Are the Neighbors Cheating? Evidence from a Social Norm Experiment on Property Taxes in Peru

Job Market Paper

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Abstract

I study the role of norms on tax compliance through a field experiment on property taxes in Peru. Randomly chosen subsets of residents in two municipalities in the Lima province were informed, through an official letter from the municipality, about the average rate of compliance, the average level of municipal enforcement, or both. A last group was only reminded of the payment deadline. The results of the experiment reveal a more complex response to information on norms than has previously been documented. They also show that simple nudges can have large and long-lasting effects. Analysis of the administrative data reveals that disclosing information on the level of compliance had a large positive impact on compliance (20% relative to the control group). The payment reminder also raised compliance by 10%, however, an effect that persisted even after the municipality initiated legal proceeding against delinquents. The enforcement treatment did not have a significant effect on compliance net of the reminder effect. The study design also included surveys, conducted both before and after the intervention, in which a subsample of taxpayers was asked about their beliefs concerning the levels of compliance and enforcement. Both the norms and the enforcement treatments raised beliefs about compliance as well as about enforcement. Interestingly, the reminder letter also raised beliefs about compliance. To assess quantitatively the impact of norms through different channels, I fit a model in which residents take into account expected monetary penalties from noncompliance, the disutility of tax evasion rises with the fraction of residents who comply, and individuals hold subjective beliefs about the probabilities of both detection and compliance. The estimated model shows that the norm intervention acts by changing beliefs about both compliance and enforcement. There is also a large residual effect that I interpret as a strengthening of the intrinsic motivation to comply.

1   Introduction

Tax compliance remains a puzzle, in that many people pay their taxes despite low audit rates and penalties (Alm et. al 1992, Andreoni et. al 1998, Alm 1999). However, we also observe that people comply much more with some taxes than with others, in a way that closely reflects the probability of evasion being detected (Slemrod 2007, Kleven et. al 2011).[1] A widespread view is that taxpayers have a mix of motivations to comply, some intrinsic –as moral values, guilt and culture, and some extrinsic, given by material rewards (e.g. Frey 1997, Bénabou and Tirole 2006). There is still little factual knowledge, however, about how these various motivations interact in the presence of different institutional settings, and whether and how they give rise to 'social norms' (Posner 2000).[2]

Testing whether social norms have an impact on tax compliance has proved challenging and empirical evidence is scarce and mixed. Existing interventions have targeted both types of norms distinguished in the social psychology literature: descriptive –what other people actually do (Blumenthal et. al 2001), and prescriptive –what people approve of (Wenzel 2005). Blumenthal et. al 2001 studied the effect of disclosing the average compliance rate, finding no effect.[3] Wenzel 2005 analyzed the effect of correcting misperceptions in tax ethics, finding small effects. These studies, however, provide no evidence about the underlying mechanisms and many key questions remain unanswered. Do people perceive correctly the level of compliance/evasion? Do social norms relate to the level of enforcement? Can social norms be triggered and/or leveraged by policy?

This paper analyzes whether and how social norms have an effect on tax compliance. I study, in particular, the role of perceived average compliance and enforcement, and the effect of disclosing information on the true levels of aggregate compliance and enforcement when these differ. The study is conducted with the property tax in two municipalities in the Lima province of Peru. I first elicited beliefs about both the average rate of compliance and enforcement, and found a large dispersion of these beliefs. Moreover, average beliefs underestimated compliance and enforcement by as much as 30%. Randomly chosen subsets of residents were informed, through an official letter from the municipality, about the average rate of compliance, the average level of municipal enforcement, or both, 10 days prior to the payment deadline. A last group was only reminded of the payment deadline. I obtained administrative data on payments from the two municipalities, and I implemented a follow-up survey in one of the municipalities to elicit updated beliefs about both compliance and enforcement.

Four main reasons make the property tax in Lima a good setting to analyze the role of social

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[1]For example, in the US the estimated tax evasion is less than 1% for wages and salaries, and over 40% for proprietary income (U.S. Department of the Treasury, Internal Revenue Service 2006).

[2]One particular channel that has been proposed is reputational concerns and the inference of motivations from actions (Bénabou and Tirole 2006, 2011). Here, a monetary reward/penalty may crowd out the reputational motivation to comply, while inferences drawn from an action depend also on what others are doing. The latter creates strong spillovers that allow multiple norms of behavior to emerge as equilibria.

[3]However, actual compliance was 93% and they did not investigate perceived average compliance.

norms and their interaction with enforcement levels. First, a large majority complies (between 60% and 70%), but compliance is far from being universal. Second, property taxes are calculated based on property area and construction values available to the municipalities through their cadasters. The municipality, therefore, knows with certainty the amount of tax due and whether each resident has paid or not, allowing me to track compliers and non-compliers with perfect accuracy. Third, even though the municipality detects all delinquents, it may decide not to start the legal process needed to collect due taxes, either because the process is expensive or for political reasons. In fact, in 2012 the two municipalities started legal action to collect taxes due only in 70% and 80% of cases, respectively. Finally, the fact that people were underestimating both compliance and enforcement levels provided me with a good opportunity to exogenously raise these beliefs by announcing the true levels of compliance and enforcement.

Analysis of the administrative data shows that disclosing information on the level of compliance had a large positive impact on compliance (20% relative to the control group). The payment reminder also raised compliance by 10%, however, an effect that persisted even after the municipality initiated legal proceeding against delinquents. The enforcement treatment did not have a significant effect on compliance net of the reminder effect (12%), and neither did disclosing jointly the level of compliance and enforcement (11%). These results reveal how simple nudges can have large and long-lasting effects. They also show how providing information on both compliance and enforcement levels leads to a partial *crowding out* effect of the pure norms treatment, and how a norms intervention may be acting through various channels.

Investigating the mechanisms of the interventions through the follow-up survey, I find that both the norms and the enforcement treatments raised beliefs about compliance as well as about enforcement. Interestingly, the reminder letter also raised beliefs about compliance, providing an explanation of why its effect persisted even after the municipality initiated its standard enforcement policy.

The experimental study is motivated by considering a mix of motivations to comply: expected monetary penalties as well as a disutility from evading when others comply. In addition, I consider that individuals hold subjective beliefs about the probability of detection and the rate of compliance. I then estimate this model using the experimental data. The challenge is to deal with the endogeneity of beliefs about compliance and about enforcement, together with a norm intervention potentially acting through additional channels. I instrument the two endogenous regressors, beliefs about compliance and about enforcement, with the enforcement and the payment-reminder treatment assignment dummies. The fitted model shows that the norm intervention acts by changing beliefs about both compliance and enforcement. There is also a large residual effect that I interpret as a strengthening of the intrinsic motivation to comply. The results of the experiment, thus, reveal a more complex response to information on norms than has previously been documented.

Several policy implications arise from the results. In related work (Del Carpio, 2013 in progress),

for example, I show how, due to the emergence of a social multiplier, the optimal auditing policy changes when social norms impact the tax compliance decision. Moreover, the experimental and survey evidence reveals how relevant information can be credibly transmitted to residents, generating interesting opportunities to expand the policy space of the tax enforcer through communication.

The rest of the paper is organized as follows. Section 2 provides background information on the property tax in Peru, and on the project and participating districts. Section 3 describes the conceptual framework used in our analysis. Section 4 gives details regarding the experimental design and the data. Section 5 presents the results. Section 6 concludes.

2   Background

In this section I first summarize important features of the property tax in Peru that motivate the study. I then describe the scope of the project and provide a brief overview of the participating districts. The terms 'district' and 'municipality' are used indistinctly to refer to our units of analysis –the province of Lima is divided into 43 districts, and the governments of these districts are the municipalities.

2.1   The property tax in Peru

Generalities. The property tax is the main tax at the municipal level throughout Peru. It represents, in particular, one of the main sources of income for the municipalities in the province of Lima, accounting on average for 20% of their total revenues.[4] Although it is a municipal tax, the same tax base and rates apply nationwide and are regulated by the Law of Municipal Taxation; property tax rates are progressive, and apply to property area and construction values.[5]

Property registries and type of evasion targeted in study. Most municipalities hold a 'cadastre', or registry of property units in their districts. These include the information on property area and construction values needed to calculate the amount of tax due. By law, residents must self-report changes in property value. Municipalities are also required to update their cadastre (through audits) every 4 years.[6] This study deals with compliance with the property tax calculated based on the information from the property registries. Two points are worth noting in that respect. First, a resident who complies with the tax may be, nevertheless, underestimating the value of his property; I do not study this type of evasion. Second, based on the information from the property registry, the municipality knows with certainty who paid the tax and who did not.

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[4]INEI, Registro Nacional de Municipalidades (2012).

[5]Law of Municipal Taxation (D.S. 1562004–EF). The following tax rates apply: 0.2% for properties with area and construction value below $18,000, 0.6% for those between $18,000 and $72,000, and 1% for those over $72,000. Property area and construction values in Peruvian soles converted to US$ at the current exchange rate of S/. 2.8 per US$.

[6]In practice, this is done every 6 to 8 years at best.

Property tax payments. Payments must be made quarterly, with deadlines on February 28, May 31, August 31 and November 30. The tax can also be paid annually by February 28. Before the first deadline, the municipality sends to the resident a voucher stating the amount of the annual tax due.

Tax collection and administration. Tax collection policies are similar across municipalities. Before each deadline, the municipality reminds residents about the upcoming deadline through billboards and announcements on the municipality webpage. If a resident does not comply with the tax, the municipality may initiate a legal process to collect the amount due. This process starts with a warning in the form of an official notification ('You have X days to comply with the tax. If you do not pay, we will initiate a legal process to collect taxes due'). If the resident does not comply after the warning within the time allowed to regularize payment, the municipality is entitled to start a legal process to collect.[7] The latter may result in the freezing of personal accounts and/or an auction of the property, depending on the value owed.[8] Municipalities do not always actually enforce tax collections, however. In 2012, for example, the two municipalities in our study only started legal action to collect in respectively, 70% and 80% of all cases.[9]

Penalties and tax amnesties. The structure of penalties is the same across municipalities, amounting by law to 50% of the tax due if not paid by the deadline.[10] Several discounts apply, however. For example, in Jesús María the penalty is reduced to 7.5% if the resident complies before receiving the formal warning described above; to 17.5% if he complies the same day the warning is received; and to 32.5% if he complies before the judicial process is actually started. In addition, some districts grant amnesties from time to time, so as to provide incentives to pay overdue taxes, through a reduction in the penalties accrued.

Public registries of punctual residents. As another type of incentive for residents to comply with their tax obligations, some districts (Jesús María in our sample) maintain public registries of 'punctual' residents, i.e., those who always pay their taxes on time. This status also gives them preferential treatment in other municipal services as well as the right to participate in annual lotteries held at public events.

Compliance. Table 1 provides compliance data for 12 districts in Lima among those initially contacted in relationship to this project. Compliance varies significantly across municipalities: San Isidro, for example, reports over 90% compliance, whereas San Juan de Lurigancho is below 25%.

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[7]Within a certain timeframe, the resident is also allowed to appeal the official notification to a specialized fiscal court.

[8]The legal collection process is lengthy, and may take over a year.

[9]The reasons for this vary, but some explanations are related to the fact that it is expensive to start a legal process to collect. It is also not profitable in political terms to enforce municipal taxes too strongly, especially close to reelection years.

[10]Regulated by the National Tax Code (D.S.133-2013-EF).

Table 1— Compliance by district, year 2012

	Compliance (%)	Total property units
Barranco	**65**	**12,000**
Breña	65	34,000
Comas	**40**	**90,000**
Jesús María	**65**	**40,000**
La Molina	85	52,000
Lurigancho - Chosica	25	
Miraflores	90	35,000
Pueblo Libre	80	
Rimac	**40**	**43,000**
San Isidro	90	28,000
San Martín de Porras	55	230,000
Surquillo	65	
Villa María del Triunfo	**55**	**120,000**

Note: Data obtained from municipal officials in each district.
Districts in bold are the ones in which the study has been initiated.

2.2 The project and participating districts

The project. In April 2012 I contacted all 43 municipalities in the Lima province by letter, to see whether they were willing to participate in a study of compliance with the property tax in their districts. I had meetings with 17 municipalities that showed interest, and initiated the project with the five among them that (to date) formally confirmed their participation and provided me with anonymized versions of their property registries. I then implemented baseline surveys to elicit beliefs about the level of compliance in the district and neighborhood, the probability of being caught cheating, the perceived quality of the public services provided by the municipality, and some additional socioeconomic variables. Based on the administrative records provided and the baseline survey data, the experimental study was then devised. Two districts, Barranco and Jesús María have so far agreed to participate in the experiment.

Participating districts. Barranco and Jesús María rank in the top quartile of Lima municipalities in terms of income and education.[11] They are also older districts (compared to newer ones created in the 1970's to accommodate increased migration from other provinces). Barranco is located on the coast, with high-end apartments and houses by the sea, as well as middle-to low income areas. Jesús María is a traditional upper middle-income district, with more homogeneous neighborhoods as well as burgeoning commercial areas. The municipality also reports increased recent migration from the outer districts. Each district is divided into specific neighborhoods or *zonas*, which are formal geographical divisions defined by the municipalities, based on natural boundaries. Figure 1 for example, depicts Barranco's neighborhood partition. Table 2 shows, for each of our two districts, the total number of properties, the number of residential properties and their distributions by neighborhood, as well as the average property value and average compliance with the property tax. Barranco and Jesús María both have compliance rates around 65%, but Jesús María has less

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[11]Out of 43 municipalities in the Lima province, Jesús María ranks 8th in education achievement, while Barranco ranks 9th. By per capita income, Jesús María ranks 3rd, while Barranco ranks 11th.
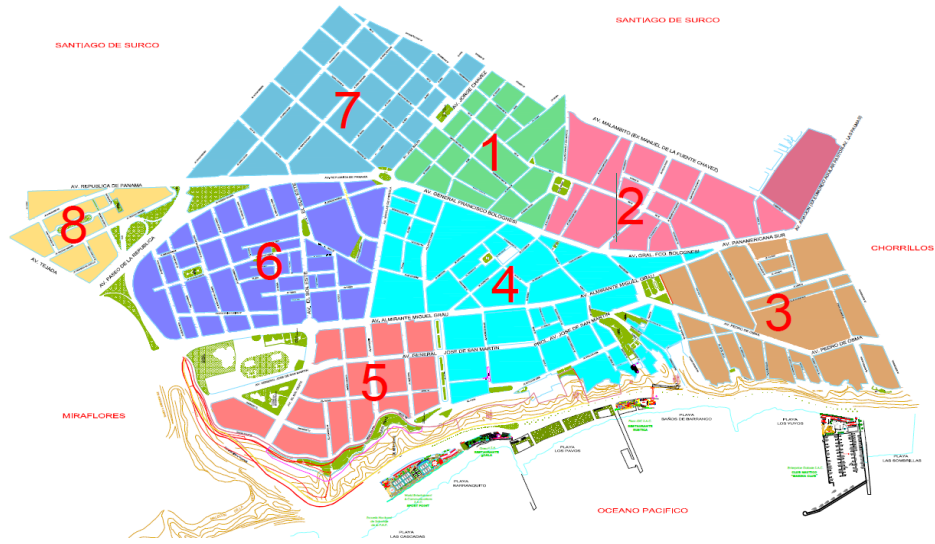
Figure 1: Barranco district neighborhoods

inter-neighborhood variation, whereas Barranco has neighborhoods with both very high and very low compliance. Jesús María also has more homogenous areas in terms of property value.

Table 2: Characteristics of properties by neighborhood

					Barranco district				
	Total	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8
Total number of properties	11,936	1,238	1,820	1,156	2,277	1,445	2,088	1,252	660
% Residential properties	89	93	91	94	85	93	91	81	87
Average property value ($)	68,459	25,958	31,261	85,646	61,318	121,122	52,094	37,723	69,438
Average compliance 2012 (%)	65.5	54.2	55.6	70.2	66.6	85.4	64.3	56.1	77.5

					Jesús María district					
	Total	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9
Total number of properties	40,519	4,613	7,520	4,146	5,892	4,550	4,949	2,607	2,911	3,340
% Residential properties	68	76	86	90	62	82	87	91	82	92
Average property value ($)	25,787	22,495	22,682	22,139	22,699	26,076	24,378	28,168	44,465	33,088
Average compliance (%)	65.7	80.2	60.5	68.5	62.3	60.1	60.7	72.5	70.4	64.1

Note: average property value and compliance are for residential units only.

3 Conceptual framework

In this section I describe the theoretical framework that motivates the experimental study and derive some testable predictions. I use a very simple model of tax compliance in which the costs of tax evasion include not only the monetary penalties payable upon detection, but also a disutility from evading when others comply. I also allow for heterogeneity in subjective beliefs about the probability of detection and the local compliance rate.

3.1 Modeling taxpayer behavior and social norms

A key feature of the data is the fact that individuals either comply or do not comply with the tax (partial compliers are less than 2% of our sample). I will thus consider a random utility model.

Let W be a taxpayer's wealth, T the total tax due, $\hat{p}$ the taxpayer's subjective belief about the probability of a legal process being started in case of non-compliance, and s the resulting penalties. We denote by $\hat{\lambda}$ the agent's belief about the proportion of residents who comply with the tax, and by $\beta = (\beta_0, \beta_1)$ his social preferences, as specified below.

The individual complies with the tax if

$$W - T \geq W - \hat{p}(1 + s)T - (\beta_0 + \beta_1\hat{\lambda})T \tag{1}$$

where the last term represents the social or moral cost of evasion. The degree of social preference has an idiosyncratic term β_0 and also depends on the perceived level of compliance $\hat{\lambda}$. For simplicity, we assume β_1 is the same across taxpayers.[12] The cost of evading also depends linearly on the amount evaded. The probability that an individual complies with the property tax is thus given by:

$$Pr\left(\beta_0 \geq 1 - \beta_1\hat{\lambda} - \hat{p}(1 + s)\right) \tag{2}$$

3.2 Challenges of the estimation and design

Two main challenges arise in the estimation of equation (2). First, it is critical to isolate exogenous variations in beliefs about enforcement and about compliance.[13] Second, in generating these variations we need to account for the fact that beliefs about compliance and about enforcement may be correlated. For example, if I am informed that the majority of residents complies with the tax, I may update my beliefs about compliance, but also my beliefs about enforcement.

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[12]In practice, however, this could not be the case. Taxpayers may respond also differently to perceived evasion. I discuss this assumption in more detail in section 5.5.

[13]Beliefs about compliance, for example, may be higher for precisely those residents who comply.

3.3 Predictions and identification of key parameters

The information treatments described in detail in the next section will focus on providing taxpayers with information on the true levels of average compliance and enforcement. I describe here the key predictions:

Announcing the average rate of compliance. If residents underestimate the true level of compliance, we expect that disclosing information about the true (previous) level will raise compliance. The mechanism at work is, at a minimum, an increase in beliefs about compliance. In addition, we may expect: (1) an increase in beliefs about enforcement, and (2) an increase in the intrinsic motivation to comply (β_0). Beliefs about enforcement may rise because taxpayers could think that if the share of non compliers is low, there are higher chances that they will be penalized if they cheat.[14] The effect on the intrinsic motivation to comply may come from the fact that as more people comply, the individual thinks complying is the right thing to do. Some studies (Frey and Torgler 2003) have documented the impact of perceived tax evasion on tax morale.

Announcing the level of enforcement. Analogously, if residents underestimate the true level of enforcement, we expect that disclosing information about the true (previous) level will raise compliance. The mechanism is again, at a minimum, an increase in beliefs about enforcement. But we may also expect changes in beliefs about compliance. For example, taxpayers may think that given the high levels of enforcement, more people are likely to be complying. Conversely, there may be more compliance because more people are being forced to pay.

Announcing both compliance and enforcement levels. I also disclose jointly true compliance and enforcement levels. If residents underestimate both true compliance and enforcement levels, we should expect an increase in both beliefs. But here the predictions on compliance are less clear. Some authors (Frey 1997, Gneezy and Rustichini 2000) have documented the *crowding-out* effect of material incentives, where small fines reduce the intrinsic motivation to comply.
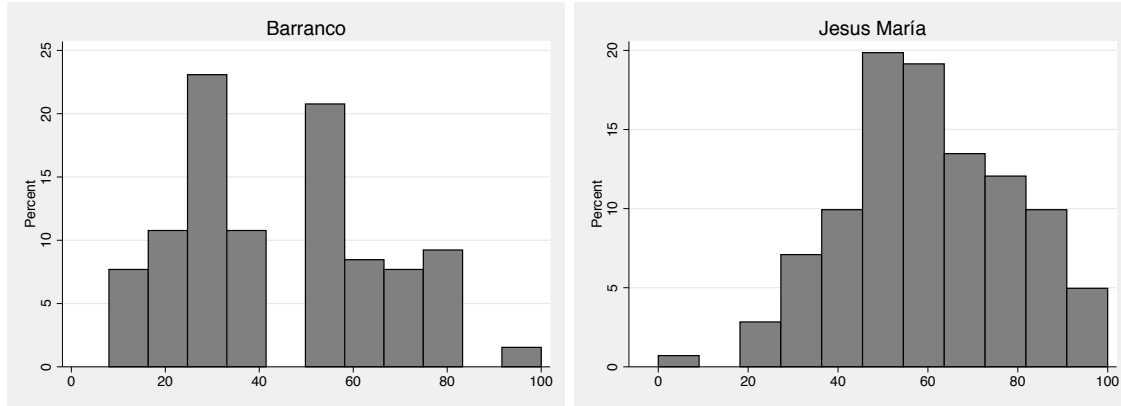
Reminder effect. All treatments are also expected to have a short-term pure reminder effect –the information was provided through an official communication from the municipality, in which the resident was also reminded of the payment deadline. However, as the municipality begins their standard enforcement policy, i.e., sending the warnings described above, the reminder effect is expected to fade away.

4 Data and research design

Key contributions of this paper are the collection of novel data and a research design that allows me to identify not only reduced-form estimates, but also the mechanisms through which norms interventions operate. Three main elements compose the research design. First, I conducted a

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[14]If we assume, for example, a fixed budget to start legal proceedings against delinquents, this will be the case.
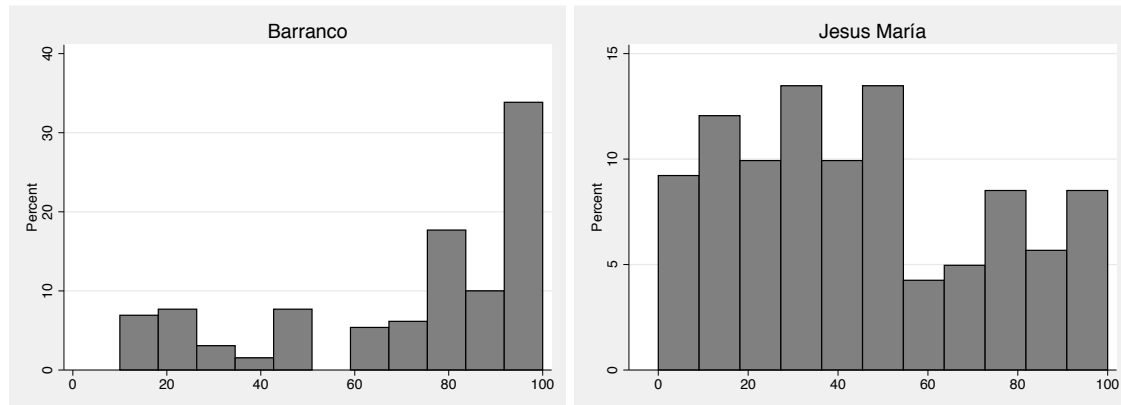
Panel A: What proportion of residents do you think comply with the property tax in this district? (<u>number</u> /100)

t-test: Compliance vs. Beliefs about compliance

	Barranco			Jesús María		
	Sample	Mean	Std.Err.	Sample	Mean	Std.Err.
Compliance	10,679	0.66	0.005	24,521	0.66	0.003
Beliefs about compliance	130	0.44	0.018	126	0.61	0.019
Difference		0.22***	0.018		0.05***	0.019

Panel B: Out of 100 cases of people who do not pay their taxes, how many do you think the municipality discovers? (<u>number</u> /100)

Enforcement vs. Beliefs about enforcement

	Barranco			Jesús María		
	Sample	Mean	Std.Err.	Sample	Mean	Std.Err.
Enforcement (% with legal action)	10,679	0.80		24,521	0.67	
Beliefs about enforcement	130	0.72	0.025	126	0.45	0.023

Figure 2: Beliefs about compliance and about enforcement

baseline survey to elicit beliefs about the levels of compliance and enforcement in each district. Second, I used random assignment for each informational treatment. Finally, I implemented a post-intervention survey to elicit updated beliefs and other key variables.

4.1   Baseline survey

The baseline survey was implemented during August 2012 through face-to-face interviews.[15] Based on the full registries of residential properties provided by the municipalities, I selected small random samples in each district, stratified by neighborhood. The sample size in both cases was 236 properties, and response rates were 55% in Barranco, and 66% in Jesús María.

Panel A of Figure 2 provides the exact wording of the question used to elicit beliefs about *compliance* and shows the distribution of these beliefs in each district. Two main facts stand out. First, we observe substantial dispersion. Second, both the modal and mean beliefs *underestimate* compliance by a large amount. In Barranco, in particular, average beliefs underestimate compliance by as much as 30%.

Panel B of Figure 2 provides the wording of the question about enforcement, and shows the distribution of the relevant beliefs. Again, we can see a large dispersion, especially in Jesús María. Given that the municipality knows for sure who pays and who doesn't, we also observe a large *underestimation*. On the other hand, people may be interpreting the question as referring to the probability of being forced to pay, in which case the perceived average enforcement ratio would still be underestimating enforcement, but by a lesser amount.

These preliminary findings motivate our choice of informational treatments.

4.2   Randomized information provision

The experiment took place prior to the deadline for the 2nd installment of the 2013 property tax (May 31). Our information treatments were disclosed through official letters from the municipality delivered 10 days prior to the deadline. Figure 3 summarizes the timeline.

Treatments. While measuring the effect of disclosing the average compliance rate in each district was my main objective, I was also interested in investigating three other dimensions of a social-norm intervention. The first one is the relevant reference group for social comparisons –specifically whether the district or the neighborhood's level of compliance has a stronger impact. The second is the role of social norms in comparison to the role of enforcement. The third is the potential interaction of social norms with beliefs about enforcement. To address these issues, I implemented six different treatments, described in Table 3.

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[15]I recruited and trained for this project a group of surveyors.

Tax payment
deadline:
May 31

Regular
enforcement
(formal warnings)
starts:
June 30

2nd Collection
of payment
data
August 15

Information
treatments
delivered:
May 20

1st Collection
of payment
data
June 24

Follow-up
survey
starts:
August 1

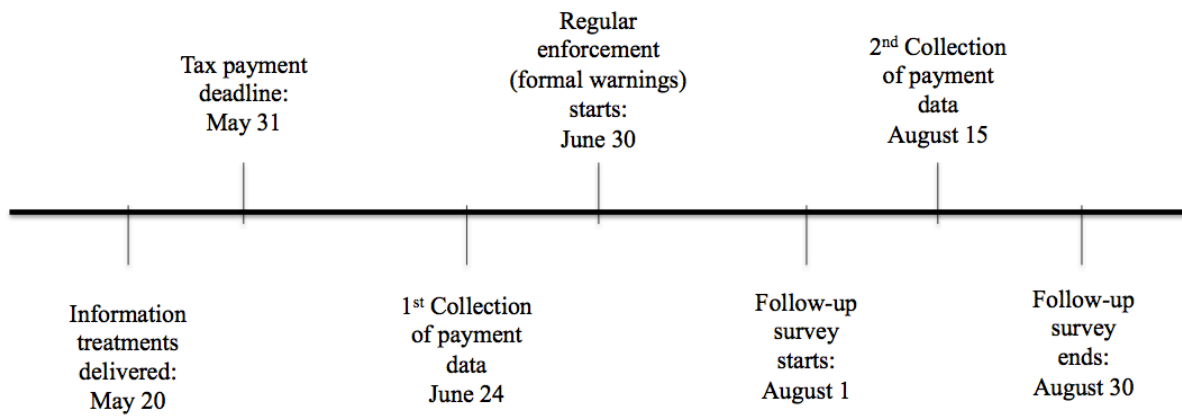Follow-up
survey
ends:
August 30

Figure 3: Timeline for the experiment

Table 3: Experimental treatments and samples

Treatment	Information sample			Survey sample	Survey respondents
	Barranco	Jesús María	Pooled	Jesús María	Jesús María
True level of compliance in district (T1)	768	915	1,683	863	576
True level of compliance in district & for lowest quartile of property (T2.1)	–	957	957	–	–
True level of compliance in neighborhood (T2.2)	771	–	771	–	–
True level of enforcement (T3)	767	957	1,724	904	587
True level of compliance and enforcement in district (T4.1)	769	924	1,693	–	–
True levels of compliance in neighborh. and enforcement in district (T4.2)	771	955	1,726	–	–
Control group, received payment reminder letter (T6)	765	937	1,702	881	584
Control group, no letter received (T0)	858	11,204	12,062	900	629
Total	5,469	16,849	22,318	3,548	2,376

Letter texts. Original letters sent (in Spanish) are included in the Appendix. The translated texts and graphs for these communications are the following:

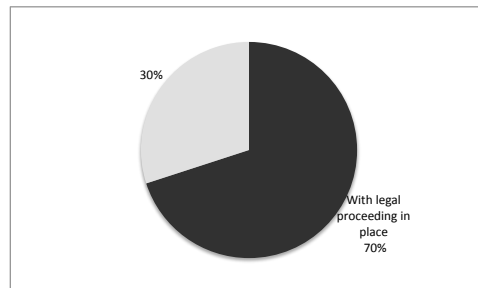Disclosing the average rate of compliance (*T*1)

We remind you that the second installment of your 2013 property tax is due on May 31. In this respect, we wanted to inform you that the large majority of residents in our district comply voluntarily with the property tax. The municipality tries to help taxpayers comply with the law. If you have any questions about your property tax return, please call us at these numbers:

% of total residential units, 2012

Disclosing the level of enforcement (*T*3)

We remind you that the second installment of your 2013 property tax is due on May 31. In this respect, we wanted to inform you that as part of the effort to ensure a more effective and fair tax collection, of the total number of residents who did not pay in 2012, we have started legal processes to collect taxes due in 70% of the cases. The municipality tries to help taxpayers comply with the law. If you have any questions about your property tax return, please call us at these numbers:

% of total residential units who did not comply, 2012

I also randomly selected a subset of residents to receive only a payment reminder. As in the other treatment groups, this had the form of an official letter from the municipality, but now stating:

We remind you that the second installment of your 2013 property tax is due on May 31. The municipality tries to help taxpayers comply with the law. If you have any questions about your property tax return, please call us at these numbers:

Finally, two treatments ($T2.1$ and $T2.2$) provided variations in the reference group for the social norm, disclosing, respectively, average compliance in the resident's specific neighborhood, and the rate of compliance at the lowest quartile of property value (in conjunction with average compliance in the district). Two other treatments ($T4.1$ and $T4.2$) provided joint information on the true level of compliance and the level of enforcement. All these announcements also reminded residents of the upcoming payment deadline.

Universe and sample design. In order to avoid contamination between different property units owned by the same resident, for the information treatments I focused on taxpayers with only one residential property in the district. This selection criteria resulted in a universe of 16,800 units in Jesús María and 5,500 in Barranco. The originally intended sample size was of 1,500 residents per treatment/control unit.[16] However, we were restricted by the size of the universe of eligible units in Barranco, and by distribution logistics in Jesús María.[17] Samples, stratified by neighborhood, were thus selected in each district according to the proportions indicated in Table 3.

4.3 Post-intervention survey

A follow-up survey was performed in the district of Jesús María, in four of the experimental groups: (1) Those treated with information about the level of compliance in the district ($T1$); (2) Those treated with information about the level of enforcement ($T3$); (3) Those who were sent only the reminder letter; and (4) Those who did not receive any letter. The survey was conducted during August 2013 through face-to-face interviews.[18] The sample included all treated residents in the experimental groups with physical addresses within the district. We selected a stratified-by-neighborhood sample from those who received no letter. Sample sizes and response rates for the post-intervention survey can be seen in Table 3.

4.4 Administrative records.

Finally, I briefly describe the administrative data provided by the municipalities.

Property registries. Based on their own property registries[19], the following information for all property units in the district was provided by the district municipalities:

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[16]Based on power calculations to identify a 5% mean difference.

[17]The municipality was delivering other documents at the same time, and agreed to deliver a total of 6,000 letters.

[18]Due to budgetary considerations I chose the largest district.

[19]Jesús María had undergone a major registry update. Barranco, on the other hand, is currently undergoing registry improvement.

(1) Property value and area;

(2) Amount of tax;

(3) Neighborhood to which property belongs;

(4) Use of property (residential, commercial, etc.); and

(5) Years of residence of the company / individual in the district.

Payment data. Prior to randomization, the municipalities also provided me with data on whether the property unit had complied with the tax in 2010, 2011 and 2012. After the experiment, they provided me with payment status almost 1 month after the 2nd installment deadline (June 24), as well as 2.5 months after the deadline (Aug 15). The standard tax collection policy in Jesús María starts by the end of June. The first section of payments thus shows the direct impact of the information treatments, while the second section of payments provides evidence on the impact of the information treatments in conjunction with the regular tax collection policy.[20]

4.5 Summary Statistics

My final dataset combines administrative data, treatment status information, and follow-up survey responses. Table 4 presents a comparison of residents who were assigned to receive the norms, enforcement and reminder treatments, together with those in the control group that received no letter. Beginning with the overall sample in the first panel of the table, we observe that 2012 compliance levels as well as log of property value are statistically indistinguishable for all groups, as expected given random assignment. The next panel pertains to the district of Jesús María. Again, we observe that 2012 mean compliance, the percent of residents in the public registry of punctual neighbors as well as log of property value are the same for all groups. Thus, we have balanced data in both our pooled and Jesus María samples.

Finally, the bottom panel of Table 4 presents comparisons in the sub-sample of residents that answered the follow-up survey. Within this sample, we cannot reject a difference between treatments and control in 2012 compliance, share of residents in the registry of punctual neighbors, and percent of people employed. However, we observe some imbalances in log of property value, as well as some differences in the degree of education attained. To control for this, we use specifications with controls that include these covariates. Table A.1 in the Appendix also reports OLS estimates of the follow-up survey response.

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[20]Barranco's standard enforcement policy is implemented at the end of the year.

Table 4 — Comparison of Main Treatments and Control

	Mean of control (no letter) group (1)	Mean of reminder group (2)	Mean of norms group (3)	Mean of enforcement group (4)	Difference norms – control (5)	t-test (6)	Difference norms – reminder (7)	t-test (8)
Pooled sample (N=22,318)								
Percent compliance 2012	69.7	67.7	67.4	67.0	0.24 (1.21)	0.20	-0.31 (1.60)	0.20
Mean log of property value	10.99	10.96	10.93	11.00	-0.02 (0.02)	1.17	-0.03 (0.03)	1.47
Jesús María sample (N=16,849)								
Percent compliance 2012	70.2	71.1	70.5	69.8	0.09 (1.57)	0.06	-0.57 (2.13)	0.27
Percent of punctual residents	16.5	15.8	15.8	14.4	-1.02 (1.25)	0.82	0.04 (1.70)	0.03
Mean log of property value	11.00	11.02	10.98	11.05	-0.023 (0.020)	1.32	-0.039 (0.027)	1.47
Survey respondents (N=2,376)								
Percent compliance 2012	69.0	72.6	71.2	71.5	2.16 (2.67)	0.81	-1.42 (2.68)	0.53
Percent of punctual residents	18.4	14.2	15.8	14.8	-3.22 (2.15)	1.50	1.14 (2.09)	0.55
Mean log of property value	10.98	11.02	10.96	11.06	-0.023 (0.032)	0.72	-0.057 (0.033)	1.75
Percent employed	70.2	65.1	66.3	67.6	-3.91 (2.69)	1.45	1.20 (2.80)	0.43
Percent high-school or less	13.3	14.3	16.7	16.4	3.53 (2.05)	1.72	2.27 (2.12)	1.07
Percent university or more	52.1	60.4	50.9	51.8	-1.34 (2.86)	0.47	-9.33 (2.89)	3.23

Notes: Entries represent means for treated and untreated individuals in indicated samples.
For the pooled sample we present weighted means in proportion to the size of the experimental samples in each district.
Difference between means are adjusted by neighborhood fixed effects to reflect the experimental design.
Standard errors, in parentheses, are adjusted to reflect the stratified by neighborhood sample design.
The t-test for the relevant difference in means is presented in columns 6 and 8.

5 Results

I now turn to the analysis of the effects of the main information treatments. I proceed in four steps. Section 5.1 provides estimates of the impact of the social norm intervention on compliance, and Section 5.2 compares these estimates to the impact of the other treatments. The following sections then turn to the investigation of mechanisms. Section 5.3 analyzes the impact of the social norm, payment reminder and enforcement interventions on beliefs about compliance and about enforcement. Section 5.4 estimates the model described in equation (2) and assesses quantitatively the contributions of each proposed mechanism on compliance.

5.1 Effect of social-norm intervention on compliance

Table 5 reports the effect on compliance of disclosing information about the (previous-year) average compliance rate at the district level (the 'norms treatment'). I measure the impact at two points in time. The first –one month after the deadline– is before the regular municipal enforcement policy takes place (columns 1 to 4). The second –2.5 months after the deadline– is post standard municipal enforcement (columns 5 and 6). Baseline specifications are given in columns 1, 3 and 5 and include neighborhood fixed effects. Columns 2, 4 and 6 include, in addition, a set of individual control variables (log of property value and share of neighbors in the public registry of punctual payers).

The estimated treatment effects are large. Prior to the municipal enforcement policy, we observe an increase in compliance of 5 percentage points in the pooled sample, and of 6 percentage points in Jesús María, representing increases of 18% and 21%, respectively, over the control group that received no letter. Moreover, these estimates increase by as much as 30% following the start of municipal enforcement. Overall compliance thus rises by 8 percentage points, representing an 20% increase over the control group.

Table 5 — Effect of Information on Average Compliance ('Norms') on Compliance

| | Prior to municipal enforcement policy | | | | After enforcement policy | |
| | Pooled sample ($N = 8,947$) | | Jesús María ($N = 7,876$) | | Jesús María ($N = 7,876$) | |
	(1)	(2)	(3)	(4)	(5)	(6)
Norms treatment ($T1$)	0.050***	0.051***	0.059***	0.062***	0.079***	0.082***
	(0.016)	(0.016)	(0.021)	(0.021)	(0.022)	(0.022)
Mean of dependent variable in the control group	0.290	0.290	0.300	0.300	0.428	0.428
Neighborhood fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Individual control variables	No	Yes	No	Yes	No	Yes

Notes: All models estimated by OLS. Dependent variable is compliance indicator obtained from administrative data.
Results are reported for the subsample that had not paid the second installment as of the first quarter.
Standard errors, adjusted for stratified (by neighborhood) sample design, are in parentheses.
***Significance at 1%. **Significance at 5%. *Significance at 10%.
Pooled sample includes the two districts in our study.
Prior to enforcement indicates payment status as of June 24, 2013 (before official municipal warnings were sent).
After enforcement indicates payment status as of August 15, 2013 (post warnings).
The omitted category is the group that received no letter ($T0$).
Individual controls include log of property value and share of residents in the public registry of punctual residents.

5.2 Effect of other treatments on compliance

Payment reminder. To understand what is driving the results in section 5.1, we first compare the norms treatment to the payment-reminder treatment. Table 6 presents these results. Prior to the municipal enforcement policy, the payment reminder raises compliance by as much as 3pp in the pooled sample and by almost 4pp in Jesús María, representing 10% and 12% increases over the control group, respectively. Even though the effect of norms is larger, the difference between the norms treatment and the payment reminder is not significant. Thus, before municipal enforcement begins, a large portion of the norms treatment effect appears to be attributable to a reminder effect.

After the municipal enforcement policy begins, however, the effect of the norms treatment relative to the payment reminder increases almost two-fold (columns 5 and 6 in Table 6), and the difference between the two is marginally significant ($p = 15\%$). Two points are worth noting here. First, the fact that the effect of the norms treatment increases after the municipal enforcement begins points to an interesting *complementarity* between the norms treatment and the standard enforcement policy. One potential explanation is that the social / moral cost of evasion has a *stigma* component, i.e., where the cost is not completely internalized, but it partially depends on being caught cheating. I discuss this in more detail in Section 5.5. Second, observing a positive impact of the pure payment-reminder treatment even after the municipal-enforcement effect has taken place is a bit puzzling, since the municipality precisely reminds all those who have not paid to comply with their taxes. A potential explanation is that the payment reminder effect is also acting through other channels, for example raising beliefs about compliance or about enforcement. In section 5.4 I explore this possibility. Overall, though, the impact of the payment-reminder is large, and corroborates the importance of 'nudge' policies in altering behavior (Sunstein and Thaler 2008), as well as the specific role of reminders (Karlan et. al 2010).

Table 7 also compares the effects of the norms and payment-reminder treatments between three different groups of residents: those with perfect compliance –who belong to the public register of punctual residents, those who never pay, and those with imperfect compliance. As can be seen from columns 1 and 2, the largest impact of both the social-norms and payment-reminder treatments *before* municipal enforcement begins is on those individuals who always pay, consistent with a pure reminder effect hypothesis. However, *after* the municipal enforcement policy begins (columns 3 and 4), the social-norms treatment has a large positive impact on those individuals with imperfect compliance (6pp), while the incremental effect in the group of residents who always comply is not significant. In contrast, the payment-reminder has no effect in the group of residents with imperfect compliance.

Table 6 — Effect of Information on Average Compliance ('Norms') and Reminder on Compliance

	Prior to municipal enforcement policy				After enforcement policy	
	Pooled sample (N = 10,032)		Jesús María (N = 8, 457)		Jesús María (N = 8, 457)	
	(1)	(2)	(3)	(4)	(5)	(6)
Norms treatment (T1)	0.051***	0.052***	0.060***	0.063***	0.079***	0.084***
	(0.0156)	(0.0155)	(0.0209)	(0.0206)	(0.0218)	(0.0216)
Reminder treatment (T6)	0.030**	0.030**	0.035*	0.036*	0.041*	0.042**
	(0.015)	(0.015)	(0.020)	(0.020)	(0.022)	(0.021)
Difference Norms (T1) - Reminder (T6)	0.021	0.022	0.024	0.027	0.038	0.042
	(0.019)	(0.019)	(0.028)	(0.028)	(0.030)	(0.029)
Mean of dependent variable in the control group	0.290	0.290	0.300	0.300	0.428	0.428
Neighborhood fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Individual control variables	No	Yes	No	Yes	No	Yes

Notes: All models estimated by OLS. Dependent variable is compliance indicator obtained from administrative data.
Results are reported for the subsample that had not paid the second installment as of the first quarter.
Standard errors, adjusted for stratified (by neighborhood) sample design, are in parentheses.
***Significance at 1%. **Significance at 5%. *Significance at 10%.
Pooled sample includes the two districts in our study.
Prior to enforcement indicates payment status as of June 24, 2013 (before official municipal warnings were sent).
After enforcement indicates payment status as of August 15, 2013 (post warnings).
The omitted category is the group that received no letter (T0).
Individual controls include log of property value and share of residents in the public registry of punctual residents.
Difference in means adjusted for neighborhood fixed effects.

Table 7—Effect of Information on Average Compliance ('Norms') on Compliance: Differences by Type of Residents

	Prior to enforcement policy		After enforcement policy	
	Jesús María (N = 8,457)		Jesús María (N = 8,457)	
	(1)	(2)	(3)	(4)
Norms treated (T1)	0.038	0.038	0.067***	0.070***
	(0.0239)	(0.0239)	(0.0251)	(0.0251)
Reminder treated (T6)	0.016	0.017	0.023	0.023
	(0.023)	(0.023)	(0.025)	(0.025)
Norms treated ×$\mathbb{1}$(Always complies)	0.156**	0.155**	0.026	0.024
	(0.068)	(0.067)	(0.066)	(0.066)
Reminder treated ×$\mathbb{1}$(Always complies)	0.129**	0.128**	0.096	0.093
	(0.064)	(0.064)	(0.061)	(0.061)
Norms treated ×$\mathbb{1}$(Never complies)	0.024	0.026	0.062	0.064
	(0.053)	(0.053)	(0.062)	(0.061)
Reminder treated ×$\mathbb{1}$(Never complies)	-0.016	-0.017	0.006	0.003
	(0.048)	(0.048)	(0.058)	(0.058)
$\mathbb{1}$(Always complies)	0.090***	0.090***	0.101***	0.100***
	(0.017)	(0.017)	(0.017)	(0.017)
$\mathbb{1}$(Never complies)	-0.191***	-0.188***	-0.265***	-0.259***
	(0.012)	(0.012)	(0.014)	(0.014)
Mean of dependent variable in control group	0.314	0.314	0.451	0.451
Neighborhood fixed effects	Yes	Yes	Yes	Yes
Individual control variables	No	Yes	No	Yes

Notes: All models estimated by OLS. Dependent variable is compliance indicator obtained from administrative data.
Results are reported for the subsample that had not paid the second installment as of the first quarter.
Standard errors, adjusted for stratified (by neighborhood) sample design, are in parentheses.
***Significance at 1% level. **Significance at 5% level. *Significance at 10% level.
Prior to enforcement indicates payment status as of June 24, 2013 (before official municipal warnings were sent).
After enforcement indicates payment status as of August 15, 2013 (post warnings).
The omitted category is the group of imperfect compliers that received no letter (T0).
Individual controls include log of property value and share of residents in the public registry of punctual residents.

Enforcement. I now turn to the three informational treatments that deal with the true level of enforcement. Results are provided in Table 8. Surprisingly, enforcement is the worse performing treatment prior to the actual municipal enforcement policy, increasing compliance by only 2pp in the pooled sample, and the effect is not even significant in Jesús María. Moreover, announcing together the level of enforcement and the average rate of compliance has a lower effect (4pp) than announcing only the average rate of compliance.

The impact of the enforcement treatment increases significantly after the municipal enforcement policy commences, again providing some evidence of *complementarity* between informational treatments and standard enforcement policy. In this particular case, it makes sense to think of the formal municipal warning having more credibility after the resident has been informed that, in the large majority of cases, the municipality actually starts a legal process to recover overdue taxes.

Two particularly interesting and related findings arise when comparing norms to enforcement-information manipulations. The first is the apparent reduction of the effects of norms when com-

bined with enforcement ($T1$ vs. $T4$ in Table 8). The second is the large and significant difference between the impact of the sole-norms treatment and the differential impact of norms controlling for enforcement ($T1$ vs. $(T4 - T3)$, row (d) in Table 8). If the second specification ($T4 - T3$) is successful in controlling for the level of enforcement, and thus measures only the partial effect of providing the rate of average compliance on compliance, then the larger impact of the norms treatment cannot be attributed to only changing beliefs about compliance. This is suggestive of *crowding-out* effects of the treatment that announces both the average rate of compliance and the level of enforcement. Such a crowding out of intrinsic motivation by extrinsic incentives has been reported in various types of social interactions (e.g. Frey 1997, Gneezy and Rustichini 2000). More generally, we can think of the norms treatment acting at least through two other channels: increasing beliefs about the level of enforcement, and generating 'priming effects' on the degree of social preference or intrinsic motivation to comply (β_0 in the model).

Table 8 — Effect of Information on Average Compliance ('Norms') and Enforcement on Compliance

| | Prior to municipal enforcement policy | | | | After enforcement policy | |
| | Pooled sample (N = 13, 315) | | Jesús María (N = 10, 228) | | Jesús María (N = 10, 228) | |
	(1)	(2)	(3)	(4)	(5)	(6)
Norms treatment (T1)	0.052***	0.053***	0.060***	0.064***	0.079***	0.084***
	(0.015)	(0.015)	(0.021)	(0.021)	(0.022)	(0.022)
Enforcement treatment (T3)	0.024*	0.025*	0.024	0.026	0.051**	0.052**
	(0.015)	(0.015)	(0.020)	(0.020)	(0.021)	(0.021)
Norms and enforcement treatment (T4)	0.044***	0.044***	0.048***	0.045***	0.050***	0.046***
	(0.012)	(0.012)	(0.015)	(0.015)	(0.016)	(0.016)
Differences:						
(a) Norms (T1) – Enforcement (T3)	0.028	0.029	0.036	0.038	0.028	0.032
	(0.019)	(0.019)	(0.028)	(0.027)	(0.029)	(0.029)
(b) Norms (T1) – Norms and enforcement (T4)	0.007	0.009	0.012	0.019	0.029	0.038
	(0.016)	(0.016)	(0.024)	(0.023)	(0.025)	(0.025)
(c) Norms and enforcement (T4) – Enforcement (T3)	0.020	0.019	0.024	0.019	-0.001	-0.006
	(0.016)	(0.016)	(0.025)	(0.024)	(0.026)	(0.025)
(d) Norms (T1) – [Norms and enforc. (T4) – Enforcement (T3)]	0.031	0.034	0.035	0.045	0.080**	0.090***
	(0.022)	(0.022)	(0.031)	(0.031)	(0.033)	(0.033)
Mean of dependent variable in the control group	0.290	0.290	0.300	0.300	0.428	0.428
Neighborhood fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Individual control variables	No	Yes	No	Yes	No	Yes

Notes: All models estimated by OLS. Dependent variable is compliance indicator obtained from administrative data.
Results are reported for the subsample that had not paid the second installment as of the first quarter.
Standard errors, adjusted for stratified (by neighborhood) sample design, are in parentheses.
***Significance at 1%. **Significance at 5%. *Significance at 10%.
Pooled sample includes the two districts in our study.
Prior to enforcement indicates payment status as of June 24, 2013 (before official municipal warnings were sent).
After enforcement indicates payment status as of August 15, 2013 (post warnings).
The omitted category is the group that received no letter (T0).
Individual controls include log of property value and share of residents in the public registry of punctual residents.
Difference in means adjusted for neighborhood fixed effects.

5.3 The effect of the treatments on beliefs

As noted in the two previous subsections, the social-norm treatment's effect on compliance appears to be operating through multiple mechanisms. To study these different channels, I use data from the follow-up survey, allowing me to examine the effect of treatments on beliefs about compliance and about enforcement.

The first mechanism I explore is beliefs about compliance. Table 9 reports the impact of the norms, enforcement and payment-reminder treatments on these beliefs. As expected, the norms treatment increases beliefs about compliance relative to the control mean (6%). Moreover, this increase leads mean beliefs in the norms group almost to reflect the true level of compliance (72%). The enforcement treatment also raises beliefs about compliance, even by a larger amount (9%). As mentioned earlier, this could be the result of people thinking that given the high levels of enforcement, more people are likely to be complying. Alternatively, that there is more compliance because more people are being forced to pay. Interestingly, the payment reminder also raises beliefs about compliance (5%).

Table 9—Effect of Information Treatments on Beliefs about Compliance

	Survey Respondents sample ($N = 2,357$)	
	(1)	(2)
Norms treatment ($T1$)	3.68***	3.67***
	(0.963)	(0.972)
Reminder treatment ($T6$)	3.25***	3.28***
	(0.914)	(0.918)
Enforcement treatment ($T3$)	6.01***	6.05***
	(0.909)	(0.919)
Difference Norms ($T1$) – Reminder ($T6$)	0.43	0.40
	(0.976)	(0.997)
Difference Norms ($T1$) – Enforcement ($T3$)	-2.35**	-2.44**
	(0.973)	(0.985)
Mean of dependent variable in the control group	66.1	66.1
Neighborhood fixed effects	Yes	Yes
Individual control variables	No	Yes

Notes: All models estimated by OLS. Dependent variable is response to survey question: 'What proportion ('X/100') of residents do you think comply with the tax in this district?' Standard errors, adjusted for stratified (by neighborhood) sample design, are in parentheses. ***Significance at 1% level. **Significance at 5% level. *Significance at 10% level. Individual controls: log of property value, share in the public registry of punctual residents, % employed, and degree of education. The omitted category is the group that received no letter ($T0$). Difference in means adjusted for neighborhood fixed effects.

The fact that the payment reminder is raising beliefs about compliance provides an explanation of why its effect does not fade away after the municipality starts its regular enforcement policy (and thus, reminds those who have not yet paid to comply with payment). As to why the payment reminder raises beliefs about compliance, some guidance is obtained from one of the questions in the follow-up survey. Residents were asked whether when someone did not pay the property tax, they thought it was mainly because they forgot, did not have the money, or did not want to pay. Thirty eight percent answered that forgetting was the main reason, only second to not having the money to pay (42%). Thus, residents appear to be aware that many people just forget to pay their taxes, and may have thought that most residents had not forgotten to pay their taxes this time, precisely because they received the reminder. As I mention in section 5.5 the effect of the reminder is consistent with findings in other settings (e.g. Karlan et. al 2010 on the role of reminders on increasing savings).

In Table 10, I report the impact of the information treatments on beliefs about *enforcement*. As expected, both the norms and enforcement treatments raise beliefs about enforcement, although the payment reminder does not.

Table 10—Effect of Information Treatments on Beliefs about Enforcement

	Overall sample ($N = 2,352$)	
	(1)	(2)
Norms treatment	3.38***	3.21**
	(1.292)	(1.302)
Reminder treatment	1.82	1.64
	(1.257)	(1.268)
Enforcement treatment	3.95***	4.06***
	(1.287)	(1.294)
Difference Norms – Reminder	1.56	1.57
	(1.306)	(1.352)
Difference Norms – Enforcement	-0.57	-0.86
	(1.339)	(1.327)
Mean of dependent variable in the control group	70.8	70.8
Neighborhood fixed effects	Yes	Yes
Individual control variables	No	Yes

Notes: All models estimated by OLS. Dependent variable is response to survey question: 'Of 100 cases of people who do not comply with the tax, how many do you think the municipality discovers?' Standard errors, adjusted for stratified (by neighborhood) sample design, are in parentheses.
***Significance at 1% level. **Significance at 5% level. *Significance at 10% level.
Individual controls: log of property value and share in the public registry of punctual residents, % employed, and degree of education.
The omitted category is the group that received no letter ($T0$).
Difference in means adjusted for neighborhood fixed effects.

5.4 Estimation of the model

The estimates reported in the previous sections provide evidence on how the various channels of a descriptive norm intervention affect compliance, but they do not allow for a quantitative assessment of the contributions of each one to compliance. To measure the impacts of the different mechanisms, I estimate the simple model proposed in Section 3. As mentioned earlier, the challenge in estimating the model is the endogeneity of beliefs about compliance and about enforcement, together with a norms treatment that may be working through different channels.

Recall from section 3 that the probability that an individual complies with the property tax is $Pr\left(\beta_0 \geq 1 - \beta_1\hat{\lambda} - \hat{p}(1+s)\right)$, where $\hat{p}$ is the taxpayer's subjective belief about the probability of a legal process being started in case of non-compliance, s the resulting penalties, $\hat{\lambda}$ the agent's belief about the proportion of residents who comply with the tax, and $\beta = (\beta_0, \beta_1)$ his social preferences.

If we let the unobserved idiosyncratic component of social preference β_0 be normally distributed with mean μ_0 and variance σ^2, the probability of complying is given by the probit:

$$Pr(C = 1) = \Phi\left(\frac{\beta_1\hat{\lambda} + \beta_2\hat{p}(1+s) + \mu_0 - 1}{\sigma}\right) \tag{3}$$

I estimate the structural effects of $\hat{\lambda}$ and $\hat{p}$ using the experimental interventions as instruments. The effects that I seek to capture are: (i) the impact of beliefs about average compliance on the probability of compliance (β_1), (ii) the impact of beliefs about enforcement on the probability of compliance (β_2), and (iii) a potential residual effect of the norms treatment on the intrinsic motivation to comply (i.e, $\Delta\mu_0$). In addition, I need to isolate the 'reminder' effect of all treatments. My identification strategy proceeds as follows:

(i) Isolating the reminder effect. I use as dependent variable compliance *after* the standard municipal enforcement policy has taken place. Given that at this stage the municipality has already sent formal notifications to most of those who did not comply, the pure reminder effect of the treatments is likely to be minimal.

(ii) Instrumentation of beliefs about compliance and about enforcement. Based on the previous results, it is likely that the norms treatment is having an impact on compliance through a channel independent of beliefs about compliance and enforcement. Thus, we cannot use our norms treatment assignment dummy as an instrument for these beliefs. However, the enforcement and payment-reminder treatments do qualify as good instruments provided that both *only* have an impact on compliance through beliefs about enforcement and about compliance. In Section 5.3 I showed that both treatments were indeed correlated with beliefs about compliance, while the enforcement treatment was in addition correlated with beliefs about enforcement. Netting out the reminder effect, I assume that these two treatments are acting through changing beliefs about compliance and about enforcement only.

(iii) Accounting for changes in the intrinsic motivation to comply. Having accounted for beliefs

about compliance and about enforcement, I use the norms treatment in the main specification to identify the residual effect –not operating through beliefs about compliance or enforcement– on compliance.

Specifically, I fit the following probit model with endogenous regressors

$$Pr(C = 1/\mathbb{1}_{(norms)}, \hat{\lambda}, \hat{p}, x) = \Phi\Big(u + \alpha\mathbb{1}_{(norms)} + b_1\hat{\lambda} + b_2\hat{p} + \theta x\Big) \tag{4}$$

where $\hat{\lambda}$ and $\hat{p}$ are instrumented with $\mathbb{1}_{enforcement}$ and $\mathbb{1}_{reminder}$ and x is a set of control variables. I estimate the model with maximum likelihood.

The estimates are reported in Table 11. As expected, beliefs about compliance have a significant positive impact on compliance. However, beliefs about enforcement have a significant negative effect. Moreover, the residual impact of the norms treatment is large and significant. In terms of marginal effects, a 1% increase in beliefs about compliance leads to an 1% increase in the probability of complying, while a 1% increase in beliefs about enforcement leads to a 0.5% decline in the probability of complying. The residual effect of the norms treatment increases the probability of complying by 4% (or 10% relative to the control group).

Table 11–Probit estimation of probability of complying (with endogenous regressors)

	Survey sample (N = 2,352) (1)
Beliefs about compliance	0.035***
	(0.007)
Beliefs about enforcement	-0.026***
	(0.001)
Norms treatment	0.130**
	(0.061)
Neighborhood fixed effects	Yes
Individual controls	Yes

Notes: Model estimated by MLE. Dependent variable is dummy for compliance. Standard errors, adjusted to reflect stratified sample design, are in parenthesis. Endogenous regressors: beliefs about compliance and enforcement, instrumented with reminder and enforcement treatments. Individual controls: log of property value and indicator for punctual resident.

As stated above, given the assumptions made, the residual impact of the norms treatment can be interpreted as a 'priming effect' on social preferences or a strengthening of the *intrinsic* motivation to comply. In terms of magnitude, it is almost four times the size of the effect of beliefs about compliance. To explain this finding, it is important to recall that the norms treatment disclosed that 'the large majority complies with the tax voluntarily', providing the exact percentage of compliance as reference. Thus, in addition to the particular percentage of people complying, a confirmation that the large majority is complying may be contributing to the individual's own sense of what is good and acceptable.

The negative impact of beliefs about enforcement is a bit more puzzling, and could be the result of people thinking some people comply because they are forced to comply and not voluntarily. Thus, what may be important is not that others comply, but their *motivation to comply*. As we discuss in the next section, it will be interesting to study in more depth these different channels.

5.5 Discussion

In the previous sections, I have provided evidence on the impact of a set of policy interventions on compliance. A key first finding is that 'nudge policies' can have large effects, in particular simple reminders. Second, experimental and survey data combined reveal that information can be credibly transmitted to taxpayers, and that they react to this information, providing interesting opportunities to expand the policy space for the tax enforcer. Further research, for example, on the effect of *recurrent* communication from the municipalities about compliance and enforcement levels is of particular interest. A third finding is the role of enforcement in crowding-out the effect of norms. More research on the policy implications of this effect is required.

A fourth set of findings pertains more specifically to the role of social-norms interventions on tax compliance. They are the best performing treatment in our study. However, the results of the experiment reveal a complex response to information on norms. More work is needed to better understand its effects operating through several channels. Two main issues are of special relevance here. First, understanding the role of norms in changing the intrinsic motivation to comply, and disentangling this effect from others. In upcoming research, I plan thus to perform a larger experiment to corroborate the difference between norms and other simple manipulations also sent by official communications. Second, understanding how beliefs about compliance affect compliance is also required, for example by allowing for heterogeneity in the response to perceived compliance.

Finally, another particular issue that deserves further investigation is the *complementarity* between the treatments and the municipal standard enforcement policy. I have requested information on which residents were sent official warnings, so that I can analyze in more detail the interaction between the treatments and the official warning, in particular between the norms treatment and the official warning. As I mentioned earlier, one of the reasons for this complementarity may be that part of the social cost of not complying is related to the probability of being caught cheating.

6   Conclusions

In this paper I randomize information provision about the average rates of compliance and enforcement, delivered through official letters, to test how taxpayers change their evasion decisions. I exploit the fact that, on average, taxpayers underestimated both compliance and enforcement. A group of residents was only sent a payment reminder, also through an official letter.

Disclosing the true rate of (previous) compliance has a large significant positive impact on compliance (20% relative to the control group). The payment reminder, however, can explain almost half of this increase. Disclosing information about enforcement does not have any net effect beyond that of the payment reminder, and neither does disclosing jointly enforcement and compliance levels. Enforcement information thus, when combined with norms, partially crowds-out the effect of the sole norms treatment. Using survey data, I also find that both the enforcement and norms treatments raise beliefs about compliance as well as about enforcement. Interestingly, the payment reminder also raises beliefs about compliance.

The experimental study is motivated by a conceptual framework in which residents, in addition to the expected monetary penalties from noncompliance, suffer a disutility from evading when other residents comply, and individuals hold subjective beliefs about both the probability of detection and the rate of compliance. The estimated model confirms that the norm intervention acts by changing beliefs about both compliance and enforcement. There is also a large residual effect that I interpret as a strengthening of the intrinsic motivation to comply. The experiment thus reveals a more complex response to norms-based interventions than has been previously documented.

Several policy implications arise from these results. First, the experimental evidence shows that relevant descriptive information can be credibly transmitted to the residents, and how the policy space of the tax enforcer can be expanded through communication. Second, optimal tax enforcement changes when social norms affect evasion decisions. I pursue this question from a mechanism design perspective in Del Carpio 2013 (in progress). Budgetary resources have a larger marginal benefit on those sectors (or neighborhoods) where more people are complying. Moreover, there is a discontinuity in the allocation of the budget across sectors. This discontinuity happens where the tax authority is no longer able to deter evasion, and thus no social norms emerge.

Finally, several questions remain unanswered that I will aim to address in future research. The districts studied here turned out to be favorable ones (from a policy perspective) in which to carry out descriptive norms-based interventions. In both districts the large majority of residents (70%) complies with the property tax, and average beliefs underestimated compliance. However, we may ask what happens when people overestimate compliance? Or do social preferences get primed, more generally, when the majority complies? Planned experiments with other districts in the Lima province, in which there is overestimation of compliance will provide a more complete picture of the role of norms on tax compliance.

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Appendix 1: Additional Tables

Table A.1 — Determinants of Follow-up Survey Response

	Overall sample ($N = 3,548$) (1)
Treatment effects:	
Norms treatment ($T1$)	-0.0314
	(0.0222)
Reminder treatment ($T6$)	-0.0360
	(0.0221)
Enforcement treatment ($T3$)	-0.0496**
	(0.0220)
Log of property value	-0.0169
	(0.0136)
Compliance 2012 dummy	0.00683
	(0.0205)

Notes: Model estimated by OLS
Dependent variable is indicator for responding to follow-up survey.
Standard errors, adjusted for stratified sample design, are in parentheses.
***Significance at 1%. **Significance at 5%. *Significance at 10%.

Appendix 2: Experimental letters

Norms treatment

Enforcement treatment

Municipalidad de
Jesús María

Rentas
Calidad de Vida es i Tributar

Jesús María, 15 de mayo de 2013

Estimado(a) vecino(a):

Le recordamos que la fecha limite para el pago de la segunda cuota del impuesto predial del año 2013 es el 31 de mayo.

Al respecto, queríamos informarle que como parte del esfuerzo para garantizar una recaudación tributaria más equitativa y efectiva, del total de vecinos que no cumplieron con el pago del impuesto predial durante el año 2012, hemos emitido órdenes de cobranza e iniciado procesos coactivos en el 68% de los casos.
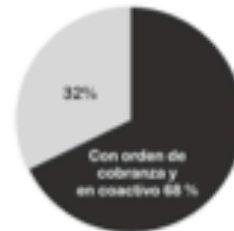
La municipalidad trata de ayudar a los vecinos a cumplir con la ley. Si usted tiene alguna pregunta acerca de su declaración del impuesto predial o pago de sus cuotas por favor llámenos a estos números:

Aló Rentas 471-1771 ó al 614-1212 anexo 2920/2924

Sinceramente,

32%

Con orden de
cobranza y
en coactivo 68 %

% del total de predios residenciales
que no pagaron, Año 2012

MUNICIPALIDAD DISTRITAL DE JESÚS MARÍA
GERENCIA DE RENTAS

Jesús María
POSITIVO

JM

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