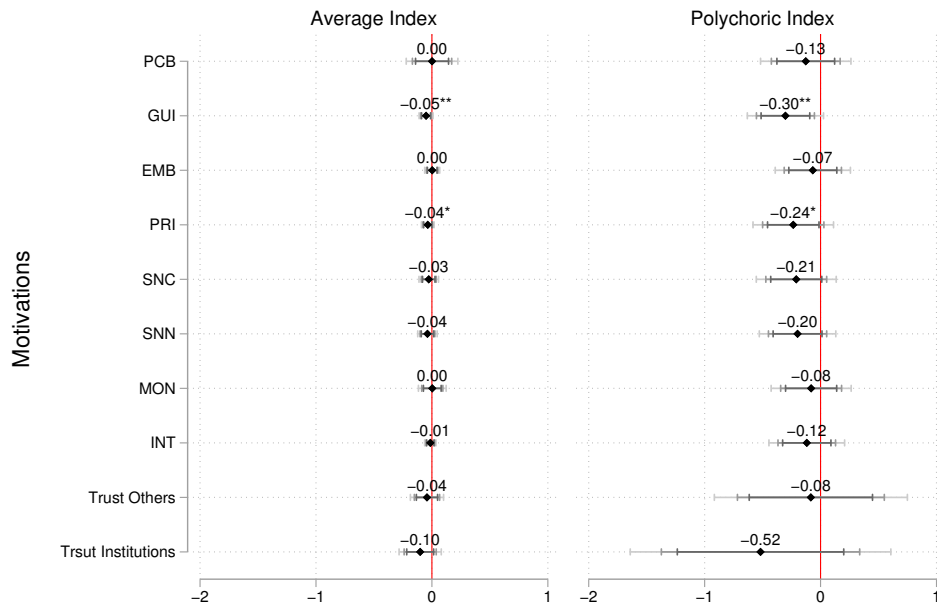


Figure 2: Estimations of the propensity score matching methods on level of PEB. The dependent variable is the average and the polychoric index of PEB. All the regressions estimates the effects of motivations separately.

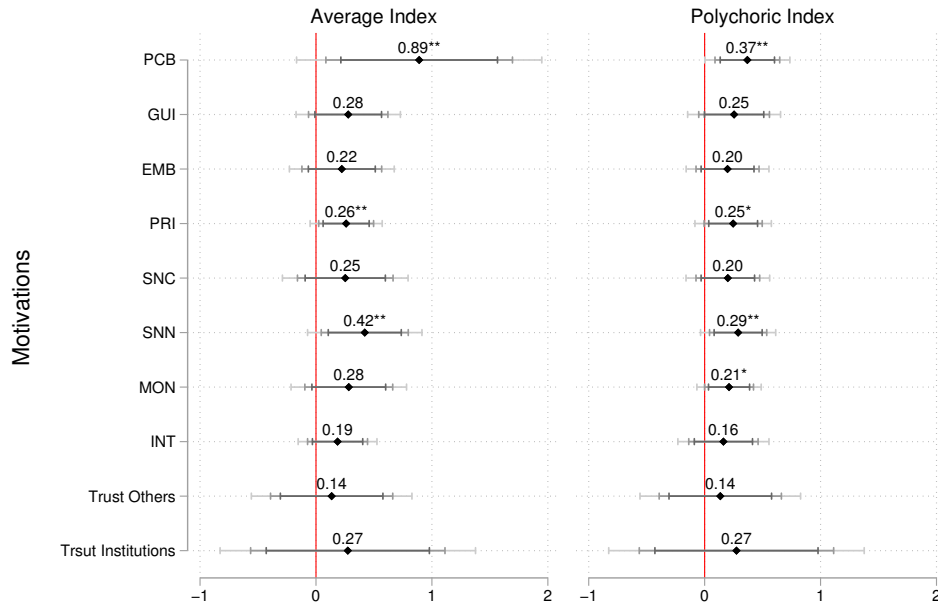


Figure 3: Estimations of the propensity score matching methods on the change of water consumption after the intervention. The dependent variable is standard deviations. All the regressions estimates the effects of motivations separately.

important, both in closest people and neighbors. Finally the intention of behavior is positive and significant. However, when I compared the results with an observed behavior (water consumption), the effects are significant only for the anticipated feelings of guilt, and pride, and for the social norm from closest people. In the last two motivations the sign of the effects are in the opposite direction of the self-declared PEB. This difference describes the bias in the using of surveys. The households could feel the need of censoring when they are asked for private sphere actions.

Second, the propensity score matching process with the previous randomized intervention show, in the case of the self-declared PEB, that the anticipated feelings of guilt and pride are important drivers to explain the decision of perform PEB in the treated households. Furthermore, using the observable PEB (change in water consumption), the perceived control of behavior and the displacement of the monetary incentives appear significant and according to the literature.

The results estimated here are important for the discussions about the motivations of pro-environmental behavior. Traditionally, the literature have shown strong correlations, in the frameworks of the Theory of Planned Behavior and Norm Activation Theory. The use of an experimental context allows to measure the effects causally. However, there is a need for conduct experiments to explore the underlying motivations more accurately.

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