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ABSTRACT

In the context of collecting property taxes from 13432 households in a district of Lima (Peru), we investigate whether prioritized enforcement can improve the effective use of limited enforcement capacity. We randomly assign households to two treatment arms: one replicating the city's usual collection policy, and one implementing a prioritized enforcement rule in which households are ordered according to a suitable rank and sequentially issued clear short-term promises of collection if they fail to make minimum tax payments. Raw findings show that prioritized enforcement improved tax collection by increasing tax revenue, and decreasing the number of costly collection actions taken. We identify an important friction ignored by existing theory: tax-payers' response to incentives is slow, which changes the optimal management of collection promises. Finally, we estimate a model of tax-payer behavior and use it to produce counterfactual treatment estimates for other collection policies of interest. In particular, we estimate that, keeping the number of collection actions fixed, prioritized enforcement would increase tax revenue over 5 months by 11.3%.

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1 Introduction

Many government functions, including tax-collection and policing, are constrained by limited enforcement capacity. This is true in both developing and developed countries.[1] In the context of tax-collection, Chassang et al. (2022) argue that enforcing collection on randomly chosen tax-payers can lead to multiple equilibria: some in which many tax-payers settle, so that limited enforcement capacity is enough to discipline non-compliers; some in which few tax-payers settle so that limited capacity is over-stretched and provides insufficient incentives for compliance. In such settings, Chassang et al. (2022) suggest that a divide-and-conquer approach can help unravel low collection equilibria. By suitably ranking tax-payers, and threatening collection against non-compliers in order of rank, it is possible to enforce the second-best collection even in environments with incomplete information and boundedly rational tax-payers. The current paper takes on the challenge of implementing a prioritized enforcement mechanism in the field. We evaluate its impact on tax-collection and other key outcomes of interest, investigate important frictions ignored by existing theory, and estimate counterfactual outcomes under relevant alternative collection processes suggested by our field experience. We believe that our findings considerably improve our understanding of how to implement divide-and-conquer mechanisms in the field, and expand the set of policy options available to resource-constrained tax-collection authorities.

Our context of interest is the collection of property taxes in the municipality of Jesús María, a relatively affluent district of Lima (Peru), counting roughly 35,000 households. From April 2021 to September 2021, we partnered with the city's tax collection unit to collect property-related taxes from 13432 households delinquent in the payment of their first-quarter (Q1) property related taxes. The experiment ended with the city's decision to adopt a prioritized enforcement mechanism for its regular collection process.

While Jesús María typically enjoys high ultimate collection rates, it expends significant

[1]For instance, in the United States, the IRS has the capacity to audit under 1% of tax returns every year. This varies by income bracket, from under .5% to roughly 5%. See IRS statistics for updated numbers.

resources on tax-collection, and a large number of tax-payers are delinquent at some point during the annual collection process. In addition, collection administrators were concerned that the Covid 19 pandemic may induce tax-payers to skip tax-payments, expecting other tax-payers to do the same. Consultation with the city's collection unit identified a specific bottleneck in their capacity to directly collect taxes from delinquent tax-payers: a costly garnishment procedure that requires the involvement of legal professionals and bank cooperation. It was established that the city's capacity to issue garnishment orders was roughly 400 per month. Other required actions taken along the process of collection include an initial notification (also referred to as *Valor*), and the issuance of a formal writ (also referred to as *REC1*) — a legal document indicating the beginning of formal collection. Although there are capacity constraints associated with these actions, in both cases, capacity was estimated to be on the order of several thousands per month, and therefore not binding.

At the end of Q1 2021, we randomly assigned delinquent tax-payers to two treatment arms. A control arm implemented the city's usual collection policy, which does not involve making specific collection promises to tax-payers, and leaves considerable uncertainty regarding the likelihood of enforcement, so that when enforcement does happen, it is effectively a surprise. A treatment arm implemented a prioritized collection mechanism structured along the lines suggested by Chassang et al. (2022). Using past repayment data, we estimated a model of tax-payer repayment, which we used to associate each tax-payer i with a score z_i defined as

$$z_i \equiv \mathsf{expected\ tax\ payment}_i / \mathsf{probability\ of\ non\text{-}repayment}_i.$$

Taxpayers were prioritized according to score z_i and dynamically assigned to three priority groups associated with different collection promises. At any given point in time, the top 400 highest ranked tax-payers who had not paid more than 50% of their taxes were assigned to group G1, the next top 400 were assigned to group G2, and the remainder of our treatment sample was assigned to group G3. Group membership was updated on a weekly basis.

Members of priority group G1 were given a clear promise that income would be garnished

within 6 weeks if taxes remained unpaid. Members of group G2 were promised that their income would be garnished within 12 weeks in the absence of tax payments. In addition, they were informed that they could be moved to group G1 at any time. In contrast, members of group G3 did not receive a definite promise. They were informed of the amount of tax they owed, of the penalty for late payment, and that they could be moved to group G2 at anytime. Tax-payers assigned to the control group (referred to as group N, for no promises) received a visually similar notification of the amount of tax they owed.

Our raw findings establish three main points. First, prioritized enforcement was effective in increasing the efficiency of collection. Over a five month period taxes collected in the treatment group were 9.4% higher than in the control group. A more conservative estimate designed to correct for large payments suggests a treatment effect of 2.8%. In addition, the number of collection actions other than garnishment (notifications, and legal writs) taken for the treatment group was three times smaller than in the treatment group, saving significant labor costs.[2] Second, prioritized enforcement increased the progressivity of tax collection. Because tax-payers with greater tax-due were assigned higher ranks, the share of taxes collected from high tax-due tax-payers was higher in treatment than control. Third, the evidence confirms that the key ingredients needed for prioritized enforcement to be effective were present: clear short-term promises significantly increased the repayment propensity of tax-payers, and repayment propensities were meaningfully predicted by our scoring rule.

Because collection actions are not kept constant across treatment and control arms — the control arm involves issuing many more notifications and legal writs than treatment — our reduced-form findings provide a lower bound for the impact of prioritized enforcement on tax revenue. Since increasing the number of legal writs issued under treatment is a feasible policy, we build a semi-structural model of tax-payers' behavior that permits the counterfactual evaluation of prioritized collection mechanisms, provided that they do not compromise the

[2]While we have reliable data on formal collection actions taken, we do not have records of internal time use by city employees: the tax collection office consists of only 15 employees with diverse duties and task assignment is fluid. Rough estimates from administrators indicate that the equivalent of 2 days a week were spent implementing treatment-arm steps, and 3 days a week were spent implementing control-arm steps.

city's ability to deliver on promises by inducing a flow of garnishment orders greater than the city's available capacity.[3] Our model estimates confirm that G1 priorities considerably increase tax-payers' repayment propensities, and show that receiving a legal writ had a similar effect. Counterfactual evaluation suggests that increasing the number of legal writs issued under treatment to match numbers under control would improve collection under treatment by an additional 8.3% corresponding to a combined improvement of 11.3% over control. In addition, we use our estimated model to evaluate the importance of the specific scoring rule used to rank tax-payers. We show that predicted tax-revenue is essentially the same for scoring models based on past repayment behavior, scoring models excluding past repayment data, and scoring models based on tax-due alone. In contrast, using a uniform random order (which may be viewed as fair) reduces tax collection by 14.8% compared to treatment.

As far as we are aware, this paper constitutes the first experimental evaluation of divide-and-conquer mechanisms in the field.[4] There is a rich and growing theoretical literature on the use of divide-and-conquer mechanisms to implement desirable social outcomes in a unique rationalizable strategy profile (Segal and Whinston, 2000, Spiegler, 2000, Segal, 2003, Winter, 2004, Dal Bó, 2007, Eliaz and Spiegler, 2015, Halac et al., 2019, 2020). Chassang et al. (2022) help bridge the gap between this theoretical literature and practical implementation by taking into account incomplete information and bounded rationality frictions. Field evidence shows that delay in best-response is a key additional determinant of the effectiveness of prioritized enforcement. As a result, seemingly payoff irrelevant actions that enhance tax-payer awareness have a meaningful impact on collection. In addition, delay in best-response creates a trade-off between making threats that can be delivered on regardless of tax-payers'

[3] A fully structural model would allow us to evaluate mechanisms that fail to deliver on promises at some rate. Since our data cannot inform such a model, we leave it for future work.

[4] Of course, the insight behind divide-and-conquer has found its way into policy, probably for as long as people have been thinking strategically. One recent notable example is Operation Ceasefire (Braga et al., 2001, Kennedy, 2011, 2012), a multi-city homicide reduction program that explicitly prioritizes the assignment of law enforcement capabilities to homicides in the order in which they are committed, thereby dissuading gangs to initiate gang wars.

behavior, and ensuring that a sufficient share of delinquent tax-payers receive an enforcement threat within the time-span allotted to collection. The main control variable used to navigate this trade-off is the ratio of collection threats to available enforcement capacity.

The paper contributes to the extensive literature on the economics of tax-compliance reviewed in Slemrod (2019). It belongs to a growing class of letter-based randomized control trials in which researchers have partnered with tax-collection authorities to evaluate how different tax-collection policies affect compliance. Slemrod et al. (2001), Kleven et al. (2011) and more recently De Neve et al. (2021) evaluate the impact of auditing threats on tax-payers' compliance, finding a meaningful impact of threats, especially on tax-payers for whom third party information is not available. Del Carpio (2014), Dwenger et al. (2016), De Neve et al. (2021) study tax-morale and evaluate the importance of intrinsic versus extrinsic incentives in achieving compliance. De Neve et al. (2021) studies the value of reducing compliance costs by simplifying communication between tax-collection agencies and tax-payers. While much of this work considers the problem of compliance within the single agent framework of Allingham and Sandmo (1972), we are interested in environments where low enforcement capacity creates a strategic interaction between tax-payers. Threats issued against all delinquent tax-payers are not in fact jointly feasible, so that ensuring faster compliance by some allows the tax-collection authority to re-deploy limited capacity to others. We investigate the potential of divide-and-conquer mechanisms to improve the effectiveness with which such limited capacity is used.

The paper also contributes to a growing literature applying mechanism design insights to improve policy enforcement in settings with limited state capacity. Pomeranz (2015) uses Chilean data to establish the informational power of value-added taxes: by giving businesses incentives to report one another's revenue (to reduce their own tax burden), they generate information that tax-authorities can use to curb tax evasion. Duflo et al. (2013) use cross validation to incentivize environmental inspectors in settings where there is potential for bribery. Johnson and Lipscomb (2017) and Hussam et al. (2022) explore the use of

mechanisms to improve the targeting of subsidies.

The paper is structured as follows. Section 2 recalls the analytic framework of Chassang et al. (2022), highlights its limits, and clarifies how they are addressed in our treatment. Sections 3 and 4 describe our experimental context and experimental design. Section 5 reports raw outcomes of interest and confirms that the key ingredients needed for prioritized enforcement to be effective are present. Section 6 estimates a semi-structural model of tax-payer behavior and uses it to evaluate counterfactual policies of interest. Section 7 speculates about the external validity of our findings and possible design improvements.

2 Framework

Our baseline framework is taken from Chassang et al. (2022). Section 2.1 clarifies key forces in a highly stylized setting. Section 2.2 introduces incomplete information and bounded rationality frictions. Section 2.3 identifies limits of this theoretical analysis, and discusses how we choose to address them in our experimental design.

2.1 Benchmark model and results

N tax-payers indexed by $i \in \{1, \cdots, N\}$ each owe the government a fixed amount D. The tax-payers and the government are all risk-neutral. If a tax-payer fails to repay on time, the government can potentially collect a penalized amount $D + K$ through direct intervention – in our experimental setting, garnishing bank accounts. The difficulty is that the government has limited enforcement capacity: the government can directly collect from only $\alpha N \geq 1$ tax-payers with $\alpha \in (0, 1)$.[5] Direct collection allows the government to collect amount $D + K$, but does not impose additional punishments. In our application, costs K correspond to administrative costs of collection and do not increase tax revenues. We assume that $\alpha \leq D/(D + K)$.

[5]This could be because forceful collection requires resources (e.g. physically seizing assets is difficult), or because due process steps must be taken.

The government makes a settlement offer and commits to an enforcement rule according to the following extensive-form game:

(i) The government gives each tax-payer the possibility to settle by paying a fixed price $P = D$. Tax-payers who settle are spared from forceful collection.

(ii) Tax-payers simultaneously decide whether or not to settle and pay price P.

(iii) The government forcefully collects $D + K$ from tax-payers who do not settle according to a known enforcement rule.

We consider two possible enforcement rules:

- Random enforcement: In period (iii) up to αN tax-payers are drawn with uniform probability from the set of non-compliant tax-payers, and designated for collection.
- Static prioritized enforcement: tax-payers are given a known priority rank in period (i). In period (iii) up to αN non-compliant tax-payers are targeted for collection in order of their preassigned rank. For simplicity, we assume that tax-payers are ranked in descending order of their index $i \in \{1, \cdots, N\}$ (i.e. tax-payer 1 has the highest priority).

The value of prioritized enforcement. The following result clarifies the value of prioritized enforcement: it selects a high collection equilibrium as the unique strategy profile surviving the iterated elimination of dominated strategies. In contrast, random enforcement induces multiple equilibria involving both high and low collection levels.

Proposition 1 (Chassang et al. (2022))**.** *(i) Consider the case of random enforcement. There exists a Nash equilibrium such that all tax-payers settle, and a Nash equilibrium such that all tax-payers refuse to settle.*

(ii) Consider the case of static prioritized enforcement. A unique strategy profile survives iterated elimination of dominated strategies: all tax-payers settle.

Under random enforcement, if most tax-payers pay their taxes, then even a small collection capacity is enough to deter unilateral deviations. However, if most tax-payers do not pay their taxes, then available capacity is thinly spread and fails to dissuade tax-evasion. Prioritized enforcement causes this last equilibrium to unravel by ensuring that available capacity is focused on a marginal set of tax-payers. Indeed, it is dominant for the αN highest ranked tax-payers to settle their taxes. Anticipating this, it is a best response for tax-payers with rank up to $2\alpha N$ to settle, and so on.

2.2 Frictions

Some of the mechanics behind Proposition 1 are unappealing. First, in practice, some tax-payers may be insolvent, or simply unwilling to repay. This will consume some capacity and reduce the effectiveness of prioritized enforcement. Second, Proposition 1(ii) relies heavily on tax-payers performing many iterated eliminations of dominated strategies. This is implausible in practice. Chassang et al. (2022) show how to adapt prioritized enforcement to environments with heterogeneous tax-payers, incomplete information, and bounded rationality frictions.

The baseline model is extended as follows. Tax settlement and collection are embedded in time $t \in [0, 1]$. Each tax-payer i owes an amount D_i and a penalized amount $D_i + K$ in the event direct collection takes place against them. Tax-payers are not always capable of paying taxes, but instead become able to make payments with Poisson intensity $-\log(q_i)$, so that over time-range $[0, 1]$ tax-payer i is able to repay with probability $1 - q_i$. With probability q_i taxpayer i is simply unable (or unwilling) to repay their taxes. This friction naturally reduces the effectiveness of prioritized enforcement: some high priority tax-payers will fail to repay their taxes, and some capacity will have to be consumed to ensure collection promises are kept.[6]

[6] Chassang et al. (2022) extends the analysis to the case of income taxes where the amount a tax-payer owes is uncertain, and privately observed by the tax-payer.

Dynamic prioritized enforcement. Each period t the government offers a tax-payer i to settle at a price $P_{i,t}$. In addition, each period t, the government can provide a signal $x_{i,t}$ to tax-payer i revealing information about the settlement behavior of others. A tax-payer's decision to settle $s_{i,t} \in \{0,1\}$ is irreversible: if $s_{i,t} = 1$ then for all $t' > t$, $s_{i,t'} = 1$.

Chassang et al. (2022) establish that the following dynamic mechanism achieves approximately optimal collection when the number N of tax-payers is large:

(i) Rank tax-payers according to score

$$z_i \equiv \frac{(1-q_i)D_i}{q_i}. \tag{1}$$

(ii) Set settlement offers $P_{i,t} = D_i - \nu \times (1-t)$ for ν small.

(iii) Inform tax-payers of their effective rank: $x_{i,t} = i - \sum_{j<i} s_{j,t}$.

Point (i) of the design orders tax-payers according to a score z_i that trades-off the expected income $(1-q_i)D_i$ from providing tax-payer i incentives to repay, with the shadow cost of expected capacity consumption q_i associated with threatening direct collection against a tax-payer who may well be unable to repay. For simplicity, we assume that tax-payers are indexed in order of descending score z_i (so that tax-payer $i = 1$ is associated with the highest score z_i).

As population size N grows arbitrarily large, Chassang et al. (2022) show that scoring rule z_i optimally partitions the population in two groups: complying tax-payers (tax-payers with rank i such that $\sum_{j<i} q_i < N\alpha$) who settle their taxes if they are able to; and non-complying tax-payers (tax-payers with rank i such that $\sum_{j<i} q_i > N\alpha$) who choose not to settle their taxes. Importantly, scoring rules that also rank compliant tax-payers ahead of non-compliant tax-payers achieve the same efficiency as z_i, even if they rank tax-payers differently within the set of compliant and non-compliant tax-payers.[7]

[7]The distinguishing feature of scoring rule z_i is that it implements the efficient partition of tax-payers into compliant and non-compliant groups for all values of capacity parameter α.

Point (*ii*) of the design sets a strictly increasing schedule for settlement prices. This gives tax-payers who know they are going to settle incentives to settle as fast as possible. Point (*iii*) updates tax-payers about the settlement behavior of tax-payers ranked ahead of them. The key element here is to inform tax-payers when it becomes dominant for them to settle. Together points (*ii*) and (*iii*) ensure that the second best settlement behavior is implemented under weak rationality. Formally, Chassang et al. (2022) show that under this mechanism, any strategy profile that is not obviously dominated in the sense of Li (2017) implements the highest settlement implementable in Bayes Nash equilibrium for arbitrary mechanisms.

In the simultaneous move game of Section 2.1 static prioritized enforcement relied on many rounds of iterated elimination of dominated strategies to implement optimal settlement behavior. In contrast, dynamic prioritized enforcement allows time and information to replicate the work of reasoning: tax-payer 1 settles as soon as possible; tax-payer 2 gets informed that settling is dominant, and settles as soon as possible; tax-payer 3 gets informed that settling has become dominant, and settles as soon as possible, and so on. Note that strictly increasing settlement prices, and timely information are both needed for this contagion behavior to unfold successfully over time.

2.3 Known limits and design implications

The approach of Section 2.2 tackles realistic frictions and provides a useful guide to design that performed well in the lab. Nonetheless it exhibits significant limits. Some anticipated limits are reflected in our field design.

Commitment. The analysis of Sections 2.1 and 2.2 assumes that the government has commitment power: it keeps feasible collection promises, and tax-payers believe that it will. In practice, tax-payers do not always take enforcement threats seriously: local governments do not always have great reputation for follow-through.

In our experimental setting we maximize the government's commitment power by making collection threats with clearly specified implementation dates, set not too far in time. This allows the government to better leverage its limited reputational capital by making failures to deliver on threats more detectable.

This argument can be formalized as follows. Let us denote by V_{failure} and $V_{\text{no failure}}$ the value of the government's reputation vis à vis a tax-payer, depending on whether or not the government fails to deliver on a promise to collect. This value may reflect politicians' value for their public image, their reputation for being effective, as well as the ongoing benefits of inducing trust in public messaging. Let p denote the probability that a failure would be detected, and c the taxpayer's perception of the government's opportunity cost of delivering on a promise.

The government's expected value if it chooses not to deliver on a promise is $pV_{\text{failure}} + (1-p)V_{\text{no failure}}$. If the government delivers on a promise, its value is $V_{\text{no failure}}$. Hence, a promise is credible if and only if

$$p\left(V_{\text{no failure}} - V_{\text{failure}}\right) \geq c. \tag{2}$$

We believe that short-term promises with definite due dates increase the credibility of promises by increasing the probability p of detection. In contrast, promises over actions far into the future are likely to be forgotten, or made irrelevant by policy and government changes.

Delay in decision making. While non-obviously dominated play is a weak solution concept, it requires that whenever tax-payers learn that it is dominant for them to repay, they do so as soon as they are able. However, in practice it may take time for tax payers to actually make payments even if they have funds available: if the slope ν of the price schedule described in Section 2.2 is small, then incentives to act fast are small.

Delay in decision making has two practical implications:

- In any given period, the design of Section 2.2 only promises direct collection to a number of tax-payers equal to the available collection capacity. This ensures that settling is dominant for these tax-payers. When decision-making takes time, this reduces the speed at which tax-payers can be effectively processed.

  In contrast, if all tax-payers are threatened with direct collection, then it is no longer a dominant strategy for tax-payers to settle their taxes. However, if tax-payers coordinate on the high settlement equilibrium, then sending out many threats allows for faster parallel processing of tax-payers.

  Delay in decision-making creates a tradeoff between the enforcement guarantees associated with direct collection threats and speed of processing. As a result, it may be optimal to issue a number of threats that is between the current available capacity, and the total number of threats that the analyst expects to be achievable in equilibrium.[8]

  Because of this trade-off, in our experimental design, we end up issuing a number of short-term collection promises that is greater than available flow enforcement capacity (i.e. infeasible in a worst case settlement scenario), but much lower that the maximum feasible flow of promises given equilibrium settlement rates.

  Section 6 develops an estimatable model of tax-payer behavior that allows for delay in decision-making. This semi-structural model permits the counterfactual evaluation of policies that do not affect the quality of promise delivery: the expanded use of cheap collection actions with little direct impact on actual collection, changes in the scoring rule, and so on.

- When there is delay in decision-making, engaging the higher level rationality of tax-payers can increase collection rates if it gets tax-payers to "get their act together" earlier. We attempted to engage higher rationality individuals in our experimental

[8] Effectively, instead of making threats that induce settlement to be a dominant strategy, we would make threats that induce settlement to be p-dominant for p small (Morris et al., 1995). See Chassang et al. (2022) for a discussion.

design by issuing different levels of promises. We believe that this aspect of our design can be improved on, and speculate how in Section 7.

3 Experimental Context

From April to September of 2021, we partnered with the municipality of Jesús María, a municipal district of Lima (Peru), to collect property-related taxes from 13,432 households delinquent in their first quarterly payment. This section details the context for our experiment, and why this context seemed well suited to evaluate prioritized enforcement.

3.1 General context

Property taxes. Our study targets the two most important municipal taxes in Peru, which are both property-related: (i) property taxes *per se*, based on land values as well as assessed building construction costs, with progressive tax rates ranging from 0.2% to 1% of total assessed value, and (ii) an 'arbitrios' contribution, covering the provision of public goods such as trash collection, street lights, and maintenance of green areas, charged to each property and also varying depending on the quantity and quality of public goods provided.[9]

In 2020, property-tax income represented the largest source of revenues for district municipalities in Lima, amounting to 28% of total revenue and 40% of current income;[10] while the arbitrios contribution represented 19% of total revenue and 28% of current income. Jointly, they account for almost 50% of total municipal revenues.

Jesús María. Jesús María is one of 43 municipal districts of Lima. It belongs to the top quartile of districts both in terms of income and educational attainment. As of 2020, there

[9]The same tax base and rates apply nationwide and are regulated by the Law of Municipal Taxation D.S. 156–2004–EF.

[10]Total revenue includes current income, as well as transfers from the central government. Source: Registro Nacional de Munipalidades (2020).

were above 60,000 properties in the district, 90% of which were residential units. The average assessed value of properties amounted to Peruvian soles S/. 110,000 (around US$30,000).[11]

Properties are linked to over 35,000 registered taxpayers, of which 90% live in the district. In 2020, total annual taxes due, including property taxes and arbitrios, stood at US$15.8 million, while the average annual tax due amounted to US$435. The distribution of taxes dues is skewed to the right. The ten largest taxpayers (mostly tax-payers with commercial properties including shopping malls and real estate agencies), represented 16% of total tax due, while the top 500 tax-payers accounted for 42% of total tax due.[12]

In 2020 Jesús María had one of the smallest tax delinquency rates in Lima, at 5.7% of total tax due (3.5% for property taxes and 7% for arbitrios). Of the total amount collected in 2020, 92% were voluntary payments by tax-payers or coming from the ordinary collection process, while only 8% came from coercive collection. However, while the ultimate collection rate is high, delinquency is frequent – roughly 30% of tax payers do not pay taxes in time – and ensuring collection is costly. Jesús María's annual collection costs are on the order of US$1 million.

Suitability for experimentation. The impetus for experimentation was partly driven by the municipality's concerns over collection in 2021. It appeared plausible that the economic shock associated with the COVID 19 pandemic may push tax-payers to a low settlement equilibrium. In addition, because tax collection costs were already high, the city council was unable to increase tax collection budgets. This motivated the tax collection authority to seek ways to deploy limited collection capacity more effectively.

Experimentation was facilitated by several other facts. First, within constraints set by national law, Peruvian municipalities have significant degrees of freedom in how they administer their tax collection process. Second, municipal property registries contain all the

[11] Properties are assessed using construction costs rather than commercial values. Official construction rates per sqm are provided by the national government.

[12] We note that the top 10 tax payers tend to pay taxes on time. For this reason, only one entered our sample of delinquent tax-payers (it was assigned to the treatment group) and for a relatively small amount of taxes due (2000 soles).

information needed to calculate tax-dues, as well as relevant characteristics of tax-payer, allowing us to implement a scoring rule along the lines of (1). Third, Jesús María had taken specific steps over the previous 5 years to enhance its reputation vis à vis tax-payers, including banning the use of tax amnesties. This means that collection promises would a priori be taken seriously.

3.2 The tax collection framework

Collection steps. Property taxes and the arbitrios contribution are enforced jointly for the most part, but they are distinct taxes, and the collection process must follow similar but distinct collection steps. Property tax payments are due quarterly, with deadlines on February 28, May 31, August 31 and November 30. The arbitrios contribution payments are due monthly, but enforced quarterly.

The standard collection process follows each quarterly payment deadline and has two main stages: *ordinary* collection and *coercive* collection. Figure 1 summarizes the key steps of each stage as well as the usual collection timeline.

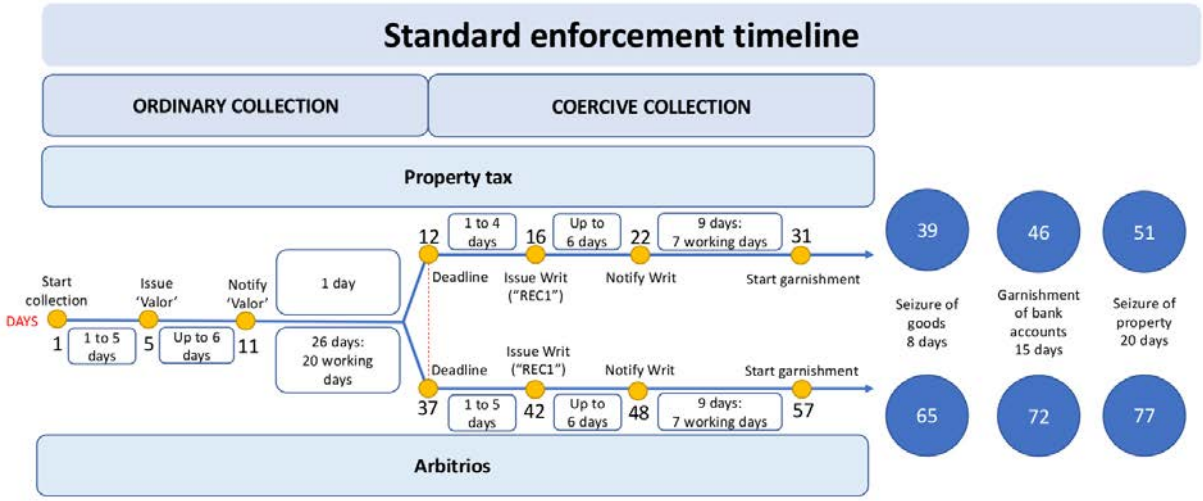


Figure 1: Standard collection timeline

Ordinary collection starts right after the payment deadline and involves: (i) bulk sending reminders (mostly through emails and sms) to all taxpayers who have missed the deadline, (ii) calling roughly the top 50% of delinquent debtors with the highest tax due to remind them of their liabilities, and (iii) a formal notification (sent through a letter) with the amount owed ("valor"), which also triggers a countdown at the end of which, legal collection procedures can proceed ("the coercive process").

Specifically, the coercive process can only begin one working day after the tax-payer is formally notified for property taxes, and 21 working days after notification for arbitrios. The government does not automatically initiate the coercive process even if it is allowed to do so. When the government initiates coercive collection, a formal writ issued by employees with formal legal training (sometimes referred to as the 'REC1') must be sent to the taxpayer. Collection actions can only begin 7 working days after the tax-payer receives notification of the writ. Administrative delays can further lengthen the process of collection.

In general, the city government has three main options for collection: (i) garnishing bank accounts, (ii) seizing goods at the property, and (iii) placing a lien on the property itself. Garnishing bank accounts is by far the most effective measure, but not every tax-payer has a bank account. Seizing durable goods from the property is used for smaller debts. In this case, a formal notification is delivered first, and then a municipal truck is sent to the property to seize the goods. Placing a lien on the property is used rarely, and only for very high debts. In this case the government asserts a right of first-repayment if and when the property is sold, but cannot provoke the sale. Due to the Covid 19 pandemic, garnishment was the only collection step taken in 2020 and 2021.

Penalties. Weekly interest rates, corresponding to an annual rate ranging between 1 and 3% is applied to all delinquent debt. Penalties apply once the coercive process begins corresponding to a 10% increase in total debt due. In addition, the tax-payer is charged for some of the collection expenses incurred by the municipality, averaging to US$35 per delinquent tax-payer. When coercive collection begins, the municipality registers all tax-payer debt

with a credit-risk agency, which lists tax-payers as delinquent in national databases.

Steps specific to tax brackets. The collection steps described above are the same for all tax-payers. Some additional collection steps depend on the tax bracket (described Table 1) the tax-payer belongs to.

Table 1: Tax brackets for standard collection

	Total Count	Average tax due	Share of total tax due
Bracket 1: Total tax due over 5000 soles	912	29,976.61	0.466
Bracket 2: Total tax due between 3000 and 4999 soles	729	3,765.85	0.047
Bracket 3: Total tax due between 100 and 2999 soles	31,078	916.74	0.485
Others: Total tax due under 100 soles	2,371	53.59	0.002

The largest 500 taxpayers by annual amount owed ("main contributors'") are assigned a dedicated collection tax-payer that manages their account.[13] In addition, collection happens in three cycles, based on brackets of total amount owed (see Table 1). Property tax is collected first, with cycles starting 2, 9 and 16 days (for brackets 1, 2 and 3 respectively) after the payment deadline. Arbitrios collection follows, with collection for brackets 1, 2 and 3 starting, respectively, 16, 23 and 30 days after the payment deadline. For smaller debtors, debts across different quarters are pooled and enforced with low intensity once or twice per year. They amount for a small share of taxes due, and we exclude them from our analysis.

Capacity constraints. Collection is conducted by 15 city employees coordinated by the head and the deputy head of the collection unit. Five employees are responsible for ordinary collection (one is dedicated to the top 500 tax-payers), three employees are responsible for coercive collection. Two persons are in charge of delivering notifications, one person is in charge of IT, and two employees provide overall support.

[13]We balanced the assignment of these 500 tax-payers to treatment and control, with the same collection agent performing collection duties for both arms

Collection steps are limited by the available workforce, limited budget, and the capacity of service providers (e.g. banks). Table 2 depicts total monthly enforcement capacity by collection action, as estimated by city officials. The city has very large capacity for cheap messaging and collection steps, including issuing formal writs (between 5000 and 16000 a month), and much lower capacity for actual garnishment (400 a month). This represents a bottleneck in the city's collection capacity. The effective use of limited garnishment capacity was therefore the focus of our experimental treatment.

Table 2: Operational capacity and unit costs

	Monthly capacity (units)	Unit cost (soles)
Phone calls	5237	1.60
SMS	16000	0.16
E-mails	16000	0.18
'Valor' issue	10687	0.90
'Valor' notification	10687	1.83
Writ ("REC1") issue	5990	2.68
Writ ("REC1") notification	5990	1.92
Garnishment issue	400	60.80
Garnishment notification	400	6.37

4 Experimental Design

4.1 Scope and treatment arms

The experiment was pre-registered with the American Economic Association's Randomized Controlled Trial registry under number 7305. The sample population for our experiment consisted of tax-payers delinquent on their first quarter (Q1) property or arbitrios taxes by April 5th, 2021.[14] Figure 2 summarizes the experiment's timeline.

[14]The regular tax payment deadline of February 28th was extended to March 31st due to the Covid 19 pandemic. No enforcement measure was taken before that date.

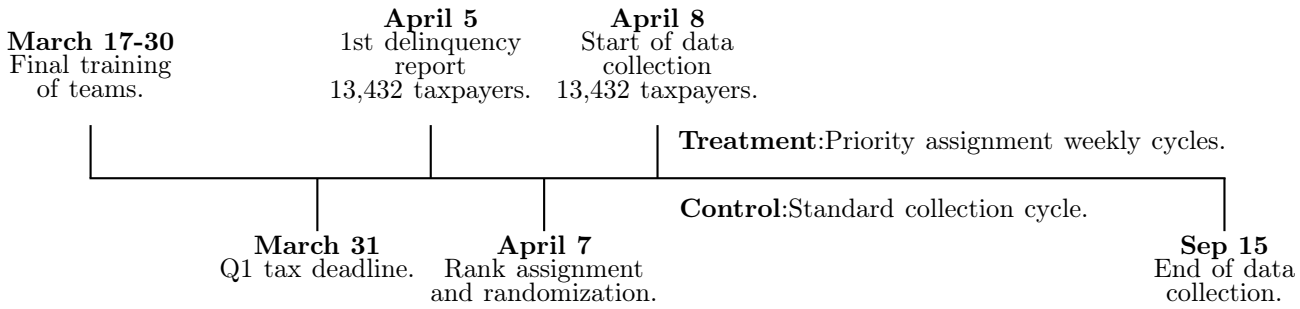


Figure 2: Experiment timeline.

Following the payment deadline, 13,432 tax-payers who had not paid their Q1 2021 taxes as of April 5th and had a tax due above Peruvian soles S/.100 (around US$25) entered our experimental sample. Smaller debts were excluded. Debtors were all assigned a priority rank based on scores z_i defined using a statistical model of repayment described below.

Half of tax-payers were randomly assigned to a prioritized enforcement mechanism described below, while the remaining tax-payers were assigned to the standard collection procedure used by Jesús María. Following Banerjee et al. (2020), we drew our sample assignment uniformly from the set of 10% most balanced samples under the Mahalanobis distance, targeting balance on tax-payer age, tax due, status as a top 500 tax-payer, and expected repayment probability. Table 3 provides summary statistics.

Failure of SUTVA. Our design is intrinsically limited by the fact that although we were able to randomly assign large number of tax-payers to treatment and control, we were also dealing with a single implementation organization: the tax-collection department of Jesús María.

The first difficulty is that the collection department of Jesús María is a small organization, so that assigning employees to treatment or control would not provide any balance guarantee with respect to employee characteristics. In addition, in a resource constrained, tight-knit

Table 3: Summary statistics by treatment status

	Control	Treatment
Exo. Score	459.5	460.0
Endo. Score	545.0	555.2
$\mathbf{1}_{\text{Last year 3m repayment share>20\%}}$	0.498	0.515
Total Due	374.5	377.5
Property taxes Due	138.1	129.6
Arbitrios Due	236.4	247.9
Is Large Firm	0.050	0.054
Is Pricos	0.020	0.020
Has Employer	0.448	0.444
Has Education	0.199	0.205
Has Email	0.652	0.653
Has Cellular	0.792	0.788
Num Observations	6728	6704

Note: *Is Pricos* is an indicator used by the tax administration for the 500 top tax amounts owed. *Has Employer/Education/Email/Cellular* are indicator variables that take value 1 when a taxpayer has an entry in our data for the relevant characteristic.

organization, we could not guarantee that employees implementing the control collection process would not be influenced by the treatment collection mechanism. For these reasons, we organized a rotation of employee assignments to the treatment and the control collection mechanisms. This balances employees over time, which seemed preferable to potentially having long-term fixed differences.

More importantly, prioritized enforcement ended up being less labor intensive than the city's usual collection process (this is reflected in observable collection actions taken; informal estimates from our implementation partners suggest that the control collection process was 50% more time consuming than prioritized enforcement). As a result, employees nominally assigned to the treatment group spent part of their work-week helping employees assigned to the control treatment.

Because of this fluid labor assignment, our reduced form analysis includes both tax revenue and the number of collection actions taken as primary outcomes, allowing us to evaluate

both the revenue-enhancing and labor-saving impacts of prioritized enforcement. In addition, Section 6 shows that estimating individual repayment behavior as a function of collection actions and priority group assigned allows us to perform counterfactual evaluations for a range of mechanisms, including measuring the treatment effect of city-wide implementation.

4.2 Rank assignment

We used repayment data from 2019 and 2020, as well as information obtained by the government from credit rating agencies to build a simple predictive model of repayment behavior following delinquency. We set as our predicted variable of interest

$$Y = \mathbf{1}_{\text{3M repayment}>20\%}$$

i.e. the binary variable equal to 1 whenever the tax-payer repays at least 20% of their debt within 3 months of the debt becoming due. The threshold 20% was chosen in order to maximize the variance of the outcome variable: roughly 50% of tax-payers make that threshold.

Endogenous vs. exogenous covariates. We used covariates listed in Table 4, all of which are normalized to take values in $[0, 1]$. We distinguish models using or not the share of taxes repaid in the last year. The difficulty here is that if the mechanism assigns a low collection rank based on past failures to pay, then it provides dynamic incentives not to make repayments: repayment behavior is endogenous. Everything else equal, we would rather use only exogenous covariates, but we wanted to evaluate the potential gains from using endogenous information.

We refer to models using past repayment as endogenous, and to models excluding past repayments as exogenous. We fit linear, LASSO, and Random Forest models on training data using k-fold cross-validation. Table 4 reports coefficients from LASSO. As expected, past repayment behavior is a key predictor of current repayment. Having an email address,

covariate	exogenous covs only	incl. endogenous covs
is_local	0	0
has_email	0.155	0.104
has_cellular	0.091	0.077
has_employer	0.074	0.048
has_education	0.011	0
quantile_total_due	0.302	0.200
quantile_predial_due	0	0
quantile_arbitrios_due	0.031	0.029
quantile_tax_base	0	0
quantile_credit_score	0.034	0
quantile_salary	0	0
quantile_year_most_recent_car	0	0
quantile_age	0.062	0.008
quantile_past_delinquency	-0.010	0
last_year_share_repaid_by_3M	—	0.370
Num Observations	7940	7940

Table 4: LASSO Coefficients with and without endogenous covariate

and a mobile phone are also important predictors, possibly for selection reasons, but quite plausibly because these make it much easier for city officials to get in touch with the taxpayer.

We then evaluate all three models on 3441 out-of-sample data points by ranking tax-payers according to their predicted probability of repaying at least 20% of tax-due within 3 months, and computing the share of tax payers who actually do repay. There are three main takeaways. First, estimated ranks have predicting power, with 70 to 90% of highest ranked tax-payers being in partial repayment status within 3 months, and between 10 to 25% of the lowest ranked tax-payers being in partial repayment within 3 months. Second there is little difference across the linear, LASSO, and Random Forest models. Finally, while using endogenous past repayment behavior improves on the ranking of tax-payers (the curve of actual repayment shares is steeper, by construction it must have the same mean), the difference is not large. This suggests that excluding endogenous variables does not come at a high efficiency cost.

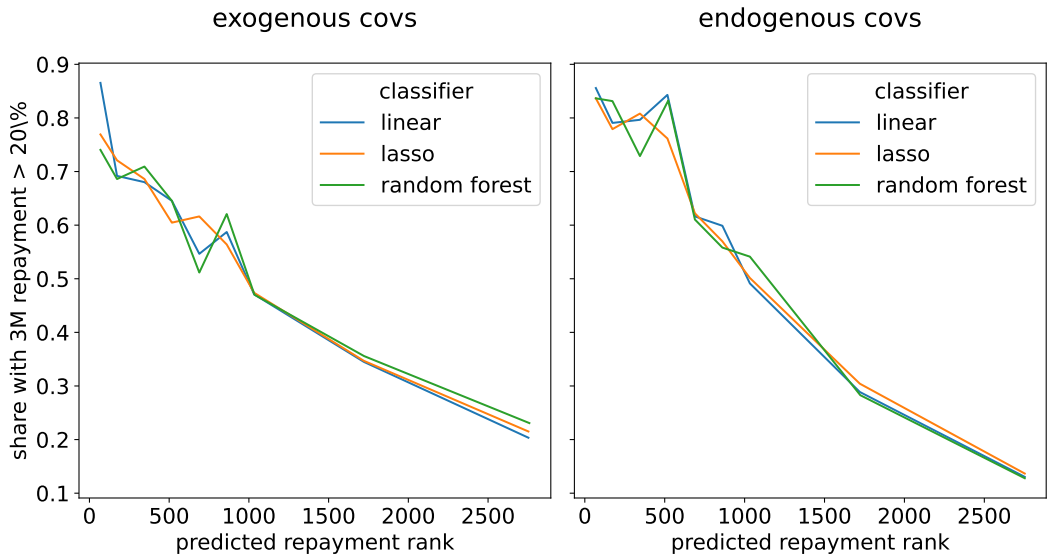


Figure 3: Classification performance, with exogenous and endogenous covariates.

Ultimately we assign each tax-payer i a subjective settlement probability $1 - q_i$ equal to the out-of-sample share of tax-payers with similar predicted repayment rate, repaying more than 20% of their taxes within 3 months. We average predictions across linear, LASSO, and random forest models. Half of treated tax-payers are assigned a subjective probability of repayment $1 - q_i$ based on models excluding endogenous covariates, half of treated tax-payers are assigned a subjective probability of repayment $1 - q_i$ based on models including exogenous covariates. The randomization is performed using the same balance objectives as in Section 4.1.

Progressivity. A difficulty with prioritized enforcement mechanisms is that in principle, they can be regressive. For instance, if tax-payers who owe relatively little are also very likely to repay, while tax-payers who owe large amounts are unlikely to repay, then scoring rule

$$z_i = \frac{(1 - q_i)D_i}{q_i}$$

may rank tax-payers who owe little ahead of tax-payers who owe large amounts. Fortunately this is not the case in our application. As Table 4 highlights, the predicted probability of

non-repayment q_i is decreasing in amount of tax due: tax-payers who owe more are therefore ranked ahead of tax-payers who owe less. As a result, we expect prioritized enforcement to enhance the progressivity of tax-collection.

4.3 Prioritized enforcement in the field

Our field implementation of prioritized enforcement reflects legal constraints on the timing of notification and collection steps, as well as concerns over commitment power, and delay in tax-payers' reactions. A total of 6704 tax-payers were assigned to this collection process.

Priority groups. At any given point in time during the experiment, we grouped tax-payers in three priority groups, G1, G2, and G3, corresponding to distinct collection promises. At any given point in time, the top 400 highest ranked tax-payers who had not paid more than 50% of their taxes were assigned to group G1, the next top 400 were assigned to group G2, and the remainder of our treatment sample was assigned to group G3. Group membership was updated on a weekly basis. New members of a given groups were sent a physical card, as well as an email clarifying the collection promise applying to them. A translated information letter for group G1 is reproduced in Table 5. Translated information letters for other groups are reproduced in Appendix A, along with Spanish originals.

Priority group G1 was given a promise that income would be garnished within 6 weeks if taxes remained unpaid. Information letters sent to priority group G2 were similar. Members of group G2 were promised that their income would be garnished within 12 weeks in the absence of tax payments. In addition, they were informed that they could be moved to group G1 at any time. The rationale for group G2 was to engage tax-payers higher level rationality, specifically level 2, and get this second group to start getting ready to make payments earlier. In contrast to group G2, members of group G3 did not receive a definite promise. They were informed of the amount of tax they owed, of the penalty for late payment, and that they

NOTICE OF IMMINENT COLLECTION	
We remind you that you have the following debt outstanding with the municipality:	**Amount**
The coercive collection process will start at the latest on:	**Today + 6 weeks**
and it can start at any time and without prior warning.	
If the coercive collection process is started your debt will include the penalties and administrative expenses regulated by law and will amount to:	**Amount*1.1 +US$35**
In addition to accruing a weekly interest of:	**Interest**
We remind you that it is on your own interest to pay immediately to avoid higher expenses. You can use any of our payment options listed below.	

Table 5: Information letter for priority group G1

could be moved to group G2 at any time. Tax-payers assigned to the control group (referred to as group N, for "no promises") received a notification of the amount of tax they owed, of similar complexity (see Appendix A, Figures C.1, C.2, C.3, and C.4).

We deviated from the general rule of assigning the 400 highest tax-payers to group G1 in two ways. The first time assignment took place (April 5th, 2021), 200 G1 spots were assigned to the highest ranked 200 tax-payers, and 200 G1 spots were randomly assigned to tax-payers with rank below the top 200. This allowed us to get an early estimate of the impact of getting a G1 collection promise versus a G3 or N collection promise, validating one of the key assumptions needed for prioritized enforcement to work: specific short-term promises significantly increase the settlement rate of tax-payers; and estimated repayment propensity predicts actual repayment propensity. A second deviation is that we increased the size of group 1 to 600 in June 2021, reflecting the fact that the number of garnishment orders issued remained significantly below the available capacity.

Excess promise making. We note that along the lines discussed in Section 2.3, we ended up issuing a higher flow of collection promises than the city government could really process in the worst case scenario where no tax-payer repaid their taxes. Indeed, in principle only

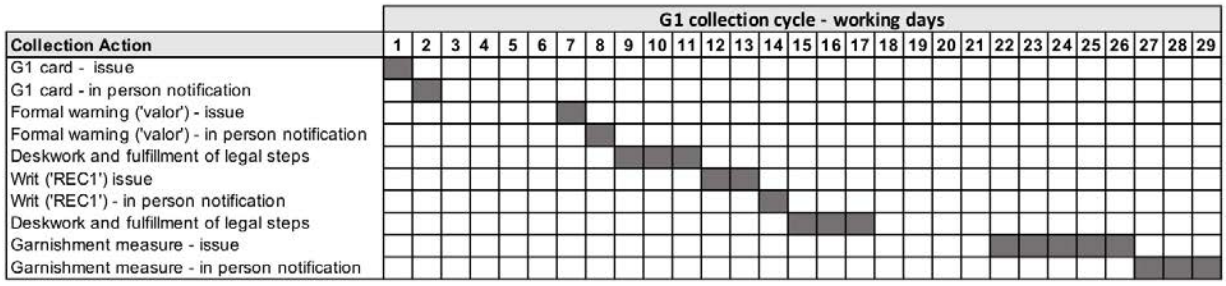


Figure 4: Schedule of collection actions for G1 tax-payers.

a half of the garnishment capacity is available to the treatment arm, this corresponds to a capacity of 200 tax-payers over 4 weeks, so roughly 300 tax-payers over 6 weeks. Therefore, if more than 3/4th of tax payers do not make required payments within 6 weeks, we would break promises made to members of group G1. This could potentially lead to multiple equilibria. As it turns out, even with this excess promise making, we do not consume all available garnishment capacity (across treatment and control, we end up issuing roughly 1100 garnishment orders over 5 months, instead of 2000). Issuing more promises than can be satisfied in the worst case scenario is motivated by significant delays in repayment.

Collection actions. To minimize the time-horizon of promises made to G1 members, in the treatment arm, collection actions were only taken if a G1 collection promise was issued. This led us to establish a fast processing schedule achieving the minimum delay in promise-delivery compatible with regulation. It is illustrated by Figure 4.

We did not implement any collection actions for members of groups G2 and G3 apart from sending them an initial information letter, and making reminder phone calls to the same proportion of delinquent tax-payers as in the control group. This choice was motivated by the fact that garnishment is the only collection step that has direct real consequences to tax-payers. As we discuss in Section 6 this assumption turned out to be wrong: sending legal writs likely has a large impact on tax-payer behavior, even if most cannot actually be acted

on by the city. This benefited collection in the control arm, where much larger resources were spent on issuing writs.

5 Raw Findings

This section documents raw findings. Because the treatment arm turned out to be less labor intensive than the control arm, we use as our main outcome both the total tax revenue as well as the number of collection actions taken by the city government. In addition we document key forces driving the effectiveness of prioritized enforcement: first, receiving clear short-term collection promises increases the settlement rate of tax-payers; second, it is possible to predict repayment propensity.

5.1 Main outcomes

Tax collection. Figure 5 displays cumulative 2021 tax collection for the treatment and control groups over the five months following the 2021 Q1 tax deadline. We include all 2021 property taxes paid during that period, even if they correspond to Q2, Q3 or Q4 taxes. A similar figure restricted to Q1 taxes only is provided in Appendix A.

As of September 15, 2021, total tax collection in the treatment group was 9.4% higher when compared to the control group. The speed of collection is also higher under treatment than control throughout the experiment. These raw findings require qualification. By design, we prioritize tax-payers who owe more taxes, and tax-payers with the highest taxes due are effectively under treatment for a larger amount of time. Along with the fact that the distribution of taxes-due has a long right-tail, it follows that the estimated 9.4% increase in collection associated to treatment is driven by the behavior of large tax-payers (see Appendix A). In Section 6, we estimate a treatment effect of 2.8% using a more robust model that uses only payment decisions, rather than payment amounts, to estimate the impact of prioritized enforcement on tax-payer behavior. This is our preferred estimate of the true expected

collection difference across treatment and control, before accounting for differences in the number of collection actions across treatment and control.

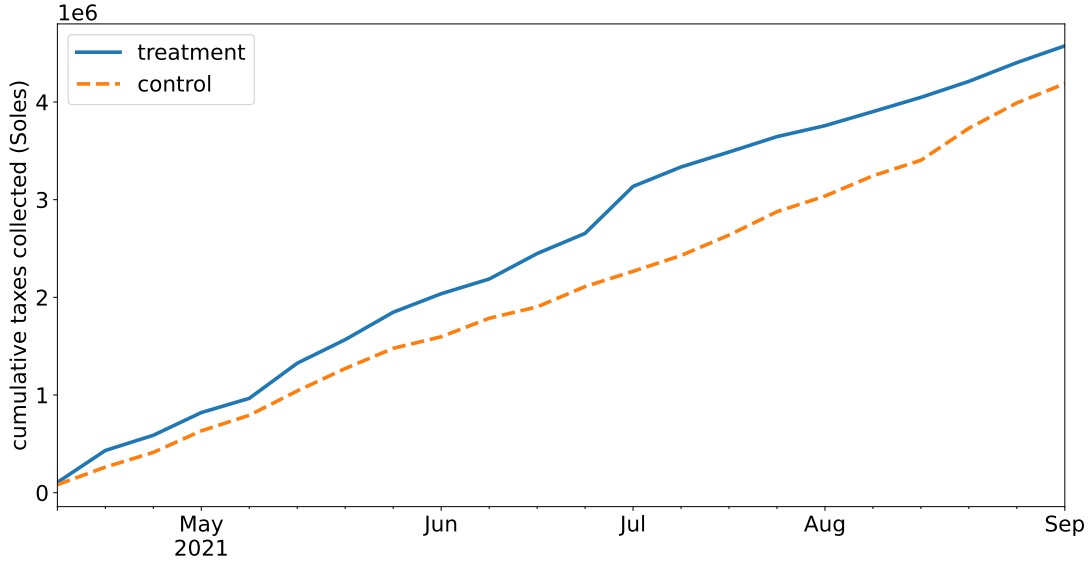


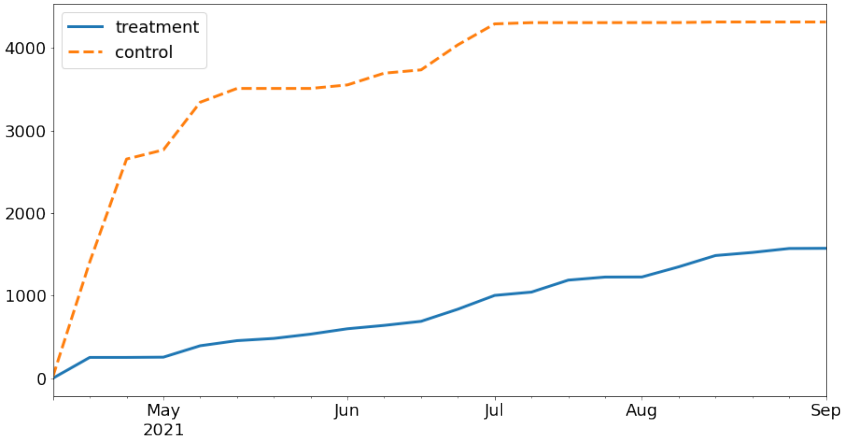
Figure 5: Cumulative Tax Collected April - September 2021

Collection actions. As we highlighted in Section 4, the collection process implemented in the treatment arm ended up being less labor intensive than the collection process implemented in the control arm. This is reflected in the number of collection actions taken, reported in Table 6 and illustrated in Figure 6.

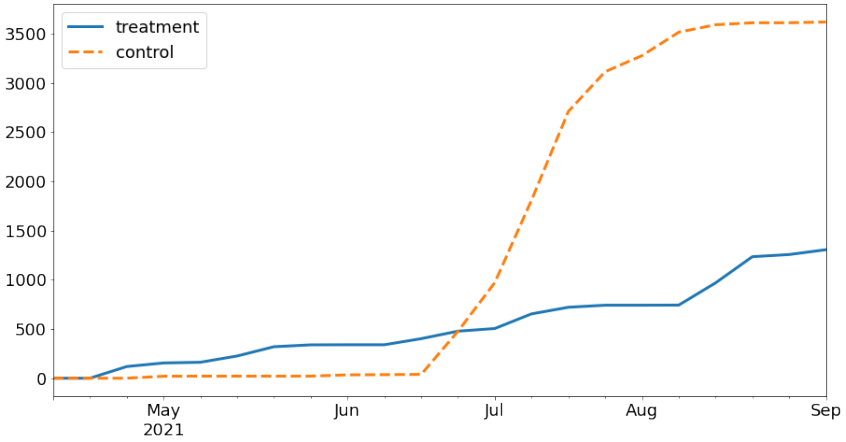
	Number of tax-payers who have received		
	notification	writ	garnishment
Treatment	1,534	1,283	537
Control	4,301	3,581	528

Table 6: Number of collection actions taken.

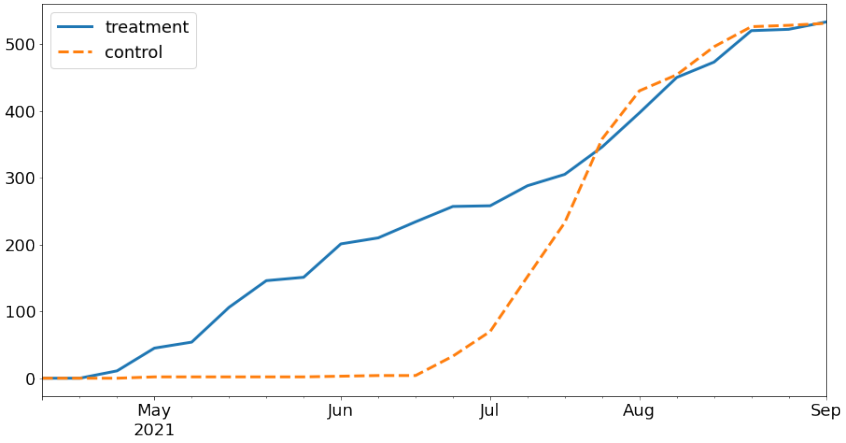
Although the number of garnishment orders issued is roughly the same across treatment and control, the city government issued 3 times as many notifications and writs in the



(a) Notifications issued.



(b) Writs issued.



(c) Garnishment orders issued.

Figure 6: Number of collection actions taken

control arm as in the treatment arm. This was driven by our focus on keeping garnishment promises, which led us to only issue notifications and writs to tax-payers in group G1. We study the impact of this greater use of relatively cheap collection actions in Section 6. We note that although group G1 was larger than available capacity, we were not able to reach the theoretical capacity for garnishment orders (approximately 2000 over 5 months of collection).

Progressivity of tax-collection. Because the predicted likelihood of repayment is an increasing function of taxes due, prioritized enforcement enhances the progressivity of tax-collection. This is illustrated by Figure 7 which plots the share of the total tax collected raised from tax-payers who fall within the bottom $q\%$ of the distribution of amount of taxes due, for increasing quantiles q. Treatment shifts the relative tax-collection curve to the right, indicating that tax-payers who owe large amounts of taxes pay a larger share of total taxes under treatment than control.

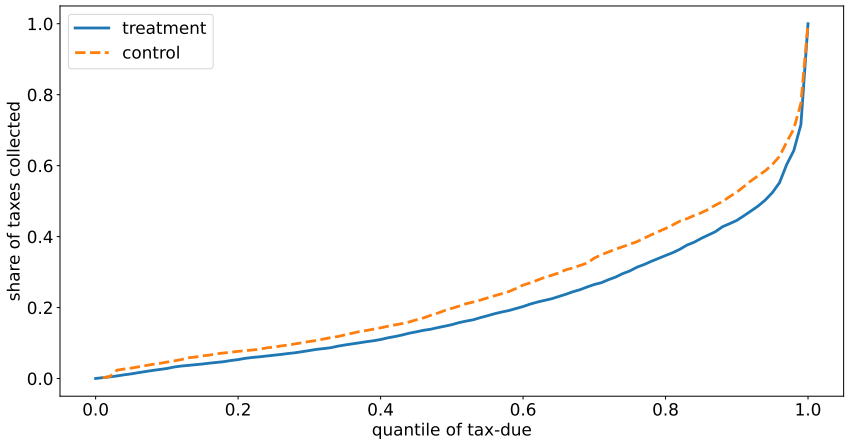


Figure 7: Share of total tax revenue collected as a function of quantile of taxes due.

5.2 Evidence on mechanisms

Most importantly, raw findings confirm that the basic ingredients needed for prioritized enforcement to improve collection are present:

- clear short-term promises significantly increase the settlement rate of tax-payers;
- our ranking of tax-payers usefully predicts repayment behavior.

In addition, we provide evidence that the impact of prioritized enforcement is likely to get stronger over time, as the government's reputation for delivering on promises grows.

Impact of short-term promises on settlement. Figure 8 focuses on tax-payers with rank less than 200 included in group G1 of the treatment arm as part of the first batch of group G1 assignments. It plots the share of tax-payers who have repaid at least 50% of tax-due. We use control tax-payers with similarly distributed scores as a comparison.

Tax-payers exhibit a significantly higher settlement rate under treatment than control. We emphasize that this is true in the first few weeks of group assignment. Since no collection actions take place during this period, the early impact of G1 membership is entirely driven by collection threats, rather than collection actions.

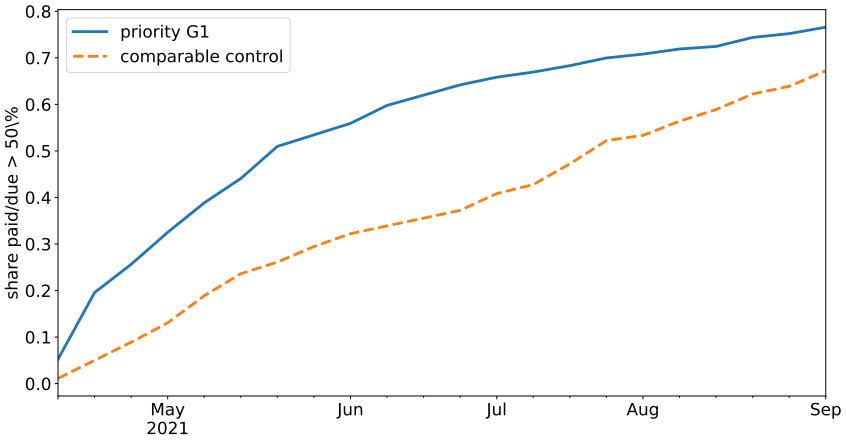


Figure 8: Repayment G1 vs Control, Rank<200

Predictability of repayment behavior. Figure 9 illustrates differential settlement behavior for the top 33% and the bottom 33% of tax-payers with respect to different predictors of repayment: predicted repayments from a model using endogenous past repayment, predicted repayments from a model excluding past repayments, and predicted repayments

ranking tax-payers based on total taxes due alone. Figure 9 suggests that all three rankings predict repayment behavior, but using endogenous data yields significantly better classification.

Note that better classification does not necessarily translate into better performance. As we noted in Section 2.2, the scoring rule only affects collection to the extent that it correctly ranks tax-payers into settlers and non-settlers. Improving the ranking of tax-payers within the group of settlers does not improve collection. We return to this point in Section 6.

Reputation formation. We assess the impact of treatment on the propensity of tax-payers to be delinquent in subsequent quarters. For all tax-payers delinquent in the first quarter, we observe the amount by which they are delinquent in Q1 (their Q1 Debt), and whether they had any debt related to second quarter taxes (Q2 Debt). If the tax-payer is not delinquent with respect to Q2 taxes, then their Q2 Debt is set to 0. For the sample of tax-payers delinquent in Q1, we estimate the following linear model via OLS:

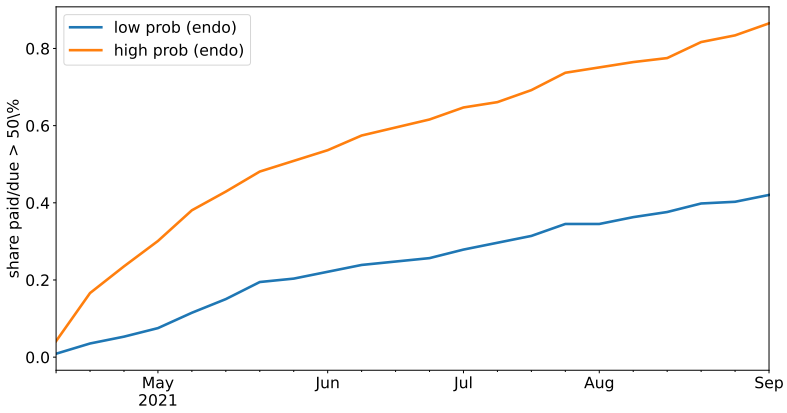
$$\frac{\text{Q2 Debt}}{\text{Q1 Debt}} \sim 1 \oplus \text{Treatment} \oplus \text{Assignment to G1}. \tag{3}$$

Estimated coefficients are reported in Table 7. Being assigned to treatment does not reduce Q2 Debt, but being assigned to group G1 does. This suggests that the effect of treatment may grow over time, as the number of tax-payers assigned to group G1 grows.

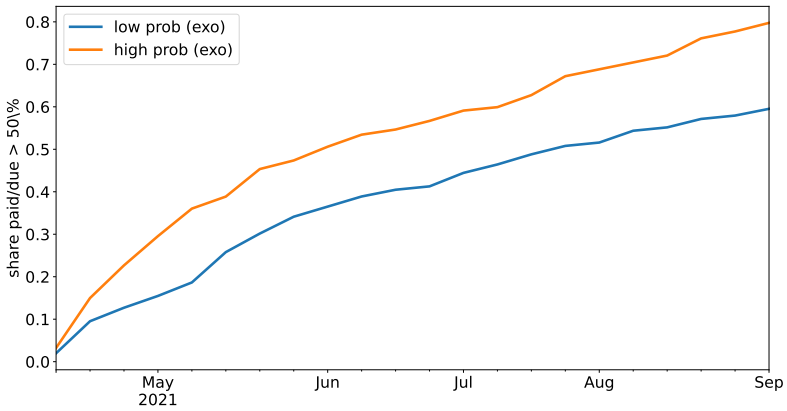
6 Counterfactuals

6.1 A Semi-structural model

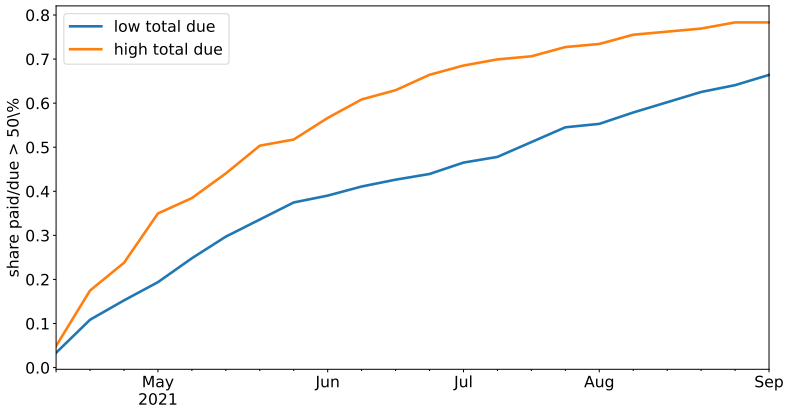
The core of our empirical strategy is to estimate a model of settlement as a function of threats made, and collection actions taken. This model is semi-structural in the sense that it allows us to evaluate many relevant, but not all, counterfactual policies. In particular, we



(a) predicted repayment, using past repayment behavior.



(b) predicted repayment excluding past repayment behavior.



(c) predicted repayment given taxes due.

Figure 9: Share of population having repaid more than 50% of taxes due, by top third, and bottom third of predicted repayment probability

	Q2 Debt
Constant	1.3771***
	(0.0106)
Treatment	0.0075
	(0.0141)
Assignment to G1	-0.2181***
	(0.0354)
Observations	13432

Robust standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7: Impact of treatment on subsequent delinquency.

cannot estimate how failures to deliver on promises on time affects the settlement rate of tax-payers. For this reason we only consider counterfactual policies that do not affect the city government's ability to deliver on promises. This includes an estimate of the impact of prioritized enforcement, keeping the number of collection actions the same across treatment and control.

Repayment behavior. We assume that each tax-payer i is associated with a persistent observed characteristic $\xi_i \in \mathbb{R}$, and an unobserved persistent type $\theta_i \in \mathbb{R}$, drawn i.i.d. across tax-payers from a Gaussian distribution $\mathcal{N}(0, \sigma^2)$. In our implementation, we use as observed characteristic the tax-payer's predicted repayment probability from our most predictive model (which includes past repayment behavior).[15] Unobserved type θ_i serves to explain correlation in repayment behavior across periods, and captures the impact of selection over time: tax-payers who have not made repayments after 3 months are systematically different from tax-payers who have not made repayments after 2 weeks.

At the beginning of each period t (before payment actions are taken), the city government assigns the tax-payer a priority $g_t \in \{G1, G2, G3, N\}$ and takes a collection action $a_t \in \{\text{garnishment}, \text{writ}, \text{notification}, N\}$. Both priorities and actions are ordered: $N \prec G3 \prec$

[15] This does not affect individual incentives, since this data is not used to specify the tax-payer's individual rank, but rather to control for heterogeneity in our analysis of overall tax-payer behavior.

$G2 \prec G1$ and $N \prec$ notification $\prec$ writ $\prec$ garnishment. We assume that both priorities and actions increase over time.

In each period t, a tax-payer i makes a payment with Poisson intensity $\lambda_{i,t}$. We denote by $s_{i,t} = 1$ the event that the tax-payer makes a payment, and by $s_{i,t} = 0$ the event that they don't. We assume that conditional on making a payment, the share of taxes-due repaid with this payment, $\pi_t \in [0, 1]$, is drawn from a fixed distribution $f_{\pi,i}$. Let $T_i(t)$ denote the set of tax-payer i's payment times occurring strictly before t. We denote by $\Pi_{i,t} = \sum_{s \in T_i(t)} \pi_{i,s}$ the running sum of relative payments made up to period t. The distribution of payments $f_{\pi,i}$ is conditioned on amount due: tax-payers are placed into one of 13 bins based on amount due, and π_t for a taxpayer in a bin is drawn from the empirical distribution of payments in that bin. If a tax-payer's payments exceed our estimate of total taxes due for the year (i.e. 4 times quarterly taxes due, or $\Pi_{i,t} > 4$), settlement intensity $\lambda_{i,t}$ is set to 0.

Let $X_{i,t}$ denote the vector of covariates

$$X_{i,t} = \begin{bmatrix} \mathbf{1}_{\Pi_{i,t}>0} \\ \Pi_{i,t} \\ \mathbf{1}_{g_{i,t}=g} \text{ for } g \in \{G1, G2, G3\} \\ \mathbf{1}_{a_{i,t}=a} \text{ for } a \in \{\text{garnishment}, \text{writ}, \text{notification}\} \\ \xi_i \end{bmatrix}.$$

We assume that in each period, tax-payer i makes a payment with Poisson intensity $\lambda_{i,t}$ taking the form

$$\lambda_{i,t}(\theta_i, \beta) = \max\{10^{-3}, \phi(\langle X_{i,t}, \beta \rangle + \theta_i) \times \mathbf{1}_{\Pi_{i,t}<4}\} \tag{4}$$

where ϕ is a non-decreasing S-shaped function, parameterized by $\varphi \in \mathbb{R}^2$, specified below. Note that conditional on type θ_i, the intensity of payment behavior at time t depends only on the current priority group $g_{i,t}$, and the latest collection action taken $a_{i,t}$ (alternative specifications described in Appendix A lead to very similar estimates). The past only affects

expected settlement intensity through the posterior distribution over types θ_i.

The per-period payment probability associated with intensity $\lambda_{i,t}$ is denoted by $\Lambda_{i,t} \equiv 1 - \exp(-\lambda_{i,t}) \simeq \lambda_{i,t}$.

Collection actions and priorities. Let us denote by $h_{i,t} = (\xi_i, a_{i,s}, g_{i,s}, \pi_{i,s})_{s \leq t}$ the public history of actions, priority assignments, and payments made, associated with tax-payer i at time t.

Assumption 1 (info)**.** *We assume that the distribution of priority assignments $g_{i,t}$ and collection actions $a_{i,t}$ are functions of public data $h_{i,t}$ alone. We denote by*

$$G(\cdot|h_{i,t}) \in \Delta(\{G1, G2, G3, N\} \times \{\textit{garnishment, writ, notification, N}\})$$

the joint distribution of distributions of $g_{i,t}$ and $a_{i,t}$ conditional on public history $h_{i,t}$.

The assumption that priorities $g_{i,t}$ and actions $a_{i,t}$ are a function of public data alone is true by construction in the treatment arm of our experiment: we assigned priorities and collection actions on the basis of data shared by the city government. In principle it is possible that in the control arm, collection actions taken by the government could have depended on signals of type θ_i unavailable to us. This is ruled out by Assumption 1.

In the language of Engle et al. (1983), Assumption 1 guarantees that priorities $g_{i,t}$ and actions $a_{i,t}$ are weakly exogenous to parameters (φ, β, σ), so that we don't need to explicitly specify the data generating process for priorities and actions in order to estimate (φ, β, σ). Specifically the likelihood of final histories $h_{i,T}$ can be factorized as follows.

For any final history $h_{i,T}$,

$$\mathsf{prob}(h_{i,T}|\varphi,\beta,\sigma) = \prod_{t=1}^{T} G(g_{i,t},a_{i,t}|h_{i,t}) \times \prod_{t=1}^{T} f_{\pi,i}(\pi_{i,t})^{s_{i,t}} \times \underbrace{\int_{\theta\sim\mathcal{N}(0,\sigma)} \prod_{t=1}^{T} \Lambda_{i,t}(\theta,\beta)^{s_{i,t}} \cdot (1-\Lambda_{i,t}(\theta,\beta))^{1-s_{i,t}}}_{\equiv\Psi(h_{i,T}|\varphi,\beta,\sigma)}.$$

Importantly, the first two factors do not depend on parameters of interest $\varphi, \beta,\ \sigma$. This implies that parameters $\varphi, \beta,\ \sigma$ can be efficiently estimated using the conditional log-likelihood.

$$\mathcal{L}(h_T|\varphi,\beta,\sigma) \equiv \sum_{i\in I} \log(\Psi(h_{i,T}|\varphi,\beta,\sigma)). \tag{5}$$

In turn, $f_{\pi,i}$ can be estimated parametrically or non-parametrically, using conditional payment data in the event a payment is made, for tax-payers owing an amount of tax-due similar to tax-payer i.

We note that by construction, parameters of interest are not affected by tax-payers with large amounts of tax-due. Instead, parameters of interest are estimated using only tax-payers binary decision to make a payment or not in any period. This allows us to form more robust estimates of treatment effects than those obtained from raw averages.

6.2 Findings

Implementation. We compute a posterior distribution over parameters φ, β, σ using Markov Chain Monte Carlos (Chernozhukov and Hong, 2003).[16]

[16]We use the stretch-move kernel transition functions proposed in Goodman and Weare (2010), implemented for the Python programming language by Foreman-Mackey et al. (2013), available as the emcee package. We run 4,000 iteration steps with 128 walkers. We seed the initial state with parameter estimates obtained by applying a differential evolution algorithm (Storn and Price, 1997) to 11 parameter configurations chosen with uniform probability over the range of possible parameters.

Given parameters $\varphi = (\underline{\varphi}, \overline{\varphi}) \in \mathbb{R}^2$, we specify function ϕ (defined in 4) as

$$\phi(x) = \min\left\{\overline{\varphi} - \underline{\varphi}, \max\{x - \underline{\varphi}, 10^{-3}\}\right\}.$$

Recall that ϕ is the function mapping covariates and persistent types in equation 4 to payment intensity $\lambda_{i,t}$. We aggregate payments at the weekly level, so that $1 - \exp(-\lambda_{i,t}) \simeq \lambda_{i,t}$ is the probability tax-payer i makes a payment in week t.

Our preferred specification imposes that the coefficient $\beta_{\text{notification}}$ associated with notifications be non-negative. This is an intuitive restriction: every collection process needs to start with a notification, so receiving a notification should increase perceived incentives to repay. However, our data partially challenges this prior restriction: during the first 2 months of the experiment, tax-payers in the control group that receive a formal notification tend to make payments at a lower rate than tax-payers who have not received a notification. The pattern is not present in the treatment group, or in the control group during the second half of the experiment. We discuss the data, possible explanations (other than noise), and their implication for design in Appendix A. Removing this prior-restriction does not qualitatively change the inferences we draw from data.

From this estimation, we recover 12 parameters:

$$\begin{aligned}
&\beta_{\Pi_{i,t}>0}, \beta_{\Pi_{i,t}},\\
&\beta_{G1}, \beta_{G2}, \beta_{G3},\\
&\beta_{\text{garnishment}}, \beta_{\text{writ}}, \beta_{\text{notification}},\\
&\beta_{\xi}, \sigma,\\
&\underline{\varphi}, \overline{\varphi}.
\end{aligned}$$

Parameters. Table 8 reports posterior means and standard deviations for parameters of interest.[17] Corner plots, as well as estimates computed considering only the payment of

[17]Following recommended practice, we discard all but the last 1000 iterations of the MCMC chain (with 128 parallel walkers). We then drop parallel walkers that have smaller likelihood in their final iteration than

Q1-dated taxes only, are provided in Appendix A. The following findings are particularly notable.

Consistent with the reduced-form evidence reported in Section 5, inclusion in group G1 has a large impact on payment intensity, and predicted settlement probability ξ_i is indeed predictive of settlement behavior. In contrast, the coefficient associated with priority G2 is much smaller. This means that our design did not successfully engage the higher level rationality of tax-payers. We speculate about possible alternatives in Section 7.

Issuing formal writs has a meaningfully large impact on settlement behavior.[18] This suggests that the systematic use of writs in the control sample may have increased settlement rates in the control sample. Our estimate of coefficient σ also suggest significant amounts of unobserved heterogeneity in types. Coefficients on payment variables suggest that tax-payers who have made some payments are subsequently more likely to make further payments, but less so if the relative amount paid is larger.

6.3 Counterfactuals

Assumption 2 (valid extrapolation)**.** *Provided that promises are kept, changing the process for priorities $g_{i,t}$ and actions $a_{i,t}$ does not affect the settlement behavior of tax-payers.*

This implies that estimated parameters φ, β, σ allow us to evaluate counterfactual mechanisms assigning actions and priorities as a function of public histories, provided that promises continue to be kept under the counterfactual, keeping fixed the settlement behavior of tax-payers.

In the language of Engle et al. (1983), this ensures that the priority assignment and collection action process is super-exogenous to settlement behavior over the restricted class

the 15^{th} percentile of likelihood across walkers. This leaves us with 108 walkers, which are combined into a single sample for each parameter. We do not thin the samples (i.e. discarding $n-1$ of every n observations for some $n > 1$). The estimates are not sensitive to these decisions.

[18] Note that the coefficients associated with each collection action should not be added to get the current impact of collection actions. Instead, the coefficient associated with each collection action summarizes the aggregate effect of the current action and preceding required collection steps.

	Mean	(std. dev.)
$\beta_{\Pi_{i,t}>0}$	$3.22 \cdot 10^{-2}$	$(2.62 \cdot 10^{-3})$
$\beta_{\Pi_{i,t}}$	$-3.78 \cdot 10^{-2}$	$(1.10 \cdot 10^{-3})$
β_{G1}	$3.06 \cdot 10^{-2}$	$(2.55 \cdot 10^{-3})$
β_{G2}	$0.50 \cdot 10^{-2}$	$(2.87 \cdot 10^{-3})$
β_{G3}	$-0.65 \cdot 10^{-2}$	$(1.37 \cdot 10^{-3})$
$\beta_{\text{garnishment}}$	$1.08 \cdot 10^{-2}$	$(3.38 \cdot 10^{-3})$
β_{writ}	$2.96 \cdot 10^{-2}$	$(2.15 \cdot 10^{-3})$
$\beta_{\text{notification}}$	$0.16 \cdot 10^{-3}$	$(0.15 \cdot 10^{-3})$
β_{ξ}	$1.20 \cdot 10^{-1}$	$(4.05 \cdot 10^{-3})$
$\underline{\varphi}$	$0.86 \cdot 10^{-2}$	$(1.92 \cdot 10^{-3})$
$\overline{\varphi}$	$3.07 \cdot 10^{-1}$	$(0.74 \cdot 10^{-1})$
σ	$0.49 \cdot 10^{-1}$	$(2.30 \cdot 10^{-3})$

Table 8: Estimating the settlement behavior of tax-payers.

of mechanisms that maintain promises. Throughout the rest of this section, counterfactuals are chosen so that under simulated behavior they do not break the capacity constraint of 200 garnishments per month.[19] We provide simulations of capacity use in Appendix A.

Relevant counterfactuals. We are interested in the following counterfactuals whose results are summarized in Table 9:

1. *Replicating experimental findings in a manner robust to large repayments.* We reproduce collection rates under simulated treatment and control group subjected to collection actions similar to the ones respectively used under treatment and control in our actual experiment. The goal here is to estimate the treatment effect of the actual policies put in place, averaging out noise associated with large repayments.

   Table 9 reports a 3.8% increase in repayment, taking as given the very lopsided profile

[19] To make sure our counterfactuals do not break capacity constraints, we promote tax-payers into group G1 gradually: we initialize 200 tax-payers in G1 and all other tax payers in G3, and restrict promotion into G1 to a maximum of 70 a week. This ensures that the no more than 200 garnishments per month in any simulation.

of collection actions under actual treatment and control.

2. *Increasing the number of notifications and writs to match the control group.*[20]

   This lets us evaluate the uncontaminated counterfactual treatment effect of introducing prioritized enforcement without changing the number of relatively cheap collection actions taken across the treatment and control groups.

   As Table 9 reports, increasing the number of writs has a significant impact, increasing tax collection by 8.3% over treatment, resulting in a combined 11.3% increase in tax collection over control. This is our preferred estimate of treatment effects adjusting for differences in the number of collection actions taken.

3. *Ranking tax-payers based on endogenous scores, exogenous scores, total tax due, and a uniform random order.*

   This addresses several policy relevant questions. Is the loss from using exogenous data to rank tax-payers large? Second, can we simplify the scoring rule, and use only tax-due as a basis for ranking? Third, is ranking players at all important? Could we use a random order which may be perceived as a fairer procedure?

   As Table 9 reports, whether we use a rank based on endogenous scores, exogenous scores, or total tax-due has a negligible impact on tax-revenue. This is because to a first order what matters is how the ranking splits tax-payers between those who are assigned a priority G1 at some point, and those who aren't. Changes of the relative ranking within the group of tax-payers ultimately assigned priority G1, and within the group of tax-payers not assigned priority G1 matter less.

   In contrast, using a uniformly random rank causes meaningful losses in revenue, -14.8% against the treatment group, and -12.5% against the control group.

[20] We target issuing 3000 notification within the first 4 weeks, and 3000 writs from week 4 to week 8.

counterfactual policy	change in tax-revenue vs. treatment	vs. control
treatment	–	+2.8%
increased number of writs	+8.3%	+11.3%
endogenous rank	−0.1%	+2.6%
exogenous rank	+0.9%	+3.7%
tax-due rank	+0.8%	+3.6%
random rank	−14.8%	−12.5%

Table 9: Counterfactual treatment effects.

7 Conclusion

7.1 Summary

We study the practical implementation of prioritized-enforcement mechanisms in the context of a field application to the collection of property taxes in a municipality of Lima (Peru).

Raw findings, as well as inference from a semi-structural model suggest that:

(i) As is, our implementation was beneficial to the city, moderately increasing collection amounts, and reducing the number of collection actions taken.

(ii) The key ingredients needed to run a prioritized-enforcement mechanism are present: clear threats increase the rate at which tax-payers settle, and tax-payers' propensity to settle is predictable.

(iii) Tax-payers' delay in reacting to threats changes the trade-off between making promises that can be robustly delivered on, and affecting as many tax-payers as possible.

7.2 Speculation

Along lines suggested by Banerjee et al. (2017), we conclude by speculating about the external validity of our findings across environments and across designs.

Commitment. An essential requirement of prioritized enforcement mechanisms is that threats from the principal should be credible, this is why the principal refrains from issuing more threats than can plausibly be acted on. Because the city of Jesús María had stopped issuing pardons for tax delinquency in the 5 years prior to our experiment, we believe its commitments were quite credible to tax-payers. We expect that prioritized enforcement may be slower to affect settlement intensities in circumstances where the principal is less credible. Instead the principal would have to rebuild credibility by ensuring that threats are indeed delivered on.

This perspective has implications for how the effectiveness of prioritized enforcement may change over time. If the principal is cautious about issuing threats, and delivers on a high share of threats conditional on non-settlement, then its credibility will grow over time. Credibility may be further enhanced by publishing information about the city's enforcement rates. In contrast, if the principal issues too many threats so that rates of enforcement on deliquent debts fall, then the principal's credibility, and the effectiveness of prioritized enforcement will diminish over time.

Incentives for faster repayment. Legal constraints limited the incentives for early repayment we were capable of providing. The yearly interest rate charged on debts is quite low (on the order of of 1 to 3% a year depending on the nature of the debt), and the main penalty corresponds to administrative costs incurred in enforcing the debt (on average, USD 35), and a 10% penalty applied to debts for which a legal writ has been issued. We believe that greater, and especially more explicit, incentives for fast repayment would have improved the effectiveness of prioritized enforcement. One possible design, seeking to exploit loss aversion, would be to set a high penalty on day 1 of taxes becoming past due, and giving the tax

payer reduction vouchers forgiving part of the penalty. Vouchers would expire one by one at the end of every month.

Engaging higher level rationality via small enforcement groups. We think there may be significant benefits from finding better ways to engage the higher level rationality of tax-payers. For instance, if the coefficient β_{G2} associated with G2 priorities were half as high as the coefficient β_{G1} associated with G1 priorities, then total collection would increase by a further 1.7% over treatment.

One possible design, discussed in Chassang et al. (2022) consists in pairing each G2 tax-payer with a single G1 tax-payer and let them know that: (1) they are ranked number 2 in a small prioritized enforcement group; (2) as soon as the tax-payer ahead of them settles, then they will be ranked number 1; (3) they will be forgiven a late payment penalty if they pay before they get ranked number 1 in their small enforcement group. The idea here is that being ranked number 2 within one of 400 small enforcement groups is more striking than being ranked number 401 within one large enforcement group in which 400 collection steps are concurrently initiated.

Appendix

A Further Empirical Analysis

This appendix provides further analysis, specifically: we provide corner plots for the MCMC estimation of the parameters of our semi-structural model; we evaluate the robustness of findings to various specification changes; we study the possibility that notifications may have a negative impact on settlement, at least in some circumstances; we clarify that most of the treatment effect is driven by the behavior of tax-payers with high taxes-due.

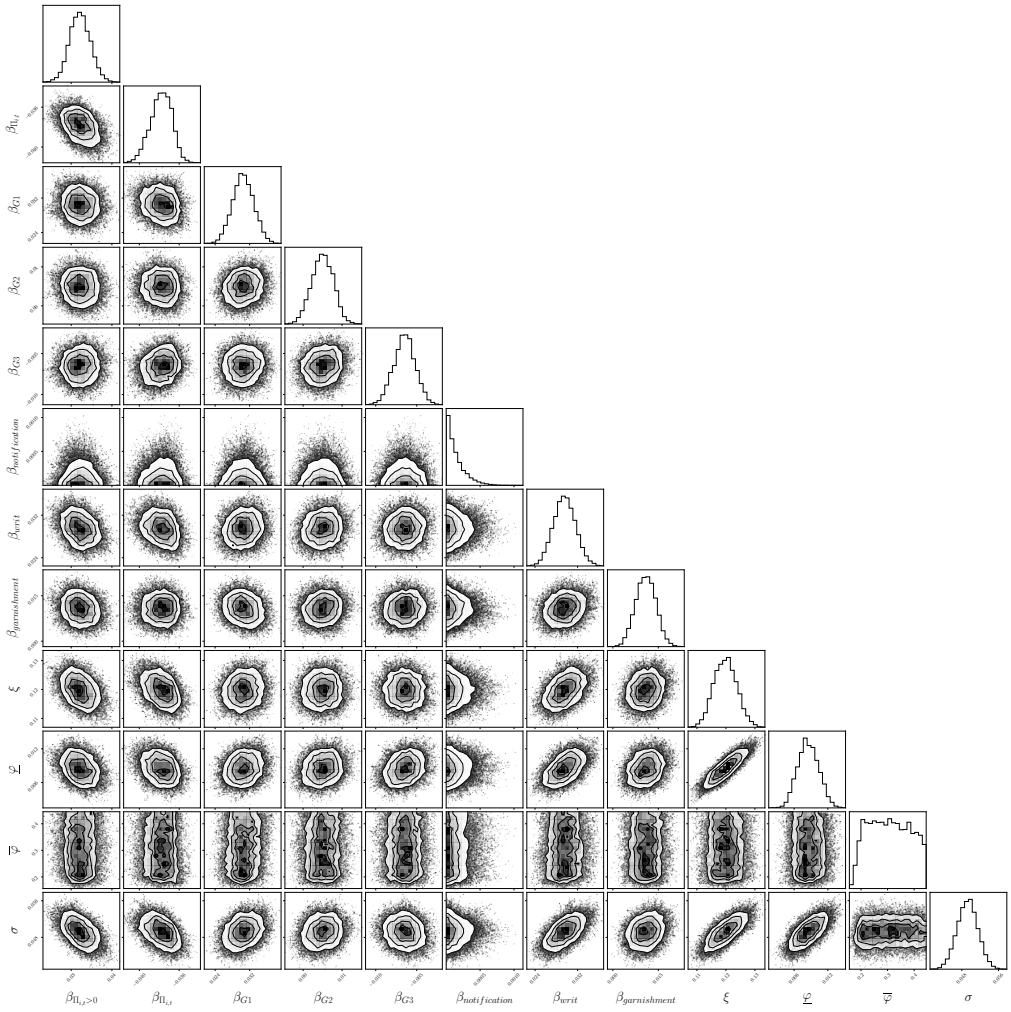


Figure A.1: Corner plot of MCMC estimation.

A.1 Corner plots

Figure A.1 provides corner plots describing the distribution of parameters from the MCMC sampler, using the python package corner (Foreman-Mackey, 2016). The top panel in each column is the distribution of model parameters and all other plots show pairwise joint distributions. To compute these plots, all but the final 1000 samples are discarded. We further restrict attention to samples from the chain that are above the 15^{th} percentile of the likelihood distribution.

A.2 Other model specifications

Findings using Q1 taxes only. The main text of the paper considers all tax payments made by tax-payers delinquent on their Q1 taxes, whether the payments correspond to Q1, or Q2-Q4 taxes.

Our findings are similar if we focus on payments relating to Q1 taxes alone, though parameter estimates from the model are mechanically smaller since there are less payment events. We report both tax collection by experimental group, and parameter estimates for the model of Section 6.

Cumulative 2021 tax collection of Q1 debt by experimental group during the five months following the first-quarter 2021 tax deadline is shown in Figure A.2. The pattern is very similar to total tax collection for unrestricted payments presented in Figure 5.

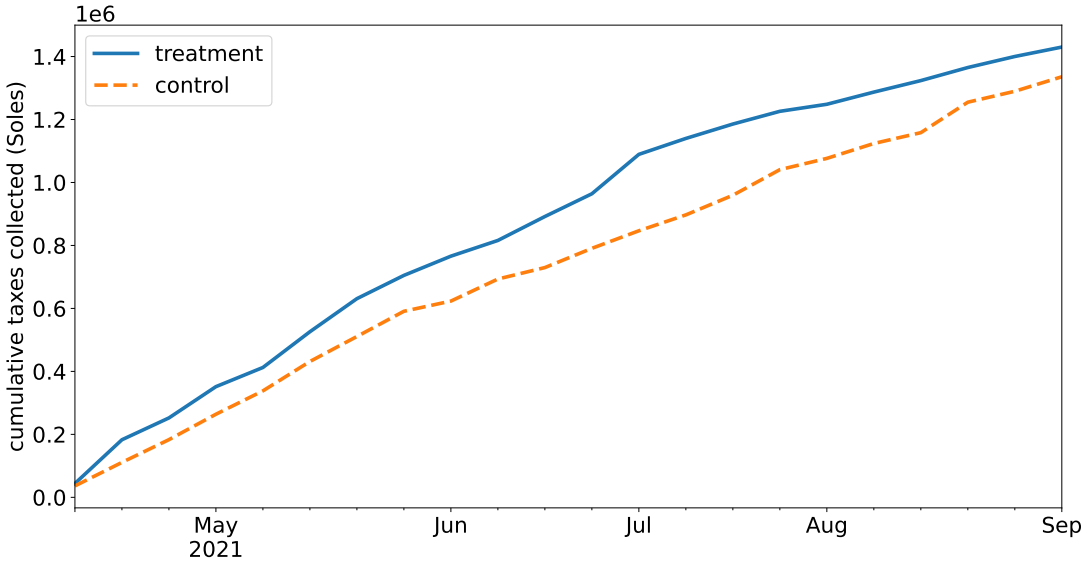


Figure A.2: Cumulative Tax Collected April - September 2021, Q1 Debt Only

Table A.1 reports posterior means and standard deviations for parameters of interest in the estimation restricted to payments of Q1 debt only. Estimates are qualitatively similar to those for unrestricted payments reported in Table 8, though settlement intensities are

	Mean	(std. dev.)
$\beta_{\Pi_{i,t}>0}$	$4.75 \cdot 10^{-1}$	$(0.20 \cdot 10^{-1})$
$\beta_{\Pi_{i,t}}$	$-5.65 \cdot 10^{-1}$	$(0.22 \cdot 10^{-1})$
β_{G1}	$1.48 \cdot 10^{-2}$	$(0.22 \cdot 10^{-2})$
β_{G2}	$0.15 \cdot 10^{-2}$	$(0.24 \cdot 10^{-2})$
β_{G3}	$-0.19 \cdot 10^{-2}$	$(0.07 \cdot 10^{-2})$
$\beta_{\text{garnishment}}$	$0.23 \cdot 10^{-2}$	$(0.20 \cdot 10^{-2})$
β_{writ}	$1.17 \cdot 10^{-2}$	$(0.15 \cdot 10^{-2})$
$\beta_{\text{notification}}$	$0.90 \cdot 10^{-4}$	$(0.92 \cdot 10^{-4})$
β_{ξ}	$8.85 \cdot 10^{-2}$	$(0.22 \cdot 10^{-2})$
$\underline{\varphi}$	$0.40 \cdot 10^{-5}$	$(0.69 \cdot 10^{-3})$
$\overline{\varphi}$	$7.23 \cdot 10^{-2}$	$(0.16 \cdot 10^{-2})$
σ	$3.54 \cdot 10^{-3}$	$(0.24 \cdot 10^{-2})$

Table A.1: Estimating the settlement behavior of tax-payers for Q1 debt.

mechanically smaller. The coefficient on $G1$ is smaller by a factor of roughly two, while the coefficient on writs is smaller by a factor of roughly two and a half.

Time trend. In Table A.2, we report posterior means and standard deviations from an estimation in which we allow for a linear time trend equal to the number of weeks elapsed since the beginning of the experiment, while still imposing the lower bound of 0 on the coefficient on notifications. Estimates are similar to those reported in Table 8. The coefficient on the linear time trend, β_t, is positive, though small. A notable difference is that the coefficient on having made some payment ($\beta_{\Pi_{i,t}>0}$) has flipped sign and become negative. This is consistent with the fact that payments $\Pi_{i,t} > 0$ are mechanically increasing in time, and therefore positively correlated to t.

	Mean	(std. dev.)
$\beta_{\Pi_{i,t}>0}$	$-1.17 \cdot 10^{-2}$	$(0.40 \cdot 10^{-2})$
$\beta_{\Pi_{i,t}}$	$-5.94 \cdot 10^{-2}$	$(0.23 \cdot 10^{-2})$
β_{G1}	$5.22 \cdot 10^{-2}$	$(0.41 \cdot 10^{-2})$
β_{G2}	$0.85 \cdot 10^{-2}$	$(0.42 \cdot 10^{-2})$
β_{G3}	$-0.52 \cdot 10^{-2}$	$(0.23 \cdot 10^{-2})$
$\beta_{\text{garnishment}}$	$0.97 \cdot 10^{-2}$	$(0.48 \cdot 10^{-2})$
β_{writ}	$3.60 \cdot 10^{-2}$	$(0.28 \cdot 10^{-2})$
$\beta_{\text{notification}}$	$0.23 \cdot 10^{-3}$	$(0.24 \cdot 10^{-3})$
β_{ξ}	$2.25 \cdot 10^{-1}$	$(0.98 \cdot 10^{-2})$
β_{t}	$0.41 \cdot 10^{-2}$	$(0.28 \cdot 10^{-3})$
$\underline{\varphi}$	$1.00 \cdot 10^{-1}$	$(0.78 \cdot 10^{-2})$
$\overline{\varphi}$	$2.92 \cdot 10^{-1}$	$(3.66 \cdot 10^{-2})$
σ	$1.11 \cdot 10^{-1}$	$(0.53 \cdot 10^{-2})$

Table A.2: Estimating the settlement behavior of tax-payers allowing for linear time trend.

Alternative ϕ. In Table A.3, we report posterior means and standard deviations from an estimation in which ϕ (defined in 4) takes the form of a logistic function:

$$\phi(x) = \frac{\overline{\varphi}}{1 + e^{-(x-\underline{\varphi})}}$$

for $\underline{\varphi} \in \mathbb{R}$ and $\overline{\varphi} \in \mathbb{R}_+$.

Findings remain qualitatively similar: both group G1 assignment and writs have a large impact on settlement intensities.

A.3 Investigating the impact of notifications

As we discuss in Section 6, our main specification imposes the prior restriction that the coefficient on notifications is weakly positive. This restriction is at least in part challenged by aspects of our data.

	Mean	(std. dev.)
$\beta_{\Pi_{i,t}>0}$	1.30	(0.27)
$\beta_{\Pi_{i,t}}$	−1.37	(0.47)
β_{G1}	1.05	(0.34)
β_{G2}	0.15	(0.50)
β_{G3}	−0.21	(0.26)
$\beta_{\text{garnishment}}$	0.34	(0.32)
β_{writ}	1.15	(0.30)
$\beta_{\text{notification}}$	0.14	(0.63)
β_{ξ}	4.40	(0.40)
$\underline{\varphi}$	3.23	(0.63)
$\overline{\varphi}$	0.15	(0.16)
σ	1.78	(0.24)

Table A.3: Estimating the settlement behavior of tax-payers using a logistic ϕ.

Data. In Figure A.3, we plot the average across control-group tax-payers of the relative payments they make each week, as a fraction of annualized Q1 debt. We split the population in two subgroups: (1) the group of tax-payers for whom the most recent collection-action taken is a notification, and (2) the group of tax-payers who have not yet been subjected to any action. In Figure A.4, we plot the same statistic for the treatment group. In April and May 2021, control group tax-payers who had received no collection action settled their taxes at a much higher rate than tax-payers who received just a notification. This is not the case in the treatment group, and this is not the case in later periods.

We note that there is no evidence that the city engaged in significant selection when issuing notifications: tax-payers who are issued a notification by June are not predicted by our scoring model to be more likely to repay than those against whom no action had been taken by June (0.40 v.s. 0.41), but do have higher amount owed on average (440 soles v.s. 338 soles).

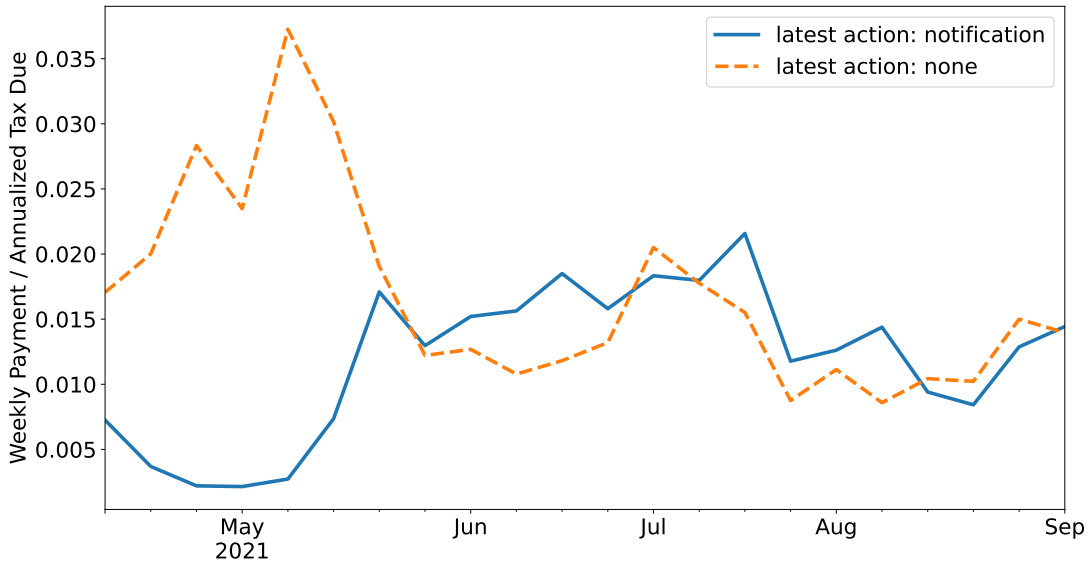


Figure A.3: Payment given latest action (notification or none), control group.

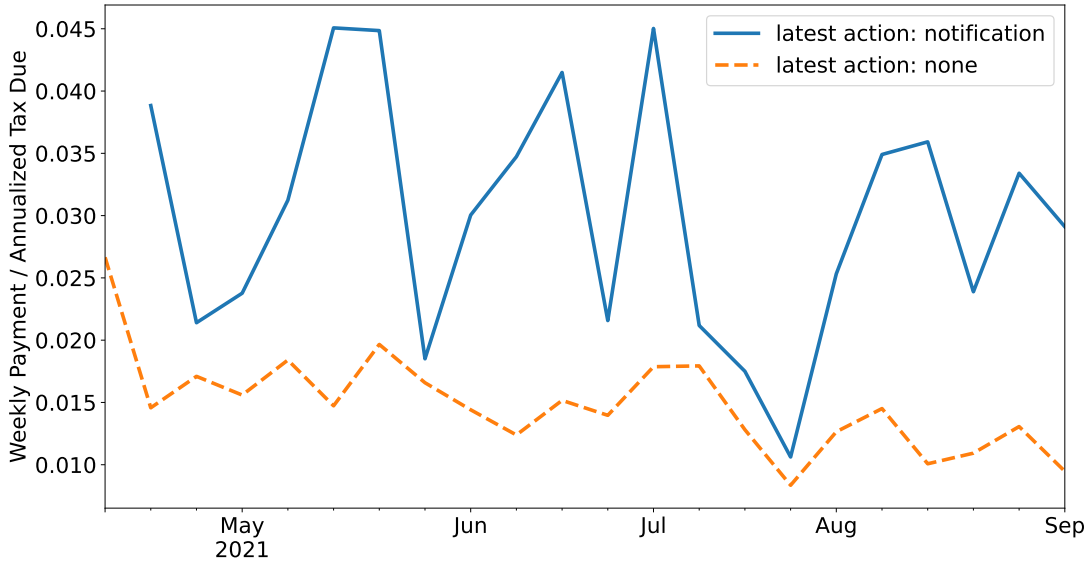


Figure A.4: Payment given latest action (notification or none), treatment group.

Unconstrained estimation. Table A.4 reports parameters' posterior means and standard deviations using a specification in which we do not constrain the coefficient on collection notifications to be positive. The coefficient on notifications is then -0.0169, while the coefficients

on G1 priorities and writs are 0.0316 and 0.0214 respectively.[21]

	Mean	(std. dev.)
$\beta_{\Pi_{i,t}>0}$	$3.46 \cdot 10^{-2}$	$(0.25 \cdot 10^{-2})$
$\beta_{\Pi_{i,t}}$	$-3.93 \cdot 10^{-2}$	$(0.11 \cdot 10^{-2})$
β_{G1}	$3.16 \cdot 10^{-2}$	$(0.26 \cdot 10^{-2})$
β_{G2}	$-0.15 \cdot 10^{-2}$	$(0.30 \cdot 10^{-2})$
β_{G3}	$-1.29 \cdot 10^{-2}$	$(0.15 \cdot 10^{-2})$
$\beta_{\text{garnishment}}$	$0.24 \cdot 10^{-2}$	$(0.33 \cdot 10^{-2})$
β_{writ}	$2.14 \cdot 10^{-2}$	$(0.21 \cdot 10^{-2})$
$\beta_{\text{notification}}$	$-1.69 \cdot 10^{-2}$	$(0.16 \cdot 10^{-2})$
β_{ξ}	$1.20 \cdot 10^{-1}$	$(0.38 \cdot 10^{-2})$
$\underline{\varphi}$	$0.17 \cdot 10^{-2}$	$(0.18 \cdot 10^{-2})$
$\overline{\varphi}$	$3.13 \cdot 10^{-1}$	$(7.63 \cdot 10^{-1})$
σ	$4.82 \cdot 10^{-2}$	$(0.23 \cdot 10^{-2})$

Table A.4: Estimating the settlement behavior of tax-payers allowing for negative collection notification coefficient.

A flexible specification. Table A.5 reports posterior means and standard deviations for parameters of interest in an estimation with no lower bound on the coefficient on notification, but allowing the coefficient on notification to take different values before and after June 1st. The coefficient $\beta_{\text{notification}}$ is an indicator for receiving a notification any time, while $\beta_{\text{notification after June}}$ is an indicator for receiving a notification after June 1^{st}. We find, consistent with Figure A.3, that the coefficient on notifications is negative before June, but becomes approximately 0 (by adding up the two notification coefficients) after June. Other coefficients of the model are similar to those reported in Table 8.

[21] Recall that the collection action dummy variables are exclusive: they capture the latest collection action taken. Hence the coefficient of 0.0214 associated with writs captures the joint impact of receiving a notification and then receiving a writ.

	Mean	(std. dev.)
$\beta_{\Pi_{i,t}>0}$	$1.57 \cdot 10^{-2}$	$(0.34 \cdot 10^{-2})$
$\beta_{\Pi_{i,t}}$	$-4.55 \cdot 10^{-2}$	$(0.15 \cdot 10^{-2})$
β_{G1}	$3.95 \cdot 10^{-2}$	$(0.32 \cdot 10^{-2})$
β_{G2}	$-0.28 \cdot 10^{-2}$	$(0.37 \cdot 10^{-2})$
β_{G3}	$-1.61 \cdot 10^{-2}$	$(0.20 \cdot 10^{-2})$
$\beta_{\text{garnishment}}$	$-0.44 \cdot 10^{-4}$	$(0.40 \cdot 10^{-2})$
β_{writ}	$2.17 \cdot 10^{-2}$	$(0.25 \cdot 10^{-2})$
$\beta_{\text{notification}}$	$-2.38 \cdot 10^{-2}$	$(0.21 \cdot 10^{-2})$
$\beta_{\text{notification after June}}$	$2.32 \cdot 10^{-2}$	$(0.20 \cdot 10^{-2})$
β_{ξ}	$1.55 \cdot 10^{-1}$	$(0.60 \cdot 10^{-2})$
$\underline{\varphi}$	$2.81 \cdot 10^{-2}$	$(0.37 \cdot 10^{-2})$
$\overline{\varphi}$	$3.13 \cdot 10^{-1}$	$(6.32 \cdot 10^{-2})$
σ	$6.99 \cdot 10^{-2}$	$(0.36 \cdot 10^{-2})$

Table A.5: Estimating the settlement behavior of tax-payers allowing for different notification parameters before and after June.

Interpretation and policy impact. It is possible to attribute the pattern of early repayment in control to a meaningful mechanism rather than just noise. One possible interpretation is that this pattern reflects the temporary crowding out of intrinsic incentives: along the lines of Gneezy and Rustichini (2000) tax-payers interpret the notification as a clarifying price for late payment. Alternatively, tax-payers may be surprised by the relatively mild short-term penalties associated with late payment. These considerations do not apply in the treatment group since notifications are always preceded by an information letter promising clear short-term enforcement.

While our primary interpretation is that this pattern is noise, the potential implications for design if it were in fact persistent, are clear. While the notification is a legal constraint which cannot be eliminated, the city government should ensure that the delay between notification and writs is short. Instead of first sending all notifications, and only then sending all legal writs, it may be preferable to prioritize completing (notification, writ) pairs

close together in time.

A.4 Effect of treatment on tax collection.

The difference between collection rates across treatment and control is driven by the behavior of large tax-payers. The point is illustrated in Figures A.5 and A.6 which plot the analogue of Figure 5 for tax-payers in the bottom 98% and top 2% by amount owed, respectively. This makes raw findings sensitive to the behavior of a few large tax-payers. This is further illustrated by Figure A.7 which plots the analogue of Figure 5 for tax-payers in the top 2% by amount owed, excluding the top 5 tax-payers.

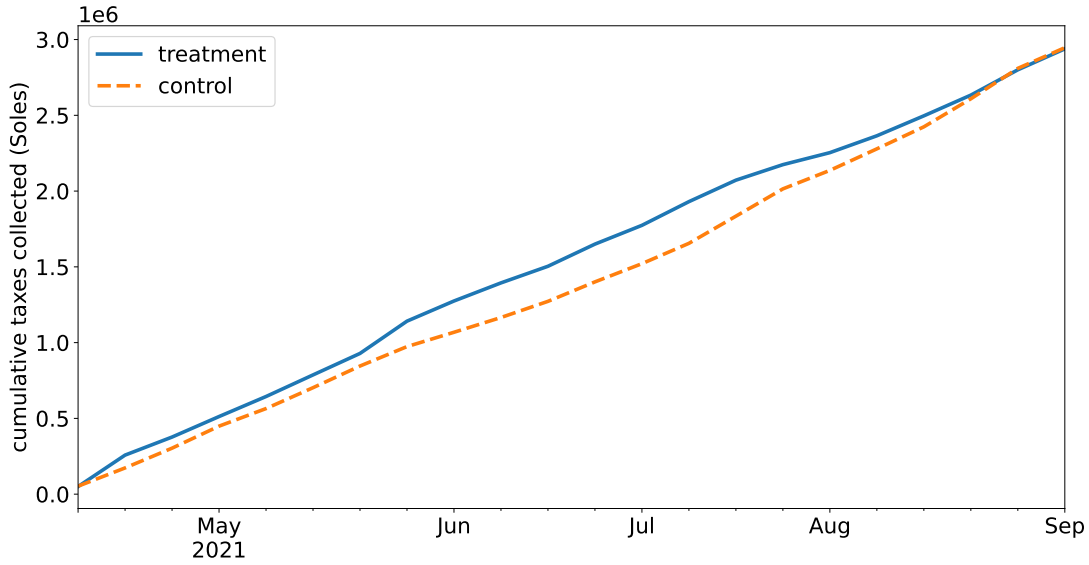


Figure A.5: Cumulative Tax Collected April - September 2021, Bottom 98% Amount Owed

This observation is further confirmed by regression analysis. Table A.6 reports OLS estimates of the linear model

$$\mathsf{tax\_collected} \sim \mathsf{amount\_owed} \oplus \mathsf{amount\_owed} \times \mathsf{treatment} \tag{A.1}$$

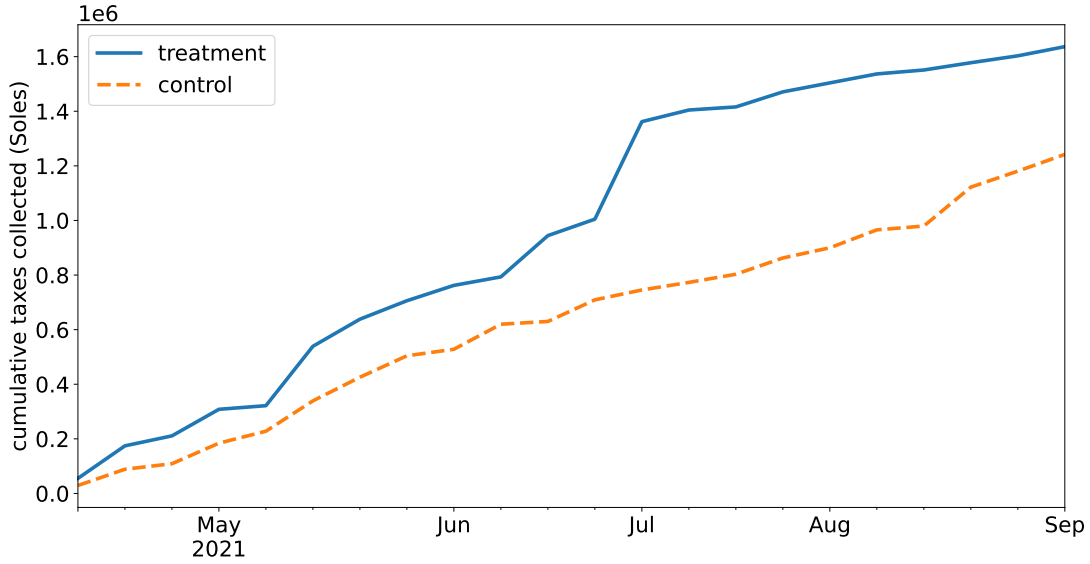


Figure A.6: Cumulative Tax Collected April - September 2021, Top 2% Amount Owed

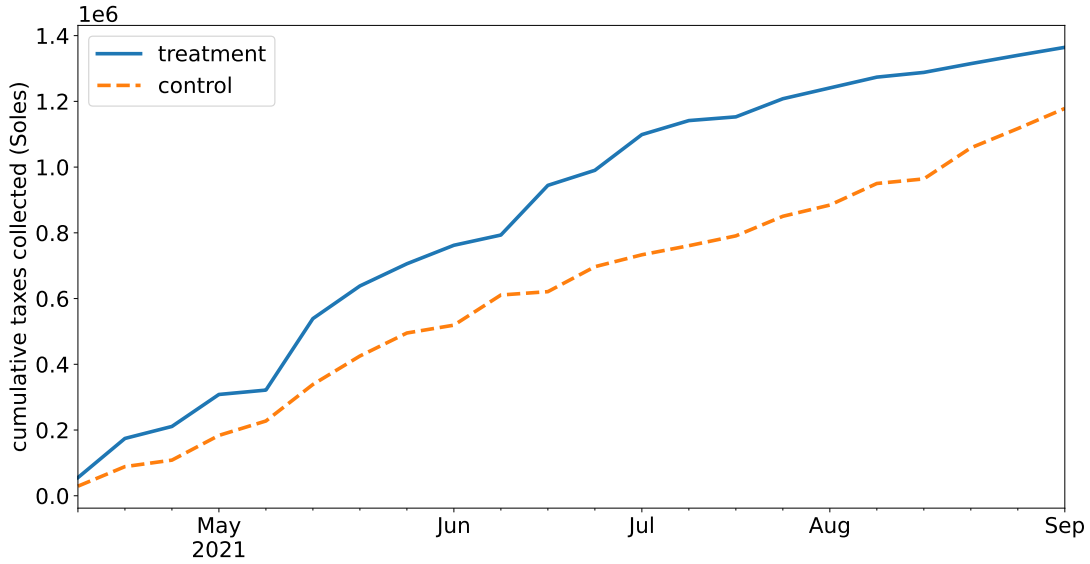


Figure A.7: Cumulative Tax Collected April - September 2021, Top 2% Amount Owed, without top 5 tax-payers by amount owed

for various sub-groups, where tax_collected is the amount collected divided by the annualized amount owed.

The effect associated with treatment is large, corresponding to a 27.6 percentage-point

increase in the share of taxes due repaid. This is in part driven by the fact that the OLS estimate for (A.1) places a higher weight on tax-payers who owe more. Since these tax-payers are more likely to receive G1 status, it makes sense that the effect of treatment on large tax-payers should be larger than the effect of treatment on the population as a whole. Only 1882 tax-payers received G1 status, compared to a population of 6704 tax-payers in the treatment group.

Columns 2 to 4 report OLS estimates of (A.1) for subgroups of tax-payers in the bottom 98% and the top 2% of tax amount owed (including and excluding the top 5 tax-payers by amount due). Differences across treatment are driven by the behavior of taxpayers owing a large amount. Table A.7 verifies that the sample is balanced between treatment and control when restricted to tax-payers in the top 2% by amount owed. Though some differences are larger than in Table 3, all are insignificant at the 10% level.

	Total Collected	Total Collected (top 2%)	Total Collected (bottom 98%)	Total Collected (top 2%, excl. top 5)
Amount Owed	0.3939***	0.3906***	0.4264***	0.4195***
	(0.0610)	(0.0672)	(0.0188)	(0.0677)
Treatment	0.2759*	0.2981*	0.0333	0.1346
× Amount Owed	(0.1371)	(0.1445)	(0.0476)	(0.1783)
Observations	13432	269	13163	264

Robust standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.6: Impact of treatment on collection

A.5 Capacity simulation

Figure A.8 provides simulations of capacity use under the *increased number of writs* counterfactual from Table 9, in which we increase the number of notifications and writs to match the control group. The number of new garnishments each month never exceeds 200. This figure is similar for all the other policies in Table 9.

	Control	Treatment
Exo. Score	7790.4	7373.5
Endo. Score	9269.4	8922.2
$\mathbf{1}_{\text{Last year 3m repayment share>20\%}}$	0.542	0.604
Total Due	5386.0	5285.5
Property taxes Due	2371.9	1828.1
Arbitrios Due	3014.1	3547.3
Is Large Firm	0.533	0.551
Is Pricos	0.699	0.610
Has Employer	0.233	0.176
Has Education	0.045	0.096
Has Email	0.526	0.581
Has Cellular	0.774	0.735
Num Observations	133	136

Table A.7: Summary statistics by treatment status (top 2%)

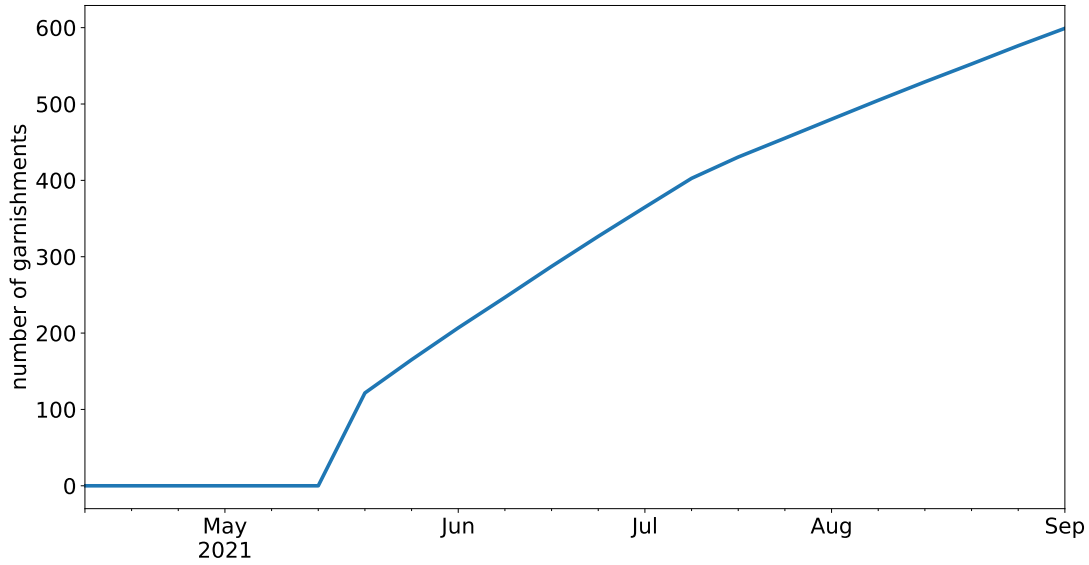


Figure A.8: Cumulative number of garnishments in counterfactual simulation of treatment with increased number of writs.

B Further Discussion

This section discusses further policy relevant aspects of our findings.

B.1 Why do early payments matter?

Our field evidence suggests that prioritized enforcement speeds up tax-collection. One question is whether the speed of tax-collection is welfare relevant, even from the government's perspective: if the collection mechanism only affects the intensity with which payments occur, then taxes are ultimately repaid with probability 1 given a sufficiently long collection horizon. De Neve et al. (2021) contend with the same question in their context: they find that simplifying communication with tax-payers speeds up but does not necessarily increase ultimate tax collection. Does the timing of payments really matter?

The answer is yes, but it is worth articulating why. From a revealed preferences perspective, we note that even under its usual collection protocol, the city spends considerable resources collecting taxes (roughly 1/15th of the taxes it expects to collect). It could surely save on costs and collect with a lower intensity, for instance by collecting taxes every other year. The fact that the city expends resources reveals the importance of timely payments. One rationale for preferences for early settlement derives from the cost of borrowing, and the fact that debts become harder to collect as they age. For simplicity, assume that the city expects a single payment π that takes place with Poisson intensity λ while the tax-payer is not in default. The tax-payer permanently defaults on their debt with intensity γ. The city can borrow and lend at a rate r. In this setting, the net present value of debt is

$$\frac{\lambda\pi}{\lambda + r + \gamma},$$

which is strictly increasing in λ: faster settlement saves on both discounting and default costs which grow with delay.

B.2 A fully structural model

We refer to our model of repayment propensities as semi-structural because it takes as given the tax-payer's behavior following collection actions and threats. As a result is lets us

plausibly evaluate counterfactuals in which promises are unchanged, and promises made do not stretch the city's actual collection capacity under equilibrium behavior.

This excludes some counterfactuals of interest. For instance, what would be the impact of extending the horizon of G1 collection priorities to 8 weeks? Also, what if we increased the size of the G1 group so that promises are met but with a distribution of possible delays, so that up to 25% of G1 tax-payers may be collected on with a delay of up to 4 weeks? Would that severely reduce the effectiveness of G1 priorities over time?

We leave developing such a model for future work, especially since our data is not suited to estimate this endogenous response from tax-payers. However we are able to point out two modeling objectives: first, there should be some feedback from failed, delayed, or longer-term promises on perceived commitment; second the model should reflect the fact that as the number of threats issued becomes much larger than available capacity, multiple equilibria become a possibility. Chassang et al. (2022) suggests that p-dominance (Morris et al., 1995) may be a useful solution concept for such a model.

C Experimental Materials

C.1 Information letters for groups G2 and G3

Tables C.1 and C.2 illustrate the information letters sent to tax-payers in priority groups G2 and G3.

C.2 Spanish originals

Figures C.1, C.2 and C.3 report the original information letters sent to tax-payers in treatment groups G1, G2, and G3. Figure C.4 provides the template for information letters sent to the control group. The treatment and control groups were sent identical notifications

NOTICE OF IMMINENT COLLECTION

We remind you that you have the following debt outstanding with the municipality:	**Amount**
The coercive collection process will start at the latest on:	**Today + 12 weeks**
and you can be promoted at any time and without prior warning to the top priority group (which will imply the start of the coercive collection in maximum 6 weeks).	
If the coercive collection process is started your debt will include the penalties and administrative expenses regulated by law and will amount to:	**Amount*1.1 + US$35**
In addition to accruing a weekly interest of:	**Interest**
We remind you that it is on your own interest to pay immediately to avoid higher expenses. You can use any of our payment options listed below.	

Table C.1: Information letter, priority group G2

NOTICE OF DEBT OUTSTANDING

We remind you that you have the following debt outstanding with the municipality:	**Amount**
and that you can be promoted at any time and without prior warning to the high priority group (which will imply the start of the coercive collection process in maximum 12 weeks).	
If the coercive collection process is started your debt will include the penalties and administrative expenses regulated by law and will amount to:	**Amount*1.1 +US$35**
In addition to accruing a weekly interest of:	**Interest**
We remind you that it is on your own interest to pay immediately to avoid higher expenses. You can use any of our payment options listed below.	

Table C.2: Information letter, priority group G3

(*Valor*, Figure C.5) and legal writs (*REC1*, Figure C.6).

Municipalidad de Jesús María

GERENCIA DE ADMINISTRACIÓN TRIBUTARIA Y RENTAS

Jesús María, DIA de MES de AÑO

Aviso de Deuda Pendiente y Cobranza Inminente

Estimado contribuyente **Nombre**
Dirección **DIRECCION**

Le recordamos que tiene la siguiente deuda pendiente con el municipio*:		**Monto Deuda**: **S/ Monto_Deuda**
*Por concepto de:	1era cuota predial 1era cuota predial + Arbitrios 2021	
El proceso de cobranza coactiva **se iniciará a más tardar** el día:		**Fecha límite:** **Fecha_limite**
Y la cobranza **puede ser iniciada en cualquier momento** y sin previo aviso.		
Si se inicia el proceso de cobranza coactivo, su deuda incluirá las gastos y costas procesales reguladas por Ley y ascenderá al monto de **:		**Monto Deuda con Gastos Adicionales:** **S/Monto_Deuda_Coactivo**
**Incluye gastos administrativos de 10% y otros derechos de emisión		
Además de acumular un interés semanal de:	**Interés semanal** **S/ Interes_semanal**	

Le recordamos que **le conviene pagar inmediatamente** para evitar costos mayores. Use nuestros siguientes canales de pago:

Si quiere pagar y no puede, llámenos o escríbanos para evaluar las opciones de pago:

Whats App
962 727 311 / 940 396 206 / 940 385 948

servicios_rentas@munijesusmaria.gob.pe

Figure C.1: Information letter template, priority group G1

Municipalidad de Jesús María

GERENCIA DE ADMINISTRACIÓN TRIBUTARIA Y RENTAS

Jesús María, DIA de MES de AÑO

Aviso de Deuda Pendiente y Cobranza Inminente

Estimado contribuyente **Nombre**

Le recordamos que tiene la siguiente deuda pendiente con el municipio*:		**Monto Deuda**: **S/ Monto_Deuda**
*Por concepto de:	1era cuota predial 1era cuota predial + Arbitrios Ene-Feb 2021	
El proceso de cobranza coactiva **se iniciará a más tardar** el día:		**Fecha límite:** **Fecha_limite**
Y su deuda **puede pasar en cualquier momento y sin previo aviso al grupo de máxima prioridad** (lo que implicará el inicio del proceso de cobranza coactivo en máximo 4 semanas).		
Si se inicia el proceso de cobranza coactivo, su deuda incluirá las gastos y costas procesales reguladas por Ley y ascenderá al monto de **:		**Monto Deuda con Gastos Adicionales:** **S/Monto_Deuda_Coactivo**
**Incluye gastos administrativos de 10% y otros derechos de emisión		
Además de acumular un interés semanal de:	**Interés semanal** **S/ Interes_semanal**	

Le recordamos que **le conviene pagar inmediatamente** para evitar costos mayores. Use nuestros siguientes canales de pago:

Si quiere pagar y no puede, llámenos o escribanos para evaluar las opciones de pago:

Whats App
962 727 311 / 940 396 206 / 940 385 948

servicios_rentas@munijesusmaria.gob.pe

Figure C.2: Information letter template, priority group G2

Municipalidad de Jesús María

GERENCIA DE ADMINISTRACIÓN TRIBUTARIA Y RENTAS

Jesús María, DIA de MES de AÑO

Aviso de Deuda Pendiente

Estimado contribuyente **Nombre**

Le recordamos que tiene la siguiente deuda pendiente con el municipio*:		**Monto Deuda**: **S/ Monto_Deuda**
*Por concepto de:	1era cuota predial 1era cuota predial + Arbitrios Ene-Feb-Mar 2021	
Y que su deuda puede pasar **en cualquier momento y sin previo aviso** al **grupo de cobranza prioritaria** (lo que implicará el inicio del proceso de cobranza coactivo en máximo 8 semanas).		
Si se inicia el proceso de cobranza coactivo, su deuda incluirá las gastos y costas procesales reguladas por Ley y ascenderá al monto de **:		**Monto Deuda con Gastos Adicionales: S/Monto_Deuda_Coactivo**
**Incluye gastos administrativos de 10% y otros derechos de emisión		
Además de acumular un interés semanal de:	**Interés semanal S/ Interes_semanal**	

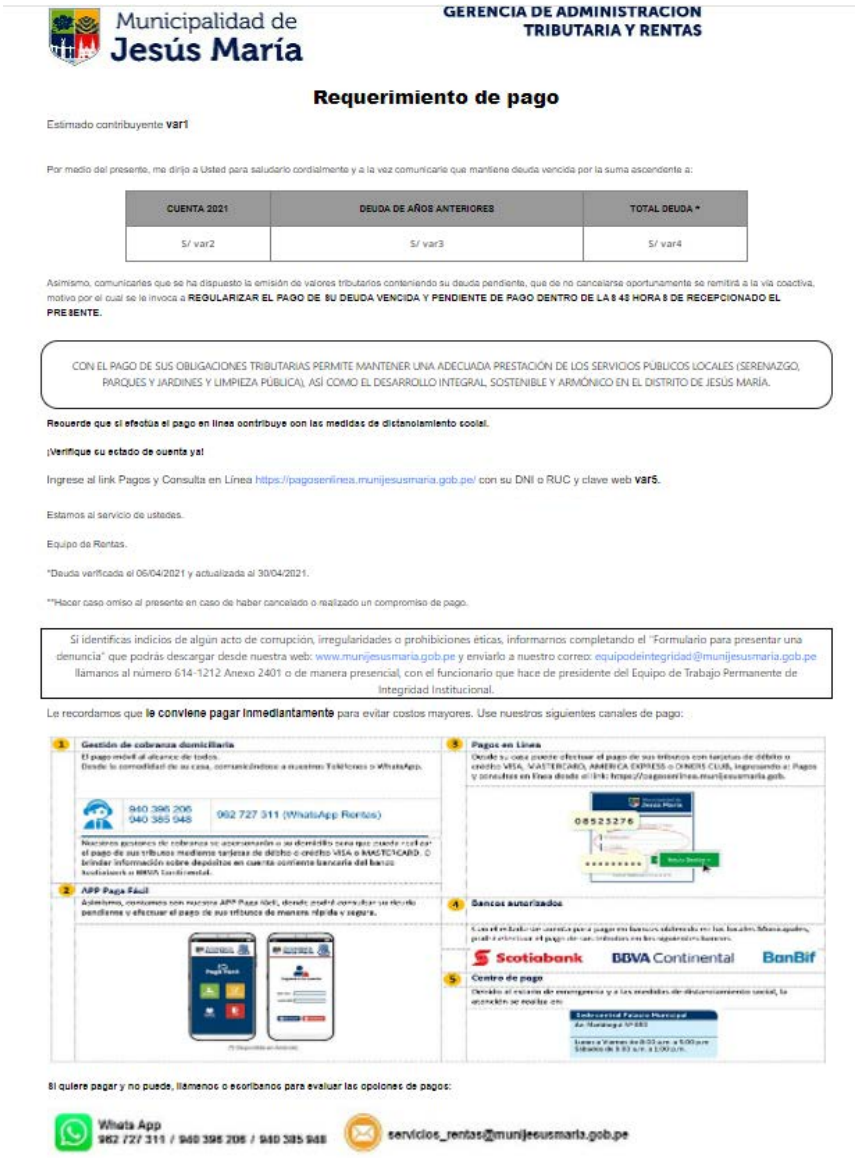
Le recordamos que **le conviene pagar inmediatamente** para evitar costos mayores. Use nuestros siguientes canales de pago:

Si quiere pagar y no puede, llámenos o escribanos para evaluar las opciones de pago:

Whats App
962 727 311 / 940 396 206 / 940 385 948

servicios_rentas@munijesusmaria.gob.pe

Figure C.3: Information letter template, priority group G3


Municipalidad de Jesús María

GERENCIA DE ADMINISTRACION TRIBUTARIA Y RENTAS

Requerimiento de pago

Estimado contribuyente **var1**

Por medio del presente, me dirijo a Usted para saludarlo cordialmente y a la vez comunicarle que mantiene deuda vencida por la suma ascendente a:

CUENTA 2021	DEUDA DE AÑOS ANTERIORES	TOTAL DEUDA *
S/ var2	S/ var3	S/ var4

Asimismo, comunicarles que se ha dispuesto la emisión de valores tributarios conteniendo su deuda pendiente, que de no cancelarse oportunamente se remitirá a la vía coactiva, motivo por el cual se le invoca a **REGULARIZAR EL PAGO DE SU DEUDA VENCIDA Y PENDIENTE DE PAGO DENTRO DE LA 8 48 HORA 8 DE RECEPCIONADO EL PRESENTE.**

CON EL PAGO DE SUS OBLIGACIONES TRIBUTARIAS PERMITE MANTENER UNA ADECUADA PRESTACIÓN DE LOS SERVICIOS PÚBLICOS LOCALES (SERENAZGO, PARQUES Y JARDINES Y LIMPIEZA PÚBLICA), ASÍ COMO EL DESARROLLO INTEGRAL, SOSTENIBLE Y ARMÓNICO EN EL DISTRITO DE JESUS MARÍA.

Recuerde que si efectúa el pago en línea contribuye con las medidas de distanciamiento social.

¡Verifique su estado de cuenta ya!

Ingrese al link Pagos y Consulta en Línea https://pagoseenlinea.munijesusmaria.gob.pe/ con su DNI o RUC y clave web **var5.**

Estamos al servicio de ustedes.

Equipo de Rentas.

*Deuda verificada el 06/04/2021 y actualizada al 30/04/2021.

**Hacer caso omiso al presente en caso de haber cancelado o realizado un compromiso de pago.

Si identificas indicios de algún acto de corrupción, irregularidades o prohibiciones éticas, informarnos completando el "Formulario para presentar una denuncia" que podrás descargar desde nuestra web: www.munijesusmaria.gob.pe y enviarlo a nuestro correo: equipodeintegridad@munijesusmaria.gob.pe llamanos al número 614-1212 Anexo 2401 o de manera presencial, con el funcionario que hace de presidente del Equipo de Trabajo Permanente de Integridad Institucional.

Le recordamos que **le conviene pagar inmediantamente** para evitar costos mayores. Use nuestros siguientes canales de pago:

1 **Gestión de cobranza domiciliaria**

El pago móvil al alcance de todos.
Desde la comodidad de su casa, comunicándose a nuestros Teléfonos o WhatsApp.

940 396 206
940 385 948
962 727 311 (WhatsApp Rentas)

Nuestros gestores de cobranza se apersonarán a su domicilio para que cuente con el pago de sus tributos mediante tarjetas de débito o crédito VISA o MASTERCARD. O brindar información sobre depósitos en cuenta corriente bancaria del banco fusionado a BBVA Continental.

2 **APP Paga Fácil**

Asimismo, contamos con nuestra APP Paga fácil, donde podrá consultar su deuda pendiente y efectuar el pago de sus tributos de manera rápida y segura.

3 **Pagos en Línea**

Desde su casa puede efectuar el pago de sus tributos con tarjetas de débito o crédito VISA, MASTERCARD, AMERICA EXPRESS o DINERS CLUB, ingresando a: Pagos y consultas en línea desde el link: https://pagoseenlinea.munijesusmaria.gob.

08523276

4 **Bancos autorizados**

Con el código de cuenta para pago en bancos disponible en las locales Municipales, podrá efectuar el pago de sus tributos en los siguientes bancos:

Scotiabank BBVA Continental BanBif

5 **Centro de pago**

Debido al estado de emergencia y a las medidas de distanciamiento social, la atención se realiza en:

Embarcadero Palacio Municipal
Av. Huaraz N° 283

Lunes a Viernes de 8:30 a.m. a 5:00 p.m.
Sábados de 8:30 a.m. a 1:00 p.m.

Si quiere pagar y no puede, llámenos o escríbanos para evaluar las opciones de pagos:

Whats App
962 727 311 / 940 396 206 / 940 385 948

servicios_rentas@munijesusmaria.gob.pe

Figure C.4: Information letter template, control group

Municipalidad de Jesús María

Gerencia de Administración Tributaria y Rentas
SubGerencia de Recaudación Tributaria y Ejecutoría Coactiva

Lote: 2020-0122
Fecha: 22/12/2020

ORDEN DE PAGO N° 014483-2020-MDJM-SGRTEC

IDENTIFICACION DEL DEUDOR TRIBUTARIO:

Nombre o Razón social: 265951 HERRERA GILVONIO ERNESTO ERICK
Documento de Identidad: DNI: 40674714
Domicilio Fiscal: AV. BRASIL NUM. 1055 BLOCK. A DPTO. 1201 LIMA\LIMA\JESUS MARIA

Tributo: IMPUESTO PREDIAL

Se le requiere la cancelación de la deuda contenida en el presente documento, bajo apercibimiento de iniciar el procedimiento de ejecució n coactiva.
La presente se emite por los tributos y periodos que se indican, cuyo monto se ha actualizado al 30/12/2020, luego de esta fecha se actualizar á con una tasa diaria de 0.04%, conforme a la tasa de interés moratorio fijada.

Motivo Determinante: Se ha verificado la existencia de una deuda tributaria no cancelada dentro de los plazos establecidos
Declaración Jurada: Actualización 2016 de DJ N°0016040239 de fecha 2020-08-29
Actualización 2017 de DJ N°0017041683 de fecha 2020-08-29
Actualización 2018 de DJ N°0018044121 de fecha 2020-08-29
Actualización 2019 de DJ N°0019046083 de fecha 2020-08-29

Año	Base Imponible	Tramos	Alicuota	Insolutos	Imp. Anual	Trim. acotados:	Insoluto	Reajuste(1)	Interes(2)	Total
2016	81,602.17	Hasta 15 UIT Mas de 15 UIT a 60UIT Mas de 60 UIT	0.20% 0.60% 1.00%	118.50 134.11 0.00	252.61	01 02 03 04	319.42	0.00	192.86	512.28
2017	107,773.84	Hasta 15 UIT Mas de 15 UIT a 60UIT Mas de 60 UIT	0.20% 0.60% 1.00%	121.50 282.14 0.00	403.64	01 02 03 04	379.34	0.00	182.33	561.67
2018	111,013.48	Hasta 15 UIT Mas de 15 UIT a 60UIT Mas de 60 UIT	0.20% 0.60% 1.00%	124.50 292.58 0.00	417.08	01 02 03 04	392.18	0.00	139.25	531.43
2019	114,524.73	Hasta 15 UIT Mas de 15 UIT a 60UIT Mas de 60 UIT	0.20% 0.60% 1.00%	126.00 309.15 0.00	435.15	01 02 03 04	435.15	0.00	114.16	549.31
								Gastos de Emisión de la Cuponera:		25.38
								Total Deuda General:		2,180.07

UIT: AÑO 2016 = S/3950.00,AÑO 2017 = S/4050.00,AÑO 2018 = S/4150.00,AÑO 2019 = S/4200.00

(1) Factores de Reajuste: 2016-01=0.0000,2016-02=0.0000,2016-03=0.0000,2016-04=0.0000,2017-01=0.0000,2017-02=0.0000,2017-03=0.0000,2017-04=0.0000,2018-01=0.0000,2018-02=0.0000,2018-03=0.0000,2018-04=0.0000,2019-01=0.0000,2019-02=0.0000,2019-03=0.0000,2019-04= 0.0000

(2) TIM Aplicada: 2016-01=64.96%,2016-02=61.91%,2016-03=58.84%,2016-04=55.80%,2017-01=52.23%,2017-02=49.73%,2017-03=46.67%,2017-04=43.63%,2018-01=39.95%,2018-02=37.56%,2018-03=34.07%,2018-04=30.45%,2019-01=26.23%,2019-02=26.23%,2019-03=26.23%,2019-04=26.24%

BASE LEGAL:

Art. 33°, 78° inc. 1 y 104° del TUO del Codigo Tributario aprobado por D.S. N° 133-2013-EF y sus modificatorias
Art. 8° y siguientes del TUO de la Ley de Tributacion Municipal aprobado por D.S. 156-04-EF y sus modificatorias
Redondeo: Novena Disposición Final del TUO del Codigo Tributario D.S. 133-2013
Ordenanza N° 551 -MDJM; que aprueban la TIM para el distrito de Jesús María.

MUNICIPALIDAD DISTRITAL DE JESUS MARIA
SUBGERENCIA DE RECAUDACION TRIBUTARIA Y EJECUTORIA COACTIVA
Abog. SILVIA PATRICIA CORRALES RUIZ
SUBGERENTE

Ordenanza No. 476-MDJM, que regula el monto de la tasa por concepto de la emisión mecanizada del Impuesto Predial y los Arbitrios Municipales para el ejercicio 2016., Ordenanza No. 510-MDJM, que regula el monto del derecho de emision mecanizada de actualización de Valores, determinación del tributo y distribución domiciliaria del Impuesto Predial y Arbitrios Municipales del ejercicio 2017., Ordenanza N°538-MDJM, que prórroga para el ejercicio 2018, la vigencia de la ordenanza N° 510 que establece el monto de derecho de emisión mecanizada de actualización de valores, determinación y distribución del Impuesto Predial y Arbitrios Municipales, Ordenanza N°554-MDJM, que prórroga para el ejercicio 2019, la vigencia de la ordenanza N° 510 que establece el monto de derecho de emisión mecanizada de actualización de valores, determinación y distribución del Impuesto Predial y Arbitrios Municipales

NOTA:

- Si a la recepción de esta, usted ya realizó el pago de tales conceptos, le rogamos no prestar atención a la presente.
- De no estar conforme, podrá interponer recurso de reclamación debidamente sustentado, para la cual deberá acreditar la cancelación de la totalidad de la deuda,salvo sea evidente la improcedencia de la cobranza.
- Cualquier consulta, los esperamos en la SubGerencia de Recaudación Tributaria y Ejecutoría Coactiva en el Palacio Municipal. Tlf. 940396206 , 940385948 o al WhatsApp Tributario 962-727311

Figure C.5: Notification (Valor), treatment and control groups

Municipalidad de
Jesús María

Expediente : 2020-016517
Auxiliar coactivo : ROSARIO PEREZ CAMARA
Código : [0000070283]

RESOLUCIÓN COACTIVA NÚMERO :UNO
JESÚS MARÍA.

JESUS MARIA, JUEVES, 17 DE DICIEMBRE DE 2020
En mérito a la RESOLUCION DE DETERMINACION cuyo detalle es:

Nro. RESOLUCION DE DETERMINACION	Fecha Emisión	Fecha Notific.	Monto Insoluto	Gasto Emisión	Intereses 30/12/2020	Total S/
050869 2019 2018.FEB,MAR,ABR,MAY,JUN,JUL,AGO,SET,OCT,I	11/12/2019	17/12/2019	424.82		149.11	573.93

Gastos Administrativos S/	57.39
Costas Procesales S/	15.05
Total General S/	646.37

De conformidad con lo dispuesto en los artículos 15°,25°,29° Y 30° del TUO de la Ley Nº 26979 Ley del Procedimiento de Ejecución Coactiva, aprobado por D. S. Nº 018 - 2008 - JS

Notifíquese a : **CHAMBI VELASCO MARIA ANGELA Y TACO VELASQUEZ MIGUEL**

Con Domicilio en : **JR. HUAMACHUCO NUM. 1741 DPTO/INT. 0101 LIMA\LIMA\JESUS MARIA**

Para que dentro del plazo de **SIETE (7) DÍAS HÁBILES**, cumpla con cancelar a la Municipalidad de Jesús María la suma de **S/646.37(SEISCIENTOS CUARENTA Y SEIS Y 37/100 SOLES)** mas los intereses generados hasta la cancelación de la deuda, asi como las costas y gastos procesales, que ocasione el presente procedimiento, bajo apercibimiento de trabarse las medidas cautelares contempladas en los artículos 32° y 33° del Texto Único Ordenado de la Ley 26979 - Ley del Procedimiento de Ejecución Coactiva,aprobado mediante Decreto Supremo N° 018-2008-JUS.

Base Legal Texto Único Ordenado de la Ley 26979 Ley del Procedimiento de Ejecución Coactiva,aprobado mediante Decreto Supremo N° 018-2008-JUS.
Ley N° 27972, Ley Orgánica de Municipalidades.

Decreto Supremo N° 133-13-EF. Texto Único Ordenado del código tributario
Decreto Supremo N° 069-2003-EF, Reglamento de la Ley de Ejecución Coactiva.
Ley N° 27444,Ley de Procedimiento Administrativo General y Decreto Legislativo N° 1029.
Ordenado N° 07-MJM, Modificado por Ordenanza N° 110-MJM.

Firmado Ejecutor Coactivo
HUAMAN FARFAN FARITA MERCEDES

Auxiliar Coactivo.
ROSARIO PEREZ CAMARA

MUNICIPALIDAD DISTRITAL DE JESUS MARIA
SUBGERENCIA DE RECAUDACIÓN TRIBUTARIA Y EJECUTORIA COACTIVA
Abog. FARITA HUAMAN FARFAN
EJECUTORA COACTIVA

MUNICIPALIDAD DISTRITAL DE JESUS MARIA
SUBGERENCIA DE RECAUDACIÓN TRIBUTARIA Y EJECUTORIA COACTIVA
Bach. ROSARIO PEREZ CAMARA
AUXILIAR COACTIVO

Figure C.6: Writ (REC1), treatment and control groups

We note that although similar, the notification letters across treatment and control groups are different, and it's possible that differences across letters contribute to the measured effect of treatment. This concern is alleviated by the fact that all subsequent communication (.e.g. the legal writ) was identical across treatment and control groups. In addition, the effect of receiving a G3 notification, instead of being in the control group is small and negative.

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