# Becoming Legible to the State: The Role of Detection and Enforcement Capacity in Tax Compliance

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Increasing tax collection is a priority for many low- and middle-income countries. This paper distinguishes two dimensions of low state capacity that hinder tax collection: the inability to ascertain the tax base (detection capacity) and the inability to enforce unpaid liabilities (enforcement capacity). A randomized experiment with Liberian property owners leverages enhanced detection capacity from the creation of a new electronic property database. It finds that including identifying information such as property photographs in tax notices more than quadruples the payment rate, from 2 percent to almost 10 percent, when the notice includes details on the penalties for noncompliance. A second experiment finds a further increase in compliance from signaling greater enforcement probability to delinquent property owners. These results highlight the importance of investments in both detection and enforcement capacity.

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# 1 Introduction

Building state capacity to collect taxes effectively is an important policy goal in many low- and middle-income countries. Developing this fiscal capacity is considered crucial for economic and political development (Besley and Persson, 2009). This paper examines how two distinct dimensions of fiscal capacity determine tax collection: the ability of the state to identify the tax base (henceforth referred to as "detection capacity"), and the ability to enforce tax laws and ensure that taxpayers pay their liabilities (henceforth referred to as "enforcement capacity"). It investigates these questions using randomized interventions by the Liberian Revenue Authority (LRA).

Detection capacity is crucial for knowing the income, assets, or transactions that are subject to taxation. However, with high levels of informality and limited state capacity to collect and codify data, many low- and middle-income countries lack systematic information on the tax base. Some contexts are reminiscent of Scott's (1999) description of the pre-modern state as "in many crucial respects, partially blind; it knew precious little about its subjects, their wealth, their landholdings and yields, their location, their very identity." In order to tax, the pre-modern state sought to make society "legible" through the creation of permanent last names, establishment of cadastral surveys and population registers etc. Similarly, effective tax collection by modern revenue agencies relies on third-party information and other electronic databases for information on the tax base (e.g. Kleven et al., 2011; Kleven, Kreiner and Saez, 2016; Jensen, 2019).

Enforcement capacity includes the use of measures such as delinquent notices, penalties and interest charges, wage garnishment, and legal prosecution to recover unpaid taxes. In countries with strong enforcement capacity, some of these sanctions are automatically triggered and are routinely applied to taxpayers. However, in variety of low-capacity contexts, majority of unpaid liabilities go uncollected for several years[1]. As these two dimensions of tax capacity require different types of investments and have different implications for the choice of policy instruments and administrative strategy, it is important to distinguish their

[1] See evidence of low compliance rates on known property tax liabilities from Pakistan (Khan, Khwaja and Olken, 2015), Ghana (Dzansi et al., 2022), Haiti (Krause, 2020), Senegal(Knebelmann, 2019) and Democratic Republic of Congo (Weigel, 2020; Balán et al., 2022)

impacts in understanding what works to improve fiscal capacity.

This paper studies the roles of detection and enforcement capacity in tax compliance using two randomized experiments by the LRA in Monrovia, the capital city. This project occurs in the context of the Liberian government undertaking technology investments to make the property tax base more legible by creating a new electronic property database. Prior to these interventions, only five percent of properties were on the tax database. The vast majority of property owners in Monrovia were not paying real estate taxes as they had never received a tax notice.

In the first experiment, the LRA used its newly acquired detection capacity to alert a randomly selected group of property owners that were not on the tax roll that their noncompliance had been discovered. The control group received a generic tax notice addressed to "Dear Property Owners." It requested compliance and provided information on the procedure for tax registration and payment. The treatment group received a tax notice that, in addition, included the name of the property owner and a photograph of the property. In addition, the notice included information on legal penalties for noncompliance. There were two additional treatment groups that received notices with either the detection information alone (name of owner and photograph of property) or the penalty information alone.

The combined detection and penalty information significantly increases compliance: property owners are more than four times as likely to pay the tax. The payment rate increases from 2.2 percent of property owners in control group to 9.8 percent in the treatment group. The effect of bringing people into the tax net persists as the treatment group continues to have a higher payment rate over the next 3 years of available data. We are unable to detect a statistically significant impact of either the individual Detection or Penalty treatments. While the treatment effect from the combined detection and penalty treatment is large, there remains an outstanding puzzle: contrary to the prediction of standard tax compliance models, 87 percent of property owners do not respond when alerted that the tax authority has detected their noncompliance and when given information on the penalties for noncompliance.

We use a second experiment to examine the hypothesis that the high non-response rate may be due to low expectations that the stated penalties would be enforced. In this experi-

ment, the tax authority sends out notices to raise the perceptions of enforcement probability among delinquent taxpayers (those already on the tax roll but who did not pay taxes for at least one year prior). The control group receives a notice requesting payment. Similar to the combined detection and penalty information notice in Experiment One, this notice includes the name of the property owner, photograph of the property and information on legal penalties for non-compliance. The treatment group receives a similar notice with additional information that they have been selected for the next batch of properties to receive enforcement action if they do not comply. This intervention increases the payment rate by 7 percentage points (a 35 percent increase over a payment rate of 20 percent in the control group), highlighting the additional impact of signals of enforcement capacity.

These findings enhance our understanding of state capacity and taxation. This paper is the first that we are aware of to explicitly test for and distinguish between detection and enforcement capacity, which are otherwise typically conflated in the literature. Standard economic models of tax compliance (e.g. Allingham and Sandmo, 1972) focus on the detection problem and many experiments vary information on audit probability to test the models as they implicitly assume that enforcement occurs once noncompliance is detected. Similarly, recent empirical literature on tax compliance has emphasized the centrality of information about the tax base for tax collection (e.g. Kleven et al., 2011; Kleven, Kreiner and Saez, 2016; Jensen, 2019; Pomeranz, 2015; Naritomi, 2019), with less emphasis on the recovery of known but unpaid liabilities.

This paper highlights the reality in many low- and middle-income countries that there is often limited state capacity to collect taxes even after an individual is found to be non-compliant through audits or third-party information (Best, Shah and Waseem, 2021; Carrillo, Pomeranz and Singhal, 2017). Consequently, detection is insufficient to improve upon low rates of compliance. This paper leverages the visible and immobile features of real estate to provide a stark demonstration of the limitations of even close to perfect information about the tax base. Specifically, this paper finds that information on penalties as well as enforcement signals are key complements of detection information. This finding directly informs policy. Whereas many policy conversations on tax administration reform are centered

around adopting new technology and improved databases to better understand the tax base, these results emphasize the unavoidable need for investments in traditional enforcement, which are typically more politically difficult to implement.

In addition, this paper contributes to our understanding of how technology can improve tax administration in emerging economies (Okunogbe and Santoro (forthcoming) provides a review of this literature). It shows how the introduction of a new property enumeration technology improved the tax authority's knowledge of the tax base and ability to increase tax compliance, when used alongside penalty and enforcement information. While the increase in detection capacity is common across all property owners in the sample, this experiment randomizes the *use* of this information in tax notices to property owners, which is the policy relevant application for signaling the change in detection capacity. It complements recent papers on how increased detection capacity could also be used to improve the effectiveness of tax collectors (Dzansi et al., 2022) or improving the accuracy of property valuation (Knebelmann, Pouliquen and Sarr, 2022).

Lastly, this paper contributes to a growing literature on randomized experiments conducted in collaboration with tax authorities to understand different approaches to promoting tax compliance. Hallsworth et al. (2015), Mascagni (2018), Pomeranz and Vila-Belda (2019), and Slemrod (2019) provide reviews of this literature. Many papers in this literature feature letter experiments that emphasize the risk of audits, the severity of penalties and tax morale motivations. This paper adds to this literature in two key ways. First, the legibility treatment in this paper (name of owner and photo of property) is the first of its kind that we are aware of. Unlike many papers that give a generic nudge or reminder to taxpayers, this paper (specifically, Experiment One) leverages a significant real investment in the detection capacity of the government. While some interventions in this literature signal detection capacity by alerting recipients that the tax authority has some information about their income such as through the use of third party information(e.g. Carrillo, Pomeranz and Singhal, 2017), this paper demonstrates detection capacity in a graphic manner. Second, whereas most papers in this literature can only study the immediate impact of the notice, this paper is able to show that the impact of detection information and penalty information on compliance persists over

three years.[2]

The rest of the paper proceeds as follows. Section 2 provides background information on Liberia and the administration of property taxes while Section 3 outlines a simple conceptual framework in thinking about these two aspects of state capacity on tax compliance. Sections 4 and 5 describe the design of the two experiments respectively and present the corresponding results. Section 6 concludes and provides policy implications.

## 2 Context

Real estate tax compliance in Liberia is very limited. Prolonged civil conflict in the 1990s and early 2000s led to the erosion of state capacity across several sectors, including tax administration. In 2018, in the Greater Monrovia area, the largest urban metropolis with over 1 million residents, the tax roll contained fewer than 7,000 properties, belonging to about 5,000 property owners.[3] Even among properties on the tax roll, timely collection remains a challenge. After taxpayers enter the tax base in one year, over 60 percent of them do not pay taxes in the subsequent year (author's analysis of administrative tax data from 2015-2018). Many property owners who pay are motivated by the desire to obtain a tax clearance needed for administrative purposes in another sector, such as to bid for a contract with the government or to import goods at the port.

Several factors related to weak detection and enforcement capacity contribute to the low collection of real estate tax. In the absence of a cadaster that outlines all the properties in the city, the LRA adds properties to the tax register on a case-by-case basis, resulting in very low coverage, with about 5 percent of taxable properties on the tax register. Further, it is difficult to locate registered properties for tax administration because there is no proper address system and the tax database is not geo-coded. Often the addresses provided at the time of registration are vague (e.g. "18th Street" or "Catholic Hospital community"). As a result, officials from the tax authority typically rely on information from community

[2] Important exceptions are Brockmeyer et al. (2019) in Costa Rica, and De Neve et al. (2021) in Belgium who find sustained impacts of messages on tax compliance over 2-3 years.

[3] Other tax categories face similar challenges. In 2014, there were fewer than 20,000 individuals and businesses on the income tax roll in the country of over 4 million people.

members to identify buildings from the tax database, especially in cases where there is no readily available photograph that can be used.[4] With the lack of addresses, tax bills are not routinely delivered to property owners. Instead, they are required to visit the tax authority to request their bill.

Besides the challenges for identifying properties, there are legal, political and logistical constraints on implementing the penalties for noncompliance. The most common consequence for noncompliance is that penalties (up to 25 percent of tax liability per year) and interest (average of 15 percent per year) are added to the tax liability. Although the revenue code allows for closure and seizure of delinquent properties, these actions require a court ruling which implies significant time and administrative costs. As a result, in practice, enforcement consists of repeated written notices and in-person visits to property owners and, at the limit, the posting of a delinquent notice on the property for 72 hours. Furthermore, given the limited staff and resources of the revenue authority, these enforcement actions are focused on select properties that have the highest revenue potential, leaving majority of the tax base essentially free of enforcement.

An additional key feature of real estate tax in this context is the tax rate. The real estate tax rate in Liberia is non-trivial. It is 1.5 percent of the property value per annum for commercial property and 0.25 percent for residential property.[5] Property values for residential properties are self-declared by the owner, subject to verification by the tax authority. For commercial properties, the property is valued by a valuation firm from a list of approved providers. The average annual tax liability for residential property is $70 per annum, about two-thirds of the one month GDP per capita in Liberia of $96. Further, for newly registered properties, typically the first bill is issued for not only the current tax year but also the previous four years. To ease liquidity constraints, payment plans are available.

[4] Although property owners are required to submit a photograph at the time of property registration, these records are typically kept in hard copy and not organized in such a way that allows easy matching with electronic records for enforcement purposes.

[5] Commercial properties are those that are used for income generating activities such as a rented apartment, store or office building whereas residential property is strictly used for housing and does not generate any income.

# 3 Conceptual Framework

In the canonical model of tax evasion, the taxpayer decides how much of her true income to reveal to the tax authority by trading off the utility gains from a lower tax bill in the event that she is not discovered against the risk of being discovered and punished by having to pay a penalty in addition to the tax (Becker, 1968; Allingham and Sandmo, 1972; Yitzhaki, 1974). In the case of a property tax, where the tax base is visible and verifiable (with some costs by the tax authority), we model the taxpayer as deciding whether to pay a fixed tax liability (as opposed to how much tax to pay) given the perceived costs and benefits.[6]

An agent with income $Y$ ($Y \geq 0$) owns property valued at $V$ ($V \geq 0$) and faces a tax rate $t$ ($0 \leq t \leq 1$) on the property. If the agent pays the tax, he is left with post-tax income of $Y - tV$. If the agent does not pay the tax, there is a $p$ ($0 \leq p \leq 1$) probability that noncompliance is detected.[7] As such, with probability $1 - p$ , his noncompliance is undetected by the tax authority and he keeps his full income $Y$. Further, the penalties for non compliance are only enforced with probability $q$ ($0 \leq q \leq 1$). As such, there is $p(1-q)$ probability that the agent keeps his total income when noncompliance is detected but penalties are not enforced. Lastly, there is $pq$ probability that noncompliance is detected and the penalties are implemented, in which case, the agent faces penalty $aV$ ($0 \leq a$) in addition to the tax $tV$.

Faced with the choice of whether to pay the tax ($i = 1$) or not pay ($i = 0$), the agent therefore chooses i to maximize

$$U_i = \begin{cases} Y - tV & \text{if i=1} \\ (1-p)Y + p((1-q)Y + q(Y - tV - aV)) & \text{if i=0} \end{cases}$$

The agent will pay the tax when $U_1 > U_0$, that is, when

$$pq(t + a) > t \tag{1}$$

[6] This framework can also be used to understand the decision of a taxpayer to pay income tax after they declare the income (Hallsworth et al., 2015, 2017).

[7] Although real estate taxes have the advantage of having an observable and immobile tax base, without effective data management tools, noncompliance of individual property owners may remain undetected.

From this condition, the higher are $p$, $q$ and $a$, the more likely the agent is to pay the tax. Experiment One aims to increase property owners' perceptions of $p$ (the probability that the tax authority has detected their noncompliance) and provide information on $a$ (the associated penalties) to examine to what extent this increases tax compliance.

Another implication is that even when $p$ is very high or takes on its maximum value of $p = 1$, the case in which the property owner knows their noncompliance has been detected, if $q$ is very low, that is they do not expect any sanctions to follow, then it is possible that $q(t + a) \leq t)$ and the property owner does not pay the tax. This contrasts with the standard Allingham-Sandmo model which does not include $q$, suggesting that the model implicitly assumes that detected evasion is always penalized, that is $q = 1$ or that $q$ is not distinct from $p$. Under the scenario where $q = 1$, if $p = 1$ (perfect detection), there is no incentive to evade any amount if there are penalties for evasion, that is, $a > 0$. Experiment Two aims to increase property owners' perception of $q$ and examine to what extent this increases tax compliance. These experiments thus attempt to separately manipulate taxpayers' perceptions of both $p$ (detection) and $q$ (enforcement).[8]

# 4 Experiment One

## 4.1 Experiment Design

This study takes place among property owners in Congo town, one of the tax zones in the capital city of Liberia (the Greater Monrovia area). This area was identified as having many potential properties that could be added to the tax roll.

The first activity was to create a property database. From April to June 2014, the tax authority conducted a "block mapping" project to collect information on property location and features. Enrollment agents (short-term contractors of the government) went door-to-door in teams of two to conduct awareness of the real estate tax using brochures and flyers. They also completed a brief survey with the residents using mobile devices to obtain information about the property and its owner. The data collected in this process resulted in

[8] As discussed in Section 5.3, beyond giving information on penalties, $a$ may also signal enforcement probability, in which case, our estimates of the impact of increasing $q$ in Experiment Two would be a lower bound.

an electronic property database for taxation.[9]

From the enumeration list, high-valued properties such as hotels, banks, and other commercial property were excluded as the tax authority did not want to include them in the experiment given their revenue potential. In addition, five percent of the enumerated properties were found to already be on the tax roll and were removed from the experiment sample. In all, 571 properties belonging to 464 owners made up the sample.

Properties in the sample were randomly assigned to four groups. The control group received a generic notice that informed property owners of their responsibility to pay the real estate tax and gave instructions on how to comply. It did not contain any personal information specific to the property owner but was simply addressed to "Dear Property Owners." The notice for the first treatment group (Detection and Penalty notice) contained the same information on how to comply; however, it was personalized by including the owner's name and a photo of the property (obtained during the prior door-to-door enumeration). It also included the legal penalties for noncompliance, citing relevant sections of the Revenue Code. The notice for the second treatment group (Detection notice) contained only the personalized information (owner's name and photograph of property) with the compliance instructions. Lastly, the notice for the third treatment group had no personalized information but included the information on penalties (Penalty notice). Appendix Figure A1 provides images of the notices.

Due to the unfortunate Ebola outbreak in 2014, field activities were suspended following the property enumeration. In March 2017, using the information from the property enumeration list, the tax office prepared the different variants of notices for property owners according to their randomized group. These agents were provided with "address books" with the photograph and location of each property. These notices were then hand-delivered to each property. If the property owner was not present, the notice was handed to the resident to deliver to the property owner.

Given the three-year lag between the enumeration and delivery of the notices, there was some attrition in the sample. The team successfully delivered notices to 90 percent of the

[9] This was the first phase of a large data collection project by the government that was subsequently expanded to about 40,000 properties across Monrovia.

property owners in the sample and this rate was not significantly different across the treatment and control groups.[10]

### 4.2 Data and Empirical Specification

The data for this study comes from two main sources: the baseline enumeration data and administrative tax records on tax payment.

The baseline enumeration data includes the property block and number (using a numbering system put in place by a pilot project of the postal office), community name, name and phone number of the resident with whom the enumeration survey was completed and his/her relationship to the property owner, name and phone number of the property owner(s) (if they were not the survey respondent), as well as property characteristics such as number of rooms, bathrooms, porches, garages, building materials, and the usage of the property for residential or commercial purposes. The enumerators also measured and recorded the exterior dimensions of the property using sketches and took photographs of the property exterior. The LRA determined property values using a formula that incorporates the square footage of the buildings calculated from the sketches and the construction materials observed from the images.

Tax administration records provide data on whether the property owner visited the tax office in response to the notice, whether or not the owner paid the tax and how much tax was paid. Visiting the tax office was the first step of the compliance process. To track responses, each notice included a unique number and property owners were asked to bring the notice along when they came to register their properties. Responding to the letter typically resulted in property registration but we do not have sufficient data to verify who completed the registration process. Data on tax payment comes from the integrated tax administration systems that records all tax payments electronically and is available for this sample from 2017 - 2020.

Although tax revenue leakages may occur in several ways, this paper focuses on the extensive margin of compliance where it is possible determine with certainty the compliance

[10] The reasons for non-delivery were relocation of the property owner, destruction of property or inability to locate property.

status of a property owner, i.e., whether or not the property owner made a tax payment. In addition, it reports whether the property owner responded at all to the tax notice. Besides the extensive margin, taxpayers may seek to reduce their tax liability by misclassifying their commercial property as residential, or may underdeclare the value of their property at the time of registration. Therefore the paper also reports the total amount paid.

The unit of observation for outcomes is at the owner level; however, randomization was done at the property level. To address this, we use the property-level randomization to infer owner-level treatment assignments using the cumulative exposure that each property owner had to different elements of the treatments, as follows: (i) property owners that have only one property are assigned to the treatment for that property; (ii) property owners for whom all their properties were assigned to the same treatment group (or to a given treatment group and the control group) were assigned to that group; (iii) property owners for whom any of their properties was assigned to the detection and penalty treatment were assigned to the detection and penalty group as they are considered to be exposed to both detection and penalty messages; (iv) property owners for whom some of their properties were assigned to the detection group and others to the penalty group were assigned to the detection and penalty treatment as they were exposed to both detection and penalty messages.

One implication of this assignment process is that owners of multiple properties are significantly more likely to be assigned to the Detection and Penalty group for the owner-level randomization (but not for the property-level randomization). Thirty percent of the Detection and Penalty group own multiple properties, compared to 10 percent in each of the other groups. To account for this, we control for owning multiple properties in all regressions.[11] We also show results in the Appendix from conducting our main analyses on a restricted sample of property owners that are not affected because they own only one property or they received the same treatment for all their properties and find comparable results.

Table 1 provides summary statistics for the different variables and shows that randomization achieved balance across different characteristics.[12] For property owners who own more

[11] Alternatively, we include dummy variables for the number of properties owned in the sample and obtain identical results.

[12] Appendix Table A1 provides the analogous balance table for the property-level randomization.

than one property, we used the characteristics of the highest valued property. The average property has 3 rooms, 2 bathrooms, and the average value is $27,000. About 70 percent of property owners own solely residential properties and 24 percent of property owners are women (or include a woman if there is more than one owner).

We use Equation (1) below to examine the relative impact of the three treatments in promoting compliance:

$$D_i = \beta_0 + \beta_1 T_{1,i} + \beta_2 T_{2,i} + \beta_3 T_{3,i} + \alpha X_i + \epsilon_i \tag{2}$$

where $D_i$ is one of four outcome variables–an indicator variable for whether a property owner responds to the notice (presumably to register their property), an indicator variable for whether a property owner paid real estate tax, the amount of tax paid and its inverse hyperbolic sine transformation. $\beta_1$, $\beta_2$, and $\beta_3$ estimate the causal effect of receiving each of the three treatments respectively on the outcomes. $X_i$ are control variables for whether the property owner owns more than one property, the value of the property, whether the property has a female owner/co-owner, whether any of the properties is used for commercial purposes and the location (one of three blocks) of the property.[13]

Since the delivery rate was balanced across the treatment and control groups (Appendix Table A2), the subsequent analysis will focus on those who received the notices.

### 4.3 Results and Discussion

Table 2 show the impact of the different treatments (Figure 1 displays the results graphically). The Detection and Penalty notice leads to an 8.1 percentage point increase in the likelihood of responding to the notice, almost tripling the 4.4 percent rate in the control group. Similarly, this combined intervention more than quadruples tax payment rates by resulting in a 7.6 percentage point increase over the control mean of 2.2 percent. For the impact on the amount of tax paid, the coefficient ($66 increase) is large relative to the control mean of $6. However, the standard errors are large given the low overall compliance rate and we are unable to

[13] For most property owners with multiple properties, the properties were co-located. When not co-located, the location of the highest valued property was used.

detect a statistically significant difference. Using the inverse hyperbolic sine transformation in column 4 helps to address the large number of zeros and indicates that the notice leads to a 39 percent increase in the amount of tax paid.

The two other treatments–receiving a notice with the owner's name and the photo of their property (Detection notice), and the notice with information on penalties (Penalty notice) did not have a detectable statistically significant effect on any of the outcomes. For the Detection Notice, we can reject a 5.1 percentage point increase and a 4.3 percentage point decrease in likelihood or paying. For the Penalty Notice, we can reject a 2.6 percentage point increase in likelihood of making a payment and a 5.2 percentage point decrease.

Notably, we find a positive long-term effect on making a tax payment and amount of tax paid (IHS) from bringing people into the tax net using this intervention (Figure 2). Table 3 shows that the Detection and Penalty treatment leads to a 4.3 percentage point increase in the likelihood that a property owner paid property tax at least once over the next 3 years (2018 - 2020) –this represents a five-fold increase over a base of 1.1 percent in the control group. Similarly, those in the Detection and Penalty treatment group paid 29 percent more in taxes over the next three years relative to the control group.

Lastly, we repeat the analysis on a restricted sample of property owners for whom we do not infer owner-level treatment from property level randomization because they own only one property or they received the same treatment for all their properties. These results (shown in Appendix Table A3) are of comparable magnitude but only statistically significant at the 10 percent level given the smaller sample (coefficient is a 6 percentage point increase, p=0.055 for making a tax payment and 32 percent increase, p=0.079 for the amount paid (IHS)).

#### 4.3.1 Why did so many citizens seem to ignore the messages?

While the 13 percent response rate obtained in the Detection and Penalty treatment is four times the rate in the control group, this leaves 87 percent of recipients who do not respond to information that the government has detected their noncompliance and to notification of the legal penalties for noncompliance.

Since the notices were hand-delivered, it is unlikely that this is due to property owners

not receiving the notices. It is also unlikely that this can be fully explained by illiteracy since the respondents are relatively of higher socioeconomic class since they are property owners in the capital city. Further, this pattern is consistent with evidence from other studies (e.g. Carrillo, Pomeranz and Singhal, 2017) where a large majority do not respond to messages that their noncompliance has been detected.

One hypothesis is that taxpayers have a low expectation that any penalties associated with noncompliance would be enforced on them. That is, taxpayers have low $q$ from the condition under which a taxpayer would comply, given in Equation (1) above. To investigate this hypothesis, Experiment Two aims to vary taxpayers' perceptions of their enforcement probability.

# 5 Experiment Two

## 5.1 Experiment Design

This experiment was implemented among delinquent property owners across different communities in the Greater Monrovia area. Unlike the sample for Experiment One that included owners of properties not the tax roll, the sample for Experiment Two are individuals who were on the tax roll and had paid taxes at least once but had overdue taxes for at least one year. Based on conversations with the tax authority, the sample for the experiment was excluded individuals with tax liabilities above USD $1,000 as they did not wish to experiment with those with higher revenue potential.

Property owners were randomized into two groups. The control group received a notice requesting payment of delinquent tax liability. The notice was comparable to the combined Detection and Penalty treatment in Experiment One: it was personalized to include the name of the property owner and photograph of the property; it also stated the penalties for noncompliance. The treatment group received a similar notice with one addition. The notice included a sentence informing the recipient that they have been included in the next batch of properties designated for "intensive follow-up" and if they did not respond by the deadline, the LRA would proceed to the next stage of enforcement actions. Appendix Figure

A2 provides an image of the notice.

The randomization was stratified by two variables: location (communities across the city were divided into three broad areas) and payment history (whether the individual had only one year or more than one year of unpaid taxes). These variables were considered to be potential dimensions of heterogeneity in the responses of taxpayers to the intervention.

To locate these delinquent properties, a verification team was dispatched with the name of the owner and the property address provided on file. The task of the team was to go to the broad location indicated on the property registration records (e.g."18th Street" or "Catholic Hospital Community") and ask around in the community to identify the property. Once the property was verified, the team was to take the GPS coordinates of the property and a photograph using a form on a mobile device.

Of the 1,382 properties the team attempted to locate, 728 were identified. The properties were located in October/ November 2018 and the treatment notices were send out in May 2019. By then, the owners of 145 of these properties had become compliant. As such the final sample to which notices were sent out were 529 individuals who own 580 properties. Of these, 3 percent did not receive notices due to not meeting anyone at the property during all delivery attempts. The delivery rate for both treatment and control groups were equal at 97 percent of property owners so we use that subsample for the subsequent analysis (Appendix Table A4).

### 5.2 Data and Empirical Specification

The data for this study comes from two main sources: the property location verification data, and administrative tax records on tax payment.

The property location verification data provides the name of the property owner, as well as the address (directions), photograph and GPS coordinates of the property. It also includes descriptions of the external property characteristics as provided by the enumerators based on their observations, such as number of floors, whether or not it has a fence, quality of landscaping and what kind of road the property is on.

The administrative tax records provide the payment history of each property owner on

each property from 2014 to 2020. In addition, clerks at the tax office made note of each property owner that visited the tax office in response to the notice: even if no payment was recorded, taxpayers may visit the office to set up a payment plan or dispute the tax notice.

Table 4 provides summary statistics and shows that randomization achieved balance across different characteristics. The average property value was about $38,000. About 8 percent own more than one property, about 84 percent have only one floor, 56 percent do not have a fence and over 90 percent own solely residential properties. For property owners with multiple properties, we use the characteristics of the highest-valued property.

We use Equation (4) below to examine the impact of the Enforcement notice in promoting the payment of property tax arrears:

$$P_i = \beta_0 + \beta_1 T_i + \alpha X_i + \lambda S_i + \epsilon_i \tag{3}$$

where $P_i$ is one of four outcome variables–an indicator variable for whether a property owner responds to the notice by visiting the tax office, an indicator variable for whether a property owner pays their real estate tax, the amount of tax paid, and its inverse hyperbolic sine transformation. $\beta_1$ estimates the causal effects of the Enforcement notice on the outcomes. $S_i$ is a vector of six strata indicator variables (one for each pair of the three areas in the city and whether the individual has more than one year of arrears). $X_i$ are control variables for whether the property owner owns more than one property, the value of the property, whether there are any female owners, and whether the property owner owns any commercial properties.

### 5.3 Results and Discussion

Before turning to the impact of the Enforcement notice, an interesting observation is that the payment rate in the control group is much higher than the payment rate for owners who received the identical Detection and Penalty treatment in Experiment One (21 percent versus 10 percent). This likely reflects the difference in the two samples–the property owners in Experiment Two are already on the tax roll and have paid taxes in the past; as such, there

is less of a hurdle associated with tax payment.

Table 5 shows the main results from Experiment Two (Figure 3 displays the results graphically). It reveals that receiving a notice with the enforcement message leads to a 7.6 percentage point increase (p=0.057) in responding to the tax notice, from 23.7 percent in the control group and a 6.9 percentage point increase (p=0.068) in the likelihood of paying the tax, from 20.6 percent in the control group. The average payment also rises by $47 (p=0.032), from $67 in the control group or by 47 percent (p=0.052) using the IHS.

These results indicate that the signal of higher enforcement probability sent by the tax authority was effective in causing more property owners in the treatment group to pay their arrears, relative to property owners in the control group that were informed that the tax authority was aware of the delinquency on their arrears (given the photograph of the property attached to their letter) and that were informed about the penalties for noncompliance. This finding demonstrates that the implicit assumption in standard models that $q = 1$ does not hold and that taxpayers' perception of enforcement probability is an important parameter to consider in tax compliance models (alongside probability of detection and penalties, which are typically included).

While we find an additional impact from the enforcement message, the response rate in the treated group is still only 31 percent, meaning that there is a large proportion of taxpayers for whom there remains significant compliance barriers, such as their perceived enforcement probability remaining low despite the message, liquidity constraints, difficulty with navigating the tax system, or political economy factors such as low tax morale (Prichard et al., 2019).

We conduct heterogeneity analyses to examine whether certain recipients were more responsive to the enforcement treatment, focusing on the two variables by which the randomization was stratified. First, we find no differential response from taxpayers by the length of the delinquency (one year versus multiple years). As such, the results do not support the hypothesis that taxpayers with longer delinquencies are more difficult to bring back to compliance. Second, as shown in Table 6, we find evidence that the treatment effect is driven by two of the three tax areas (Area 2 and Area 3). The three Areas of the city differ along

multiple dimensions, such as property values, commercial activity, degree of enforcement etc. While it is difficult to disentangle the different factors, we find some evidence consistent with the hypothesis that property owners that had been more exposed to prior enforcement activity by the LRA are more responsive to the enforcement message.

In the absence of direct information on the different enforcement activities carried out by area, the billing and payment records provide some suggestive evidence of the outcome of enforcement efforts across areas. We use the delinquency recovery rate from the prior fiscal year as a proxy for the extent of prior enforcement efforts. Appendix Table A5, column 4 shows that for properties similar to the experimental sample (tax liability below $1,000 and with tax arrears), the payment rate in Area 2 is 9 percentage points higher than in Area 1 (p=0.0003) and the rate in Area 3 is 5 percentage points higher than Area 1 (p=0.057). This pattern is consistent with a greater effect of the enforcement treatment in Area 2 due to the higher credibility of enforcement from past experience.

Lastly, we find no impact of the intervention beyond the first year (Table 7 and Figure 4), indicating the need for consistent action to shift long-term beliefs about enforcement probabilities. In addition, the LRA did not systematically record enforcement activities carried out against delinquent property owners in the treatment group that did not respond by the deadline, so we are unable to assess follow on impacts.

# 6 Conclusion

Understanding how to improve tax systems is critical for emerging economies to mobilize resources for growth-promoting investments in public goods. The results in this paper highlight the importance of making citizens legible to the state, consistent with the growing consensus that tax authorities' access to information about the tax base is essential for promoting compliance. However, legibility alone is insufficient and this paper demonstrates further conditions for increasing compliance.

First, as shown in Experiment One, information on the penalties for noncompliance is an important complement to alerting people that their noncompliance has been detected.

Second, as shown in Experiment Two, higher perceived enforcement probabilities lead to additional compliance (even with perfect detection and information on penalties).

These findings underscore the need for governments to invest in both detection and enforcement capacity. Given the crucial role of information, there is a significant amount of policy interest in investments in detection capacity, such as third-party reporting, the use of electronic databases, and technology-based tools for understanding and monitoring the tax base. However, donors and governments may over-prioritize investments in big, costly information technology projects, especially in the presence of disbursement targets or rankings on international indexes, to the detriment of the less attractive and often politically costly task of increasing traditional enforcement to ensure payment of known tax obligations (Arewa and Davenport, 2022). Further, investments in enforcement capacity are often outside the tax system, such as improving the efficiency of the legal system, requiring coordination with other government agencies. In some cases, governments may consider having specialized tax courts to adjudicate issues in a timely manner.

Finally, the substantial remaining noncompliance despite perfect detection, information on penalties and signals of higher enforcement probability indicates that other factors besides these three are important for compliance. For example, liquidity constraints, tax morale and trust in government, and compliance costs may all play a role in determining people's willingness and ability to comply.

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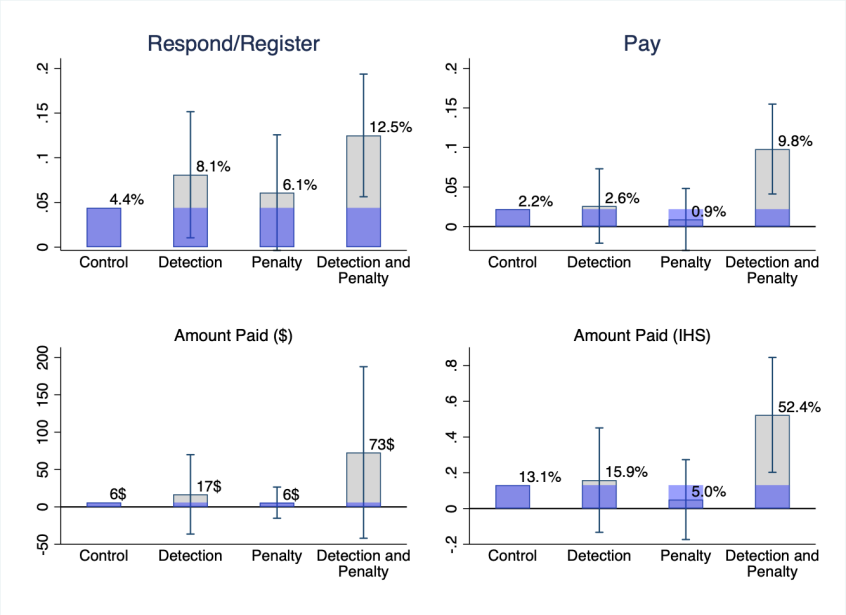
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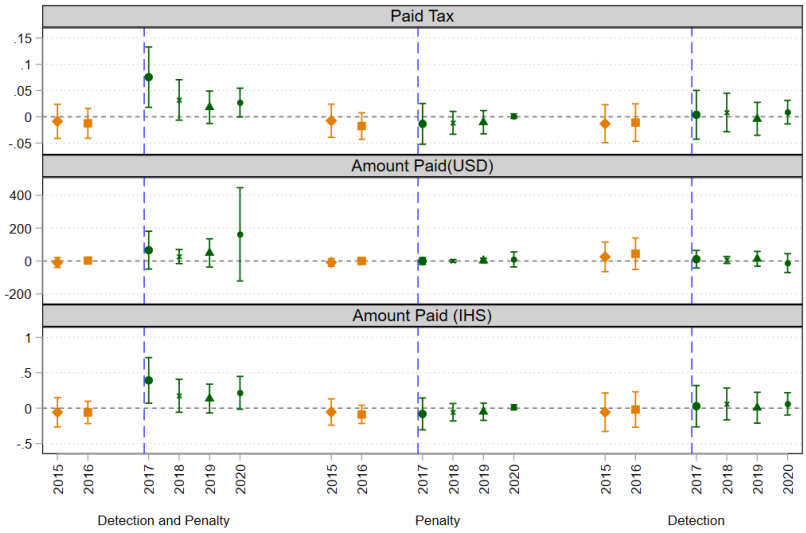
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Figure 1: Experiment One: Impact of Detection and Penalty Notices on Registration, Payment and Amount Paid



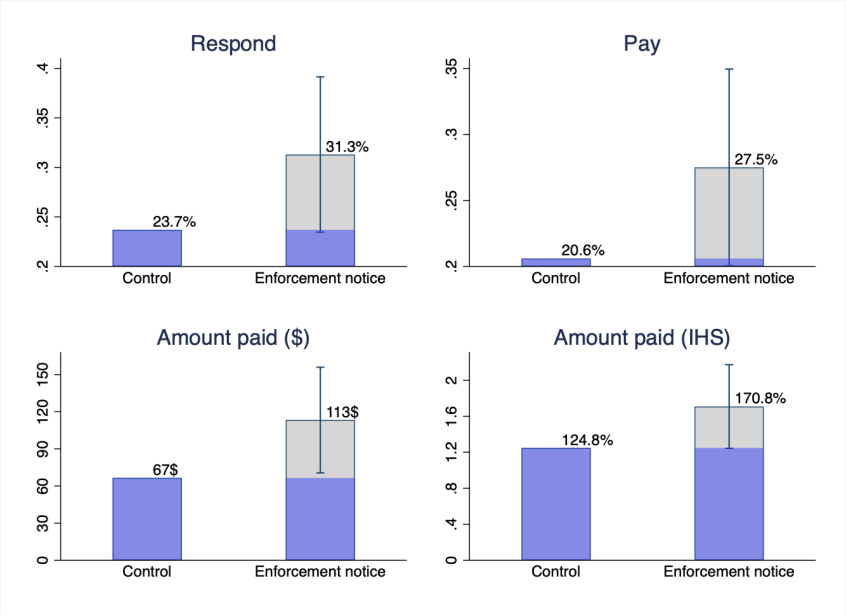

Notes: This figure shows the treatment effect and 95 percent confidence interval from OLS regressions of the outcomes on the different treatment groups in 2017. Control variables are owning multiple properties, owning commercial property, property value (highest value for those with multiple properties), having a female owner or co-owner and location (one of 3 subareas). N=421

Figure 2: Experiment One: Event Study Graph




Notes: This figure shows the treatment effect coefficient and 95 percent confidence interval from OLS regressions of the outcomes on the indicator for the treatment group for each year. Control variables are owning multiple properties, owning commercial property, property value (highest value for those with multiple properties), having a female owner or co-owner and location (one of 3 subareas). N=421

Figure 3: Experiment Two: Impact of Enforcement Notice on Response, Payment and Amount Paid




Notes: This figure shows the treatment effect and 95 percent confidence interval from OLS regressions of the outcomes on the indicator for the treatment group in 2019. Control variables are owning multiple properties, owning commercial property, property value (highest value for those with multiple properties), having a female owner or co-owner, and strata fixed effects (interaction of being located in one of three areas and owing more than one year of arrears). Dotted line shows the year of the intervention. N=511

Figure 4: Experiment Two: Event Study Graph




Notes: This figure shows the treatment effect coefficient and 95 percent confidence interval from OLS regressions of the outcomes on the indicator for the treatment group for each year. Control variables are owning multiple properties, owning commercial property, property value (highest value for those with multiple properties), having a female owner or co-owner, and strata fixed effects (interaction of being located in one of three areas and owing more than one year of arrears). Dotted line shows the year of the intervention. N=511

Table 1: Experiment One: Randomization Balance Table (Property Owners)

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | | Difference between control group and | | | | |
| | Mean and [SD] of Control group | Penalty and Detection | Penalty | Detection | P-value of f-test | N |
| Property value | 27675.179 | -408.047 | -3953.585 | -147.644 | 0.480 | 464 |
| | [24722.092] | (3305.840) | (3470.772) | (4270.585) | | |
| Area | 1380.313 | 68.927 | -119.299 | 100.742 | 0.224 | 464 |
| | [1058.523] | (140.543) | (141.497) | (180.037) | | |
| Rooms | 3.349 | 0.204 | -0.160 | 0.132 | 0.220 | 463 |
| | [2.541] | (0.307) | (0.289) | (0.312) | | |
| Bathrooms | 1.925 | 0.029 | -0.239 | -0.255 | 0.257 | 462 |
| | [1.516] | (0.221) | (0.209) | (0.220) | | |
| Has Porch | 0.840 | 0.002 | -0.045 | -0.038 | 0.630 | 464 |
| | [0.369] | (0.048) | (0.053) | (0.053) | | |
| Has Garage | 0.113 | -0.034 | -0.057 | -0.028 | 0.507 | 464 |
| | [0.318] | (0.039) | (0.038) | (0.041) | | |
| Commercial property | 0.358 | -0.031 | -0.031 | -0.019 | 0.781 | 464 |
| | [0.482] | (0.063) | (0.065) | (0.066) | | |
| Block 2 | 0.509 | -0.124* | -0.033 | -0.047 | 0.288 | 464 |
| | [0.502] | (0.065) | (0.069) | (0.069) | | |
| Block 3 | 0.311 | -0.130** | -0.059 | -0.028 | 0.103 | 464 |
| | [0.465] | (0.058) | (0.062) | (0.063) | | |
| Female owner | 0.236 | 0.010 | 0.026 | 0.085 | 0.574 | 464 |
| | [0.427] | (0.057) | (0.059) | (0.062) | | |

Notes: Column 1: Standard deviation in brackets. Columns 2,3,4: Coefficient and robust standard errors (in parenthesis) from OLS regression of property/ property owner characteristic on treatment indicator variables, controlling for owning multiple properties. ***, **, and * indicate significance at the 1, 5, and 10 percent level.

Table 2: Impact of Detection and Penalty Notices on Registration, Payment and Amount Paid

| | (1) Responded to Notice | (2) Paid in 2017 | (3) Amount Paid ($) | (4) Amount Paid (IHS) |
|---|---|---|---|---|
| Detection and Penalty | 0.081** | 0.076** | 65.885 | 0.393** |
| | (0.035) | (0.029) | (58.546) | (0.164) |
| Penalty | 0.017 | -0.013 | -0.232 | -0.081 |
| | (0.033) | (0.020) | (10.639) | (0.114) |
| Detection | 0.037 | 0.004 | 10.849 | 0.028 |
| | (0.036) | (0.024) | (27.093) | (0.149) |
| Number of observations | 421 | 421 | 421 | 421 |
| Control mean of dependent var | 0.044 | 0.022 | 5.929 | 0.131 |

Notes: OLS regressions of the outcome variables on the treatment indicator variables. Robust standard errors in parenthesis. Omitted group is control group. Control variables are owning multiple properties, owning commercial property, property value (highest value for those with multiple properties), having a female owner or co-owner and location (one of 3 subareas). ***, **, and * indicate significance at the 1, 5, and 10 percent level.

Table 3: Long-Term Impact of Detection and Penalty Notices on Payment and Amount Paid

| | (1) Paid in 2018-2020 | (2) Amount Paid 2018-2020($) | (3) Amount Paid 2018-2020 (IHS) |
|---|---|---|---|
| Detection and Penalty | 0.043** | 237.914 | 0.286* |
| | (0.021) | (209.154) | (0.148) |
| Penalty | -0.011 | 13.001 | -0.062 |
| | (0.012) | (33.462) | (0.071) |
| Detection | 0.006 | 6.797 | 0.052 |
| | (0.019) | (55.909) | (0.131) |
| Number of observations | 421 | 421 | 421 |
| Control mean of dependent var | 0.011 | 2.691 | 0.068 |

Notes: OLS regressions of the outcome variables on the treatment indicator variables. Robust standard errors in parenthesis. Omitted group is control group. Control variables are owning multiple properties, owning commercial property, property value (highest value for those with multiple properties), having a female owner or co-owner and location (one of 3 subareas). ***, **, and * indicate significance at the 1, 5, and 10 percent level..

Table 4: Experiment Two Randomization Balance Table (Property Owners)

| | (1) Mean and [SD] of Control group | (2) Difference in Treatment Group | (3) N |
|---|---|---|---|
| Value | 37.943 | 3.888 | 528 |
| | [48.800] | (4.359) | |
| One floor | 0.836 | -0.032 | 528 |
| | [0.371] | (0.032) | |
| No fence | 0.557 | 0.045 | 528 |
| | [0.498] | (0.041) | |
| Has landscaping | 0.511 | 0.006 | 528 |
| | [0.501] | (0.043) | |
| Very good quality | 0.706 | -0.030 | 528 |
| | [0.456] | (0.040) | |
| On footpath | 0.187 | 0.018 | 528 |
| | [0.391] | (0.033) | |
| Owner has 2+ properties | 0.080 | 0.014 | 528 |
| | [0.272] | (0.024) | |
| Owner has commercial property | 0.069 | 0.021 | 528 |
| | [0.253] | (0.024) | |
| Female owner | 0.351 | -0.084** | 528 |
| | [0.478] | (0.040) | |
| One year of arrears | 0.508 | 0.000 | 528 |
| | [0.501] | (0.000) | |
| Zone 2 | 0.294 | 0.000** | 528 |
| | [0.456] | (0.000) | |
| Zone 3 | 0.355 | -0.000 | 528 |
| | [0.479] | (0.000) | |

Notes: Column 1: Standard deviation in brackets. Column 2: Coefficient and robust standard errors (in parenthesis) from OLS regression of property/ property owner characteristic on treatment indicator variable, controlling for strata fixed effects. ***, **, and * indicate significance at the 1, 5, and 10 percent level.

Table 5: Impact of Enforcement Notice on Response, Payment and Amount Paid

| | (1) Responded to Notice | (2) Paid in 2019 | (3) Amount Paid ($) | (4) Amount Paid (IHS) |
|---|---|---|---|---|
| Enforcement notice | 0.076* | 0.069* | 46.754** | 0.460* |
| | (0.040) | (0.038) | (21.781) | (0.237) |
| Number of observations | 511 | 511 | 511 | 511 |
| Control mean of dependent var | 0.237 | 0.206 | 66.521 | 1.248 |

Notes: OLS regressions of the outcome variables on the treatment indicator variable. Robust standard errors in parenthesis. Omitted group is control group. Control variables are owning multiple properties, owning commercial property, property value (highest value for those with multiple properties), having a female owner or co-owner, and strata fixed effects (interaction of being located in one of three areas and owing more than one year of arrears). ***, **, and * indicate significance at the 1, 5, and 10 percent level.

Table 6: Heterogeneous Impact of Enforcement Notice on Response, Payment and Amount Paid

| | (1) Responded to Notice | (2) Paid in 2019 | (3) Amount Paid ($) | (4) Amount Paid (IHS) |
|---|---|---|---|---|
| Impact of treatment in Area 1 | -0.031 | -0.016 | 56.458 | -0.030 |
| | (0.070) | (0.067) | (49.750) | (0.434) |
| Impact of treatment in Area 2 | 0.140** | 0.128** | 45.444* | 0.812** |
| | (0.064) | (0.060) | (24.974) | (0.363) |
| Impact of treatment in Area 3 | 0.124* | 0.101 | 38.436 | 0.636 |
| | (0.069) | (0.067) | (33.532) | (0.412) |
| Number of observations | 511 | 511 | 511 | 511 |
| Control mean of dependent var | 0.237 | 0.206 | 66.521 | 1.248 |

Notes: Robust standard errors in parenthesis. Control variables are owning multiple properties, owning commercial property, property value (highest value for those with multiple properties), having a female owner or co-owner, and strata fixed effects (interaction of being located in one of three areas and owing more than one year of arrears). ***, **, and * indicate significance at the 1, 5, and 10 percent level.

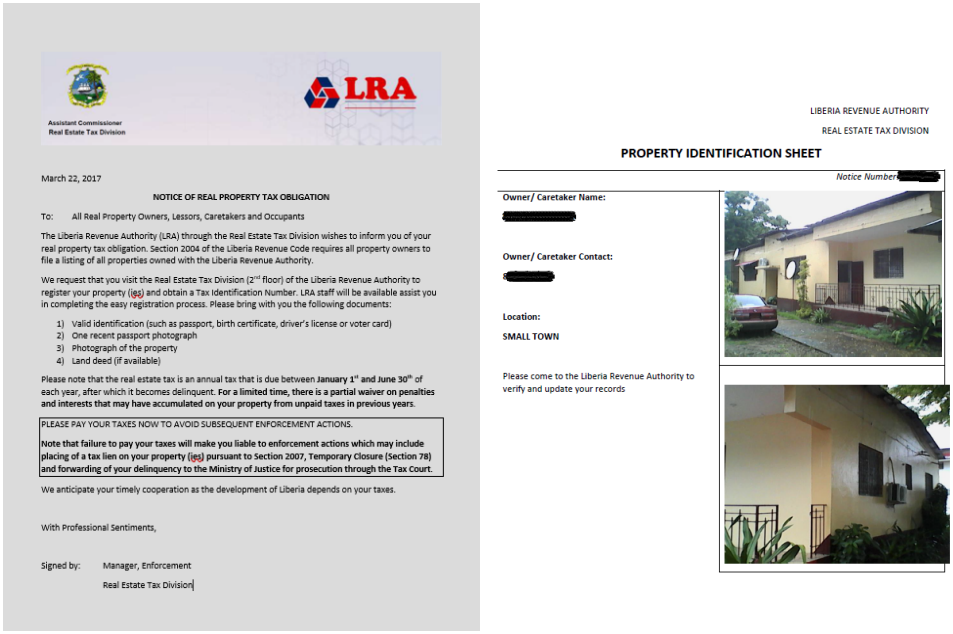
Table 7: Long-term Impact of Enforcement Notice on Response, Payment and Amount Paid

| | (1) Paid in 2020 | (2) Amount Paid in 2020 ($) | (3) Amount Paid in 2020 (IHS) |
|---|---|---|---|
| Enforcement notice | -0.002 | 10.924 | 0.000 |
| | (0.028) | (12.289) | (0.160) |
| Number of observations | 511 | 511 | 511 |
| Control mean of dependent var | 0.107 | 21.521 | 0.599 |

Notes: OLS regressions of the outcome variables on the treatment indicator variable. Robust standard errors in parenthesis. Omitted group is control group. Control variables are owning multiple properties, owning commercial property, property value (highest value for those with multiple properties), having a female owner or co-owner, and strata fixed effects (interaction of being located in one of three areas and owing more than one year of arrears). ***, **, and * indicate significance at the 1, 5, and 10 percent level.

# Appendix

Figure A1: Experiment One Notices



Assistant Commissioner
Real Estate Tax Division

March 22, 2017

**NOTICE OF REAL PROPERTY TAX OBLIGATION**

To: All Real Property Owners, Lessors, Caretakers and Occupants

The Liberia Revenue Authority (LRA) through the Real Estate Tax Division wishes to inform you of your real property tax obligation. Section 2004 of the Liberia Revenue Code requires all property owners to file a listing of all properties owned with the Liberia Revenue Authority.

We request that you visit the Real Estate Tax Division (2nd floor) of the Liberia Revenue Authority to register your property (ies) and obtain a Tax Identification Number. LRA staff will be available assist you in completing the easy registration process. Please bring with you the following documents:

1) Valid identification (such as passport, birth certificate, driver's license or voter card)
2) One recent passport photograph
3) Photograph of the property
4) Land deed (if available)

Please note that the real estate tax is an annual tax that is due between **January 1st and June 30th** of each year, after which it becomes delinquent. **For a limited time, there is a partial waiver on penalties and interests that may have accumulated on your property from unpaid taxes in previous years.**

PLEASE PAY YOUR TAXES NOW TO AVOID SUBSEQUENT ENFORCEMENT ACTIONS.

**Note that failure to pay your taxes will make you liable to enforcement actions which may include placing of a tax lien on your property (ies) pursuant to Section 2007, Temporary Closure (Section 78) and forwarding of your delinquency to the Ministry of Justice for prosecution through the Tax Court.**

We anticipate your timely cooperation as the development of Liberia depends on your taxes.

With Professional Sentiments,

Signed by: Manager, Enforcement
Real Estate Tax Division

LIBERIA REVENUE AUTHORITY
REAL ESTATE TAX DIVISION

**PROPERTY IDENTIFICATION SHEET**

*Notice Number* [redacted]

**Owner/ Caretaker Name:**
[redacted]

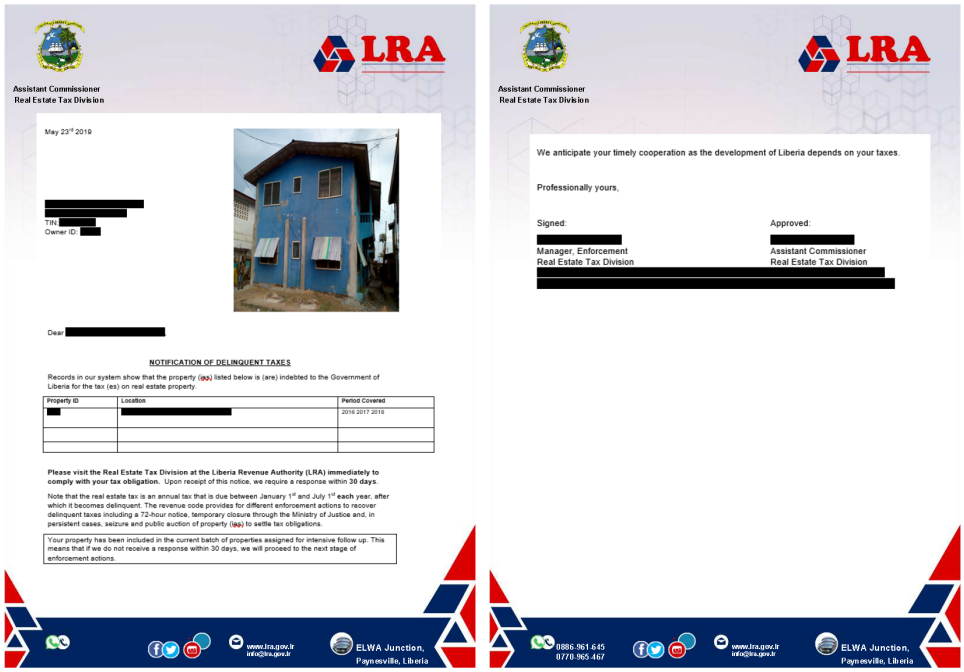
**Owner/ Caretaker Contact:**
[redacted]

**Location:**
**SMALL TOWN**

Please come to the Liberia Revenue Authority to verify and update your records

Notes: The Detection and Penalty treatment included both the letter and the Property Identification Sheet above, stapled together. The Penalty treatment had only the letter above. The Detection treatment had the letter and the Property Identification sheet, but did not have the boxed section of the letter than contains penalty information. The Control notice had only the letter, without the boxed section of the letter.

Figure A2: Experiment Two Notice




Notes: These are the front and back pages of the Enforcement Notice. The Control Notice did not have the boxed section of the letter.

Table A1: Experiment One: Randomization Balance Table (Properties)

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | | Difference between control group and | | | | |
| | Mean and [SD] of Control group | Penalty and Detection | Penalty | Detection | P-value of f-test | N |
| Owner has multiple properties | 0.329 | 0.000 | -0.005 | -0.038 | 0.886 | 571 |
| | [0.471] | (0.055) | (0.055) | (0.055) | | |
| Property value | 26410.108 | -2708.321 | -4376.582 | -139.630 | 0.406 | 571 |
| | [24036.384] | (2715.693) | (2848.788) | (3543.005) | | |
| Area | 1356.580 | -43.713 | -188.388 | 67.002 | 0.245 | 571 |
| | [1061.960] | (119.624) | (118.068) | (153.369) | | |
| Rooms | 3.370 | 0.013 | -0.263 | 0.003 | 0.481 | 570 |
| | [2.441] | (0.272) | (0.241) | (0.277) | | |
| Bathrooms | 1.932 | -0.267 | -0.313 | -0.215 | 0.393 | 568 |
| | [1.745] | (0.184) | (0.194) | (0.225) | | |
| Has Porch | 0.829 | 0.024 | -0.054 | -0.045 | 0.271 | 571 |
| | [0.378] | (0.043) | (0.047) | (0.047) | | |
| Has Garage | 0.103 | -0.036 | -0.053* | -0.021 | 0.355 | 571 |
| | [0.305] | (0.033) | (0.031) | (0.035) | | |
| Commercial property | 0.397 | -0.089 | -0.073 | -0.084 | 0.364 | 571 |
| | [0.491] | (0.056) | (0.057) | (0.057) | | |
| Block 2 | 0.521 | -0.138** | -0.063 | -0.028 | 0.093 | 571 |
| | [0.501] | (0.058) | (0.059) | (0.060) | | |
| Block 3 | 0.281 | -0.073 | -0.041 | -0.020 | 0.503 | 571 |
| | [0.451] | (0.050) | (0.052) | (0.053) | | |

Notes: Column 1: Standard deviation in brackets. Columns 2,3,4: Coefficient and robust standard errors (in parenthesis) from OLS regression of property/ property owner characteristic on treatment indicator variables, controlling for owning multiple properties. ***, **, and * indicate significance at the 1, 5, and 10 percent level.

Table A2: Experiment One: Delivery Balance Across Treatment Groups

| | (1)<br>Notice Delivered |
|---|---|
| Detection and Penalty | 0.052 |
| | (0.042) |
| Penalty | 0.046 |
| | (0.044) |
| Detection | 0.064 |
| | (0.043) |
| Number of observations | 464 |
| Control mean of dependent var | 0.858 |

Notes: OLS regression of property/ property owner characteristic on treatment indicator variables, controlling for owning multiple properties. Robust standard errors in parenthesis. ***, **, and * indicate significance at the 1, 5, and 10 percent level.

Table A3: Impact of Detection and Penalty Notice on Registration, Payment and Amount Paid (Property Owners with properties assigned to only one treatment group)

| | (1) Responded to Notice | (2) Paid | (3) Amount Paid ($) | (4) Amount Paid (IHS) |
|---|---|---|---|---|
| Detection and Penalty | 0.050 | 0.060* | 73.537 | 0.318* |
| | (0.036) | (0.031) | (71.445) | (0.178) |
| Penalty | 0.022 | -0.011 | -1.585 | -0.067 |
| | (0.034) | (0.020) | (10.896) | (0.116) |
| Detection | 0.041 | 0.007 | 9.184 | 0.047 |
| | (0.037) | (0.024) | (29.211) | (0.152) |
| Number of observations | 371 | 371 | 371 | 371 |
| Control mean of dependent var | 0.044 | 0.022 | 5.929 | 0.131 |

Notes: This table shows the impact of receiving an enforcement notice on tax payments among a restricted sample– property owners who own only one property or whose multiple properties were all assigned to the same treatment group. OLS regressions of the outcome variables on the treatment indicator variables. Robust standard errors in parenthesis. Omitted group is control group. Control variables are owning multiple properties, owning commercial property, property value (highest value for those with multiple properties), having a female owner or co-owner and location (one of 3 subareas). ***, **, and * indicate significance at the 1, 5, and 10 percent level.

Table A4: Experiment Two: Delivery Balance Across Treatment Groups

| | (1)<br>Notice Delivered |
|---|---|
| Enforcement notice | 0.004 |
| | (0.015) |
| Number of observations | 528 |
| Control mean of dependent var | 0.966 |

Notes: OLS regression of property/ property owner characteristic on treatment indicator variable. Robust standard errors in parenthesis. ***, **, and * indicate significance at the 1, 5, and 10 percent level.

Table A5: Experiment Two: Prior Year's Tax Arrears Payment Rate Across Areas of Monrovia

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | All | Below USD 1000 liability | Owes tax arrears | Below USD 1000 liability and owes tax arrears |
| Area 2 | 0.101*** | 0.086*** | 0.115*** | 0.091*** |
| | (0.012) | (0.013) | (0.024) | (0.025) |
| Area 3 | 0.046*** | 0.043*** | 0.066** | 0.053* |
| | (0.013) | (0.014) | (0.027) | (0.028) |
| Number of observations | 7496 | 6390 | 2203 | 2067 |
| Mean of Area 1 | 0.207 | 0.228 | 0.290 | 0.320 |

Notes: This table shows the success of prior enforcement actions in different areas of Monrovia. Robust standard errors in parenthesis. ***, **, and * indicate significance at the 1, 5, and 10 percent level. Omitted group is control group. Control variables are owning multiple properties, owning commercial property, property value, having a female owner, and location (one of 3 subareas).