The Direct and Indirect Effects of Messages on Tax Compliance: Experimental Evidence from Peru

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Abstract: We carry out a randomized controlled trial to evaluate the effect of three types of messages sent to taxpayers on their compliance with the rental income tax (direct effect) and the spillovers produced on the capital gains and the self-employment income taxes (indirect effects). One message highlights detection, other appeals to social norms, and the third appeals to altruism. We also perform a 15-month follow-up to determine if the treatment increases tax revenues in a sustained manner. We find that the message addressing detection produces a positive and sustained direct effect and a negative but transitory spillover on the other two taxes. The social norms message has no direct effect but produces a sustained negative spillover on the capital gains tax. The message appealing to altruism produces a transitory negative effect and no spillovers. We show there is substantial risk of overestimating the tax revenues produced by the messages if one relies only on their direct effects.

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1 Introduction

Developing countries usually experience high evasion rates, which greatly hinder their ability to provide public goods and services (Besley and Persson, 2014). Because income taxes are more difficult to administrate in contexts of high informality, developing countries tend to have a larger share of their tax revenue collected from the value added tax and other consumption taxes. However, there could be large benefits of improving the collection of income taxes.

In this regard, there is a large body of research about income tax evasion and, in particular, about field experiments designed to increase tax compliance by sending messages that appeal to different drivers of taxpayers' behavior. Messages inspired in the standard theory of tax evasion (e.g those that remind taxpayers about the costs of trying to cheat) appear to be effective in many settings.[1] However, evidence for messages appealing to moral considerations and social norms is mixed and several studies have documented that these messages can backfire or have no effect.[2]

Targeting a single tax type is quite common in the literature[3] but messages can have indirect effects on compliance with taxes other than the one addressed in the message. For example, targeting state taxes may have an indirect effect on federal tax compliance. Also, targeting taxes collected from a particular source of income may have an indirect effect on taxes collected from other sources.[4] Therefore, it is important to evaluate if messages can produce indirect effects, but the literature offers little evidence on this, with the exception of a recent literature in behavioral economics studying how incentives and behavioral policy interventions affect individuals' allocation of scarce cognitive resources leading to spillovers (Nafziger, 2020; Altmann et al., 2021).

To the best of our knowledge, there is only one study explicitly addressing indirect impacts on compliance across different taxes (Lopez-Luzuriaga & Scartascini, 2019; henceforth

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[1]For example, Slemrod, Blumenthal, and Christian, (2001). See review in Slemrod (2019).

[2]Positive effects were documented by Del Carpio, 2014; Bergolo et al., 2017; Hallsworth et al., 2017; Meiselman, 2018; Bott et al., 2020. No effect or backfiring were documented by Blumental, Christian, and Slemrod, 2001; Fellner et al., 2013; Castro and Scartascini, 2015; Perez-Truglia and Troiano, 2018; John and Blume, 2018; Chirico et al., 2019; Cranor et al., 2020; and De Neve et al., 2021.

[3]For papers studying taxpayers' responses to messages addressing a single tax type (e.g. a particular category of the income tax, or a state tax vis-a-vis a federal tax), see Blumenthal, Christian, and Slemrod (2001), Slemrod, Blumenthal, and Christian, (2001), Del Carpio (2014), Castro and Scartascini (2015), Meiselman (2018), Perez-Truglia and Troiano (2018), Bott et al., (2020), Lopez-Luzuriaga and Scartascini (2019), Ortega and Scatascini (2020), Cranor et al. (2020), and De Neve et al. (2021).

[4]Moreover, since firms are owned and managed by people, indirect effects may also be relevant to papers studying firms' responses to messages. See for example Bergolo et al. (2017), Brockmeyer, et al. (2019), Boning et al., (2020).

LLS). This study focuses on the indirect effects (or spillovers) of messages highlighting penalties and detection. The authors propose a model that predicts that an increase in penalties can produce a positive spillover but an increase in detection can produce a negative spillover if taxpayers assume that higher detection in one tax means lower enforcement in other taxes because the tax administration has limited resources. They find evidence consistent with the positive spillover produced by messages highlighting penalties.

In this paper, we study the direct and indirect effects of targeting a single type of income tax. We carry out a randomized controlled trial in six districts of Lima, Peru to evaluate the direct and indirect effects of three different types of messages addressing the payment of the rental income tax. The direct effect refers to the payment of the rental income tax which taxes the income that comes from leasing real properties and goods. The indirect effects refer to the payment of the capital gains tax and the self-employment income tax. The first is charged when individuals sell a property or securities, while the second is charged when individuals earn an income stream without having an employer. All three taxes share the characteristic of being difficult to enforce because taxpayers can easily under-report or avoid reporting their income stream.

We send three types of message and a reminder letter. The first type of message (henceforth "deterrence") highlights the effectiveness of the tax authority's control actions. The second type (henceforth "social norms") informs about the compliance of other taxpayers living in the same districts. The third type (henceforth "altruism") highlights that tax revenues can be used for the provision of public goods targeted on disadvantaged citizens. All the information presented in these messages makes explicit reference to the rental income tax.

The comparison group received a short reminder that was repeated in all three messages. In this way, we identify the effect of adding just a couple of lines on top of the reminder letter. In addition, we conduct a post-intervention survey with a random sub-sample of the taxpayers included in our research to identify some subjective drivers of their tax paying behavior such as their social preferences and their beliefs about tax compliance, the quality of public goods, and the prevalence of corruption in public institutions.

Each message was physically sent once per month between October 2018 and January 2019, for a total of four messages. Using a long panel of administrative data from the Peruvian tax authority we are able to follow about 9,000 taxpayers until January 2020. Our main results can be summarized as follows.

We find that the "deterrence" message produces a positive direct effect on the total amount paid of the rental income tax. This effect is sustained throughout the 15-month

follow-up period. It also produces a negative transitory indirect effect on the payments related to the capital gains and the self-employment income taxes. This negative spillover can be explained by the LLS (2019) framework (i.e. taxpayers understand that increase enforcement efforts devoted to one tax will reduce efforts devoted to other taxes), or through a cash-flow effect (i.e. taxpayers lower payments of other taxes to reduce the cash strain produced by the additional payments of the rental income tax), or through a cognitive spillover mechanism (as in Altmann, et al., 2021).

We also find the the "social norms" message has no direct effect but, interestingly, produces a sustained negative indirect effect on the total amount paid of the capital gains tax. One possible explanation for this pattern is that the message did not induce an update in the taxpayers' beliefs regarding compliance with the rental income tax (nor the self-employment income tax) but was able to induce a *downward* update in the taxpayers' beliefs regarding compliance with the capital gains tax. We note that our results point out the need to improve our understanding on how messages addressing beliefs about compliance with a certain tax type may nudge individuals to update their beliefs about compliance with other tax types.

Further, the "altruism" message produces a negative transitory direct effect on compliance with the rental income tax and no indirect effects on the other two taxes. We argue this message backfires because it compounds the negative effect of non-altruistic preferences and the perception that public institutions are highly corrupt and ineffective. We show that taxpayers in our sample have these preferences and perceptions using the results of the post-intervention survey.

As an illustration of the quantitative importance of the indirect effects relative to the direct effects, we simulate the distribution of direct and total gains for each type of message using 1,000 bootstrapped samples. The direct gains consider the effect on the rental income tax. The total gains add the additional resources coming from the capital gains and self-employment income tax. This exercise indicates that there is substantial risk of overestimating the tax revenues produced by the messages if one relies only on their direct effects. This is particularly true for the "social norms" message.

This paper makes several contributions to the existing literature. First, we document the existence of indirect effects or spillovers produced by messages that appeal to behavioral aspects of taxpayers' response (i.e. "social norms" and "altruism"). Even though targeting a single tax type is quite common in the literature, to the best of our knowledge, no other study has evaluated the spillovers produced by these types of messages. Second, we expand the evidence for the indirect effects of "deterrence" messages presented in LLS

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(2019) by focusing on detection (in LLS, messages appealed to penalties) and by performing a 15-month follow-up (LLS evaluated the short-term effects only). Third, we use a post-intervention survey to document taxpayers' social preferences and perceptions and shed light on the reasons why messages that appeal to altruism can backfire.[5]

Fourth, previous estimates of the effect of "deterrence", "social norms" and "altruism" messages are often "one shot", and hence, do not take into account the possibility that messages may lose effectiveness or even backfire if the tax authority does not follow up. In our study we sent the messages four times and show positive and persistent effects on compliance for the "deterrence" message. Finally, we focus on taxes affected by large informational asymmetries and test messages tailored to situations where the authorities are unable to fully identify who is a debtor and to calculate an exact compliance rate. This relates to the particular wording of our messages, which we explain in detail in Section 3.2. Thus, our results can be relevant to authorities in other parts of the world because of the pervasiveness of situations where the tax administration is unaware of or cannot easily infer through third-party reporting that a taxpayer has earned an income (consider, e.g., the popularity of Airbnb).[6]

The rest of the study is organized as follows: In Section 2, we describe the conceptual framework and the related research. Section 3 presents the experimental design. Section 4 shows the direct and indirect effects of the messages. Section 5 concludes.

2   Conceptual Framework and Literature Review

In this section, we describe the theoretical framework and empirical literature that inspire the design of our experiment. We focus on three theories related to tax compliance and their corresponding results in the literature. These are: (i) deterrence model, (ii) the theory of social norms, and (iii) the theory of altruism. We use these theories to design different types of messages and test whether they produce direct effects on taxpayers' compliance with the tax addressed in the message and indirect effects on compliance with other taxes.

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[5]We registered our plan for the analysis of the direct effects of the three types of messages in December 18, 2018, within the first three months since the start of the intervention, but before collecting the survey data. Survey data was collected in August 2019. Initially, the plan was to collect enough survey data to have a reliable and adequately powered way of testing mechanisms. Because of budget restrictions, however, we were unable to collect enough observations. At this point we also learned that the tax authority was willing to share administrative data regarding other income tax payments. Thus, we shifted our attention to testing the existence of spillover effects. The initial plan can be found in https://doi.org/10.1257/rct.3596-1.0.

[6]With the pervasiveness of Airbnb, it has become more difficult for tax authorities across the globe to enforce their housing and rental laws. Airbnb has a history of playing rough with authorities. For example, see this article on how regulators in New York City have coped with Airbnb data sharing; or this one explaining a similar problem in Germany.

Deterrence model. The deterrence model of tax compliance suggests that the taxpayer faces a trade-off between evading and thereby keeping a portion of the due money and confronting the potential costs of being detected. The extent of evasion is chosen to maximize the expected utility (Allingham & Sandmo, 1972; Yitzhaki, 1974; Alm, 2019). One prediction of this model is that tax evasion decreases when either the penalty or the probability of getting caught rises thereby reducing the expected utility of evading. Numerous studies have successfully tested this prediction.[7]

Indirect effects produced by messages inspired in the deterrence model are less clear. For instance, they can vary depending on whether the message highlights the penalty or the probability of being caught. A first explanation is due to LLS (2019). They propose a theoretical model predicting that messages addressing penalties that are uniform across taxes will produce a positive spillover. However, the messages that focus on detection can produce a negative spillover if taxpayers infer that more efforts devoted to enforce payment of one tax can lead to lower enforcement in other taxes. In other words, taxpayers informed that the tax administration is devoting resources to detect evasion in a certain tax can expect a decline in the probability of being caught evading other obligations and, thus, respond by reducing compliance. LLS (2019) present evidence consistent with the positive spillovers produced by messages focused on penalties. They found that taxpayers in one municipality in Argentina who received a message that explained the consequences of not paying their property tax increased their gross-sales tax declarations in the short-run.

A second explanation relies on a cash-flow effect. Taxpayers facing a higher expected tax burden may reduce the cash strain by cutting down payments related to other taxes. This behavior, but at the firm level, has already been suggested by Boning et al. (2020) to explain why subsidiaries of treated firms remitted less tax in a large field experiment carried out in the US.

Some predictions of the deterrence model do not match to what occurs in real life. For instance, the actual levels of compliance are higher than those predicted. The response of the literature to this challenge has been to extend the deterrence model to incorporate several concerns raised recently by the field of Behavioral Economics (Alm, 2019). In particular, there is evidence showing that an individual's behavior is affected by group behavior as people are motivated by diverse concepts such as fairness, altruism, reciprocity, empathy, trust, guilt, shame, morality, alienation, patriotism and social norms (Alm, 2019). In this

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[7]See for instance, Kleven et al., 2011; Fellner et al., 2013; Dwenger et al., 2016; Bergolo et al., 2017; Carrillo et al., 2017; Meiselman, 2018; Brockmeyer et al., 2019; Boning et al., 2020; Bott et al., 2020; Drago et al., 2020.

research, we are particularly interested in the concepts of social norms and altruism.

Social norms. A social norm is usually defined as an informal rule of behavior that individuals comply with for reasons unrelated to the likelihood of penalties and penalties themselves (Alm, 2019). The main mechanism proposed by the literature is that actors internalize observed social norms in such a way that any deviation generates guilt and other self-imposed costs (Elster, 1989; Wenzel, 2004; Hallsworth et al., 2017). This mechanisms means that correcting any miss-perception about other people's compliance can increase (or decrease) individual's compliance.

In this setting, indirect effects can arise if two conditions are met. First, individuals should be able to update their beliefs about compliance with a certain tax from messages that address compliance with other taxes. Moreover, individuals may be able to extract a negative description of a social norm ('people do not pay their type B tax') from a message conveying a positive description of another norm ('people pay their type A tax'). For example, this is akin to what the psychology literature describes as the 'innuendo effect' (Kervyn et al., 2012). The 'innuendo effect' is the tendency for individuals to draw negative conclusions from descriptions that omit a particular information. In this way, innuendo allows one to convey negative information on a relevant dimension by omitting information on this dimension. In our context, we are providing information about the norm on rental income tax, but we are omitting information about the norm on capital gains tax and self-employment income tax. The second condition to generate negative or positive indirect effects is that the update in beliefs should be such that the updated perceived compliance should be either lower or higher than the initial perceived compliance. In the example above, one can expect a negative indirect effect on tax B payments if taxpayers originally believed that people did comply with paying this tax.

The studies related to social norms messages have found mixed results so far. Some find that giving information about the prevalence of compliance increases individual compliance,[8] while others find that this strategy can backfire or have no effect at all, [9] albeit there is considerable heterogeneity in the response of taxpayers.[10] To the best of our knowledge there is no paper testing indirect effects across taxes of social norms messages.

Altruism. Altruism is usually attributed as an influencing factor when people make

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[8]See Del Carpio, 2014; Kettle et al., 2016; Hallsworth et al., 2017

[9]See Blumental, Christian, and Slemrod, 2001; Fellner et al., 2013; Castro & Scartascini, 2015; Dwenger et al., 2016; Perez-Truglia and Troiano, 2018; John and Blume, 2018; Chirico et al., 2019; Cranor et al., 2020; and De Neve et al., 2021.

[10]Hallsworth et al. (2017) find that the way these messages are framed can influence payment decisions. For instance, providing information about norms that are more specific to the individual tends to be more effective.

donations to public goods (Andreoni, 1989, 1990). To the extent that individuals care about others, messages highlighting that tax revenues can be used for the provision of public goods targeting disadvantaged citizens can be expected to generate positive effects on tax compliance. However, if individuals are not altruistic or have low-inequality aversion, this message can backfire because it makes more salient the fact that money collected through taxes can be used to provide public goods that taxpayers do not enjoy. Moreover, regardless of altruistic preferences, a message appealing to altruistic feelings may backfire in an environment where corruption is pervasive if it makes more salient to taxpayers that tax revenues should be used to provide public goods to the poor but are instead wasted or appropriated by corrupt bureaucrats.

In a setting with altruistic preferences, positive indirect effects can be expected if tax messages make more salient the fact that, not only a particular tax type, but also other tax types can be used to provide public goods to the poor. However, if individuals are not altruistic, these messages can generate negative indirect effects to the extent that taxpayers infer that they are not going to enjoy the public goods that will be funded with their payments to other taxes. Similarly, if taxpayers believe that the money they pay to other taxes is going to be appropriated by corrupt bureaucrats, we can also expect negative indirect effects.

Overall, the studies related to the effect of altruism or public goods messages also show mixed results. Some find that this type of messages increases compliance,[11] while others find that it backfires or has no effect.[12] Special attention should be given to Dwenger et al. (2016). They unify the altruism view with the deterrence model of tax compliance (Allingham & Sandmo, 1972). They predict and show that deterrence efforts increase reported income for evaders but do not affect reported income for donors, that is, those that were intrinsically motivated by altruism notions. There are other papers that test similar views but tend to conflate altruistic motives with those referred to the concept of reciprocal altruism in which taxpayers comply only if there is the possibility of reward.[13] As we explain later in the paper, the wording of our messages refer to altruistic motives. Finally, we should note that, to the best of our knowledge, there are no previous studies that address the potential spillovers to other taxes from altruism messages.

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[11]For example, Bergolo et al., 2017; Hallsworth et al., 2017; Meiselman, 2018; Bott et al., 2020.

[12]See: Blumental, Christian, and Slemrod, 2001; Castro and Scartascini, 2015; Chirico et al., 2019; and De Neve et al., 2021.

[13]See for example: Castro & Scartascini, 2015; Bergolo et al., 2017; Hallsworth et al., 2017; Chirico et al., 2019; Bott et al., 2020; and De Neve et al., 2021.

3 The Experiment

We contacted the Peruvian tax authority and they agreed to send different types of messages to a sample of potential rental income taxpayers in the context of a randomized trial. In particular, they agreed to test messages that refer to the three theories described above. We also conducted a post-intervention survey on a small sub-sample to shed light on taxpayers' social preferences and perceptions and beliefs that might affect their behavior such as the quality of public goods and the degree of corruption in public institutions.

3.1 Institutional Background: the Peruvian Income Tax

The Peruvian income tax is divided into five categories that depend on the source of income. These categories are (i) rental income tax, (ii) capital gains tax, (iii) corporate income tax, (iv) self-employment income tax, and (v) dependent work income tax. We focus this study on three categories for which the tax authority was willing to share information and that share the characteristic of having low compliance rates due to the existence of large informational asymmetries. The three taxes considered here are the rental income tax, the capital gains tax, and the self-employment income tax.[14]

Since our messages address the rental income tax, the direct effects of the messages are measured in terms of the compliance with the rental income tax. This tax is based on the income earned by the leasing of real properties and goods. It is paid monthly according to a personal schedule defined by the tax authority. The amount to be paid each month is equivalent to 5% of the monthly income earned through leasing activities. Landlords have to pay it regardless of whether their tenants have paid their rent or not. To prove they are reporting the correct amount of income earned, taxpayers have to present the leasing contract.

Indirect effects are measured in terms of taxes that were not addressed directly on the messages. The indirect effects of the messages are measured considering the payments related to the capital gains tax and the self-employment income tax. The first is charged when an individual (i) sells a property, (ii) sells securities, (iii) receives dividends due to an investment in a mutual or investment fund, or (iv) receives royalties or payments for transferring rights (e.g. trademark rights or patents). In all cases, individuals are required to pay a 5% tax. The payment schedule varies according to the type of transaction. In the

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[14]For these tax categories, the tax authority is unable to fully identify who is a debtor and calculate an exact compliance rate. This is less of a problem, for example, for the dependent work income tax, for which employers are responsible of providing information and making payments in advance to the tax authority.

case of properties, individuals are required to pay the tax within a month after the sale. In the case of securities, individuals have to pay the tax annually. In the case of dividends, the investment fund must retain the tax when the transaction is executed.

The self-employment income tax is charged when an individual earns an income without having a particular employer. Tax rates fluctuate between 8 percent and 30 percent depending on the total yearly income. Individuals are required to make monthly payments in advance and, at the end of the year, they must declare and pay the difference between the total tax due and the amount already paid.[15]

Taxpayers who fail to comply with their income tax obligations are subject to penalties. For each of the three taxes considered here, there is a penalty of 2,150 soles (around $630) each time a taxpayer delays his or her payments. This penalty is large and is equivalent to the second largest penalty given to traffic offenders. However, if taxpayers regularize their payments before they are notified by the tax authority, they have to pay only 10% of the penalty. Furthermore, any unpaid tax liability accrues interest at the daily rate of 0.04%.

Compliance with the three taxes is, in general, relatively low although there is some heterogeneity. In fact, enforcement of the rental income and the self-employment income taxes is particularly difficult because many leasing activities and services provided by self-employed individuals are carried out under informal agreements that do not require an official contract or receipt. Thus, landlords and self-employed individuals can easily under-report their income or even avoid reporting it at all. According to the tax authority's estimations, the compliance rate for these taxes is around 50%. Compliance with the capital gains tax is estimated to be larger (reaching around 75%) because transactions are less informal, although taxpayers can still under-report their incomes.

3.2   The Messages

We sent four different types of messages. One of them was simply a reminder letter, while the other three messages, which we refer as the treatment messages, were inspired by each of the three theories discussed in Section 2. The content of each treatment message was a small variation of the reminder message as the objective was to estimate the effect of adding just a few lines of information. This information was designed to persuade the message recipients to pay the amount that they owed in terms of the rental income tax (if

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[15]Monthly payments are collected in two ways: through an 8% retention made by the client for transactions that exceed 1,500 soles (around $450) and through direct payments made by the income earner to cover the difference between the 8% of the total income earned and the retentions made by his/her clients, in case total income exceeds 3,135 soles (around $940). Our data include the sum of the two.

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any) and the information varied accordingly to the type of message. Thus, the reminder message served as a baseline or control group as we compared the effect of the treatment messages against it. The contents of the letters are shown in Table 1.[16]

For the deterrence theory, the text inside the brackets read: "*Be informed that the SUNAT is striving to detect those who do not pay their taxes. We have already identified 78 thousand persons in the districts of Barranco, La Molina, Miraflores, San Isidro, San Borja, and Surco.*" The purpose of this message was to indicate that the probability of being caught was large. Therefore, its objective was to discourage tax evasion by increasing its expected cost.

Regarding the letter inspired in the theory of social norms, the text inside the brackets reads "*Be informed that the majority of the residents of Barranco, La Molina, Miraflores, San Isidro, San Borja and Surco do comply with the payment of their rental income taxes.*" The idea was to inform taxpayers that the social norm was to comply by making the payment. Because deviations from the social norm generate self-inflicted costs, this treatment should increase compliance. According to previous experiments, the effect is greater when the norm refers to people that are socially close to the message recipients (Hallsworth et al., 2017). Thus, to reduce the "psychological distance" to the norm, the messages referred to the people that lived in similar districts as the individuals included in the experiment (Trope & Liberman, 2010).

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[16]The original messages in Spanish are included in the Appendix A.1.

Table 1: Structure of letters

Mr(s) taxpayer,

If you receive any rental income, remember to pay your tax.

[small added text]

Find out how to declare and pay this type of income in

http://personas.sunat.gob.pe/alquilo-mi-casa-o-auto.

For general inquiries, you can call our Consultation Center from your landline

at 0801-12-100 or from your mobile phone at (01) 315-0730, by typing the option

3, from Mondays to Fridays from 8.30 a.m. to 6:00 p.m., and Saturdays from 9:00

a.m. to 1:00 p.m. You can also contact any of our Taxpayer Service Centers.

If you perceive any rental income and have already paid your tax, congratulations!

Sincerely,

Regarding the letter inspired on the theory of altruism the text inside the brackets read *"Be informed that if all the residents of Barranco, La Molina, Miraflores, San Isidro, San Borja and Surco pay their rental income taxes, more than 90 Health Centers could be built in the poorest regions of Peru."* With this message our objective was to highlight the importance of paying taxes to provide public goods that benefit the poorest population of the country. We expected this message to be persuasive if redistribution and social justice were important for the sample of individuals studied

All our messages addressed their recipients in a neutral way (i.e., we did not address them as debtors). This was because our sample comprised potential rental income taxpayers as we could not be completely sure that they were leasing a property (we explain in detail how we built the sample in Section 3.4).

Furthermore, the contents of our messages varied with respect to those already tested in the literature. Regarding the deterrence theory, previous studies have attempted to raise the expected costs of evasion by directly mentioning the probability of being audited (e.g. Kleven et al., 2011; Del Carpio, 2014; Dwenger et al., 2016; Bergolo et al., 2017), while others have threatened taxpayers with an audit or have revealed (third-party) information

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about their income.[17] In contrast, our "deterrence" message only points out that there is a large number of cases being processed by the tax authority without stressing the exact probability of audit nor threatening taxpayers with one.[18]

If this strategy proves to be effective, other authorities could try to replicate it in contexts of uncertainty regarding who has a tax liability.[19]

With respect to the "social norms" message, most of the literature has used the exact compliance rate to inform taxpayers. This wording may be especially helpful when tax compliance is high and easy to calculate.[20] However, in developing countries tax compliance tends to be just above 50%. For example, in Kettle et al. (2016) tax compliance was of 64.5%. In our context, according to some estimations provided by the tax authority, compliance was just above 50%. Hence, we preferred to describe the norm in a general fashion as in Del Carpio (2014) and Hallsworth et al. (2017). This method means that our results may be informative to authorities trying to assess the effectiveness social norms in a setting of low compliance such as ours.

Finally, it is worth noticing that our "altruism" message distinguishes from others that also have made reference to public goods because it explicitly refers to services provided to (poor) people out of the sample. This differs from other studies, which have tended to describe how taxes contribute to the funding of public goods that everybody could potentially use and enjoy, including in-sample taxpayers.[21]

3.3   Mode of Delivery and Timeline

Because of administrative and legal reasons, the tax authority had to send a letter to everybody in the sample as in Hallsworth et al. (2017). Each individual from the four

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[17]Fellner et al., 2013; Carrillo et al., 2017; Meiselman, 2018; Brockmeyer et al., 2019; Boning et al., 2020; Bott et al., 2020; Drago et al., 2020.

[18]We must acknowledge that by stating that a 78,00 taxpayers have been detected, our message may also convey information about a negative social norms (i.e.low compliance), fostering tax evasion. If this is true, the negative impacts measured in the paper would be an underestimation (in absolute value) of the effect of manipulating the deterrence parameters.

[19]Papers highlighting the size of the penalty are, for example, Bergolo et al. (2017); Castro and Scartascini (2015); Chirico et al. (2019); Cranor et al. (2020); De Neve et al. (2021); Gemmell and Ratto (2018); Perez-Truglia and Troiano (2018).

[20]For papers using the exact compliance to describe the norm, see Fellner et al. (2013), Castro and Scartascini (2015), Chirico et al. (2019), Cranor et al. (2020), and De Neve et al. (2021).

[21]For instance, Bott et al. (2020) tests the following message: *"our tax payment contributes to the funding of publicly financed services in education, health and other important sectors of society."* Castro and Scartascini (2015) tests the following message: *"In the first 6 months of this year, CVP's collection contributed to placing 28 new streetlights, water connections in 29 streets and sewerage networks in 21 blocks."*

message groups received exactly the same letter four times, once per month.[22]

The tax authority sent these messages through four different channels to increase the probability that message recipients would read them. They sent them through: (i) the e-mail address that taxpayers reported to the tax authority, (ii) a special web interface that is normally used by the tax authority to send special communications, (iii) a physical letter to the home address taxpayers had reported to the tax authority, and (iv) a SMS message to the cellphone number taxpayers had reported to the tax authority.

Within each message type, we randomly varied the timing at which the tax authority issued the messages. For a random subsample of individuals, we delayed the issue of the messages by two weeks. So, for example, within the group of individuals that received the reminder message, a subgroup always received a reminder message two weeks earlier than the other subgroup. These subgroups of individuals were randomly selected at the beginning of the experiment and stayed the same throughout all of it. Our goal is to compare those that received an early letter against those that received a late letter (at the beginning of the experiment) to identify the short-term effect of receiving the reminder letter, as in Hallsworth et al. (2017).

In Appendix A.2 we provide the timeline of the experiment. In sum, we sent a message each month starting in October 2018 until January 2019. We carried out the post-intervention survey in August of 2019. We measured tax-related behavior by using the administrative data available from January 2018 to January 2020.

3.4   Final Sample of Taxpayers

Because of the nature of the rental income tax, it is impossible to know with 100% confidence who owes money and who does not. Therefore, with the help of the tax authority, we identified those who ex-ante had a higher chance of owing money. In particular, we included in the experiment individuals who[23]:

- lived in the municipalities of Barranco, La Molina, Miraflores, San Borja, San Isidro, or Surco that are the richest municipalities of the city;

- owned three or more properties with different addresses within the region of Lima or Callao[24];

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[22]Evaluating the effect of this type of treatment can be informative as sending too many letters may have a crowding-out effect (i.e. by 'suffocation'). Also, the impact of "one shot" messages may be limited if there is no follow-up by the tax authority.

[23]Firms were not included.

[24]Peru is comprised of 24 regions and one constitutional province (Callao) which belongs to the metropoli-

- had not reported any rental income for the year 2018 by June 2018.

These criteria led to a sample of 9,024 individuals. Table 2 shows the characteristics of this sample based on the data that was provided by the tax authority. First, individuals are on average 54.8 years old, and women are underrepresented in this sample (36%). Furthermore, the average number of owned properties is 3.9. On average, these properties are valued at 131,000 US$ according to taxpayer reports.

Compliance is low in this sample: only 26% of the sample had paid rental income tax at least once between 2013 and 2017. Thus, for this period tax compliance was at least 5% per year (=26%/5). This number is a lower bound of the true tax compliance, since not everybody in the sample necessarily had leased his or her properties. Some individuals may have made more than just one payment as well. On average, the last year they made a payment, they paid a total amount of 23,000 US$ for the whole year. Table 2 shows that the median individual earns between 15,000 and 30,000 US$ per year. Considering that the minimum wage is around 4,000 US$ per year, this income means that these individuals are particularly wealthy.

Table 2: Characteristics of final sample

| Variable	Average	p25	p50	p75	Min	Max	N
Age	54.8	45.0	54.0	64.0	18.0	103.0	9,024
Female	0.36	0.00	0.00	1.00	0.00	1.00	9,024
Number properties	3.9	3.0	3.0	4.0	3.0	81.0	9,024
Properties' value (thousand $)	131.1	39.9	71.8	127.0	0.0	36,800	9,024
Paid rental income tax? (years 13-17)	0.26	0.00	0.00	1.00	0.00	1.00	9,024
Date of last payment (year)	2015.8	2015	2016	2017	2013	2017	2,385
Amount paid (thousand $)	2.3	0.5	0.8	1.7	0.0	752.5	2,385
Yearly income (0-15 thousand $)	0.37	0.00	0.00	1.00	0.00	1.00	9,023
(15-30 thousand $)	0.16	0.00	0.00	0.00	0.00	1.00	9,023
(30-150 thousand $)	0.37	0.00	0.00	1.00	0.00	1.00	9,023
($\geq$ 150 thousand $)	0.10	0.00	0.00	0.00	0.00	1.00	9,023

tan area of the city of Lima. The region of Lima is by far the largest in terms of population as it harbors more than 30% of the country's population.

3.5 Randomization and Power

We randomly allocated our final sample of 9,024 individuals to eight subgroups (considering those receiving the early and late messages) that equals 1,128 individuals per subgroup. We controlled this randomization based on the individuals' age and sex, income dummies, a dummy that indicates whether they have made a previous rental income tax payment, previously paid amounts and their years, and the number of properties and their self-assessed values. In particular, we ran 1,000 repetitions of the randomization and chose the first one that showed no statistically significant t-statistics when comparing groups across the above variables. These variables are reported in Table 2.

As a result of the randomization, 2,256 individuals received a reminder message, 2,256 received a message inspired by the deterrence theory, 2,256 received a message on social norms, and 2,256 received a message on altruism (see Figure 1). Assuming a base compliance of 5%, we have a statistical power of 80% to identify a difference of 2 percentage points[25] This is a reasonable minimum detectable size of the effect considering that in the literature these types of treatments tend to have a total effect of 0.0 to 10.0 percentage points when compared to a control group that did not receive any message. However, we recognize that outcome variables are different across studies and institutional contexts.

Figure 1: The Experiment Arms

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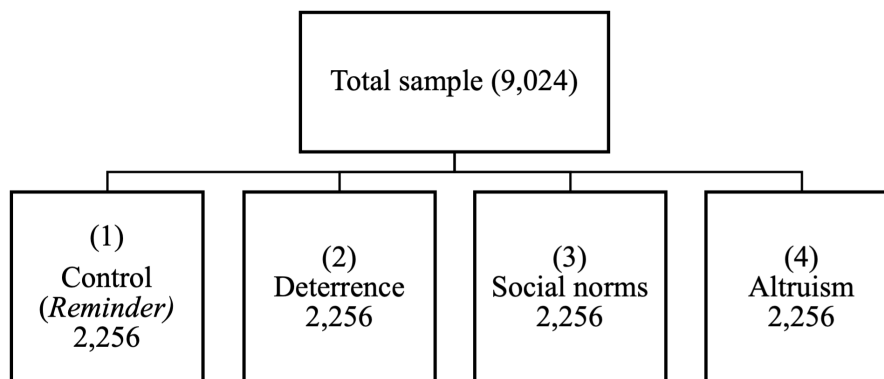
[25]This was computed using a two-sample proportions power calculation. We use 5% as base compliance considering that, in five years, only 26% made a payment. If we assume a base compliance of 10%, we have 80% power to identify a difference of 2.65 percentage points. If we assume a base compliance of 26%, we have 80% power to identify a difference of 3.75 percentage points. An ex-post analysis suggests that we are adequately powered. Compliance in the control group (those who received a reminder later) was 6% in the first month since the start of the experiment. This would imply a power of 80% to identify a difference of 2.15 percentage points given our sample size. It should be noticed, however, that we lose power progressively as time goes by and as compliance increases in the control group.

4 The Direct and Indirect Effects of Messages

In this section, we report the effect of the treatment messages on the payment of the rental income tax (direct effect) and on the payment of the capital gains and self-employment income taxes (indirect effects).

4.1 Data and Outcome Variables

We were provided with a database at the individual-day level that indicated the amount of the rental income tax payments and to which date the payments are referring to. Note that individuals can pay in advance or catch up with their due payments. The database also included tax payments related to capital gains and self-employment activities. We also collected survey data on a random sub-sample of 867 individuals. The survey consisted of several questions regarding individuals' social preferences and beliefs. More information is available in Appendix B.

Our main results are based on two outcome variables. First, the total amount paid of each type of tax since the start of the experiment until a particular month. We transform this amount using the inverse hyperbolic sine function, which allows us approximate the natural logarithm retaining zero-valued observations.[26] Second, we define a dummy variable that equals one if the individual has made a tax payment since the start of the intervention until a particular month. The tax administration also provided us with data on taxpayers' characteristics that were described in Table 2.

Our main results are based on these two outcome variables because they convey complementary information about the nature of the treatment effect. This happens in two ways. First, one can distinguish between effects that operate in the intensive or extensive margin. Consider a positive shift in the total amount paid. If it is accompanied by a positive shift in the probability of making a payment, it means that the treated group is paying more by making new payments (extensive margin). However, if the probability of making a payment does not change, it means that the treated group is paying more by making only larger payments (intensive margin) but not new ones. The converse logic applies to a negative shift on the total amount paid. A decline in the probability of making a payment means that the treated group is paying less by making fewer payments. However, if the probability of making a payment does not change, it means that the treated group is paying less by reducing the size of their payments.

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[26] For more on the inverse hyperbolic sine function, refer to Friedline et al. (2015).

Second, one can learn about the dynamic nature of treatment effects. Consider a transitory positive shift in the intensive margin, that is, in the total amount paid. The transitory nature of the shift in the total amount paid means that either the treatment induced more payments today at the expense of fewer or smaller payments in the future, or it induced taxpayers to pay current obligations that they would have otherwise paid in the future (i.e. the additional payments made by the treated group were equated later by additional payments made by the control group). Importantly, one can distinguish between these two situations using information about the extensive margin. In fact, if the transitory shift in the amount paid is accompanied by a sustained shift in probability of making a payment, then the only possibility consistent with a transitory shift in the amount paid is that the additional payments made by the treated group were compensated later by smaller or fewer payments (first situation). However, if the shift in the probability of making a payment is transitory, then the additional payments made by the treated group were equated later by additional payments made by the control group (second situation).

Another interesting case to consider is a transitory decline in the total amount paid. The transitory nature of the decline in the total amount paid means that the treatment has induced fewer payments today that were compensated later by more or larger payments (i.e., taxpayers are delaying their payments), or it has brought forward future defaults (i.e., the smaller number of payments made by the treated group is equated later by a smaller number of payments made by the control group). Although this last situation is unlikely, the two scenarios can be identified by looking at the decline in the probability of making a payment. If the decline in the probability of making a payment is transitory, then the treatment has induced a delay in payments (first case). If the decline is sustained, then the treatment has brought forward future defaults (second case). There are, of course, more cases but we focus on these for illustrative purposes.

4.2 Empirical Strategy

4.2.1 The effect of the treatment letters relative to the reminder letter

We estimate the following equation at different points in time:

$$y_{ist} = \alpha + \beta_1 T_{i,1} + \beta_2 T_{i,2} + \beta_3 T_{i,3} + \gamma' X_i + \varepsilon_{ist} \tag{1}$$

where y_{ist} is the tax compliance of i measured either as the probability of paying a tax or the total amount paid since date s and until date t, where s is the beginning of the experiment (October 2018) and t any month between October 2018 and January 2020.

X_i is a set of covariates that includes age, sex, the number of properties and their total value, a dummy indicating if a rental income tax payment was made between 2013 and 2017, income dummies, and a set of district fixed effects (see Table 2). Even though these covariates are not required for identification, we control for them to increase statistical power. We also include the pre-intervention level of compliance with the corresponding tax, that is, the average measure of y_{ist} computed for the period between January (s) and September of 2018 (t). Finally, $T_{i,m}$ is a dummy that equals one if the individual i received the "deterrence" (i.e., $m = 1$), "social norms" (i.e., $m = 2$), or "altruism" (i.e., $m = 3$) message. The dummy equals zero if i received the reminder message or if i received a treatment message different than m. Our parameters of interest are β_m as they describe the effect of sending four messages of type m relative to the effect of sending four reminder messages.

4.2.2 The effect of the *reminder* letter

In the previous subsection we explained how we estimate the effect of each treatment message relative to the reminder. Here we describe how we estimate the effect of the reminder message. This estimation is important to account for the total effect of each type of message.

To approximate the size of the effect of the reminder message, we exploit the random assignment of the time intervals in which we sent the messages. In general terms, we compare those that received an early reminder message against those that received a late message at a point in time when only the early messages were sent. Hence, we estimate the following regression:

$$y_{ist} = \alpha + \delta_0^{1st} T_{i,0}^{1st,early} + \gamma' X_i + \varepsilon_{ist} \tag{2}$$

where $T_{i,0}^{1st,early}$ is a dummy that equals one if the individual i received the early reminder messages and zero if i received the late messages. The window of analysis is the days between October 5 (s) and October 18, 2018 (t). This exercise allows us to estimate the short-term effect of sending one reminder message with respect to sending no message at all.[27]

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[27]To evaluate the effect of the first wave of reminder messages, we pool together the other types of *late* messages to increase the power. The results are almost unchanged if we compare those that received an early reminder against those that received a late reminder message only.

4.3   Pre-treatment balance

We use the administrative records provided by the tax authority to first test if the observable characteristics are equal across treatment groups. For this, we run multiple regressions of each of these characteristics on the treatment dummies defined above. We report our results in Table 3. We confirm that in terms of age, sex, number of properties, value of properties, and income, individuals in each treatment group and in the group receiving the reminder message are similar. To account for multiple hypothesis testing, an F-test also shows balance for each message ($F_1 = 0.655$, $F_2 = 0.312$, $F_3 = 0.675$). This is consistent with the random assignment.

We also construct several pre-treatment outcome variables to verify if the pre-treatment tax behavior was similar across groups. For each month in 2018 before the start of the experiment (i.e., between January 2018 and October 2018), we compute the probability of making a payment and the amount paid for each type of tax. Thanks to the randomization, the pre-treatment tax behavior should be similar across treatment arms (this includes *any* tax). In other words, randomization should assure internal validity when evaluating the impact of the message on the rental income tax, the self-employment tax or the capital gains tax. To test this, we run multiple regressions akin to equation (1) for each pre-treatment month, that is, defining the dependent variables for the starting period s=January 2018 and the end period t, where t is a particular month between January and September of 2018. We report our results for the "deterrence", "social norms", and "altruism" messages in A.3, A.4 and A.5, respectively.

For most taxes, we cannot reject the null hypothesis that the pre-treatment tax behavior is equal across treatment arms. The only exception is that by September of 2018, we find that individuals who receive the "social norms" message made larger payments of the self-employment income tax. To account for this, we control for either the total amount paid or the probability of making a payment of the corresponding tax between January and September of 2018 in all our regressions. Overall, we interpret this evidence as indicating that randomization was performed correctly and that the results described in the following sections can be interpreted as causal.

Table 3: Balance in pre-treatment characteristics

| | Age | Female | Number of properties | Value of properties | Yearly Income (bins, thousand $) | | | | F-statistic |
| | | | | | 0-15 | 15-30 | 30-150 | ≥ 150 | |
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
"Deterrence" message	0.2903	-0.0040	0.0355	-20,208.9989	-0.0021	-0.0092	0.0170	-0.0057	0.655
	(0.4024)	(0.0143)	(0.0510)	(30,281.6831)	(0.0144)	(0.0110)	(0.0144)	(0.0090)	[0.710]
"Social norms" message	0.0891	-0.0098	0.0013	7,148.2104	-0.0084	-0.0093	0.0151	0.0027	0.312
	(0.4078)	(0.0143)	(0.0478)	(35,939.3365)	(0.0143)	(0.0110)	(0.0143)	(0.0091)	[0.949]
"Altruism" message	0.0182	0.0027	0.0949	32,584.1764	-0.0062	-0.0080	0.0084	0.0058	0.674
	(0.4012)	(0.0144)	(0.0612)	(62,049.3090)	(0.0144)	(0.0110)	(0.0143)	(0.0092)	[0.694]
Constant	54.7070	0.3666	3.9065	427,907.9785	0.3701	0.1676	0.3586	0.1037	–
	(0.2843)***	(0.0101)***	(0.0329)***	(23,973.0966)***	(0.0102)***	(0.0079)***	(0.0101)***	(0.0064)***	–
N	9,024	9,024	9,024	9,024	9,023	9,023	9,023	9,023	–

Robust standard errors between parenthesis. Column 9 indicates p-values for the overall F-test in square brackets. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level. One individual did not have a record for their yearly income, hence columns (5) - (8) show one fewer observation.

4.4 Results

4.4.1 Direct and indirect effects

Deterrence. Figure 2 presents the direct effect of the "deterrence" message on compliance with the rental income tax and the indirect effects of this message on payments related to the capital gains and the self-employment income taxes. In Table A.1 we report the corresponding table from which these figures were constructed. Pre-trends in tax behavior are shown in Figure A.3. Panel A in Figure 2 shows the effect on the total amount paid, and Panel B shows the effect on the probability of making a payment. These cumulative effects are calculated for every month after the start of the experiment up to January 2020.
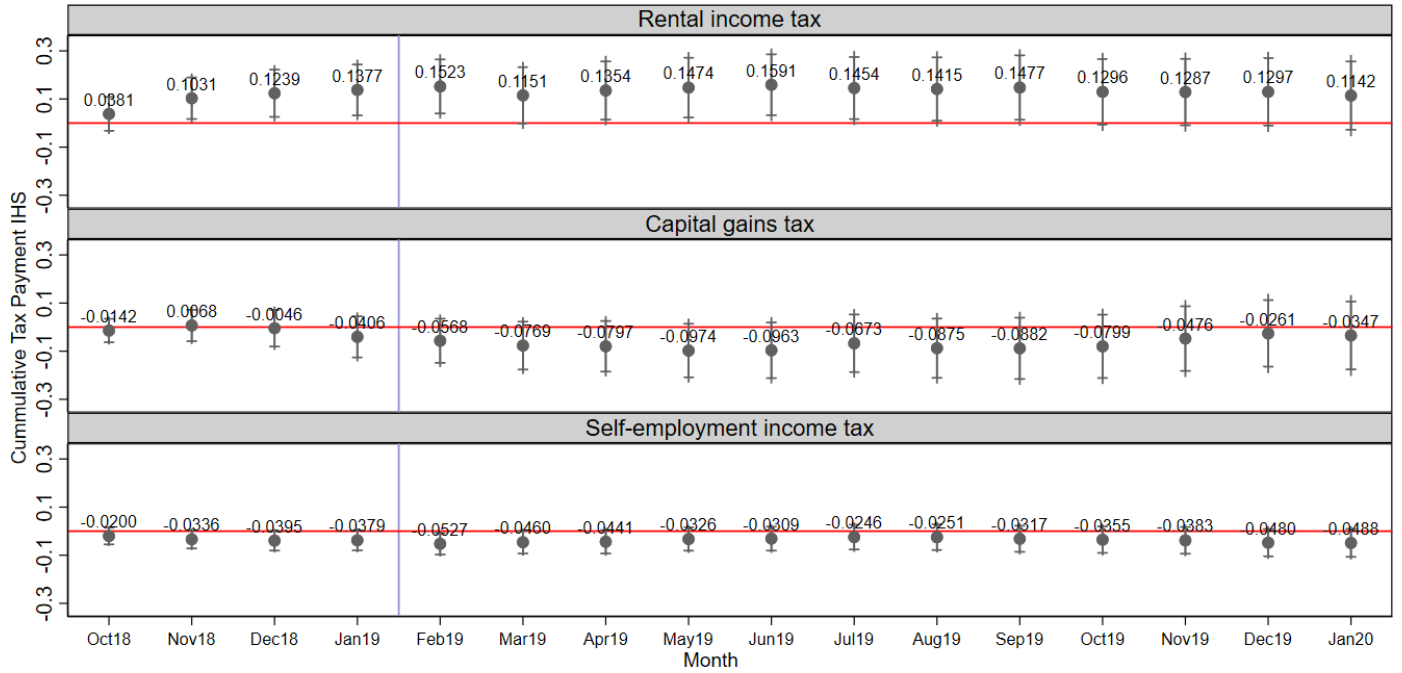
Panel A in Figure 2 shows that the "deterrence" message had a direct effect on the total amount paid of rental income tax that was sustained throughout the 15-month follow-up. In fact, by the time the experiment was phased out (February 2019), taxpayers receiving this message had made a total payment around 15% larger than those receiving only the reminder.[28] This positive effect persisted in the months that followed up to January 2020 (a year after the last message was sent) as taxpayers who received the "deterrence" message still had a total amount paid around 11 percentage points larger than the control group.

In Panel B we observe a sustained increase of around 2 percentage points in the probability of making a rental income tax payment. As explained in Section 4.1, this increase means that the treatment has induced taxpayers to increase the amount they pay by making new payments and not by making larger payments only. Moreover, because the shifts are sustained, one can assert that the additional payments induced by the "deterrence" treatment were not later offset by fewer or smaller payments made by the treated group, or equated by more or larger payments made by the control group (i.e. the message did not just brought forward payments that would have otherwise been made in the future).

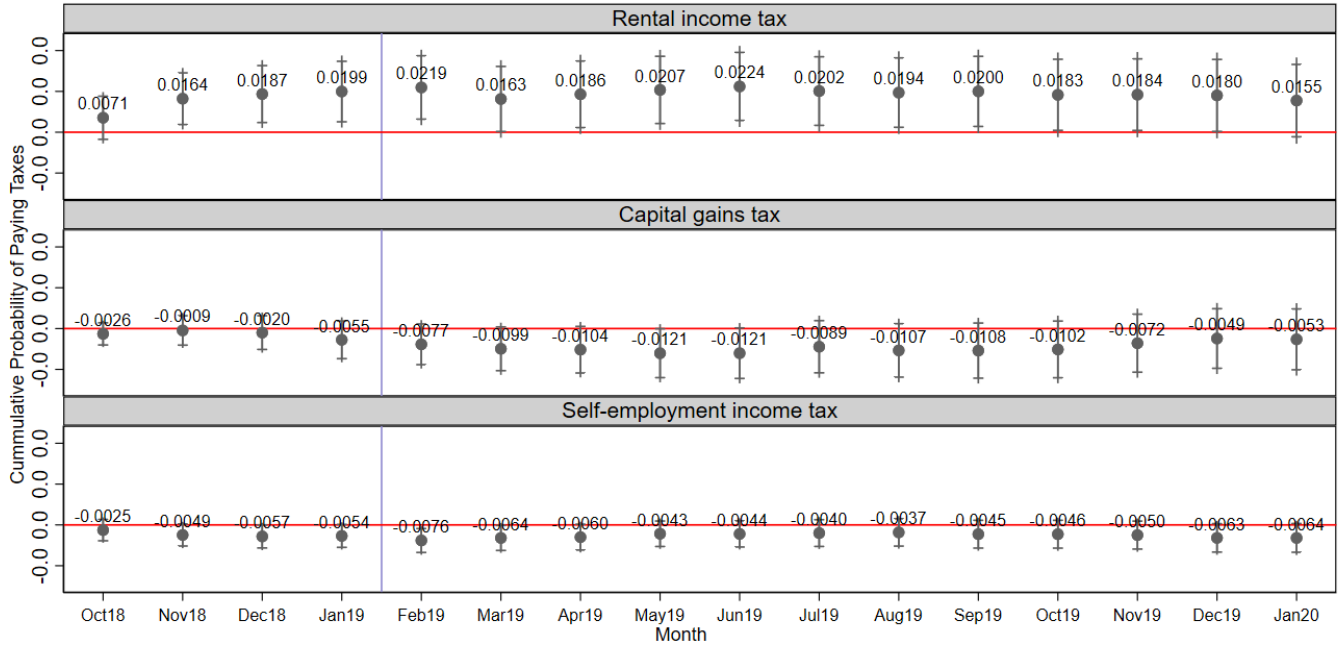[28]To compute semi-elasticities from the inverse hyperbolic sine function one can use the following expression: $\exp{(\hat{\beta} - 0.5\hat{Var}(\hat{\beta}))} - 1$ as derived in Bellemare and Wichman (2019). For simplicity, we focus on the coefficients reported in the figures which provide good approximations of these semi-elasticities. Conclusions are not affected if we focus on the exact semi-elasticities instead.

Figure 2: Direct and indirect effects of the "deterrence" message on tax compliance

Panel A: IHS transformation of amount paid between Oct 18 and month X

Panel B: Likelihood of paying taxes between Oct 18 and month X

Notes: 90% and 95% confidence intervals. Violet line indicates the end of the treatment period. We report the marginal effects implied by a probit model for the results on the likelihood of paying taxes. We transform the amount paid using the Inverse Hyperbolic Sine function. For more information, see Friedline, et al. (2015). All regressions include a set of covariates which is comprised by: age in years, a dummy for sex, the number of properties and their value, dummies for income bins, a dummy for rental income tax payments during the period 2013 to 2017, and district fixed effects. We also control for initial value of the dependent variable between Jan 18 and Sept 18, that is, before the intervention.

These results suggest that the "deterrence" message generated new resources for the tax authority. This assessment, however, would be incomplete if we ignore the effect of this treatment on other taxes. The results for the indirect effects of the "deterrence" message show that it produced a transitory decline of around 5% in the total amount of the self-employment income tax that was paid by the time the experiment was phased out (see Panel A). The results in Panel B show it also produced a transitory decline in the probability of making a payment. Combined, this evidence indicates that the message induced taxpayers to delay their self-employment income tax payments. In particular, treated taxpayers made fewer payments and contributed a smaller amount at first, but this amount was later compensated for by making more payments. Although the results are not statistically significant, Panels A and B in Figure 2 provide suggestive evidence that the "deterrence" message also had a negative and transitory indirect effect on the total amount paid of the capital gains tax due to a delay in payments.

There are three potential explanations for the negative spillover described above. The first stems from the theoretical model of LLS (2019) which predicts that messages that appeal to enforcement actions can provoke a negative indirect effect on compliance with other taxes if taxpayers understand that increased enforcement efforts devoted to one tax will reduce efforts devoted to other taxes. The second explanation relies on the cash-flow effect. Taxpayers reduce their cash strain by cutting down payments related to other taxes. This behavior, but at the firm level, has already been suggested by Boning et al. (2020) to explain why subsidiaries of treated firms remitted less tax in a large field experiment carried out in the US. The third possibility is the presence of cognitive spillovers as in Altmann, et al., (2021). They argue that policies that steer individuals' attention to a particular domain may induce negative cognitive spillovers on the quality of choices in other domains.

Social norms. Figure 3 shows the direct effect of the "social norms" message on compliance with the rental income tax as well as its indirect effects on payments related to the capital gains and the self-employment income tax. In Table A.2 we report the corresponding table from which these figures were constructed.[29] This message indicates that the majority of the taxpayers' neighbors comply with their rental income tax.

Interestingly, this message has no direct effect but produces a negative indirect effect on the amount paid of the capital gains tax of around 13% and on the probability of making a payment of around 1.5 percentage points. These effects were sustained throughout the 15-month follow-up period. Combined, this evidence implies that the "social norms" message induced taxpayers to contribute less by making fewer capital gains tax payments and that

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[29]Pre-trends in tax behavior are shown in Figure A.4.

this was not later compensated by making more or larger payments. Notice that there was no indirect effect on the self-employment income tax.

It is interesting that the "social norms" treatment had no direct effect but had a sustained indirect effect only on the capital gains tax. One possible explanation for this pattern is that the treatment message did not induce a change in the taxpayers' beliefs regarding compliance with the rental income tax or the self-employment income tax but was able to induce a *downward* shift in the taxpayers' beliefs regarding compliance with the capital gains tax. In this scenario, the social norms theory predicts that one would observe the negative effect reported above.

For this explanation to be true two conditions must be met, as explained in Section 2. First, individuals should be able to update their beliefs about compliance with a certain tax from messages that address compliance with other taxes. In fact, individuals may be able to extract a negative description of a social norm ('people do not pay their capital gains tax') from a message conveying a positive description of another norm ('people pay their rental income tax'). This is akin to what the psychology literature describes as the 'innuendo effect' (Kervyn et al., 2012). Second, to rationalize the observed patterns using the social norms theory, the updated beliefs about compliance with the rental income tax and the self-employment tax should be similar to the initial beliefs. However, the updated belief about compliance with the capital gains tax should be lower than the initial belief.

Of course, the above explanation should be taken with caution and more research is needed in order to fully understand the underlying mechanisms. In particular, our results point out the need to improve our understanding on how messages addressing beliefs about compliance with a certain tax type may nudge individuals to update their beliefs about compliance with other tax types.

<u>Altruism.</u> Figure 4 shows the direct effect of the "altruism" message on compliance with the rental income tax as well as its indirect effects on payments related to the capital gains and the self-employment income taxes.[30] These results show that our "altruism" message has a transitory negative effect on the size of rental income tax payments and on the probability of payment. We do not observe an statistically significant spillover to other taxes.

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[30]In Table A.3 we report the corresponding table from which these figures were constructed. Pre-trends in tax behavior are shown in Figure A.5.

Figure 3: Direct and indirect effects of the "social norms" message on tax compliance

Panel A: IHS transformation of amount paid between Oct 18 and month X

Panel B: Likelihood of paying taxes between Oct 18 and month X

Notes: 90% and 95% confidence intervals. Violet line indicates the end of the treatment period. We report the marginal effects implied by a probit model for the results on the likelihood of paying taxes. We transform the amount paid using the Inverse Hyperbolic Sine function. For more information, see Friedline, et al. (2015). All regressions include a set of covariates which is comprised by: age in years, a dummy for sex, the number of properties and their value, dummies for income bins, a dummy for rental income tax payments during the period 2013 to 2017, and district fixed effects. We also control for initial value of the dependent variable between Jan 18 and Sept 18, that is, before the intervention.

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It is important to recall that the "altruism" message highlighted how complying with the payment of the rental income tax could result in the construction of health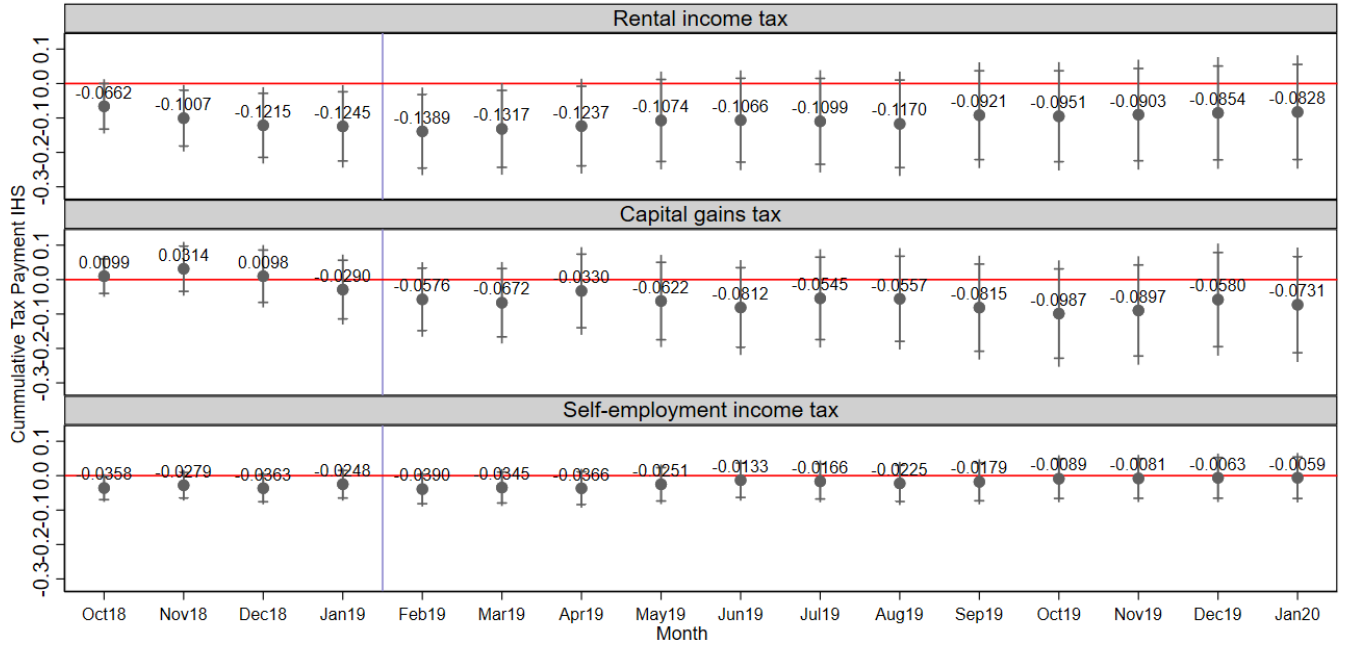 centers in the poorest areas of the country. That is, our messages highlighted redistribution, since the beneficiaries would be the poor and not the taxpayers from our sample. Notice, however, that this treatment message did not aim at shifting taxpayers' altruism but sought to leverage on the effect of an altruistic preference for tax compliance by making more salient the fact that tax revenues can be used to provide public goods to the poor. Based on this, one possible explanation as to why this treatment message backfired could be that taxpayers in our sample are not altruistic or have a low inequality aversion. In this case, the message could backfire because it made more salient the fact that the money collected through the rental income tax was used to provide public goods that the taxpayers did not enjoy.

In this regard, the evidence collected through the survey indicates that taxpayers in our sample have non-altruistic preferences and a low inequality aversion. In fact, the majority of taxpayers appear unwilling to share the money they earn because of luck of through their own effort. Most taxpayers totally disagreed (9.5%), disagreed (37.9%), or neither agreed nor disagreed (19.4%) with the statement: "If I earn money because I was lucky, I should share it with someone else apart from my family". If the source of money is their own effort, then individuals are even less willing to share it with others. The corresponding numbers are 13.7, 42.7, and 14.7%, respectively. Moreover, a significant share of taxpayers in the control group either totally disagreed (5.2%), disagreed (25.6%), or neither agreed nor disagreed (17.8%) with the statement "income should be more equal".

Furthermore, taxpayers perceive their payments of the income tax to be high relative to payments by individuals from other districts. This may have compounded the negative response triggered by the "altruism" message. In fact, our survey shows that a good share felt that they pay either very high (19.5%) or high (29.2%) income taxes. In addition, taxpayers perceived that around 60% of those living in their neighborhoods complied with their taxes, while the perceived average tax compliance of those living in Lima and in Peru was 38 and 31%, respectively.

Figure 4: Direct and indirect effects of the "altruism" message on tax compliance

Panel A: IHS transformation of amount paid between Oct 18 and month X

Panel B: Likelihood of paying taxes between Oct 18 and month X

Notes: 90% and 95% confidence intervals. Violet line indicates the end of the treatment period. We report the marginal effects implied by a probit model for the results on the likelihood of paying taxes. We transform the amount paid using the Inverse Hyperbolic Sine function. For more information, see Friedline, et al. (2015). All regressions include a set of covariates which is comprised by: age in years, a dummy for sex, the number of properties and their value, dummies for income bins, a dummy for rental income tax payments during the period 2013 to 2017, and district fixed effects. We also control for initial value of the dependent variable between Jan 18 and Sept 18, that is, before the intervention.

Another possible explanation for the negative effect produced by the "altruism" treatment is related to taxpayers' perceptions regarding the high levels of corruption and the inefficacy of the government. In this case, the message can backfire by making more salient that tax revenues should be used to provide public goods (but are not) which compounded the effect of taxpayers' perceptions about government corruption and inefficacy on tax compliance. In this regard, our survey data showed that 63% of the control group believes that corruption is the main problem in the country.[31] Furthermore, the "altruism" message made reference to the provision of health centers and corruption in public hospitals is perceived to be very high, high, or moderate by 79% of the sample. We find similar patterns when asking individuals about their satisfaction and the efficacy of publicly provided health services.

4.4.2 The effect of the reminder letter

The results of estimating equation (2) are reported in Table 4. We find that the reminder message by itself increases compliance with the rental income tax. In fact, it increases the likelihood of compliance with this tax by 2.14 percentage points and the size of the payments by 15.04% in the short run. We do not find a short-run effect of the reminder on payments related to the capital gains tax or the self-employment income tax.

4.4.3 Quantitative importance of indirect effects

The literature has shown that sending messages to increase tax compliance has, in many cases, a positive net benefit.[32] However, most studies do not consider that individuals may be adjusting compliance with the tax addressed in the message at the expense of other taxes. Therefore, these studies may be overestimating the gains produced by their interventions. In this subsection, we illustrate this point by simulating the distribution of the effect of our messages on the per capita tax revenues coming from (i) the rental income tax (i.e. direct gains) and from (ii) the rental income, self-employment and capital gains taxes (i.e. total gains). These impacts were estimated using the reminder letter as control group, so they should be interpreted as marginal gains. In particular, since the reminder in all likelihood had a positive effect (as we have shown in Section 4.4.2 for the short run), these gains should be interpreted as lower bounds.

We took 1,000 bootstrapped samples and estimated the effect of each type of message

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[31]Second and third place are high crime rates (43.1%) and the bad quality of public education (12.3%).

[32]See, e.g., Chirico et al., 2019.

on the amount paid of rental income tax, capital gains tax and self-employment income tax by the time the experiment was phased out (5-month follow up), and the effect of each type of message on the amount paid of rental income tax, capital gains tax and self-employment income tax at the end of the 15-month follow-up. These effects were applied to the average revenue collected by the corresponding tax and time period in the control group.

Figure 5 shows the distributions of these direct and total gains. For each type of message and follow-up period, direct gains are plotted in blue and total gains in red. Results for the 5-month follow up indicate that there is a substantial risk of overestimating the tax revenues produced by the messages if one relies only on their direct effects. This is particularly true for the "social norms" message. In fact, notice that almost all the probability mass of the distribution of total gains lies below the distribution of direct gains, and the average direct gain clearly lies above the upper limit of the 95% confidence interval of total gains.

Precision is lost when calculating the total gains and this is much more apparent in the simulations carried out for the 15-month follow up. However, the risk of overestimating total gains if one ignores the indirect effects of the message is still evident for the "social norms" letter. Results for the "deterrence" message are consistent with the transitory nature of the negative spillover reported above (the entire distribution of direct gains now lies within the confidence interval of total gains). Results for the "altruism" message suggest a negative spillover in tax revenues but we lack precision to confirm its statistical significance.

5   Concluding Remarks

In this study, we carried out a randomized controlled trial to estimate the direct and indirect effects produced on tax compliance by three different types of messages sent to a large sample of potential income taxpayers in the city of Lima, Peru. During the experiment, the tax authority sent a "deterrence" message that highlighted the effectiveness of its control actions, a "social norms" message that informed taxpayers about the compliance of others, and a "altruism" message that highlighted that tax revenues could be used to provide public goods to disadvantaged citizens. The direct effects refer to the change in compliance with the tax addressed in the messages (i.e. the rental income tax). The indirect effects refer to the changes in compliance with the capital gains and the self-employment income taxes. These three income taxes share the characteristic of being difficult to enforce because taxpayers can easily under-report or avoid declaring their income streams.

Table 4: The effect of the reminder letter on tax compliance

	Likelihood of paying taxes between the 5th and 18th of Oct 2018	IHS of amount paid between the 5th and 18th of Oct 2018
	(1)	(2)
Panel A: Rental income tax		
Reminder	0.0214	0.1504
	(0.0059)***	(0.0389)***
N	5,639	5,639
Panel B: Capital gains tax		
Reminder	0.0033	0.0251
	(0.0031)	(0.0213)
N	5,639	5,639
Panel C: Self-employment income tax		
Reminder	0.0012	0.0033
	(0.0034)	(0.0172)
N	5,639	5,639

Robust standard errors between parenthesis. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level. We report the marginal effects implied by a probit model for the results on the likelihood of paying taxes. We transform the amount paid using the Inverse Hyperbolic Sine function. For more information, see Friedline, et al. (2015). All regressions include a set of covariates that contains: age in years, a dummy for sex, the number of properties and their value, dummies for income bins, a dummy for tax payments during the period 2013 to 2017, and district fixed effects.

Figure 5: Per capita changes in tax revenues caused by the messages (*direct marginal gain* in blue, *direct + indirect marginal gain* in red)
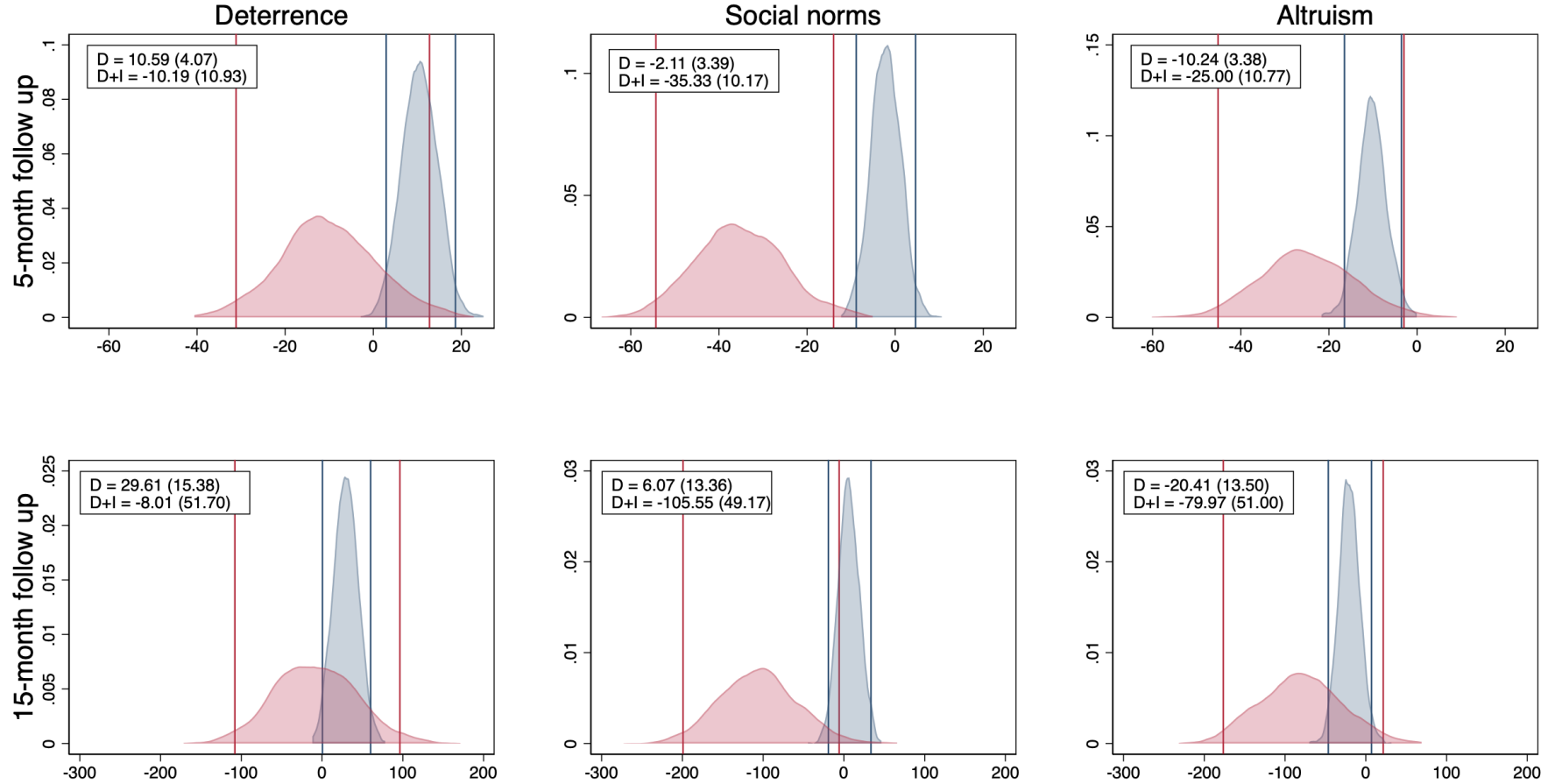
Notes: We report bootstrapped distributions (n=1000) of per capita changes in tax revenues caused by the messages. Vertical lines indicate 95% confidence intervals. Estimates correspond to the average potential taxpayer of our sample, in USD. Bootstrapped standard errors are reported in parentheses. "D": *direct marginal gain*, in blue, considers the effect on the rental income tax. "D+I": *direct + indirect marginal gain*, in red, adds to this the additional resources coming from the capital gains and self-employment income tax. In A.6 we report the empirical distribution of the messages on each particular tax type.

Our results confirm that "deterrence" messages have a positive direct effect of increasing payments. We also confirm that these messages can produce spillovers to compliance with other taxes and that they can be negative. Potential explanations for this negative indirect effect are a downward adjustment in taxpayer's expected enforcement with other taxes (as postulated by LLS (2019)), or a cash-flow effect by which taxpayers reduce their cash strain by cutting down payments related to other taxes. We also provide new evidence that social norm messages can produce negative spillovers. Moreover, our results for the "altruism" message confirm that this type of messages can also backfire. We use a survey to document the context in which one can expect this negative response and find evidence that the taxpayers in our sample have non-altruistic preferences and low inequality aversion, and perceive that public institutions are highly corrupt and ineffective. This suggests that "altruism" messages can backfire by compounding the negative effects of these preferences and perceptions on compliance.

In this study we consider effects across different taxes as well as across different time periods. This process allowed us to provide a comprehensive analysis of the quantitative importance of indirect impacts. This exercise highlights the risk of ignoring potential spillovers across taxes. Our results are relevant to tax authorities in other parts of the world facing informational asymmetries that prevent them from fully identifying who is a debtor. Our findings also suggest new avenues for future research. In particular, further research on why messages appealing to social norms can trigger a negative spillover or on the role of altruistic preferences and the perception of corruption in government for the effect of messages that make more salient the use of tax revenues are the most promising.

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A   Appendix

Figure A.1: Experiment Letters in Spanish

Panel A: Reminder message

[Logo]

Denominación del año

Carta N° <<*Número de carta* >>

Lima, *XX* de *XXX* de 2018

RUC :
Nombre o razón social :
Domicilio :

Señor/a contribuyente:

Si Ud. percibe ingresos por alquileres, recuerde pagar su impuesto.[1]

Entérese como declarar y pagar este tipo de renta en _____.

Para consultas generales, comuníquese con nuestra Central de Consultas, llamando desde sus teléfonos fijos al XXXX-XX-XXX o desde sus teléfonos móviles al (XX) XXX-XXXX, digitando la opción 3, de lunes a viernes, de 8.30 a.m. a 6:00 p.m. y sábados de 9:00 a.m. a 1:00 p.m. Asimismo, puede dirigirse a cualquiera de nuestros Centros de Servicios al Contribuyente.

Si Ud. percibe ingresos por alquileres y ya cumplió con el pago de su impuesto, ¡felicitaciones!

Atentamente,

---

[1] *Los alquileres son Rentas de Primera Categoría que incluyen el arrendamiento o subarrendamiento de predios (casa, departamento, habitaciones, cocheras, entre otros); la cesión de muebles (autos, máquinas, etc,), las mejoras introducidas al predio por el inquilino y l*a cesión gratuita o a precio no determinado de predios (terrenos o edificaciones)

Panel B: "Deterrence" message

[Logo]

Denominación del año

Carta N° <<*Número de carta* >>

Lima, *XX* de *XXX* de 2018

RUC :
Nombre o razón social :
Domicilio :

Señor/a contribuyente:

Si Ud. percibe ingresos por alquileres, recuerde pagar su impuesto.

Sepa que la SUNAT está esforzándose por detectar a quienes no pagan ese impuesto en su distrito. Ya hemos identificado 78 mil personas en Barranco, La Molina, Miraflores, San Isidro, San Borja y Surco.[1]

Entérese como declarar y pagar este tipo de renta en _____.

Para consultas generales, comuníquese con nuestra Central de Consultas, llamando desde sus teléfonos fijos al XXXX-XX-XXX o desde sus teléfonos móviles al (XX) XXX-XXXX, digitando la opción 3, de lunes a viernes, de 8.30 a.m. a 6:00 p.m. y sábados de 9:00 a.m. a 1:00 p.m. Asimismo, puede dirigirse a cualquiera de nuestros Centros de Servicios al Contribuyente.

Si Ud. percibe ingresos por alquileres y ya cumplió con el pago de su impuesto ¡felicitaciones!

Atentamente,

---

[1]*Los alquileres son Rentas de Primera Categoría que incluyen el arrendamiento o subarrendamiento de predios (casa, departamento, habitaciones, cocheras, entre otros); la cesión de muebles (autos, máquinas, etc,), las mejoras introducidas al predio por el inquilino y l*a cesión gratuita o a precio no determinado de predios (terrenos o edificaciones)

(Figure A.1, continued)

Panel C: "Social norms" message

Denominación del año

Carta N° <<*Número de carta* >>

Lima, *XX* de *XXX* de 2018

RUC   :
Nombre o razón social   :
Domicilio   :

Señor/a contribuyente:

Si Ud. percibe ingresos por alquileres, recuerde pagar su impuesto.

Sepa que la mayoría de los vecinos de Barranco, La Molina, Miraflores, San Isidro, San Borja y Surco cumplen con declarar sus ingresos por alquileres.[1]

Entérese como declarar y pagar este tipo de renta en _____ .

Para consultas generales, comuníquese con nuestra Central de Consultas, llamando desde sus teléfonos fijos al XXXX-XX-XXX o desde sus teléfonos móviles al (XX) XXX-XXXX, digitando la opción 3, de lunes a viernes, de 8.30 a.m. a 6:00 p.m. y sábados de 9:00 a.m. a 1:00 p.m. Asimismo, puede dirigirse a cualquiera de nuestros Centros de Servicios al Contribuyente.

Si Ud. percibe ingresos por alquileres y ya cumplió con el pago de su impuesto ¡felicitaciones!

Atentamente,

---

[1]*Los alquileres son Rentas de Primera Categoría que incluyen el arrendamiento o subarrendamiento de predios (casa, departamento, habitaciones, cocheras, entre otros); la cesión de muebles (autos, máquinas, etc,), las mejoras introducidas al predio por el inquilino y l*a cesión gratuita o a precio no determinado de predios (terrenos o edificaciones)

Panel D: "Altruism" message

[Logo]

Denominación del año

Carta N° <<*Número de carta* >>

Lima, *XX* de *XXX* de 2018

RUC :
Nombre o razón social :
Domicilio :

Señor/a contribuyente:

Si Ud. percibe ingresos por alquileres, recuerde pagar su impuesto.[1]

Sepa que si todos los vecinos de Barranco, La Molina, Miraflores, San Isidro, San Borja y Surco pagasen su impuesto por alquileres, se podrían construir mas de 90 Centros de Salud en las regiones más pobres del Perú.

Entérese como declarar y pagar este tipo de renta en _____.

Para consultas generales, comuníquese con nuestra Central de Consultas, llamando desde sus teléfonos fijos al XXXX-XX-XXX o desde sus teléfonos móviles al (XX) XXX-XXXX, digitando la opción 3, de lunes a viernes, de 8.30 a.m. a 6:00 p.m. y sábados de 9:00 a.m. a 1:00 p.m. Asimismo, puede dirigirse a cualquiera de nuestros Centros de Servicios al Contribuyente.

Si Ud. percibe ingresos por alquileres y ya cumplió con el pago de su impuesto, ¡felicitaciones!

Atentamente,

---

[1]*Los alquileres son Rentas de Primera Categoría que incluyen el arrendamiento o subarrendamiento de predios (casa, departamento, habitaciones, cocheras, entre otros); la cesión de muebles (autos, máquinas, etc,), las mejoras introducidas al predio por el inquilino y l*a cesión gratuita o a precio no determinado de predios (terrenos o edificaciones)

Figure A.2: Intervention Timeline

Delivery of messages:
One message per month by e-mail (personal and SOL), text message and letter.

Survey:
Perceptions and views about the Government, social norms, and enforcement rates

| Oct 18 | Nov 18 | Dec 18 | Jan 19 | Feb 19 | Mar 19 | Apr 19 | May 19 | Jun 19 | Jul 19 | Aug 19 | ... | Jan 20 |

Monthly results monitoring:
Proportion of people that declares taxes and amount collected.

Figure A.3: "Deterrence" message: Pre-trends in tax behavior

Panel A: IHS transformation of amount paid between Jan 18 and month X

Panel B: Likelihood of paying taxes between Jan 18 and month X

Notes: 90% and 95% confidence intervals. We report the marginal effects implied by a probit model for the results on the likelihood of paying taxes. We transform the amount paid using the Inverse Hyperbolic Sine function. For more information, see Friedline, et al. (2015). All regressions include a set of covariates which is comprised by: age in years, a dummy for sex, the number of properties and their value, dummies for income bins, a dummy for rental income tax payments during the period 2013 to 2017, and district fixed effects.

Figure A.4: "Social norms" message: Pre-trends in tax behavior

Panel A: IHS transformation of amount paid between Jan 18 and month X

Panel B: Likelihood of paying taxes between Jan 18 and month X

Notes: 90% and 95% confidence intervals. We report the marginal effects implied by a probit model for the results on the likelihood of paying taxes. We transform the amount paid using the Inverse Hyperbolic Sine function. For more information, see Friedline, et al. (2015). All regressions include a set of covariates which is comprised by: age in years, a dummy for sex, the number of properties and their value, dummies for income bins, a dummy for rental income tax payments during the period 2013 to 2017, and district fixed effects.
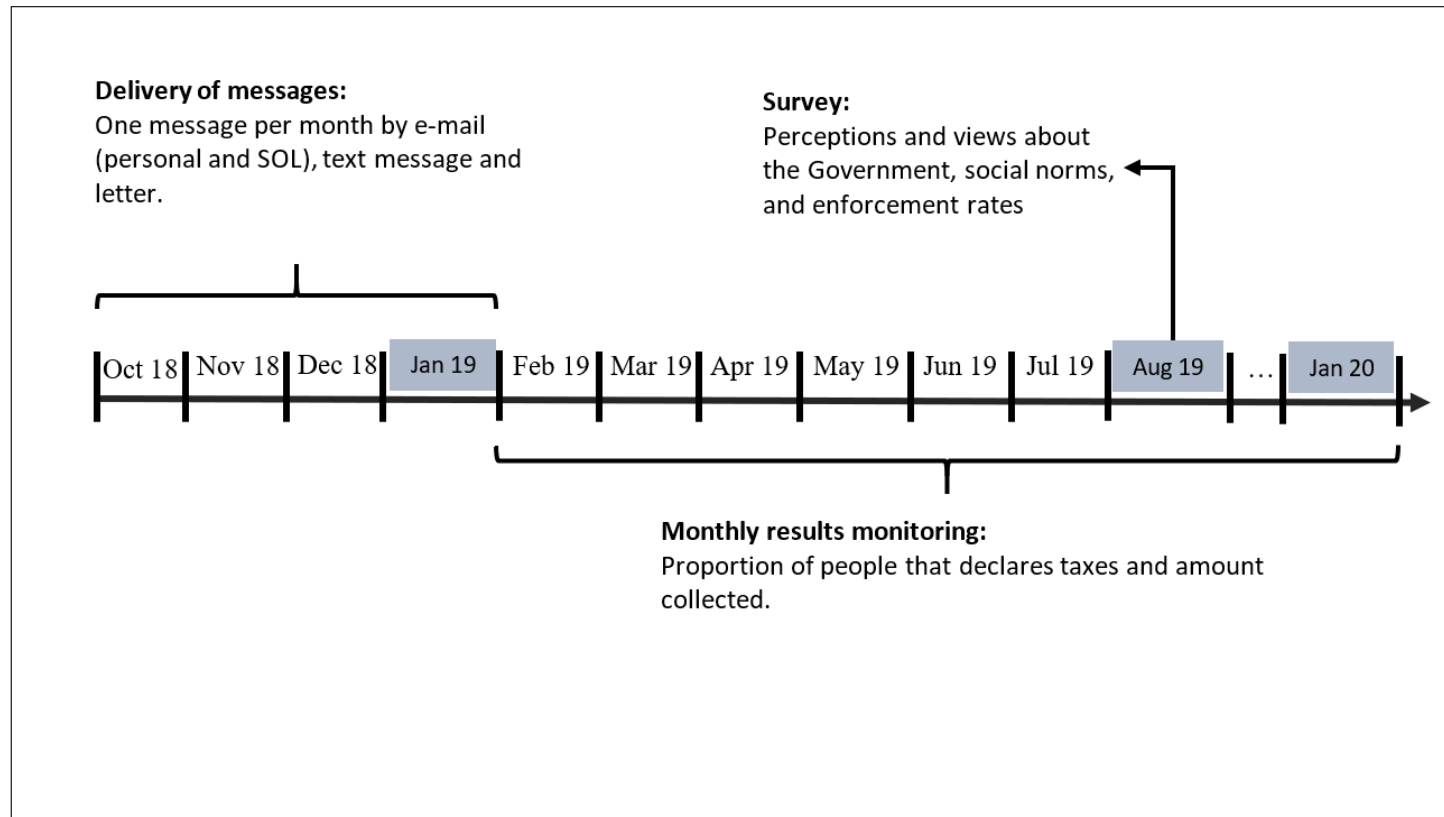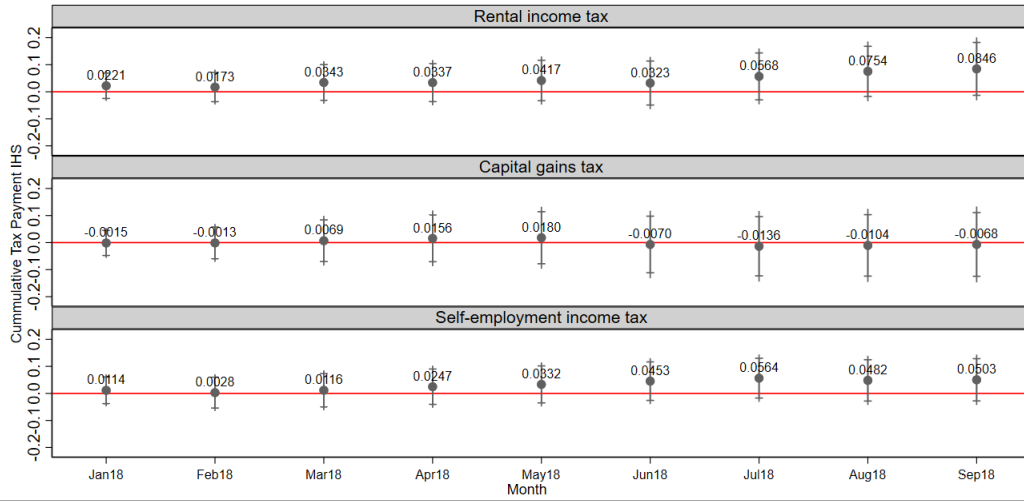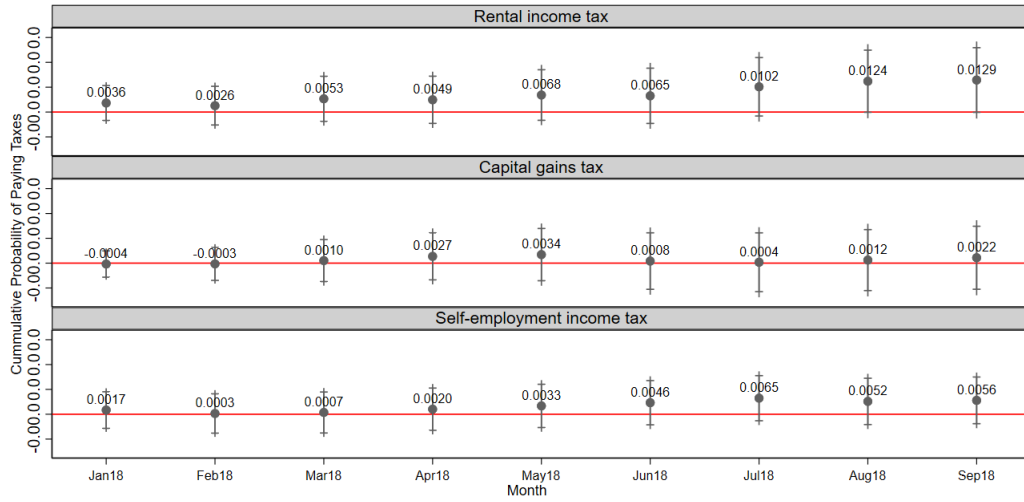
Figure A.5: "Altruism" message: Pre-trends in tax behavior

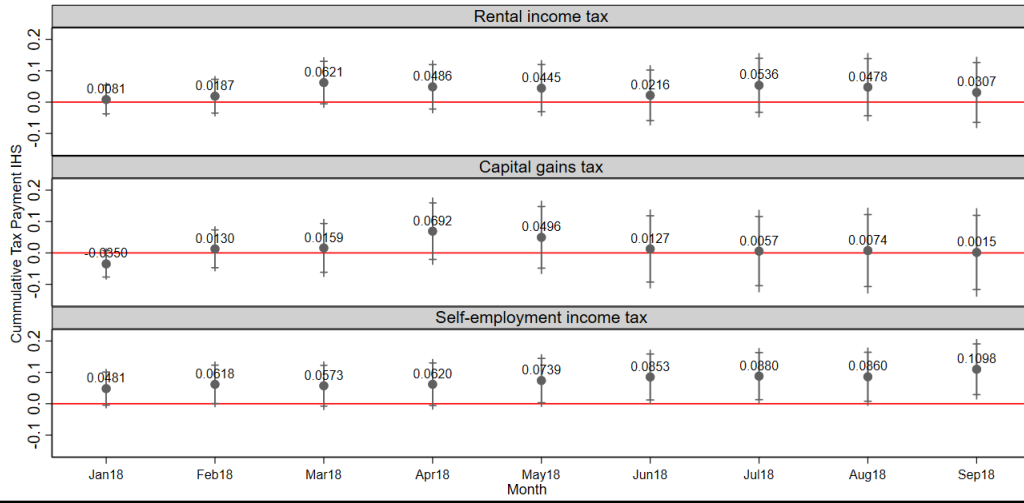Panel A: IHS transformation of amount paid between Jan 18 and month X

Panel B: Likelihood of paying taxes between Jan 18 and month X

Notes: 90% and 95% confidence intervals. We report the marginal effects implied by a probit model for the results on the likelihood of paying taxes. We transform the amount paid using the Inverse Hyperbolic Sine function. For more information, see Friedline, et al. (2015). All regressions include a set of covariates which is comprised by: age in years, a dummy for sex, the number of properties and their value, dummies for income bins, a dummy for rental income tax payments during the period 2013 to 2017, and district fixed effects.

Figure A.6: Per capita changes in tax revenues caused by the messages (effect of *reminder* in blue, effect of *additional lines* in red)
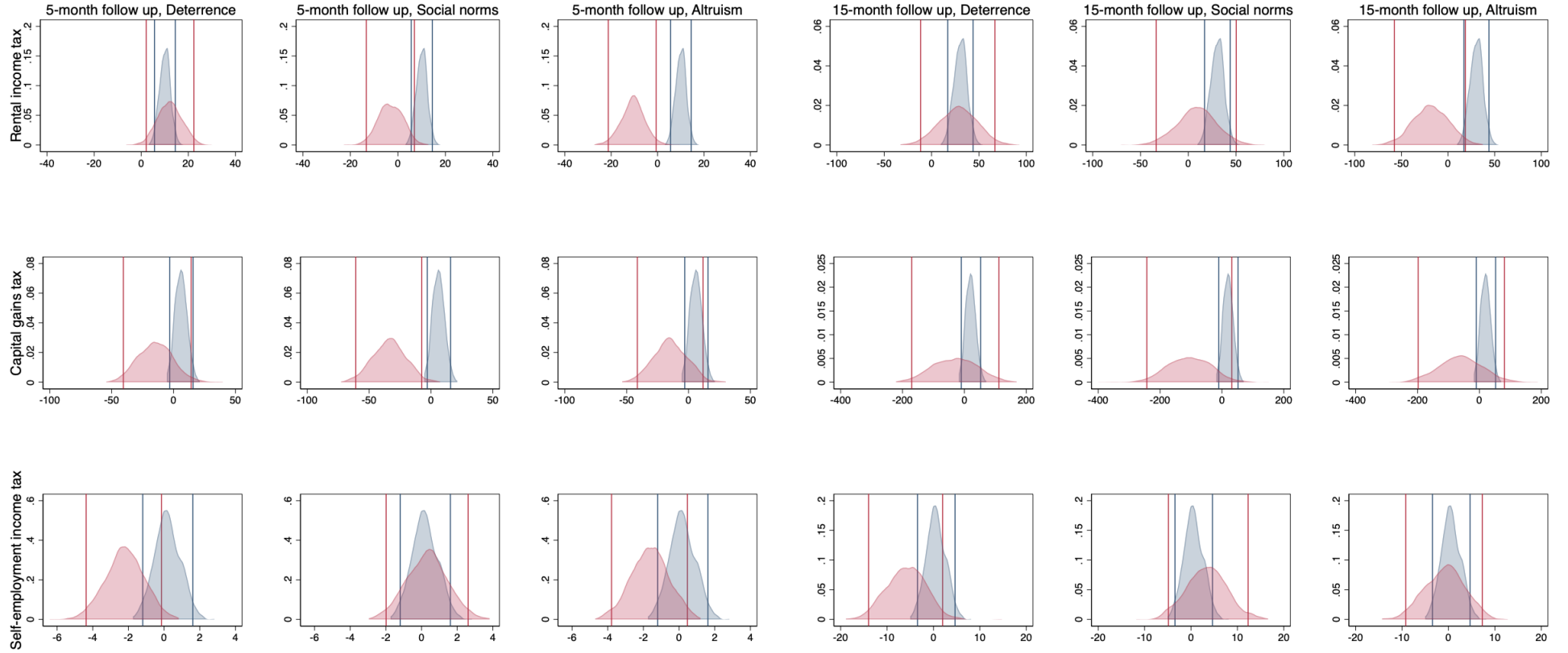
Notes: We report bootstrapped distributions (n=1000) of per capita changes in tax revenues caused by the messages. Vertical lines indicate 95% confidence intervals. Estimates are expressed in US dollars (USD/PEN=3.5) and correspond to the average potential taxpayer of our sample. *Reminder* refers to the change in tax revenues caused by the text in the letter that reminds potential taxpayers to pay their rental income tax. *Additional lines* refer to the change in tax revenues caused by the text in the letter related to the "deterrence", "social norms" or "altruism" message.

Table A.1: Direct and indirect effects of the "deterrence" message on tax compliance

	Oct18	Nov18	Dec18	Jan19	Feb19	Mar19	Apr19	May19	Jun19	Jul19	Aug19	Sep19	Oct19	Nov19	Dec19	Jan20
Panel A: IHS transformation of amount paid between Oct 18 and month X																
Rental income tax	0.038	0.103**	0.124**	0.138**	0.152**	0.115	0.135*	0.147*	0.159**	0.145*	0.141*	0.148*	0.130	0.129	0.130	0.114
	(0.043)	(0.053)	(0.060)	(0.064)	(0.068)	(0.071)	(0.074)	(0.075)	(0.077)	(0.078)	(0.080)	(0.081)	(0.083)	(0.084)	(0.085)	(0.086)
Control mean	0.387	0.631	0.854	1.011	1.121	1.248	1.331	1.396	1.442	1.495	1.540	1.588	1.637	1.675	1.725	1.761
Capital gains tax	-0.014	0.007	-0.005	-0.041	-0.057	-0.077	-0.080	-0.097	-0.096	-0.067	-0.088	-0.088	-0.080	-0.048	-0.026	-0.035
	(0.030)	(0.040)	(0.046)	(0.052)	(0.056)	(0.060)	(0.064)	(0.068)	(0.070)	(0.073)	(0.075)	(0.077)	(0.080)	(0.082)	(0.084)	(0.086)
Control mean	0.109	0.201	0.269	0.326	0.378	0.455	0.540	0.606	0.646	0.701	0.750	0.797	0.844	0.893	0.949	0.997
Self-employment income tax	-0.020	-0.034	-0.039	-0.038	-0.053*	-0.046	-0.044	-0.033	-0.031	-0.025	-0.025	-0.032	-0.035	-0.038	-0.048	-0.049
	(0.021)	(0.023)	(0.025)	(0.025)	(0.027)	(0.029)	(0.030)	(0.029)	(0.030)	(0.031)	(0.032)	(0.033)	(0.033)	(0.034)	(0.034)	(0.035)
Control mean	0.162	0.218	0.250	0.270	0.287	0.307	0.323	0.337	0.353	0.364	0.379	0.392	0.407	0.413	0.423	0.430
Panel B: Likelihood of paying taxes between Oct 18 and month X																
Rental income tax	0.007	0.016**	0.019**	0.020**	0.022**	0.016*	0.019*	0.021**	0.022**	0.020**	0.019*	0.020*	0.018*	0.018*	0.018*	0.015
	(0.006)	(0.008)	(0.008)	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.011)	(0.011)	(0.011)	(0.011)
Control mean	0.060	0.094	0.121	0.140	0.153	0.167	0.176	0.183	0.187	0.192	0.196	0.201	0.206	0.210	0.214	0.217
Capital gains tax	-0.003	-0.001	-0.002	-0.006	-0.008	-0.010	-0.010	-0.012*	-0.012	-0.009	-0.011	-0.011	-0.010	-0.007	-0.005	-0.005
	(0.003)	(0.004)	(0.005)	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)
Control mean	0.013	0.023	0.030	0.037	0.042	0.051	0.060	0.067	0.071	0.077	0.082	0.087	0.092	0.097	0.103	0.108
Self-employment income tax	-0.003	-0.005	-0.006*	-0.005	-0.008**	-0.006*	-0.006	-0.004	-0.004	-0.004	-0.004	-0.005	-0.005	-0.005	-0.006	-0.006
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Control mean	0.024	0.030	0.033	0.035	0.036	0.038	0.040	0.041	0.043	0.044	0.046	0.047	0.048	0.049	0.050	0.050

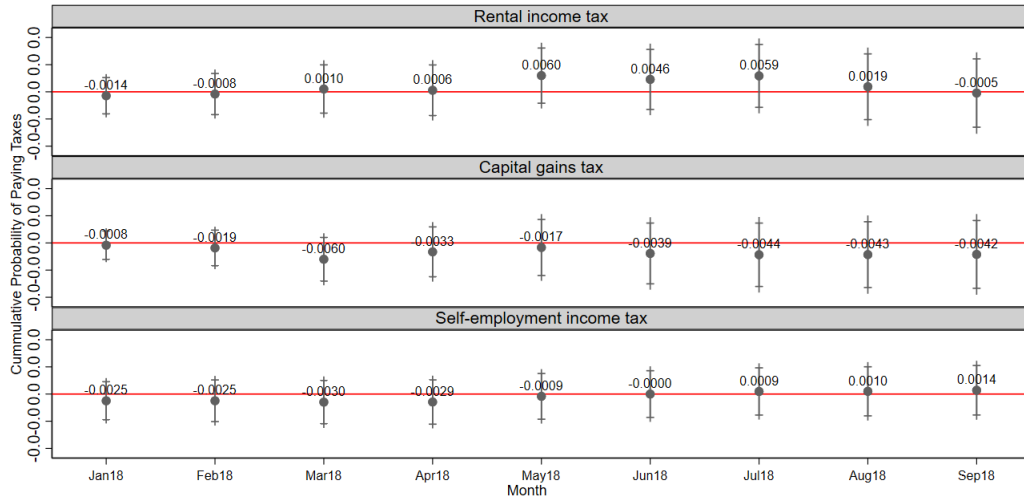Notes: Robust standard errors in parentheses. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level. We report the marginal effects implied by a probit model for the results on the likelihood of paying taxes. We transform the amount paid using the Inverse Hyperbolic Sine function. For more information, see Friedline, et al. (2015). All regressions include a set of covariates which is comprised by: age in years, a dummy for sex, the number of properties and their value, dummies for income bins, a dummy for rental income tax payments during the period 2013 to 2017, and district fixed effects. We also control for initial value of the dependent variable between Jan 18 and Sept 18, that is, before the intervention.

Table A.2: Direct and indirect effects of the "social norms" message on tax compliance

	Oct18	Nov18	Dec18	Jan19	Feb19	Mar19	Apr19	May19	Jun19	Jul19	Aug19	Sep19	Oct19	Nov19	Dec19	Jan20
Panel A: IHS transformation of amount paid between Oct 18 and month X																
Rental income tax	-0.065	-0.033	-0.036	-0.035	-0.042	-0.031	-0.007	0.016	0.010	0.014	0.014	0.005	-0.003	0.016	0.027	0.033
	(0.040)	(0.051)	(0.059)	(0.063)	(0.067)	(0.069)	(0.071)	(0.074)	(0.075)	(0.077)	(0.078)	(0.080)	(0.081)	(0.082)	(0.084)	(0.085)
Control mean	0.387	0.631	0.854	1.011	1.121	1.248	1.331	1.396	1.442	1.495	1.540	1.588	1.637	1.675	1.725	1.761
Capital gains tax	-0.042	-0.054	-0.068	-0.129***	-0.134**	-0.139**	-0.123*	-0.133**	-0.144**	-0.132*	-0.143*	-0.138*	-0.160**	-0.131	-0.148*	-0.129
	(0.027)	(0.036)	(0.044)	(0.049)	(0.053)	(0.059)	(0.063)	(0.067)	(0.069)	(0.071)	(0.074)	(0.076)	(0.078)	(0.080)	(0.082)	(0.084)
Control mean	0.109	0.201	0.269	0.326	0.378	0.455	0.540	0.606	0.646	0.701	0.750	0.797	0.844	0.893	0.949	0.997
Self-employment income tax	-0.011	0.001	0.021	0.023	0.008	0.012	0.010	0.017	0.018	0.020	0.019	0.019	0.033	0.035	0.033	0.029
	(0.022)	(0.025)	(0.027)	(0.027)	(0.028)	(0.029)	(0.030)	(0.031)	(0.031)	(0.032)	(0.033)	(0.034)	(0.036)	(0.036)	(0.037)	(0.038)
Control mean	0.162	0.218	0.250	0.270	0.287	0.307	0.323	0.337	0.353	0.364	0.379	0.392	0.407	0.413	0.423	0.430
Panel B: Likelihood of paying taxes between Oct 18 and month X																
Rental income tax	-0.008	-0.003	-0.004	-0.006	-0.006	-0.006	-0.002	0.003	0.001	0.002	0.002	0.001	-0.001	0.003	0.004	0.003
	(0.006)	(0.007)	(0.008)	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.011)
Control mean	0.060	0.094	0.121	0.140	0.153	0.167	0.176	0.183	0.187	0.192	0.196	0.201	0.206	0.210	0.214	0.217
Capital gains tax	-0.005	-0.006	-0.008*	-0.014***	-0.015***	-0.016**	-0.015**	-0.015**	-0.017**	-0.015**	-0.016**	-0.016*	-0.018**	-0.016*	-0.017**	-0.015*
	(0.003)	(0.004)	(0.005)	(0.005)	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)
Control mean	0.013	0.023	0.030	0.037	0.042	0.051	0.060	0.067	0.071	0.077	0.082	0.087	0.092	0.097	0.103	0.108
Self-employment income tax	-0.001	0.000	0.003	0.003	0.000	0.001	0.000	0.002	0.001	0.001	0.002	0.002	0.004	0.004	0.004	0.004
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
Control mean	0.024	0.030	0.033	0.035	0.036	0.038	0.040	0.041	0.043	0.044	0.046	0.047	0.048	0.049	0.050	0.050

Notes: Robust standard errors in parentheses. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level. We report the marginal effects implied by a probit model for the results on the likelihood of paying taxes. We transform the amount paid using the Inverse Hyperbolic Sine function. For more information, see Friedline, et al. (2015). All regressions include a set of covariates which is comprised by: age in years, a dummy for sex, the number of properties and their value, dummies for income bins, a dummy for rental income tax payments during the period 2013 to 2017, and district fixed effects. We also control for initial value of the dependent variable between Jan 18 and Sept 18, that is, before the intervention.

Table A.3: Direct and indirect effects of the "altruism" message on tax compliance

	Oct18	Nov18	Dec18	Jan19	Feb19	Mar19	Apr19	May19	Jun19	Jul19	Aug19	Sep19	Oct19	Nov19	Dec19	Jan20
Panel A: IHS transformation of amount paid between Oct 18 and month X																
Rental income tax	-0.066	-0.101**	-0.121**	-0.124**	-0.139**	-0.132*	-0.124*	-0.107	-0.107	-0.110	-0.117	-0.092	-0.095	-0.090	-0.085	-0.083
	(0.040)	(0.049)	(0.057)	(0.061)	(0.065)	(0.068)	(0.070)	(0.072)	(0.074)	(0.076)	(0.077)	(0.078)	(0.080)	(0.081)	(0.083)	(0.084)
Control mean	0.387	0.631	0.854	1.011	1.121	1.248	1.331	1.396	1.442	1.495	1.540	1.588	1.637	1.675	1.725	1.761
Capital gains tax	0.010	0.031	0.010	-0.029	-0.058	-0.067	-0.033	-0.062	-0.081	-0.054	-0.056	-0.081	-0.099	-0.090	-0.058	-0.073
	(0.030)	(0.040)	(0.046)	(0.052)	(0.055)	(0.060)	(0.065)	(0.068)	(0.070)	(0.073)	(0.075)	(0.077)	(0.079)	(0.080)	(0.083)	(0.085)
Control mean	0.109	0.201	0.269	0.326	0.378	0.455	0.540	0.606	0.646	0.701	0.750	0.797	0.844	0.893	0.949	0.997
Self-employment income tax	-0.036*	-0.028	-0.036	-0.025	-0.039	-0.035	-0.037	-0.025	-0.013	-0.017	-0.022	-0.018	-0.009	-0.008	-0.006	-0.006
	(0.021)	(0.023)	(0.024)	(0.024)	(0.026)	(0.027)	(0.029)	(0.029)	(0.030)	(0.031)	(0.032)	(0.033)	(0.035)	(0.035)	(0.036)	(0.037)
Control mean	0.162	0.218	0.250	0.270	0.287	0.307	0.323	0.337	0.353	0.364	0.379	0.392	0.407	0.413	0.423	0.430
Panel B: Likelihood of paying taxes between Oct 18 and month X																
Rental income tax	-0.009	-0.014*	-0.016**	-0.018**	-0.020**	-0.020**	-0.018*	-0.014	-0.014	-0.014	-0.015	-0.012	-0.012	-0.011	-0.010	-0.010
	(0.006)	(0.007)	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Control mean	0.060	0.094	0.121	0.140	0.153	0.167	0.176	0.183	0.187	0.192	0.196	0.201	0.206	0.210	0.214	0.217
Capital gains tax	0.001	0.003	0.000	-0.004	-0.007	-0.008	-0.005	-0.008	-0.010	-0.007	-0.006	-0.008	-0.010	-0.010	-0.007	-0.008
	(0.003)	(0.004)	(0.005)	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)
Control mean	0.013	0.023	0.030	0.037	0.042	0.051	0.060	0.067	0.071	0.077	0.082	0.087	0.092	0.097	0.103	0.108
Self-employment income tax	-0.004	-0.003	-0.004	-0.003	-0.005	-0.004	-0.005	-0.003	-0.002	-0.002	-0.003	-0.002	-0.001	-0.001	-0.001	-0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Control mean	0.024	0.030	0.033	0.035	0.036	0.038	0.040	0.041	0.043	0.044	0.046	0.047	0.048	0.049	0.050	0.050

Notes: Robust standard errors in parentheses. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level. We report the marginal effects implied by a probit model for the results on the likelihood of paying taxes. We transform the amount paid using the Inverse Hyperbolic Sine function. For more information, see Friedline, et al. (2015). All regressions include a set of covariates which is comprised by: age in years, a dummy for sex, the number of properties and their value, dummies for income bins, a dummy for rental income tax payments during the period 2013 to 2017, and district fixed effects. We also control for initial value of the dependent variable between Jan 18 and Sept 18, that is, before the intervention.

B Survey Appendix

We carried out our experiment on a sample of property owners which were potential rental income tax evaders according to the tax authority and that lived in some of the most affluent districts of Peru. To further understand how particular this sample is, we collected survey data on several characteristics and taxpayers' beliefs. In this section, we present our survey data. We also report how different or similar our sample of taxpayers is. This exercise sheds light on how generalizable are our results. Throughout the paper we also use this survey to further characterize our sample and provide a better understanding of some of the underlying mechanisms behind our results.

B.1 Survey data

In August of 2019, we conducted a survey to a random sub-sample of 867 taxpayers that were included in the control group and each of the treatment arms of the study. We successfully surveyed 211, 197, 218 and 241 individuals of the control group, the "deterrence" treatment arm, the "social norms" treatment arm, and the "altruism" treatment arm, respectively. The survey consisted of several questions regarding the individuals' perceived risk of being caught cheating, their belief about the overall level of compliance, their preferences for equality, their perceived quality of the public services supplied by different governmental instances and several other characteristics. Even though we would be interested in testing if treatment letters caused an impact on some beliefs, we do not have enough power to detect any changes given the small sample of the survey.

Whenever possible, we compare these descriptive statistics with the ones provided by the World Values Survey (WVS) to have a better sense of the external validity of our results. The WVS is an international standardized survey with presence in more than 60 countries investigating human beliefs, motivations, and values. It is representative at the national level and contains information similar and comparable to our survey, as the design of our questionnaire was partially based on the WVS questionnaire. We use the 2018 data for Peru. Even though we would like to compare our sample of taxpayers against the population of taxpayers, data on characteristics and beliefs for the population of taxpayers is not available, and this is the best we can do.

B.2 Results

Descriptive statistics are presented in Table B.1.[33] Since sometimes scales of measurement change from one survey to the other, in parenthesis we report a normalized scale that goes from 1% to 100%. The first block of variables show how taxpayers in our sample compare to the overall Peruvian population in terms of trust. In general terms they both seem to be alike, however taxpayers in our sample tend to be more give more trust toward people they first meet and people from other nationalities. The second block compare individuals in terms of corruption perceptions. These statistics show that taxpayers in our sample perceive less corruption in their local authorities than the overall population. This may be consistent with the fact the individuals in our sample live in the richest districts which in average may have better local institutions. In fact, perceptions about corruption in broader levels of government are similar across the two samples. The third block of variables refer to participation in groups and association. Usually these variables are used to measure social capital *à la* Putnam as they measure the embeddedness of connections among individuals. Table B.1 shows that participation in groups and associations is more widespread in the overall population, especially in religious organizations. Finally, the last block is referred to variables such as the justifiability of evading taxes, political inclination, and preferences on inequality. Taxpayers in our sample justify the possibility of cheating on taxes in a larger proportion than the overall population, which may suggest that in fact their likelihood of cheating is larger. Finally, politically, taxpayers in our sample seem to be leaning to the right.

All in all, these results show that in some dimensions individuals from our sample may be similar to the overall population, but in some others they may not. If policymakers are interested in replicating this experiment and extrapolate our results to other contexts, it would be helpful to first take into account how different their sample of taxpayers is with respect to that of our experiment. The information provided in this section can be used to shed light on this.

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[33]Since in this section we want to characterize our sample in absence of any treatment, we focus on the control group to prevent any contamination from the treatment letters as they could in principle have had an impact on some of the variables collected in the survey. Nonetheless, results are very similar if we focus on the overall sample.

Table B.1: Comparison between control group and the overall Peruvian population

Experiment Survey	Average	WVS Data	Average
The majority of persons can never be trusted (% yes)	5.7%	Most people can be trusted (% no)	5.3%
How much do you trust your family (scale: 1 to 5)	4.6 (92%)	How much do you trust your family (scale: 1 to 4)	3.6 (90%)
How much do you trust your neighborhood (scale: 1 to 5)	3.0 (60%)	How much do you trust your neighborhood (scale: 1 to 4)	2.1 (53%)
How much do you trust someone you first meet (scale: 1 to 5)	2.3 (46%)	How much do you trust someone you first meet (scale: 1 to 4)	1.5 (37%)
How much do you trust someone of another nationality (scale: 1 to 5)	2.9 (58%)	How much do you trust someone of another nationality (scale: 1 to 4)	1.6 (40%)
Local authorities level of corruption (scale: 1 to 5)	2.9 (58%)	Local authorities involved in corruption (None: 1; All: 4)	3.2 (80%)
Central Government level of corruption (scale: 1 to 5)	3.7 (74%)	State authorities involved in corruption (None: 1; All: 4)	3.3 (83%)
Belongs to a group or association (% yes)	26%	Belongs to a group or association (% yes)	59%
Belongs to religious organization	20%	Belongs to religious organization	72%
Belongs to political party	3.4%	Belongs to political party	8.2%
Belongs to producers or merchants union	5.6%	Belongs to labor union	6.8%
Justifiability of evading taxes (scale: 1 to 5)	1.4 (28%)	Justifiability of cheating on taxes (scale: 1 to 10)	1.9 (19%)
Political inclination (Left: 1; Right: 5)	3.5 (70%)	Political inclination (Left: 1; Right: 10)	6.1 (61%)
The more free the economy, the more free the people (scale: 1 to 5)	3.6 (72%)	Which is more important, freedom or equality (% freedom)	41%
Income should be more equal (scale: 1 to 5)	3.2 (66%)	Income equality vs income differences (1: equal, 10: unequal)	6.0 (60%)