"Peer Pressure and Externalities: Evidence from a field experiment"

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Peer pressure and externalities: Evidence from a field experiment*

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Abstract

We provide experimental evidence on the effect of peer pressure on activities with externalities. Specifically, we study the effect of being exposed to an observer in a public restroom on hand-washing behavior. Our estimates show that being exposed to an observer increases the probability of hand-washing in 13 percentage points. We also observe urinal flushing behavior, with similar results. We find empirical support that peer pressure may provide an additional way of solving the social suboptimality arising from externalities.

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1 Introduction

Externalities play a central role in understanding key issues such as pollution, global warming, and rising costs of health care. An externality is present whenever the well-being of an agent is directly affected by the actions of another agent in the economy (Mas-Colell et al., 1995).[1] Since agents do not fully internalize the effects of their actions, allocations through competitive markets usually yield a socially suboptimal outcome (Stiglitz, 1988).

Classical solutions to the externalities problem include pigouvian taxes and allocation of property rights (Mas-Colell et al., 1995). Pigouvian taxes equate individual costs (benefits) with social costs (benefits), inducing agents to internalize the external effects of their actions. Property rights allow for efficient allocations through bargaining when transaction costs are sufficiently low and property rights are enforceable (Coase, 1960). There are situations, however, where none of these solutions are applicable.[2]

Recent developments suggest that social factors (such as peer pressure) may provide an additional solution to the suboptimality arising from externalities. Kandel and Lazear (1992) present a model in which peer pressure, shame, and guilt (among other factors) create incentives for higher effort in workers that would otherwise free-ride on their peers in a profit-sharing scheme. Calvó-Armengol and Jackson (2010) present a model in which agents care about the actions of their neighbors and can exert social pressure to induce them to take certain actions by lowering or raising the cost of taking them. Daughety and Reinganum (2010) present a model in which agents behave differently when being observed in order to be well perceived by their peers. Specifically, when agents are observed, they change their behavior towards the social optimum. Karlan (2007) provides empirical evidence that peer monitoring induces higher rates of repayment in poor households. The higher rates of repayment represent a positive externality since households would not have access to loans otherwise.

Our main contribution is to perform a randomized field experiment to empirically assess the effect of peer pressure on activities that generate externalities. Specifically, we study if exposure to an observer in a public restroom influences the probability that a male individual washes his hands. There is a vast literature in medicine that shows that hand-washing has multiple private (e.g. preventing contagion on oneself) and public benefits (e.g. preventing disease spread), where public benefits are higher than private benefits (Judah et al., 2009).

[1] Although the concept is widely used, a fully satisfying definition of externality has proved somewhat elusive (Mas-Colell et al., 1995).

[2] For example, pigouvian taxes solutions rely on the estimation of social costs (benefits) that sometimes may be impossible to measure (e.g. psychological costs of pollution) (Baumol, 1972). The Coasian solution may be inapplicable when property rights are not enforceable (Anderton, 1990).

The fact that public benefits are higher than private benefits indicates that hand-washing is an activity that generates externalities.[3] In addition, hand-washing is typically taught since childhood and not doing it is generally perceived by peers as a negative trait, so being exposed to an observer can act as peer pressure.

To identify the effect of peer pressure on hand-washing, we propose a randomized controlled experiment. We randomly assign treatment using a Biased Coin Design (as shown in Canay, 2013). The Biased Coin Design guarantees a consistent estimation through randomization while maximizing power through balanced group sizes.[4] Our experiment relies on direct observation, avoiding any bias associated with self reporting.[5]

Our estimates show that the presence of an observer increases the probability of hand-washing in around 13 percentage points. The results are statistically significant and robust to an array of alternative specifications that include fixed effects for time of the day, evaluator, and restroom. These results show that peer pressure influences hand-washing behavior in public restrooms.

To assess whether our results are restricted to hand-washing we also observe urinal flushing behavior. Urinal flushing in public restrooms can also be understood as a problem of externalities. Urinals provide an environment that allows for bacterial growth (Garsuta et al., 2014), so flushing them could spread disease (Mendes and Lynch, 1976), generating a private cost; but if no one flushes the urinal, bacterial growth increases (Garsuta et al., 2014), implying a negative externality for future users. Since the flushing decision does not take the externality into account, the amount of urinals flushed in equilibrium is less than the social optimum. In addition, urinal flushing is typically encouraged through diverse stimuli,[6] so being exposed to an observer can serve as peer pressure. Our estimates show that being exposed to an observer increases the probability of urinal flushing in around 15 percentage points. The results are statistically significant and robust to an array of alternative specifications that include fixed effects for time of the day, evaluator, and restroom.

Our findings provide empirical support that peer pressure may provide an additional

[3] This could explain the "surprisingly low" compliance rates of hand-washing found in various studies such as Johnson et al. (2003), Judah et al. (2009), and Scott et al. (2007).

[4] Previous studies of social influence on hand-washing behavior have methodological problems such as non-random assignment of treatment (Munger and Harris, 1989; Nalbone et al., 2005; Drankiewicz and Dundes, 2003), low statistical power because of unbalanced group sizes (Nalbone et al., 2005), and contaminated control groups (Drankiewicz and Dundes, 2003). Also, none of these papers addressed hand-washing in an externalities framework.

[5] Surveys about hand washing behavior usually suffer from over reporting, since hand hygiene is socially desirable (Judah et al., 2009).

[6] Flushing is, as hand-washing, typically taught since childhood. Moreover, public restrooms usually have various signs that remind users of flushing.

way of solving the social suboptimality arising from externalities. Specifically, peer pressure increases the probability of hand-washing and urinal flushing in public restrooms.

The rest of the paper is structured as follows. Section 2 describes the experimental design. Section 3 describes the data, introduces the econometric model, and presents the results. Section 4 presents further evidence for urinal flushing behavior. Section 5 concludes.

2 Experimental design

The purpose of this paper is to study whether social pressure influences public restroom behavior in male adults. We perform an experiment in male restrooms at *Universidad de San Andrés* in order to assess the effect of social pressure on two variables of interest: hand-washing and urinal flushing. Our hypothesis is that the presence of an external observer in the restroom can act as peer pressure and induce a change in restroom behavior.

The structure and design of the experiment is as follows. Male adults that use the public restroom are randomly assigned into two groups, a treatment group (exposed to an observer) and a control group (unexposed to an observer). Selecting the randomization procedure to assign the participants to each group brings up the problem of compromising between a perfectly balanced experiment and the advantages of a complete randomization (Canay, 2013).[7] Complete randomization has the advantage of eliminating potential selection bias and balancing out unobserved characteristics between participants in the treatment and control groups; while having balanced group sizes allows for a greater statistical power.

Standard randomization procedures used in the Randomized Controlled Trials literature are Truncated Binomial Design (TBD) and Single Random Sampling (SRS). Both TBD and SRS present inference related problems. In TBD, participants are allocated sequentially to treatment or control group with probability $\frac{1}{2}$ until one of the two groups reaches a size equal to half of the sample. All subsequent participants are allocated to the remaining group. Therefore, using TBD yields a perfectly balanced experiment but a potentially significant part of the allocation will be completely determined by previous allocations. In SRS, each participant is assigned sequentially to treatment or control group with probability $\frac{1}{2}$. In spite of ensuring complete randomization, the two groups can be very unbalanced if the number of participants is low. Since SRS implies a positive probability of presenting serious unbalance between group sizes, some researchers are willing to re-randomize the sample in the experiment in order to increase statistical power, losing the complete randomization of the procedure.

[7] In Canay (2013) a randomization procedure is completely random if the probability of being assigned to treatment is independent of past assignments, past outcomes, and current and past values of the covariates.

For our experiment, we use the randomization procedure known as Biased Coin Design (BCD), which was presented by Efron (1971) as a method that "tends to balance the experiment, but at the same time is not over vulnerable to various common forms of experimental bias". BCD sequentially assigns the participants to control or treated group: when group sizes are equal, allocation is made with probability $\frac{1}{2}$; when they are not, BCD allocate the participant to the under-represented group with a constant probability "p". Following Atkinson et al. (2014), we set $p = \frac{2}{3}$ for our experiment. BCD has several advantages over other randomization procedures. First, although the probability of being assigned to one group depends to some extent on previous assignments, it's never fully determined by them. Second, probability of providing a balanced assignment in finite samples is far superior in BCD than in SRS method Canay (2013), providing a greater statistical power in estimations.

The exact procedure of the experiment is explained in the experimental protocol available in Appendix A.

3 Econometric model and results

Table 1 presents the descriptive statistics. On average, 66% of sample individuals wash their hands after using a public restroom when they are alone[8] and 79% when someone else is present. Given random assignment, the impact of peer pressure (i.e. being observed in a public restroom) on hand-washing behavior can be estimated straightforwardly by applying Ordinary Least Squares (OLS) to the following regression model:

$$Wash_i = \alpha + \beta Treated_i + \varepsilon_i \tag{1}$$

where $Wash$ is a dummy variable that take the value of one if hand-washing is performed and zero otherwise. $Treated$ is a dummy variable that takes the value of one if the participant is treated (i.e. observed) and zero otherwise.

Table 2 presents the OLS estimates of Equation (1). Column 1 shows that, on average, 66.3% of people wash their hands in public restrooms when no one else is present. This proportion increases in 12.5 percentage points if someone else is present. In the remaining columns of Table 2 we show the results remain unchanged when we include either time of the day fixed effects (column 2), restroom fixed effects (column 3), evaluator fixed effects (column 4) or any combination of these (columns 5, 6, 7, and 8). The estimated coefficients on *Treated*

[8] This number is similar to the one found in most of the related literature: between 40 and 60% of the people wash their hands after using a public restroom (Johnson et al., 2003; Nalbone et al., 2005; Munger and Harris, 1989).

are positive and statistically significant in all the specifications of Table 2, indicating that male hand-washing in public restrooms is influenced by peer pressure.

4 Further evidence from urinal flushing behavior

In this section we present estimates of the effect of peer pressure on urinal flushing behavior. We define a *Flush* dummy as a variable taking the value of one if the participant flushes the urinal and zero otherwise. Given the random assignment of treatment, we estimate the following equation with OLS:

$$Flush_i = \alpha + \beta Treated_i + \varepsilon_i \tag{2}$$

where $Treated$ is a dummy variable that that takes the value of one if the participant is observed and zero if he is alone.

Table 3 reports the OLS estimates of Equation (2). Column 1 shows that, on average, 55.8% of people flush the urinal in public restrooms when no one else is present. Having an observer present raises the average of people flushing the urinal in 14.9 percentage points, and the result is statistically significant at the 5% level. In the remaining columns of Table 3 we show the results are robust to alternative specifications. Results remain unchanged when we include either time of the day fixed effects (column 2), restroom fixed effects (column 3), evaluator fixed effects (column 4) or any combination of these (columns 5, 6, 7, and 8). The estimated coefficients on *Treated* are positive and statistically significant in all the specifications of Table 3, indicating that urinal flushing in public restroom is influenced by peer pressure.

4.1 Potential concern

Even though our study relies on a randomized controlled experiment, there are still potential concerns regarding the identification of the effect of peer pressure on hand-washing. Since we observe hand-washing after urinal flushing for each unit, hand-washing estimates could be a result of an indirect effect of the treatment through urinal flushing. For example, it could be that peer pressure induces urinal flushing and then people wash their hands to prevent the potential health hazards associated with urinal flushing. Nevertheless, it is also possible that the probability of urinal flushing increases only as an indirect effect of the treatment on hand-washing. For instance, it could be that treated units foresee they will wash their hands because of peer pressure, so they flush the urinal knowing that future hand-washing will prevent potential health hazards associated with urinal flushing. To address this concern we estimate the correlation between hand-whashing and urinal flushing on the control group. The estimated coefficient is 0.12% and not statistically significant, so we have no evidence that supports this concern.[9]

5 Conclusions

We run a field experiment to assess whether peer pressure affects individual behavior in public restrooms. We find a positive and statistically significant effect of peer pressure on the probability of hand-washing.[10]

Hand-washing is an activity that generates externalities, since its public benefits exceed its individual benefits. Our findings provide empirical support that peer pressure may provide an additional way of solving the suboptimality arising from externalities. Our estimates indicate that peer pressure induces changes in individual restroom behavior towards the social optimum.

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[9] We also estimate the correlation between hand-hashing and urinal flushing for the treated group. The estimated coefficient is 0.04 and is not statistically significant at standard levels.

[10] We also observe urinal flushing, with similar results.

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Table 1: Summary statistics

	Mean	Std. Dev.
Washed hands	0.7268	0.4468
when someone else is present	0.7879	0.4109
alone	0.6632	0.4751

Table 2: Results for hand-washing

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treated	0.125*	0.126*	0.126*	0.136**	0.127*	0.137**	0.134**	0.136**
	(0.0639)	(0.0644)	(0.0644)	(0.0648)	(0.0653)	(0.0651)	(0.0651)	(0.0657)
Constant	0.663***	0.668***	0.655***	0.696***	0.661***	0.738***	0.748***	0.797***
	(0.0487)	(0.0946)	(0.167)	(0.0826)	(0.195)	(0.121)	(0.212)	(0.231)
Time of the day fixed effects	No	Yes	No	No	Yes	Yes	No	Yes
Restroom fixed effects	No	No	Yes	No	Yes	No	Yes	Yes
Evaluator fixed effects	No	No	No	Yes	No	Yes	Yes	Yes
Observations	194	194	194	194	194	194	194	194

Notes: Robust standard errors are in parentheses. All models are estimated by OLS. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 3: Results for urinal flushing

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treated	0.149**	0.154**	0.141**	0.148**	0.144**	0.154**	0.147**	0.149**
	(0.0688)	(0.0697)	(0.0694)	(0.0690)	(0.0707)	(0.0691)	(0.0687)	(0.0697)
Constant	0.558***	0.539***	0.644***	0.539***	0.582***	0.540***	0.641***	0.613***
	(0.0512)	(0.101)	(0.160)	(0.0901)	(0.195)	(0.128)	(0.197)	(0.226)
Time of the day fixed effects	No	Yes	No	No	Yes	Yes	No	Yes
Restroom fixed effects	No	No	Yes	No	Yes	No	Yes	Yes
Evaluator fixed effects	No	No	No	Yes	No	Yes	Yes	Yes
Observations	194	194	194	194	194	194	194	194

Notes: Robust standard errors are in parentheses. All models are estimated by OLS. *** $p<0.01$, ** $p<0.05$.

A Experimental Protocol

We observe the behavior of people using the restroom. Specifically, we register if male participants flush the urinal and/or wash their hands after using the urinal. At random, observations are assigned to a treatment group or to a control group. In cases assigned to the treatment group a person waits some seconds and enters into the same restroom.

A.1 Experiment

A.1.1 Location

The experiment is conducted in three restrooms located at *Universidad de San Andrés*, Buenos Aires, Argentina. Two restrooms have three urinals and one restroom has four urinals. All selected restrooms have nearby areas where the evaluators can wait and hear the use of the urinal and the tap from outside.

A.1.2 Teamwork

The experiment is carried out by six male persons, specially trained to perform the task and similarly dressed: jeans with a dark shirt. All movements are specifically detailed in order to minimize differences between the observations.

A.1.3 The experiment

All the participants of the experiment are male adults. They are randomly assigned to two groups, treatment and control groups, using the method of Biased Coin Design.[11]

In all cases, the evaluator must wait until a person (participant) enters any of the restrooms, then he must observe and record his behavior after using the urinals. Specifically, he must register if the participant flushes the urinal and/or washes their hands after using the urinal.

a. Treated Cases: The evaluator must enter into the restroom eight seconds after the participant. It must stop at another urinal always trying to leave a place between the participant and himself:

- if the restroom has four urinals he should place himself leaving always a free urinal in between.

[11] We include the Stata Code used for the randomization in Apendix B.

- if the restroom has three urinals he should always place himself at the opposite end and whether the participant places himself in the middle he should choose randomly between either end units.

  The evaluator must register, without being noticed, if the participant flushes the urinal and/or washes its hands after using the urinal.

b. Control Cases: The evaluator must wait outside for the participant to come out listening if the participant flushes the urinal and/or washes his hands. In case of having any doubt the evaluator must enter right away and control if the participant has used the urinal, if he has flushed it and if he has washed his hands.

Before conducting the experiment the evaluator must enter the restroom, checking that everything is clean and that alcohol gel is not available.

The experiment must be conducted in the course of the day, respecting three shifts: the morning shift from 10 am to 12 pm, the mid-day shift from 12 pm to 2 pm, and the afternoon shift from 2 pm to 4 pm.

All the cases that might be contaminated by the presence of other persons in the restrooms at the same time are discarded. Besides, if a participant enters the restroom only to wash his hands, the observation is not used. We only consider those cases in which the urinals are used.

B Stata Code for the randomization

```
**********Biased Coin Design**********
matrix A=J(150,1,.) svmat double A, name(obs)
gen obs=_n drop obs1 gen treatment=0
scalar p=2/3 local d0 = 0 local t = 0

forvalues i = 1(1)150
set seed ‘i′

local u_‘i′ = runiform()

display “obs num:‘i′”

display “num aleatorio:‘i′”
```

```
display “D=‘d0′”

if (‘d0′ == 0 & ‘u_ ‘i′ ′ <= 0.5){

local t=1
}

else if (‘d0′<0 & ‘u_‘i′ ′<=p) {

local t=1
}

else if (‘d0′>0 & ‘u_‘i′ ′<=1-p) {

local t=1
}

else {

local t=-1
}

display “T=‘t′”

local d0=‘d0′+‘t′

display “D=‘d0′”

replace treatmen= 1 if (obs== ‘i′ & ‘t′ == 1) }
```