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Treat Remind Repeat!

A Natural Field Experiment in a Tax Amnesty Context

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ABSTRACT

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A Natural Field Experiment in a Tax Amnesty Context

This study evaluates the impact of behavioural interventions on the uptake and payment of tax arrears through an amnesty program in Kenya. Using a randomised controlled trial, 43,666 tax delinquents from Nairobi region were evaluated. Taxpayers were assigned to receive either a neutral informational email, one of three behavioural messages on deterrence, social norms, payment plans, or no message at all. The experiment was conducted over three treatment rounds between December 2023 and May 2024, allowing for the analysis of both immediate effects and sequencing dynamics. Non respondents were re-randomised across message types in the final round. Results show that all message treatments significantly increased amnesty uptake relative to no communication. Additionally, deterrence messages were more effective than social norms or payment plan reminders. Changing message framing in the third round enhanced participation among late responders but was associated with smaller payments relative to early takers. Overall, the findings suggest that while behavioural messages can promote engagement, informational communication may be equally effective in improving compliance. The study contributes to the literature by highlighting the effectiveness of behavioural intervention in an amnesty context and illustrates the importance of message sequencing in sustaining taxpayer attention.

JEL Classification:

C93, H26, D04

Keywords:

Natural Field Experiment, Tax Delinquency, Tax Amnesty, RCTs, Compliance Behaviour

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1 Introduction

Tax noncompliance remains a persistent challenge for tax administrations, particularly in developing countries where tax collection outcomes are, on average, suboptimal. Slemrod (2019) notes that noncompliance gives rise to several fiscal challenges, including revenue losses, increased inequality between compliant and noncompliant taxpayers, and higher efficiency costs. Therefore, deliberate efforts to expand the tax base and address noncompliance are indispensable.

While tax noncompliance can take multiple forms, this study focuses on the non payment of declared tax liabilities. A taxpayer who is registered, reports economic activity, and files a return but fails to remit the tax due is considered tax delinquent.[1] Although tax delinquency causes fiscal leakage comparable to tax evasion, it has received relatively limited attention in the literature.

Much of the existing literature focuses on accuracy in reporting and filing rather than on payment compliance. Such approaches are more effective in settings where third party reporting and audit trails are available (Pomeranz, 2015). In contrast, developing countries face challenges arising from informality and cash-based transactions that limit detection capacity. But, compliance improves only when delinquent taxpayers are credibly identified and receive clear enforcement signals; in these contexts, weak collection capacity constrains revenue even when the a tax delinquent is known (Okunogbe, 2021).

Nevertheless, emerging evidence suggests that delinquency poses a significant challenge in both developed and developing countries. Studies examining interventions to address tax delinquency include Hallsworth et al. (2017) for the United Kingdom, Perez-Truglia and Troiano (2018) for the United States, Gil et al. (2023) for the Dominican Republic, and Dwenger and Treber (2022) for Slovenia's 2012 naming-and-shaming policy. Perez-Truglia and Troiano (2018) further report that in 2006, approximately 25 percent of the U.S. tax gap was attributable to tax delinquency.

Kenya is an ideal setting in which to study tax delinquency and compliance interventions. Despite efforts to expand the tax base, tax revenue collection has remained suboptimal, with a tax to GDP ratio averaging 15.2 percent in the 2021/22 financial year, below the government's target of 23 per cent (GoK, 2007). A large informal sector, limited enforcement capacity, and liquidity constraints among taxpayers contribute to widespread delinquency. Despite introducing measures such as late payment penalties,increased automation of the tax system and digitalisation of processes, the Kenya Revenue Authority (KRA) has faced challenges in recovering outstanding tax debt. To address increasing tax arrears, the Finance Act 2023 introduced a tax amnesty running from September 2023 to June 2024. It allowed taxpayers to clear outstanding principal tax while receiving full waivers on penalties and interest.

This study evaluates the impact of different nudging strategies on the uptake of the

[1] In the tax collection process, full compliance requires registration, reporting of economic activity, timely filing, and payment by the due date. Of these, payment directly affects government revenue and liquidity.

tax amnesty through a randomised controlled trial (RCT) conducted in a natural field setting. A total of 43,666 tax delinquents were randomly assigned to one of five groups, and the intervention was implemented over three rounds spanning seven months. One control group received no email communication, while four treatment groups received emails about the tax amnesty: a neutral information message, or the same message combined with a behavioural nudge emphasising Deterrence, Social Norms, or Payment Plans. Non compliant taxpayers after Round 1 received a second, identical reminder. In Round 3, remaining non respondents were re randomised to a new treatment condition, allowing analysis of sequencing effects from switching message framings. Specific research questions are: (i) Do behavioural interventions increase uptake of and payment under the tax amnesty? (ii) Are behavioural messages about deterrence, social norms and payment plans more effective than informational messages? (iii) Does the sequencing of behavioural intervention increase or decrease compliance?

Results show that all message interventions, including the information treatment, significantly increased the probability of amnesty uptake compared to no communication. However, behavioural intervention did not consistently outperform the neutral informational message. Deterrence messages showed a modest advantage in the second round relative to the information treatment. Changing message framings across rounds yielded additional uptake among late responders but was associated with lower payments compared to early takers. Overall, behavioural intervention appear to enhance taxpayer engagement but do not necessarily translate into greater compliance than well timed informational communication.

While deterrence messages may increase uptake by reinforcing perceptions of enforcement, their effects are modest and suggest possible trade off between trust and legitimacy. Social norm and payment plan messages show no consistent advantage, especially under repeated reminders. Drawing on the Slippery Slope Framework, these results suggest that behavioural interventions must align with institutional credibility. In contexts where enforcement capacity is limited, timely information may provide the most reliable path to compliance.

The study contributes to the literature on letter studies in three ways. First, it extends letter intervention research by incorporating sequencing effects, showing that repeated reminders are more effective when varied but risk inattention when messages remain identical. Second, it provides rare experimental evidence on tax delinquency in a tax amnesty context from a developing country. Third, it informs policy design by demonstrating that strategic sequencing of behavioural interventions can improve the success of tax amnesties.

The rest of the paper is organised as follows. The next section presents review of

literature 2.1, followed by hypothesis development in subsection 2.2,study context in subsection 2.3. Section 3 describes the experimental design, sampling and estimation approach. Section 4 presents results and section 5 discusses them while section 6 concludes.

2 Literature Review

2.1 Theoretical Literature

Assume a revenue maximising government in need of raising more revenue through an amnesty and a taxpayer who faces an optimization problem with the certainty of benefiting through an amnesty. The benefit arises from having penalties and interests waived if the conditions of an amnesty are adhered to. This is against a cost of enforcement measures after an amnesty expires. The standard model by Allingham and Sandmo (1972) is such that once the taxpayer has chosen the optimal evasion, an amnesty may not cause him to change his behaviour in anticipation of future amnesties. In the standard model, it is not optimal to take up an amnesty unless the tax administration signals detection. Since we evaluate tax delinquents known by the tax administration detection is already signalled.

Since the tax administration can identify delinquent taxpayers and penalise them for noncompliance, a tax amnesty offers these taxpayers a chance to settle their debts when the expected benefits outweigh the costs of continued non-payment. In this context, we focus on observed delinquency rather than unobserved evasion. Malik and Schwab (1991) extend the standard tax evasion model by showing that, unless taxpayers clearly perceive a risk of detection, they are unlikely to respond to an amnesty. Compliance becomes more attractive when enforcement is credible and when taxpayers expect real gains from participation. Beyond financial incentives, social considerations also matter. As Malik and Schwab (1991) and Alm and Beck (1993) suggest, awareness of social disapproval for tax misconduct and prevailing norms around honest reporting can influence compliance. When taxpayers view paying taxes as a socially valued behaviour, an amnesty can strengthen compliance not only by removing financial penalties but also by reinforcing moral and social motivations to comply.

Wenzel (2004) defines social norms as the shared expectations or acceptance of particular behaviours within a reference group. In this setting, compliance is partly shaped by what taxpayers believe others in their peer group are doing. When taxpayers think that most of their peers are paying their taxes, they are more likely to follow suit, especially when they identify with that group. Our social norm treatment therefore references other taxpayers with arrears as a relevant comparison group. Prior studies find strong

evidence that such normative cues influence compliance decisions (Hallsworth et al., 2017; Del Carpio, 2014; Kirchler et al., 2014). By informing taxpayers that many others are already taking up the amnesty and inviting them to do the same, we expect positive behavioural responses to the social norm message.

For enforcement after the amnesty, we apply the slippery slope framework. In this framework, the perception of taxpayers regarding the ability of the tax administration to detect and punish noncompliance determines power vested upon them by the tax code (Kirchler et al., 2008). Taxpayer trust is evaluated from professional engagement, service orientation, and belief in tax administration. These taxpayer perceptions are expected to determine amnesty uptake and subsequent payment of tax arrears. Despite presence of long term debtors in our sample we expect deterrence treatment to have positive outcomes as tax delinquents maximize their utility. Empirical evidence shows that these effects often vary across contexts and message designs.

This study builds on the literature by testing how different behavioural interventions influence tax amnesty uptake and whether sequencing them enhances or reduces actual payment. While prior studies have examined the isolated effects of deterrence, social norms, and benefit oriented messages, we contribute by exploring how these interventions interact over multiple rounds of communication. Our aim is to offer insights into optimising tax authority messaging strategies, particularly in settings where enforcement capacity is constrained.

2.2 Hypothesis Development

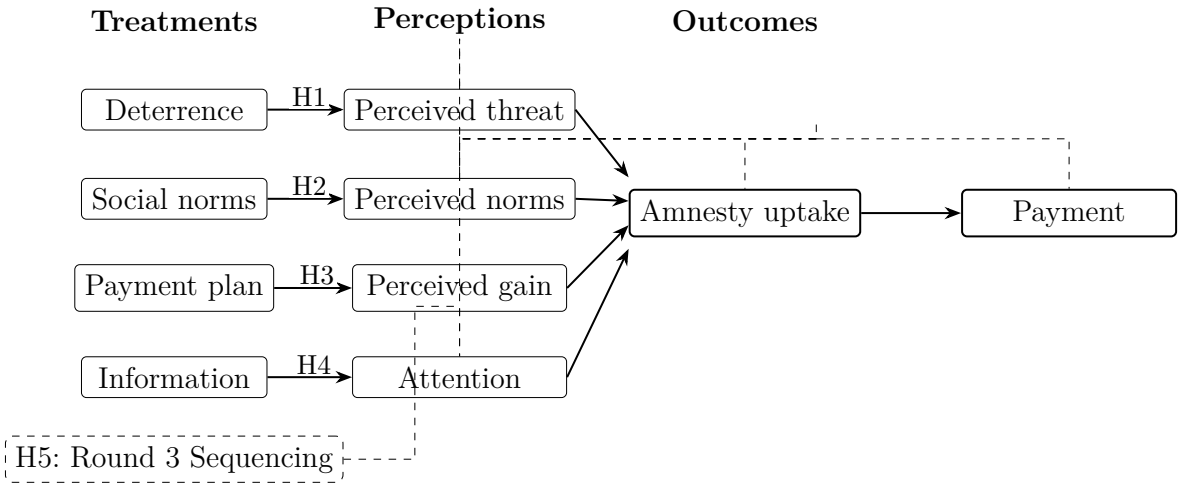
The literature points to complementary channels through which behavioural intervention affects behaviour in our case deterrence, social norms, and payment plan. In the standard model (Allingham and Sandmo, 1972), the intensive margins on up take with perceived detection and sanctioning, imply that amnesties should matter primarily when the administration credibly signals enforcement. In our context, delinquency is already known to the authority, so detection is salient and the expected benefit of compliance that waives penalties and interest is high. This setting strengthens the baseline "alert effect" of official contact (Fellner-Röhling et al., 2009) and makes even mild threats of enforcement consequential (Kleven et al., 2011; Castro and Scartascini, 2013; Ortega and Sanguinetti, 2013), while leaving room for backfire if framed too aggressively (Ariel, 2012). We assume that compliance increases when the tax debt owed is credible and enforcement is signalled. This is inline with findings from Okunogbe (2021) who uses randomised tax notices in Liberia's property tax system to separately signal identification and enforcement capacity.

Beyond deterrence, social interactions shape compliance. When individuals believe that

most peers comply, or that compliance is socially approved, they update both descriptive and injunctive expectations (Wenzel, 2004), raising payment propensities (Hallsworth et al., 2017; Del Carpio, 2014; Kirchler et al., 2014). Norm messages are most effective when the reference group is salient for example, "taxpayers with arrears like you" and when the framing avoids normalising delinquency. Private benefit messages can also promote compliance by highlighting immediate gains from amnesty terms, but their effect is heterogeneous and appears strongest when aligned with prevailing norms and backed by credible enforcement (Bobek et al., 2013; Gil et al., 2023).

A key open question is sequencing. Evidence outside taxation shows that repeated identical messages exhibit diminishing returns, whereas pausing or varying the message can restore impact (Ito et al., 2018). In tax settings, sequencing may determine whether attention from deterrence is converted into action via norms or benefits, or whether softer messages underperform without prior credibility. We therefore conceptualise amnesty communication as a dynamic treatment: initial contact establishes attention and credibility where deterrence treatment raises alert, subsequent messages shift perceived prevalence and private payoff based on norms or benefits while payments follow when the combined expectations cross individual thresholds.

We make the following predictions for known delinquents: (i) deterrence messages increase amnesty uptake and payment when enforcement is perceived to be credible; (ii) social norm messages improve compliance when they reference a well defined peer group with high stated compliance; (iii) payment plan messages are most effective after credibility is established; and (iv) Sequencing treatments outperform repeated identical messages reminders. Our experiment tests these predictions directly by varying message content and order, allowing us to assess both main effects and interaction effects of sequencing at both the intensive and extensive margins (Antinyan and Asatryan, 2019; Truzka et al., 2022).



Notes: The figure shows how message treatments are expected to influence perceptions, which in turn affect amnesty uptake and payment. H5 captures a design feature and is represented by the dotted lines: in rounds 1–2 firms receive the same message, while in round 3 they receive a different message; this switch is expected to increase attention and subsequently expected outcomes.

Figure 1: Tested Hypotheses

2.3 Study Context

This section provides background on the tax amnesty program, the institutional setting of the Kenya Revenue Authority (KRA), and the characteristics of the taxpayer population targeted by the intervention.Under Kenya's economic blueprint, Vision 2030, the government set an ambitious target of achieving a tax-to-GDP ratio of 23 percent by 2015; in practice, however, the ratio averaged only 15.2 percent by the 2021/22 financial year (GoK, 2007). While a large informal sector limits the visibility of some economic activities to the tax authority, tax noncompliance carries significant costs for individuals of working age seeking to participate in the formal economy. In particular, obtaining a tax compliance certificate, a requirement for government tenders, public sector employment, and access to credit from financial institutions, creates strong incentives for formal compliance.

Responsibility for tax and customs administration lies with the KRA which is administratively divided into six regions. The country has a population of over 50 million people, 32 million of whom are of working age as of 2022. Of these, a little over 17 million are registered for tax purposes, and a smaller proportion of 9.6 million are active in the tax register (GoK, 2023); (GoK, 2024). The law requires all those registered for tax purposes to file an income tax return by 30 June each year, regardless of their income status. In the case of additional obligations such as VAT and excise tax, the law provides due dates for payment and filing requirements.

Known tax debt arises from late payment of taxes when they fall due, despite declaration and filing being made through the tax system. The due date for tax payment varies depending on the type of tax for which a taxpayer is registered. For example, VAT is due when an invoice is issued or payment is received, whichever is sooner, and taxpayers must remit the tax due by the 20th day of the following month. Excise duty has the same due date as VAT, whereas PAYE (payroll tax) is payable by the 9th day of the following month. Additionally, self employed individuals with a tax liability exceeding Ksh 40,000 must pay tax in four instalments, with the final instalment due by 30 June the following year. Corporate income tax, on the other hand, is payable in four instalments depending on a firm's accounting period. Each instalment is due on the 20th day of the month following a quarter. Failure to observe these deadlines results in a late payment penalty of five percent and subsequent interest, calculated at one percent per month or part of a month until the arrears are settled.

The Tax Procedures Act 2015 outlines the penalties for noncompliance and the respective enforcement measures for recovering unpaid taxes. The most common enforcement measure is the distress order, which is mainly communicated to taxpayers via email. The Act specifies the penalties for various offences. For the purposes of this study, section 83A of the Act imposes a penalty of five percent of the tax due and payable on a taxpayer who fails to make a tax payment by the stipulated deadline. Despite the existence of a penalty and enforcement structure, tax debt has increased in nominal terms. Anecdotal evidence suggests that the causes of tax debt are numerous.

Firstly, some taxpayers may be delinquent by choice, while others are genuinely unable to pay taxes when they fall due due to liquidity constraints. This group may comply with other compliance requirements, such as declaration and filing, but may not make an actual payment to be fully compliant. On the other hand, tax debt has been attributed to pending bills from the government or to pending reconciliations where payment has been made but the taxpayer's account has not been updated. Furthermore, the low capacity of tax administration to enforce has driven the growth and existence of long-term tax debt. Furthermore, taxpayers may have taken advantage of a loophole that allows them to apply for the waiver of penalties and interest on payment of principal tax. This was repealed through the Finance Act 2023.

To collect tax arrears and clean the taxpayer ledger, the Finance Act 2023 introduced a tax amnesty for all tax types from 1 September 2023 to 30 June 2024. This amnesty forms the basis of the study. The amnesty offered a full waiver of penalties and interest on outstanding principal tax up to 31 December 2022, provided it was paid within the amnesty period. It was structured by tax period, enabling tax delinquents to obtain waivers based on clearing debts from a specific year rather than their total debt. During

the amnesty period, the KRA ran awareness campaigns through print, electronic and social media. Specific officers were identified to support taxpayers and tax officers with any issues related to the amnesty.

This kind of amnesty has proved successful in other jurisdictions. For example, Le Borgne and Baer (2008) asserts that the USA has implemented amnesties for tax delinquents, achieving success in gross revenue collection. It is estimated that 92 per cent of the USD 6.6 billion collected through amnesties between 1980 and 2004 came from tax arrears. Other recent field experiments focusing on tax delinquents have also found behavioural interventions targeted at this group to be successful in enhancing compliance (see, for example, (Hallsworth et al., 2017; Perez-Truglia and Troiano, 2018; Gil et al., 2023)).

3 Experimental Design

The study applied randomised controlled trials in a natural field experiment where 43,666 tax delinquents were sampled from Nairobi region. We embedded the intervention in routine communication from the tax authority. The email reminders were targeted to specific tax debtors and included carefully designed variations in message content. This design strengthens the external validity of our findings by replicating how tax administrations typically engage with taxpayers while testing improvements in communication strategies.

In the first and second round, a between subject design is adopted to include behavioural intervention in emails sent by the tax administration. As shown in figure 2, the experiment follows a between subject design in the first two rounds, where we randomly assigned tax delinquents to one of four treatment groups or a control group. Each treatment group received an email informing them about the amnesty and in three cases a specific behavioural nudge, allowing us to measure the causal effect of different messages on taxpayer compliance. We further include a randomly selected control group of 8,800 tax delinquents that were not treated. In the third round, we implemented a within subject design to examine the impact of nudge sequencing. Taxpayers who had not responded to previous reminders were reassigned to new treatment conditions. This approach allowed us to assess whether switching behavioural messages over time influences amnesty uptake and payment behaviour differently than static messaging strategies.

In addition to the amnesty information, the three treatment groups receive salient messages on amnesty payment plan benefit, enforcement post amnesty and amnesty social norms observed from tax delinquents. Since the subjects receive communication through email, the behavioural intervention in the email content is reflected in the

subject line. For example, those who receive a deterrence message have a subject line reading "apply for amnesty now to avoid enforcement". In the email body, the subject is addressed by name and informed about the amnesty, the period within which it runs, and the principal tax arrears accrued by them. The next sentence was the treatment, made salient by bolding. The email concluded with links to the amnesty guidelines and contact details. Apart from the treatment variation based on random assignment, the email content is the same for all the subjects.

Unlike vast majority of literature where deterrence messages carry a tough tone, we apply a soft enforcement message. Tax delinquents are reminded that at the end of the amnesty, tax debt including penalties and interest is payable and will be enforced as provided for in the tax law. In general, deterrence messages have been found to be effective in enhancing compliance (Fellner-Röhling et al., 2009); (Gil et al., 2023); (Holz et al., 2023); (Perez-Truglia and Troiano, 2018); (Castro and Scartascini, 2013). However, other studies find a backfiring effect from enforcement messages, especially from high income earners (Mascagni et al., 2017). Ariel (2012) finds deterrence messages to be ineffective.

In the within subject design, those who remain non takers receive altered treatment. Here, each of the four groups are broken down into three subgroups. For instance, those yet to take up the amnesty in the social norm group are divided into three subgroups. One group receives an email with information about the amnesty (second control group), the next group receives a deterrence message, and the third group receives a payment plan message. The same is implemented for those who received payment plan, deterrence and social norm messages in the first and second round.

In table 1, we present the message intervention and sample sizes per group. Five groups were implemented in the first round: four message treatments and one control group. The information message provided a neutral notification about the tax amnesty programme. Whereas the deterrence message emphasised potential enforcement actions for noncompliance. Payment plan message highlighted the advantages of entering a payment plan as social norm message appealed to conformity, noting that other taxpayers were already responding. The control group received no message and serves as the baseline for comparison in the analysis.

3.1 Sample Selection and Assignment to Treatment

The sample is drawn from the KRA's largest administrative region: Nairobi (refer to Appendix Table 11). This region covers 78 percent of total tax delinquents. To determine the sample, we assumed a statistical power of 80 percent and an effect size of 3 percent based on the lowest effect size from recent studies. The sample is composed

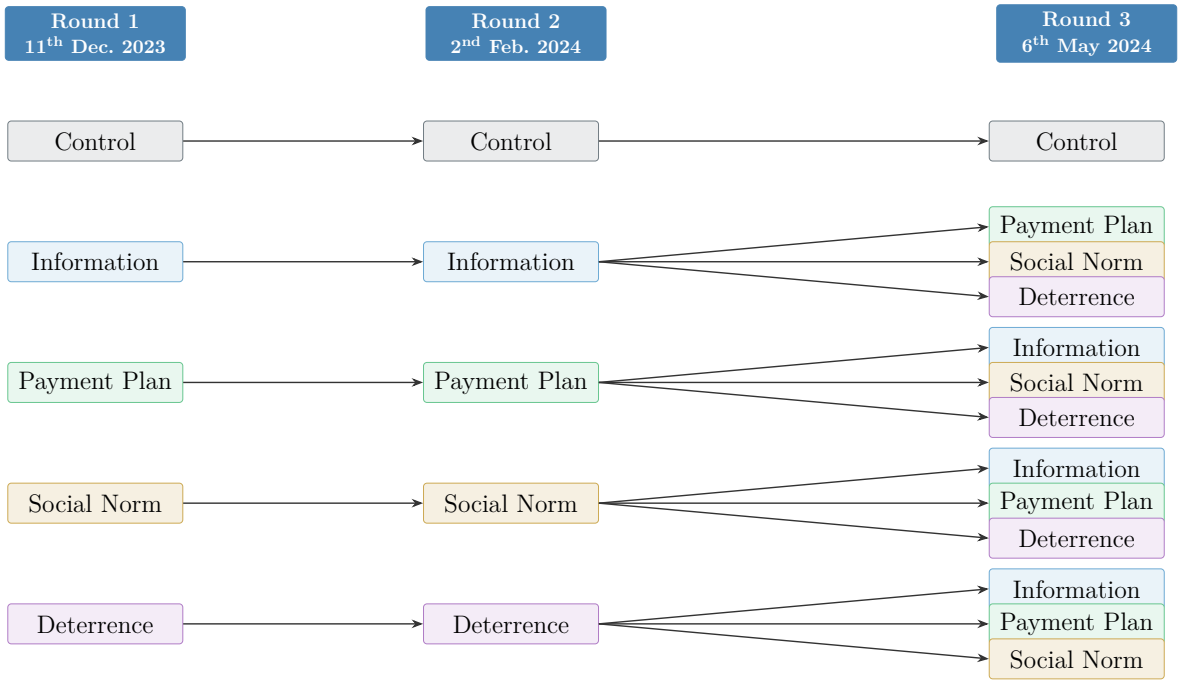


Figure 2: Experimental design

Notes: This is the implemented experimental design across three rounds; in round 1 the treatment was offered, a similar reminder was sent to nontakers in round 2 round 3 we introduced sequencing, non respondents were reassigned to other message types.

Table 1: Description of Experimental Groups and Treatment

Group	**Sample size**	**Subject line**	**Treatment**
Information	9,275	Chapa Reset na Tax Amnesty Programme	Notification on tax amnesty.
Deterrence	8,537	Apply for Amnesty now to avoid enforcement	After 30 June 2024, unpaid debt (principal, penalties, interest, fines) is payable through enforcement measures under the Tax Procedures Act (e.g., agency notices, civil suits, bankruptcy).
Payment plan	8,537	Enjoy peace of mind with a flexible amnesty payment plan	Encourages applying for a payment plan and the benefits of full compliance; apply for amnesty to avoid enforcement.
Social Norm	8,537	Join others with outstanding tax in taking steps to clear your arrears	Highlights that many taxpayers are already taking advantage of the amnesty; urges applying today.
Control	8,500	None	None

of individuals and firms. From the baseline data, most tax debtors have multiple debts across different tax heads that range from Income taxes for individuals, VAT, Excise

tax and corporate income taxes. We however summed up the outstanding principal per taxpayer and informed the tax delinquent on their overall debt.

Tax delinquents are randomly assigned to three treatment arms and a control group through stratified sampling. The exclusion criteria are based on taxpayers with less than Kshs 100,000 tax debt (704 Euros), large taxpayers, and taxpayers from the public sector whose only source of income is employment. We do not conduct further random assignments in the sequencing phase but randomly assigned non takers within groups to twelve subgroups. We assume that there are no time varying specific shocks which are correlated with tax compliance. At the same time, selection into treatment is independent of temporary individual specific characteristics.

3.2 Estimation Technique

The study estimated the impact of behavioural intervention on tax amnesty uptake and subsequent payment of tax arrears. Average treatment effect between participants randomly assigned to treatment and control group are measured using a binary model. Specifically, we use maximum likelihood estimation to measure the probability of tax amnesty uptake based on the assigned treatment they were exposed to. The probability model estimated for uptake conditional on treatment is specified as:

$$\Pr(Y_{ij}=1 \mid t=1)=\Phi\Big(\alpha+\beta_1 T_{ij}^{\text{Info}}+\beta_2 T_{ij}^{\text{Pay}}+\beta_3 T_{ij}^{\text{Soc}}+\beta_4 T_{ij}^{\text{Det}}+\gamma_1 S_{ij}+\gamma_2 \text{Type}_{ij}+\gamma_3 D_{ij}+\varepsilon_{ij}\Big) \tag{A.1}$$

Where Pr_{ij} is a dummy variable of interest that represents the potential treatment outcome for taxpayer i exposed to treatment j. It is 1 if a taxpayer takes up the amnesty and 0 otherwise. α_0 is the intercept, while β_1, β_2, β_3, and β_4 are the marginal effects for the information, payment plan, social norm, and deterrence treatments, respectively. γ_1,γ_2 and γ_3 are marginal effects for the tax office, taxpayer type and debt amount controls respectively.

To evaluate subsequent payment of tax debt, we compute the intention to treat effects at the end of the experiment by estimating an ordinary regression model represented as:

$$\text{Payment}_{ij}=\alpha+\beta_1 T_{ij}^{\text{Info}}+\beta_2 T_{ij}^{\text{Pay}}+\beta_3 T_{ij}^{\text{Soc}}+\beta_4 T_{ij}^{\text{Det}}+\delta_1 S_{ij}+\delta_2 \text{Type}_{ij}+\mu_{ij} \tag{A.2}$$

Payment_{ij} denotes the proportion paid by taxpayer i in station j. T_{ij}^{Info}, T_{ij}^{Pay}, T_{ij}^{Soc}, and T_{ij}^{Det} are treatment indicators for the information, Payment Plan, social norm, and deterrence messages, respectively.S_{ij} represents station fixed effects, Type_{ij} indicates the taxpayer type, and μ_{ij} is the error term. We use the proportion of the amount paid relative to the amount owed. This helps us to standardise payments which is the key

outcome expected from the tax amnesty. The coefficients from our intervention are $\beta_1, \beta_2, \beta_3$, and β_4, while α_0 is the intercept. In addition, δ_1 and δ_2 are coefficients for the station and taxpayer type, respectively.

For the sequencing of the behavioural interventions, we evaluate differences in tax debt payment by comparing distinct treatment paths to each other within the initial group assigned. In particular, we compare how taxpayer i who received a deterrence message in the first and second but failed to comply will react after receiving a social norm message in the third round compared to another taxpayer who received the deterrence treatment in the first two rounds but received a payment plan treatment in the third round.

To assess the robustness of the results, we re-estimate the same specification using the information treatment as the baseline category instead of the noncontacted control group. In this alternative coding, the coefficients β_1 to β_4 capture differences in outcomes relative to the Information message rather than to taxpayers who received no communication. Consequently, the coefficient on the non-contacted group (β_1) now measures the effect of receiving no message relative to the information treatment.

4 Results

In this section, we first present descriptive statistics to contextualise the subsequent treatment effects. This includes information on the outcomes of the email communication, as well as trends in amnesty uptake and payment behaviour in the three treatment rounds. Treatment effects are presented relative to two sets of control groups. First, outcomes are made comparable to the non contacted control group. Here, we can isolate mere information effects from its combination with behavioural intervention. Secondly, treatment effects relative to a control group that receives an information treatment are presented. This makes it possible to report the treatment effects net of the information treatment. We are then able to measure if behavioural intervention work better than general information. In both instances, we evaluate payment outcomes at the end of the amnesty period.

4.1 Descriptive statistics

The average outstanding tax debt for the treated sample was approximately Kshs 4.1 million. We observe considerable variations in the tax arrears with a standard deviation of Kshs 27.6 million, while the median debt was Kshs 468,270. (see Appendix tableB.1). For analysis, we winsorised the dataset at the 98th percentile and end up with a mean

of Kshs 1.7 million and a standard deviation of Kshs 4 million with median debt of Kshs 452,158.

A total of 5,997 taxpayers took advantage of the amnesty, including 695 from the control group. The takers owed Kshs 54 billion and paid Kshs 3.8 billion by the end of the amnesty, or 7.1 percent of the total debt. Uptake peaked in the third round, with 2,991 taxpayers taking advantage of the amnesty, compared to 1,926 in the first round and 1,080 in the second. Despite the lower uptake in the second round, early adopters contributed the largest share of payments. Those who responded in the first round paid 8.7 percent of their outstanding debt, compared to 6.5 percent in the second round and 6 percent in the third round as shown in table 2.

In the first round of the intervention, emails were sent to 34,794 taxpayers, of which 91 percent were successfully delivered. Of the delivered emails, 69 percent were opened. The opening rates declined in subsequent rounds to 30 percent in the second round and 28 percent in the third round, (See Appendix Table *B.2*). Because treatment began with the subject line, we treat delivered emails as a valid treatment exposure, even if we do not observe opening in the first seven days.

All tax delinquents sampled for the experiment were 43,666 the sample analysed consists of only 40,584 tax delinquents, see table 2. This excludes 3,082 delinquents whose emails were undelivered in the first round. 8,800 of the total sample were not contacted and they form our pure control group. Further details are provided in Appendix table B.3.

Table 2: Summary of Treated Sample, Uptake, Debt and Payment by Group and Round

Group	Sample	Count of Uptake	Tax Debt (Kshs. M)	Amount Paid (Kshs. M)	Proportion Paid
Round 1					
Control	8,800	361	3,228	424	13.1%
Information	8,442	409	3,737	434	11.6%
Payment Plan	7,784	377	3,574	212	5.9%
Social norm	7,764	401	3,006	250	8.3%
Deterrence	7,794	378	5,714	361	6.3%
Total	**40,584**	**1,926**	**19,260**	**1,682**	**8.7%**
Round 2					
Control	8,439	192	3,027	101	3.3%
Information	8,032	213	2,658	132	5.0%
Payment Plan	7,407	212	1,959	264	13.5%
Social norm	7,364	221	1,795	131	7.3%
Deterrence	7,416	242	3,235	195	6.0%
Total	**38,658**	**1,080**	**12,675**	**824**	**6.5%**
Group in Round 1 & 2 to Round 3					
Control	8,247	142	430	44	10.2%
Information → Payment Plan	2,265	249	2,344	170	7.2%
Information → Social norm	2,278	258	1,799	67	3.7%
Information → Deterrence	2,261	271	4,120	116	2.8%
Payment Plan → Information	2,041	229	2,204	104	4.7%
Payment Plan → Social norm	2,066	231	1,119	62	5.5%
Payment Plan → Deterrence	2,060	199	1,034	109	10.5%
Social norm → Information	2,065	233	1,270	92	7.2%
Social norm → Payment Plan	2,044	217	1,947	63	3.2%
Social norm → Deterrence	2,047	255	1,111	70	6.3%
Deterrence → Information	2,079	229	2,199	198	9.0%
Deterrence → Payment Plan	2,065	224	976	86	8.8%
Deterrence → Social norm	2,033	254	1,107	122	11.0%
Total	**33,912**	**2,991**	**21,661**	**1,302**	**6.0%**
Grand Total	**40,584**	**5,997**	**53,597**	**3,808**	**7.1%**

Note: This table excludes tax debtors who were sampled but not treated due to undelivered emails. Overall, 7.1 % of the Kshs 54 million owed was paid by the end of the experiment. Round 1 marks the start of the intervention. In this round, 1,926 tax debtors took up the amnesty, with outstanding debts totalling Kshs 19.2 billion; by the end of the experiment, 8.7 % of this amount had been paid. In Round 2, 1,080 tax debtors took up the amnesty, owing a combined Kshs 12.7 billion, of which 6.5 % was paid. In Round 3, which introduced sequenced reminders, 2,991 tax debtors took up the amnesty. These tax debtors owed a total of Kshs 21.6 billion but paid Kshs 1.3 billion.

4.2 Treatment Effects

This section presents the effects of the behavioural interventions on amnesty uptake and debt payment. First, we compare all treatments to the control group, which serves as a benchmark to test whether any form of reminder, to include or exclude behavioural intervention increases uptake and payment behaviour. These results are presented in Sections 5.2.1 and 5.2.2. Second, in Section 5.2.3, we compare the behavioural treatments with the information only group to isolate the notification effects from nudging effects.

4.2.1 Effects of Message Treatment on Tax Delinquents

In table 3 we present probit estimates on the effect of each of our four treatment conditions relative to the non contacted control group. Columns 1 and 2 indicates Round 1 outcomes with and without controls respectively, while Round 2 outcomes are presented in columns 3 and 4 with and without controls respectively and Round 3 results are in column 5 and 6 with and without controls respectively. In columns 2 ,4 and 6, the outcomes are controlled for taxpayer type, tax office, and the natural logarithm of the outstanding tax debt. The order of the columns and controls remain the same for all the results tables.

On the controls, we find that treated firms had higher and statistically significant uptake probabilities of 5.3, 3.4 and 5.6 percentage points compared to individual tax delinquent in the three treatment rounds respectively. Regarding the amount of debt, those with higher outstanding principal had a 0.6 , 0.3 and 1.1 percentage points higher probability of uptake relative to those with smaller debts in the control group for the three rounds respectively.

We now discuss the specific treatment effects on uptake from the behavioural intervention for each round. In the first round, all four treatments are associated with statistically significant increases in the probability of amnesty uptake. Coefficients range from 0.7 to 1.0 percentage points and are robust to the inclusion of covariates. Tax delinquents treated to social norms had a 1.0 percentage points higher probability of uptake relative to those in the control group but educes to 0.7 percentage points when they receive a reminder with the same treatment in the second round. Information treatment was the next strong treatment with 0.8 percentage points higher likelihood of uptake that turns statistically insignificant in the second round. On the other hand, payment plan and deterrence treatment have a 0.7 percentage points higher uptake probabilities relative to the control group. But in the second round, payment plans remain statistically significant with reduced effect size to 0.6 percentage points while deterrence reminder leads to stronger effects of 1.0 percentage points compared to the control group. There are no significant differences when control variables are included in the first and second round.

In the second round, all treatment effects remain positive and statistically significant but for the information group suggesting that neutral reminders may be less effective when repeated without variation. Although the treatment effects are smaller in magnitude for the payment plan and social norms compared to the first round,0.06 and 0.07 respectively, we observe the deterrence effects to increase from 0.07 in the first round to 1.0 percentage points in the second round compared to those in the control group. The effects are the same for the model with and without controls.

The third round entailed a sequencing of behavioural interventions to non takers different from what was sent in the first two rounds. Here, we observe positive and statistically significant effects on uptake from each of the 12 subgroups. As indicated in table 3 column 5 and 6, treated tax delinquents had over 9.0 percentage points higher likelihood of uptake relative to those in the control group. In particular, sequencing of social norms and deterrence behavioural intervention had the highest effects on uptake at 10.8 percentage points with and without controls. In this case it did not matter what treatment came first as we observe those who receive deterrence followed by social norms to have the same effects as those who were treated to social norms then deterrence. At the same time, when tax delinquents are informed about the amnesty in the first two rounds then treated to deterrence behavioural intervention in the third round, they had a 10.3 percentage points higher uptake probability compared to the control group. A clear confirmation that deterrence treatment is strong as argued in literature Gil et al. (2023),Antinyan and Asatryan (2019). These effects are weighed down when tax delinquents are promised payment plan benefits then treated to deterrence. This was the weakest effect in the third round at 8.0 percentage points relative to the control group.

Table 3: **Tax Amnesty Uptake Relative to Control Group**

Group	**Round 1**		**Round 2**		**Round 3**	
	(1)	(2)	(3)	(4)	(5)	(6)
Information	0.008**	0.007**	0.004	0.004		
	(0.003)	(0.003)	(0.002)	(0.002)		
Payment Plan	0.007**	0.007**	0.006**	0.006**		
	(0.003)	(0.003)	(0.003)	(0.003)		
Social Norm	0.010***	0.009***	0.007***	0.007***		
	(0.003)	(0.003)	(0.003)	(0.003)		
Deterrence	0.007**	0.008**	0.010***	0.010***		
	(0.003)	(0.003)	(0.003)	(0.003)		
Payment Plan - Info					0.095***	0.095***
					(0.007)	(0.007)
Social Norm - Info					0.096***	0.098***
					(0.007)	(0.007)
Deterrence - Info					0.093***	0.096***
					(0.007)	(0.007)
Info - Payment Plan					0.093***	0.094***
					(0.007)	(0.007)
Social Norm - Payment Plan					0.089***	0.090***
					(0.007)	(0.007)
Deterrence - Payment Plan					0.091***	0.093***
					(0.007)	(0.007)
Info - Social Norm					0.096***	0.097***
					(0.007)	(0.007)
Payment Plan - Social Norm					0.096***	0.096***
					(0.007)	(0.007)
Deterrence - Social Norm					0.108***	0.109***
					(0.007)	(0.007)
Info - Deterrence					0.103***	0.101***
					(0.007)	(0.007)
Payment Plan - Deterrence					0.080***	0.080***
					(0.007)	(0.007)
Social Norm - Deterrence					0.108***	0.108***
					(0.007)	(0.007)
Firms		0.053***		0.034***		0.056***
		(0.002)		(0.002)		(0.003)
ln_tax debt		0.006***		0.003***		0.011***
		(0.001)		(0.001)		(0.001)
Controls	No	Yes	No	Yes	No	Yes
Observations	40,584	40,584	38,658	38,658	33,551	33,551

Note: In the table we provide treatment outcomes on uptake relative to the control group from probit estimates. Column (1) is the pooled model with individuals and firms followed in round 1 followed by round 2 outcomes in column (3) and (4) and round 3 effects in column (5) and (6). We control for amount of debt, station and taxpayer type in model (2) (4) and (6).

4.2.2 Treatment Effects on Payment Relative to Control Group

Aside from uptake, the study sought to evaluate the payment outcomes on those who took the amnesty. A tax delinquent was only considered to have taken up the amnesty if they made a payment towards settling the tax arrears. By the start of our experiment, these tax debtors had about seven months to enjoy the temporary amnesty, we therefore evaluate effects on payment at the end of the amnesty period. In doing this, we use an ordinary regression based on final proportion of payment relative to the tax debt but considering the round of uptake. Table 4 presents OLS estimates from each treatment on the proportion of outstanding debt paid relative to the control group. As in table 3, Columns 1 and 2 display results for Rounds 1 with and without controls, while Columns 3 and 4 presents results for round 2 with and without controls and columns 5 and 6 are round 3 OLS estimates with and without controls.

In the first round, all treatments are associated with significant increases in the proportion of debt paid relative to the control condition. Taxpayers who received the deterrence message paid the highest share, 3.1 percent more than the control group , followed by those who received the social norm and information messages at 2.4 percent and 2.3 percent for those treated to payment plans benefit. The inclusion of controls slightly reduces the coefficients but does not affect statistical significance. In the second round, effects remain positive and largely similar in magnitude. The deterrence message again yields the largest payment share, followed by information , deterrence, and social norm . Again, the inclusion of controls slightly reduces the coefficients but does not affect statistical significance.

In the third round , we find significant payment effects though smaller than the first two rounds. In each of the 12 subgroups, tax delinquents paid over 1 percent more than those in the control group. The highest payment effects are drawn from those treated to deterrence then social norms and deterrence then payment plans who end up paying 1.8 percent more than those in the control group. At the same time, information treatment followed by deterrence leads to 1.6 percent more payment than the control group. In general, the payment effects demonstrate that those who take up the amnesty earlier pay slightly more than those who take it up in later rounds. This is also observed from the baseline payment which is 2.3 percent in the first round then declines to 1.3 percent and finally to 0.5 percent more payments in the third round. When controlled for tax payer type and tax office,the baseline payment is negatively affected with statistically significant effects in the second and third round.

Table 4: **Payment Outcomes Relative to Control Group**

Group	Round 1		Round 2		Round 3	
	(1)	(2)	(3)	(4)	(5)	(6)
Information	0.024***	0.023***	0.023***	0.023***		
	(0.003)	(0.003)	(0.002)	(0.002)		
Pay plan	0.023***	0.022***	0.024***	0.023***		
	(0.003)	(0.003)	(0.002)	(0.002)		
Social Norm	0.024***	0.023***	0.024***	0.023***		
	(0.003)	(0.003)	(0.002)	(0.002)		
Deterrence	0.031***	0.030***	0.030***	0.030***		
	(0.003)	(0.003)	(0.002)	(0.002)		
Pay plan - Info					0.010***	0.011***
					(0.003)	(0.003)
Social - Info					0.012***	0.012***
					(0.003)	(0.002)
Deterrence - Info					0.014***	0.014***
					(0.003)	(0.002)
Info - Pay plan					0.012***	0.013***
					(0.002)	(0.002)
Social - Pay plan					0.011***	0.012***
					(0.003)	(0.003)
Deterrence - Pay plan					0.018***	0.019***
					(0.003)	(0.002)
Info - Social					0.008***	0.009***
					(0.002)	(0.002)
Pay plan - Social					0.015***	0.015***
					(0.003)	(0.002)
Deterrence - Social					0.018***	0.019***
					(0.003)	(0.003)
Info - Deterrence					0.016***	0.016***
					(0.002)	(0.002)
Pay plan - Deterrence					0.010***	0.010***
					(0.003)	(0.002)
Social - Deterrence					0.015***	0.016***
					(0.003)	(0.003)
Firms		0.057***		0.045***		0.019***
		(0.002)		(0.002)		(0.001)
Constant	0.023***	-0.002	0.013***	-0.006***	0.005***	-0.004**
	(0.002)	(0.003)	(0.002)	(0.002)	(0.001)	(0.002)
Controls	No	Yes	No	Yes	No	Yes
Observations	40,584	40,584	38,658	38,658	33,551	33,551

Notes: In the table we present treatment effects on payment for the three rounds relative to no email group from OLS estimates. Our dependent variable is the proportion paid to account for the imbalance in the sample between payers and non payers. We construct one variable that captures takers in each round. Column (1) is the pooled model with individuals and firms followed in round 1 followed by round 2 outcomes in column (3) and (4) and round 3 effects in column (5) and (6). We include amount of debt, station and taxpayer type in model (4) (5) and (6).

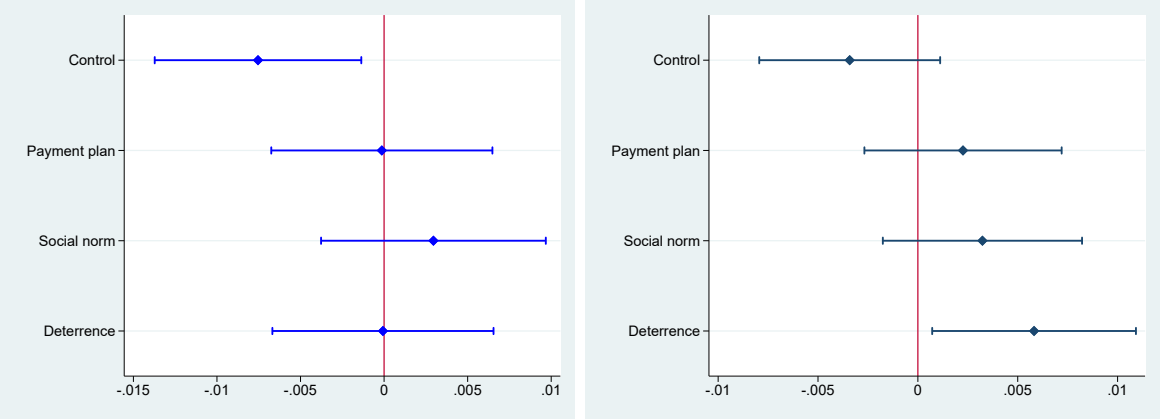
4.2.3 Treatment Effects Relative to Information Treatment

While the previous sections examined the overall effectiveness of the treatments relative to a none contacted control group, it does not allow us to isolate the specific effects of just informing tax delinquents about the amnesty. Despite all treated delinquents being informed about the amnesty, an additional nudging sentence is included dictated by the random assignment. The effects we report here are net of the effects of receiving a notification besides the salient nudge in the other treatment conditions (Fellner-Röhling et al., 2009).

The results in figure 3 show that average marginal effects are small and statistically insignificant across the alternative treatments in the first round. Relative to information treatment, the payment plan and deterrence treatments report effects in the intensive margins of uptake that are effectively zero. Social norm treatment shows a slightly positive but imprecise estimate; in each case, the 95% confidence interval includes zero. The Control group's effect is mildly negative relative to information but also not statistically significant. Overall, none of the alternatives meaningfully outperforms the information treatment in raising uptake in the first round, suggesting that the simpler information message performs about as well as the other tested approaches

in this setting. For payment outcomes in the same round, only deterrence treatment generates statistically different effect relative to information treatment with effect size of 0.7 percentage points as indicated in figure 4.

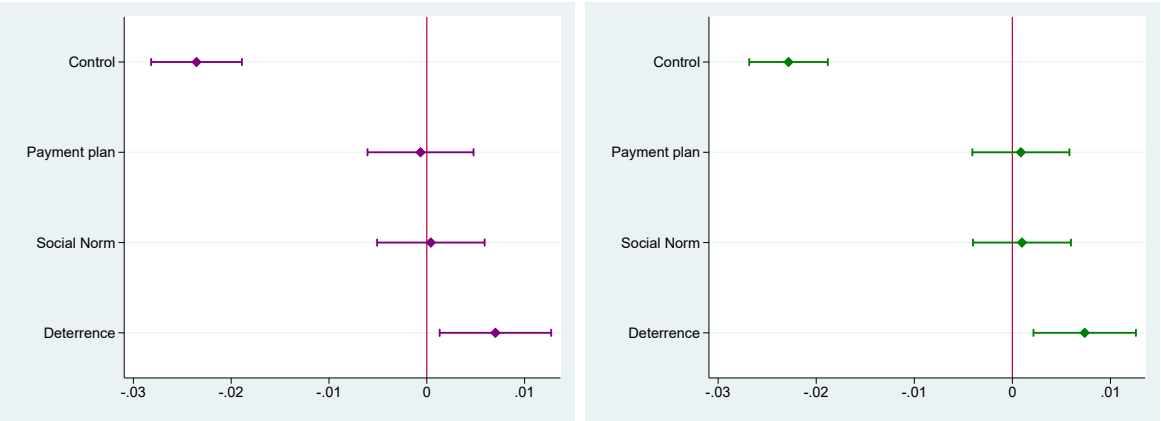
In the second round, deterrence treatment displays a positive and statistically significant effect on uptake of about 0.7 percentage points relative to information treatment. However, payment plan and social norm treatments remain statistically insignificant. The control group continues to perform worse than all treatments, though statistically insignificant. For payment outcomes, deterrence stands out again as the only treatment producing a statistically significant positive effect with 0.7 percentage point higher payment relative to Information. These findings suggest that deterrence based messages become more effective with repeated exposure, enhancing both compliance and payment behaviour, whereas the other behavioural framings and the standard information message remain broadly similar in impact. This is indicated in figure 3 and 4 respectively.



(a) Uptake Round 1 (b) Uptake Round 2

Figure 3: Average Treatment Effects on Uptake Relative to Information Treatment.

Notes: The figure shows the average treatment effects of different message framings on amnesty uptake relative to the Information treatment. Confidence intervals crossing zero indicate that most behavioural messages had effects statistically similar to the Information message.



(a) Payment Round 1 (b) Payment Round 2

Figure 4: Average Treatment Effects on Payment Relative to Information Treatment.
Note: The figure shows the average treatment effects of different message framings on payment outcomes relative to information treatment. Confidence intervals crossing zero indicate that but for deterrence treatment, behavioural messages had effects statistically similar to information message.

4.2.4 The Mechanisms of Observed Effects

In this section, we investigate the potential drivers of uptake and payment in the treatment groups. Table B.4 to table B.15 in the appendix decomposes the treatment effects on uptake and payment by firms and individuals. We begin with heterogeneity effects relative to the none contacted control group. In general, we find all but payment plan treatment to be driven by individuals in the first round while firms drive the social norm effects with a higher magnitude, table B.4 . In the second round, the strongest effect is from deterrence treatment and is driven by both individuals and firms. All other treatment effects are driven by individuals with statistically significant effects, Table B.5. The sequencing effects from the third round are observed to be driven by both individuals and firms with firms having higher effects averaging 13.1 percentage points in comparison to individuals who have effect size of 7.2 percentage points on average. We also find that individuals with high debts had a 1.3 percentage points higher probability of uptake while firms had 1.1 percentage points effects compared to the control group refer to table B.6.

On payment outcomes, our OLS regression indicates that both firms and individuals drove the effects in all the three rounds. While deterrence effects were the highest for both individuals and firms in the first two rounds (1.9 % and 4.8 % in round 1 and 1.5 % and 5.3 % in the second round), all other treatments had statistically significant payment effects for both firms and individuals, make reference to table B.7 and table B.8. In the third round, payment effects are statistically significant in all the 12 subgroups. Whereas the effects are smaller for individuals firms have slightly higher effects which

could be driven by among other factors the debt amounts and the associated benefits from waiver of penalties and interests. At the same time liquidity constraints maybe higher for individuals compared to firms. Overall, payment effects following treatment are driven by both firms and individuals albeit with differing magnitudes. While the effects from individuals decline with each round, we observe payment effects for firms to increase from the first to second round mainly driven by deterrence behavioural intervention.

In establishing the effect of behavioural intervention without information we find no effects on uptake from the first round. In the second round deterrence treatment has positive and statistically significant effects on uptake driven by individuals at 0.5 percentage points relative to information treatment (see table B.10 . On the other hand, the third round effects are driven by individuals who receive a sequence of deterrence then social norm treatment and vice versa and table B.11. From table B.12 the effect is a 2.3 percentage points higher probability of uptake relative to the reference group. At the same time, we find statistically significant effects on payment from only deterrence treatment driven by individuals in the first and second round, refer to table B.13 and table B.14. In the third round, payment effects are driven by individuals who were treated to deterrence then payment plan and information followed by deterrence treatment.

4.2.5 Heterogeneity Across Treatments and Interaction Effects

We undertake two tests. First, we begin with the null hypothesis that there exists no difference between the four treatments we administered. As shown in table 5 the F statistic is statistically insignificant for each of the three treatment rounds. This is despite the fact that the treatment as a group have differences when compared to the control group. In as much as the interventions are effective when tested for main effects, no one treatment is significantly more effective than the others.

Table 5: Wald Test for Treatment Heterogeneity Across Rounds

Treatment Round	F Statistic	p- value
Round 1	0.3948	0.7567
Round 2	1.8228	0.1406
Round 3	0.0564	0.9824

Notes: The Wald F-test evaluates the null hypothesis that treatment effects are equal across groups, indicating no treatment heterogeneity. Results suggest no statistically significant heterogeneity in treatment effects in any round.

Secondly, we test if any of our four treatments interacted with the debt and tax payer type have joint significance beyond the main effects. Results show no statistically significant evidence. This is indicated in table 6. For the interaction effects by the taxpayer type,

firms or individuals, our F statistic is statistically insignificant an indication that treatment effects do not differ significantly between firms and individuals in the first two rounds. The interaction with the tax debt is also statistically insignificant in these two rounds. However, in the third round, we observe statistically significant interaction effects that suggest meaningful heterogeneity in response to treatments based on these control variables. In particular, there is statistically significant interaction effects between taxpayer type and various combined behavioural treatments, this indicates that firms responded differently to these interventions than individual taxpayers. These findings reinforce the importance of customising behavioural interventions by taxpayer segment. The fact that firm taxpayers exhibited increased responsiveness only in Round 3 further underscores the strategic timing dimension of behavioural compliance efforts.

Table 6: Wald Tests for Interaction Effects by Round

Treatment Round	F_Firms	p_Firms	F_ Tax Debt	p_Tax Debt
Round 1	1.73	0.14	1.02	0.39
Round 2	0.24	0.92	0.24	0.92
Round 3	4.34	0.00***	8.18	0.00***

Notes: Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Very small p-values are rounded to 0.00 but indicate strong statistical significance.

5 Discussion

Emailing Outcomes. Our study builds on the standard procedure at the KRA, where emails are a common means of communicating with taxpayers. Tax delinquents automatically receive an emailed demand letter if they remain in debt for more than seven days. During the amnesty period, further communication was offered to persuade and inform taxpayers to clear their outstanding tax debt. While not directly relevant to our research question, the outcomes of the email campaign are unique in each of the three treatment rounds and offer interesting insights. When the emails were sent out on 11 December 2023, 89 per cent of the delivered emails were opened, but readership dropped drastically in subsequent rounds to 30 per cent and then to 28 per cent.

As our intervention begins with the subject line of the email, we infer that tax delinquents are intentionally unresponsive to email communication from the tax authority. We also note that over half of the tax delinquents who read our email in the first round did not pay attention to subsequent emails. This could signal a number of things. First, taxpayers may have learned from previous demand notices that enforcement is low and may not change after the amnesty period. Secondly, they may have noted the email content, so a reminder is not new information for them. We also observe that an estimated three percent forward the emails in each round, which could suggest an effort

to seek professional help from tax consultants. It could also be argued that this points to spillover effects, whereby tax delinquents communicate with each other. However, this is unlikely, as they would be communicating their noncompliance behaviour, which is socially uncommon in this context.

Since our treatment starts from the subject line of the email, we infer that tax delinquents are intentionally non responsive to email communication from the tax authority. We note that over half of tax delinquents who read our email in the first round did not pay attention to it in the subsequent rounds. These could signal a number of things. First the taxpayers may have learnt from previous communication of demand notices that enforcement is low and may not change post amnesty. Secondly, they could have noted the email content and a reminder of the subject line is no new news to them. We also observe an estimated 3 percent forwarding the emails in each round which could infer an effort to seek professional help from tax consultants. One may also argue that this points to spillover effects where tax delinquents communicate to each other. However, it is unlikely as they would be communicating their non compliance behaviour which is socially uncommon in this context.

The literature suggests that the communication channel used is important for driving the effectiveness of the message (Ortega and Scartascini, 2020). In Colombia, emails have been found to be more effective than letters, but less effective than personalised attention. While this may be administratively impossible, Mascagni et al. (2017) found that text messages were even more effective than emails in the Rwandan context. The fact that over 99 per cent of our emails are delivered in each round indicates efficiency. However, we observe a decline in effectiveness in subsequent reminders, which could imply the need for a mixed communication strategy. It should be noted that communication with the sampled taxpayers was limited to email correspondence. Nevertheless, tax debts are managed at tax office level and considerable heterogeneity exists in taxpayer management strategies.

Tax Amnesty Uptake. This study evaluates the uptake of tax amnesty based on two distinct control groups. The first control group receives no communication throughout the study period. The second control group receives information about the ongoing tax amnesty. The other three sub-samples receive a nudge sentence in addition to information about the amnesty. Uptake is evaluated in each of the three treatment rounds, but payment outcomes are analysed at the end of the tax amnesty.

This study offers several insights into the mechanisms by which behavioural and informational messages influence tax compliance in a real world context. These findings are consistent with, and also challenge, elements of the existing literature in public economics and behavioural science. A key finding is that all message

treatments significantly increased the probability of tax amnesty uptake compared to no communication. This highlights the power of administrative engagement itself and is consistent with previous evidence on the 'alert effect', whereby simply notifying taxpayers can trigger uptake (see (Fellner-Röhling et al., 2009; Antinyan and Asatryan, 2019)). In the context of tax delinquency, where the authorities already know the identity and liability of noncompliant taxpayers, higher administrative engagement may lead to higher amnesty uptake.

More specifically, the first two rounds have a modest effect on uptake. The strongest effects here are drawn from social norms, at 1.0 percentage points in the first round, driven by firms which report a 1.6 percentage point higher uptake than the control group. In the second round, the strongest effects of 1.0 percentage points were driven by firms at 1.1 percentage points relative to the 'no email' control group. These findings are consistent with the literature; for instance,Gil et al. (2023) finds that individuals only join an amnesty through deterrence messages. Mascagni et al. (2017) finds that deterrence messages are generally ineffective in Rwanda, but argues that small taxpayers remain responsive to them. Other studies that have found deterrence messages to be effective include Shimeles et al. (2017), Fellner-Röhling et al. (2009) and Dwenger and Treber (2022).

Furthermore, firms that receive deterrence messages before or after any other treatment pay more than those who receive any other combination of our behavioural message intervention. This could be because these firms may have received agency notices in the past and are therefore more cautious. Agency notices through banks are commonly used as an enforcement measure. Essentially, banks are instructed to freeze funds in accounts, thereby affecting working capital and compelling tax delinquents to settle tax arrears.

The small effects of deterrence and the lack thereof for firms could be attributed to the text of the law instituting the amnesty, which retained the status quo in terms of enforcement post-amnesty. Generally, all other treatments drive uptake relative to the no email group, with statistically significant effects. Substantial effect sizes averaging 10 percentage points are observed from sequencing behavioural intervention, mainly driven by a combination of social norms and deterrence. The effect size remains at 10.8 percentage points irrespective of the order.

When we compare behavioural messages with a neutral information treatment, we find that behavioural intervention may not yield additional benefits. In the first round, none of the behavioural behavioural intervention significantly increased amnesty uptake beyond that achieved by the information message, and in the second round, only the deterrence framing showed a small, significant effect. This finding is consistent with the

meta-analysis by De Neve et al. (2021), which argues that the impact of behavioural intervention on tax compliance is modest and is often not statistically distinguishable from that of basic administrative outreach. Specifically, we found no treatment effects in any of the three message interventions in the first round. In the second round, where tax delinquents received the same message, only the deterrence message had a statistically significant effect, again confirming that this nudge is stronger than the softer behavioural intervention we employed. As with the no email control group, we find that combining social norms and deterrence treatments is effective irrespective of sequence order. This finding is consistent with literature on the role of social norms and deterrence messages in promoting compliance (Hallsworth et al., 2017; Gil et al., 2023; Mascagni et al., 2017; Wenzel, 2004). While the literature has suggested that deterrence messages are effective due to the implied economic costs, social norms have been argued to be effective when taxpayers are compared to a reference group.

To interpret the effects of heterogeneity, we draw on the Slippery Slope Framework (Kirchler et al., 2008). According to this framework, deterrence messages appeal directly to the power dimension by signalling credible enforcement threats. Our finding that deterrence has a positive effect on uptake for both firms and individuals is consistent with this view. We also found that the combination of deterrence and social norm messages was effective, especially for firms in the sequencing phase. The treatment effects remained statistically significant and positive irrespective of the order. This aligns with prior work showing that excessive emphasis on sanctions can backfire if not supported by institutional credibility or trust (Kirchler et al., 2014).

Overall, our results show that behavioural interventions in the context of tax amnesties are more effective than no communication at all, but not significantly different to providing information about the amnesty. Despite this general conclusion, it is important to note that deterrence messages were statistically significant in promoting both uptake and payment for firms and individuals alike. At the same time, the other behavioural intervention had varying effects, but were still significantly important, especially when compared to no communication. This was particularly evident in the third round of treatment, when the behavioural interventions were altered for late takers. Therefore, behavioural interventions can complement administrative communication, particularly in early outreach efforts. However, a mismatch between message design and institutional credibility could undermine compliance, particularly in repeated outreach efforts. This aligns with broader evidence from the nudging literature, which suggests that the effects of behavioural interventions depend heavily on context and vary based on population characteristics, message type and institutional setting (Truzka et al., 2022).

Tax Debt Payment. When we evaluated payment outcomes at the end of the study

period, we found that those who took up the amnesty earlier paid more than those who took it later. In this regard, we observed payments that were 2.5% higher for those who took up the amnesty in the first and second rounds, while those who took it in the third round only paid 1.3% more than the control group. In all rounds, firms paid more than individuals, at 4.4%, 4.8% and 2.3% respectively in the first to third rounds. Although literature on the sequencing of behavioural intervention is scarce, we argue that changing communication details is an effective strategy for both firms and individuals. Additionally, the net effects imply that informing tax delinquents about their tax arrears is effective in promoting payment, particularly among those who take up the amnesty at its inception.

Overall, we find that the amount of outstanding tax debt is statistically significant in determining tax amnesty uptake. Indeed, the higher the tax debt, the greater the cost saving in terms of accrued interest and penalties. Nevertheless, the tax administration is organised so that taxpayers are domiciled in specific tax stations. In some instances, we find this attribute to be important in explaining tax amnesty uptake, particularly for firms in the MTO (recall that this is a tax office for firms only). This may imply that relationship management for firms is more structured and effective than for tax stations with mixed taxpayer types. However, firms are registered for a number of taxes, which may imply frequent contact with the tax system and make them more informed. For example, if they have a VAT obligation, returns are filed monthly, unlike individuals who only file an annual return. Our results are aligned to those of Gil et al. (2023), who found a strong response from firms as opposed to individuals.

6 Conclusion

In this study, we use a temporary tax amnesty targeting tax delinquents to evaluate the impact of behavioral interventions on program uptake and debt repayment. Our findings indicate that the information treatment has both economically and statistically significant effects. This conclusion is based on comparisons between the treatment group and a control group that did not receive an email, which reveal significant effect sizes for both amnesty uptake and payment.

While reminders have a significant effect, the results suggest that sequencing behavioral interventions within reminders is more effective when communicating with both firms and individuals. The effects of reminders are observed for individuals only when the reminder content remains unchanged across rounds. However, when the sequence of behavioral interventions is altered, outcomes increase significantly for all taxpayer types. Regarding specific treatments, no single intervention is found to be more effective

than the others overall. Nevertheless, the deterrence treatment continues to exhibit statistically significant effects in the second treatment round, while all other treatments remain insignificant.

Additionally, the timing of amnesty uptake is important for payment outcomes. Those who take up the amnesty earlier in the experiment pay, on average, 2.4 per cent more, while those who take it in the last round have an average payment rate of 1.4 per cent relative to the no email control group. This is not the case when we use an information treatment as a control group, meaning that the effects are more or less the same whether tax delinquents are nudged or informed. Therefore, we argue that it is imperative for tax administrations to intensify communication or publicity from the nascent stages of an amnesty. While our results are from a specific context, we find them to be externally valid when compared to the existing literature, and they can be adopted in a wide range of jurisdictions. In particular, the sequencing of behavioural intervention in reminders is an effective strategy that has been shown to increase both uptake and payment compared to no targeted communication. Given the modest cost of large-scale emailing compared to enforcement, this design can be adopted in contexts beyond tax delinquency.

Finally, the results of this study highlight an important public policy discussion: the difference between what encourages compliance and what maintains it. While behavioural intervention can increase uptake, this does not necessarily equate to meaningful compliance. Although message design may influence initial responses, payment outcomes may be affected by factors such as trust in the administration, timing and characteristics of taxpayers. Tax administrations can therefore adopt a more strategic approach, intensifying targeted communication earlier in any programme and taking into account the different mechanisms for firms and individuals.

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A Appendix

A.1 Behavioural Intervention

(1) *Deterrence Message*

Dear. . . ,

Kenya Revenue Authority (KRA) presents to you the Tax Amnesty program; an exciting opportunity to write off all accrued interest and penalties on the principal tax for periods up to 31st December 2022. The programme runs from 1st September, 2023 to 30th June 2024.

Our records show that you have an outstanding principal debt of Ksh . . . . . .

The not so good news is that, after 30th June 2024, all unpaid debt including penalties, interest and fines will be payable through enforcement measures. This will include implementing the Tax Procedures Act such as issuance of agency notices, civil suits and declaration of bankruptcy.

Chapa reset by accessing the guidelines on https://bit.ly/44GBBnw or visit your Tax Service Office or any of our offices countrywide in the following locations https://bit.ly/3KRsNkV

We are here to serve you, call us on: 0711 099 999 or email: callcentre@kra.go.ke

*Terms and conditions apply.

*In case of any inconsistency, visit your TSO for reconciliation by providing relevant supporting documents to aid in the process.

(2) *Payment Plan Message*

Dear. . . ,

Kenya Revenue Authority (KRA) presents to you the Tax Amnesty program; an exciting opportunity to write off all accrued interest and penalties on the principal tax for periods up to 31st December 2022. The programme runs from 1st September, 2023 to 30th June 2024.

Our records show that you have an outstanding principal debt of Ksh . . . . . .

We encourage you to apply for a payment plan and experience the peace and freedom that comes with being fully compliant.

Chapa reset by accessing the guidelines on https://bit.ly/44GBBnw or visit your Tax Service Office or any of our offices countrywide in the following locations https://bit.ly/3KRsNkV

We are here to serve you, call us on: 0711 099 999 or email: callcentre@kra.go.ke

*Terms and conditions apply.

*In case of any inconsistency, visit your TSO for reconciliation by providing relevant supporting documents to aid in the process.

(3) *Social Norm Message*

Dear. . . ,

Kenya Revenue Authority (KRA) presents to you the Tax Amnesty program; an exciting opportunity to write off all accrued interest and penalties on the principal tax for periods up to 31st December 2022. The programme runs from 1st September, 2023 to 30th June 2024.

Our records show that you have an outstanding principal debt of Ksh . . . . . .

Don't be left out! More and more taxpayers with arrears are already taking advantage of the amnesty. Apply today.

Chapa reset by accessing the guidelines on https://bit.ly/44GBBnw or visit your Tax Service Office or any of our offices countrywide in the following locations https://bit.ly/3KRsNkV

We are here to serve you, call us on: 0711 099 999 or email: callcentre@kra.go.ke

*Terms and conditions apply.

*In case of any inconsistency, visit your TSO for reconciliation by providing relevant supporting documents to aid in the process.

(4) *Information Message*

Dear. . . ,

Kenya Revenue Authority (KRA) presents to you the Tax Amnesty program; an exciting opportunity to write off all accrued interest and penalties on the principal tax for periods up to 31st December 2022. The programme runs from 1st September, 2023 to 30th June 2024.

Our records show that you have an outstanding principal debt of Ksh . . . . . .

Chapa reset by accessing the guidelines on https://bit.ly/44GBBnw or visit your Tax Service Office or any of our offices countrywide in the following locations https://bit.ly/3KRsNkV

We are here to serve you, call us on: 0711 099 999 or email: callcentre@kra.go.ke

*Terms and conditions apply.

*In case of any inconsistency, visit your TSO for reconciliation by providing relevant supporting documents to aid in the process.

B Appendix

B.1 Detailed Tables

Table B.1: Sample Size and Tax Office Distribution by Group

Group	**Information**	**Benefit**	**Social Norm**	**Deterrence**	**Total**
Sample size	9,273	8,537	8,537	8,537	34,864
Tax Office					
North of Nairobi	2,212	1,914	2,022	1,954	8,102
	(27.3%)	(23.6%)	(25%)	(24.1%)	
East of Nairobi	1,865	1,680	1,733	1,657	6,935
	(26.8%)	(24.2%)	(24.9%)	(23.8%)	
West of Nairobi	3,689	3,518	3,388	3,518	14,113
	(26.1%)	(24.1%)	(24.0%)	(24.9%)	
South of Nairobi	1,312	1,241	1,200	1,220	4,973
	(26.3%)	(24.9%)	(24.1%)	(24.5%)	
Medium Tax Office	197	184	194	188	763
	(25.8%)	(24.1%)	(25.4%)	(24.6%)	
Mean Debt	4,340,566	3,880,198	3,938,763	4,315,752	4,123,534
Taxpayer Type					
Individuals	5,536	5,052	5,021	5,093	20,702
Firms	3,737	3,482	3,507	3,438	14,164

Notes: The table indicates number of tax delinquents and proportions in parenthesis. Taxpayers are distributed equally across the three treatment groups and a slightly higher number for the control group. We show the specific groups, distribution across tax office, mean debt and taxpayer type.

Table B.2: Email Treatment by Group and Round

Group	Sent	Delivered	Undelivered	Forwarded	Opened	Uptake	Uptake Rate
Round 1							
Information	9,273	8,442	831	54	5,946	410	5.2%
Payment Plan	8,500	7,601	750	72	5,995	377	5.1%
Social Norm	8,512	7,609	764	51	5,243	400	5.4%
Deterrent	8,511	7,645	737	97	6,828	378	5.1%
Total	**34,794**	**31,122**	**3,082**	**274**	**24,012**	**1,565**	**5.03%**
Round 2							
Information	7,083	6,893	230	54	2,071	213	3.0%
Payment Plan	6,457	6,287	192	88	1,840	214	3.5%
Social Norm	6,435	6,257	182	62	1,811	221	3.5%
Deterrent	6,483	6,321	171	77	2,067	242	3.8%
Total	**26,458**	**25,758**	**775**	**281**	**7,789**	**890**	**3.4%**
Round 3							
Information	6,129	5,953	176	45	1,652	778	12.0%
Payment Plan	6,308	6,124	184	42	1,533	661	11.8%
Social Norm	6,328	6,122	206	29	1,653	705	12.5%
Deterrent	6,307	6,105	202	101	1,867	707	12.4%
Total	**25,072**	**24,304**	**768**	**217**	**6,705**	**2,851**	**11.7%**

Notes: This table excludes the non-contacted control group. Of 34,886 sampled tax delinquents, emails were sent to 34,794 in Nairobi region; 92 had incorrect addresses. In round 1, 89.4% were delivered, 77.1% opened, and 11% were undelivered. Uptake among the treated sample was 5.0% in round 1, 3.4% in round 2, and 11.7% in round 3. A few debtors forwarded emails; opens decline across rounds.

Table B.3: Sample Distribution and Uptake Across Rounds and Treatments

Group	Control	Information	Payment Plan	Social Norm	Deterrence	Total
Sample Round 1	8,800	9,273	8,534	8,528	8,531	**43,666**
Undelivered Treatment	–	831	750	764	737	3,082
Treated Sample	8,800	8,442	7,784	7,764	7,794	**40,584**
Uptake	361	410	377	400	378	1,926
Sample Round 2	8,439	8,032	7,407	7,364	7,416	**38,658**
Uptake	192	213	214	221	242	1,080
Overlap	–	1,015	1,026	987	997	4,025
Sample Round 3	8,247	6,804	6,167	6,156	6,177	**33,551**
Uptake	142	778	661	705	707	2,991

Notes: The table indicates number of tax delinquents and proportions in parenthesis. Taxpayers are distributed equally across the three treatment groups and a slightly higher number for the control group. We show the specific groups, distribution across tax office, mean debt and taxpayer type.

Table B.4: **Effects on Uptake from the First Round Relative to no Email**

	(1)	(2)	(3)	(4)	(5)	(6)
Group	**Pooled**	Individuals	Firms	**Pooled**	Individuals	Firms
Information	0.008**	0.009***	0.006	0.007**	0.008***	0.005
	(0.003)	(0.003)	(0.006)	(0.003)	(0.003)	(0.006)
Payment plan	0.007**	0.004	0.011	0.007**	0.004	0.010
	(0.003)	(0.003)	(0.007)	(0.003)	(0.003)	(0.007)
Social Norm	0.010***	0.005**	0.016**	0.009***	0.005	0.015**
	(0.003)	(0.003)	(0.007)	(0.003)	(0.003)	(0.007)
Deterrence	0.007**	0.009***	0.005	0.008**	0.009***	0.005
	(0.003)	(0.003)	(0.007)	(0.003)	(0.003)	(0.007)
taxpayer_type				0.053***		
				(0.002)		
ln_taxdebt				0.006***	0.001	0.013***
				(0.001)	(0.001)	(0.001)
Tax Office Controls	No	No	No	Yes	Yes	Yes
Observations	40,584	23,881	16,703	40,584	23,881	16,703

Standard errors in parentheses ** $p < 0.05$, *** $p < 0.01$

Notes: In the table we provide treatment outcomes on uptake relative to no email group from probit estimates. Column (1) is the pooled model with individuals and firms followed by decomposed outcomes in model (2) and (3). We include amount of debt, station and taxpayer_type in model (4) (5) and (6).

Table B.5: **Effects on Uptake from the Second Round Relative to no Email**

	(1)	(2)	(3)	(4)	(5)	(6)
Group	**Pooled**	Individuals	Firms	**Pooled**	Individuals	Firms
Information	0.004	0.004**	0.003	0.004	0.004	0.003
	(0.002)	(0.002)	(0.005)	(0.002)	(0.002)	(0.005)
Payment Plan	0.006**	0.005**	0.008	0.006**	0.005**	0.007
	(0.003)	(0.002)	(0.005)	(0.003)	(0.002)	(0.005)
Social Norm	0.007***	0.005**	0.010	0.007***	0.005**	0.009
	(0.003)	(0.002)	(0.006)	(0.003)	(0.002)	(0.006)
Deterrence	0.010***	0.009***	0.011**	0.010***	0.009***	0.011**
	(0.003)	(0.002)	(0.006)	(0.003)	(0.002)	(0.006)
Firm				0.034***		
				(0.002)		
ln_taxdebt				0.003***	0.001	0.006***
				(0.001)	(0.001)	(0.001)
Tax Office Controls	No	No	No	Yes	Yes	Yes
Observations	38658	23372	15286	38658	23372	15286

Standard errors in parentheses ** $p < 0.05$, *** $p < 0.01$

Notes: In the table we provide treatment outcomes on uptake relative to no email group from probit estimates. Column (1) is the pooled model with individuals and firms followed by decomposed outcomes in model (2) and (3). We include amount of debt, station and taxpayer_type in model (4) (5) and (6).

Table B.6: **Effects on Uptake from the Third Round Relative to no Email**

	(1)	(2)	(3)	(4)	(5)	(6)
Group	**Pooled**	Individuals	Firms	**Pooled**	Individuals	Firms
Payment plan-Info	0.095***	0.065***	0.150***	0.095***	0.065***	0.149***
	(0.007)	(0.007)	(0.015)	(0.007)	(0.007)	(0.014)
Social-Info	0.096***	0.076***	0.133***	0.098***	0.076***	0.135***
	(0.007)	(0.008)	(0.014)	(0.007)	(0.008)	(0.014)
Deterrence-Info	0.093***	0.077***	0.125***	0.096***	0.077***	0.128***
	(0.007)	(0.008)	(0.014)	(0.007)	(0.008)	(0.014)
Info-Payment plan	0.093***	0.080***	0.119***	0.094***	0.078***	0.120***
	(0.007)	(0.007)	(0.013)	(0.007)	(0.007)	(0.013)
Social-Payment plan	0.089***	0.069***	0.129***	0.090***	0.069***	0.128***
	(0.007)	(0.007)	(0.014)	(0.007)	(0.007)	(0.014)
Deterrence-Payment plan	0.091***	0.065***	0.142***	0.093***	0.065***	0.144***
	(0.007)	(0.007)	(0.014)	(0.007)	(0.007)	(0.014)
Info-Social	0.096***	0.077***	0.134***	0.097***	0.076***	0.132***
	(0.007)	(0.007)	(0.014)	(0.007)	(0.007)	(0.013)
Payment plan-Social	0.096***	0.073***	0.140***	0.096***	0.072***	0.138***
	(0.007)	(0.008)	(0.014)	(0.007)	(0.007)	(0.014)
Deterrence-Social	0.108***	0.089***	0.145***	0.109***	0.088***	0.145***
	(0.007)	(0.008)	(0.015)	(0.007)	(0.008)	(0.014)
Info-Deterrence	0.103***	0.076***	0.152***	0.101***	0.075***	0.148***
	(0.007)	(0.007)	(0.014)	(0.007)	(0.007)	(0.014)
Payment plan -Deterrence	0.080***	0.058***	0.121***	0.080***	0.058***	0.120***
	(0.007)	(0.007)	(0.014)	(0.007)	(0.007)	(0.013)
Social-Deterrence	0.108***	0.089***	0.143***	0.108***	0.089***	0.141***
	(0.007)	(0.008)	(0.014)	(0.007)	(0.008)	(0.014)
ln_taxdebt				0.011***	0.013***	0.011***
				(0.001)	(0.001)	(0.002)
taxpayer_type				0.056***		
				(0.003)		
Tax Office Controls	No	No	No	Yes	Yes	Yes
Observations	33551	21391	12160	33551	21391	12160

Standard errors in parentheses ** $p < 0.05$, *** $p < 0.01$

Notes: In the table we present sequencing outcomes relative to no email group from probit estimates. Column (1) is the pooled model with individuals and firms followed by decomposed outcomes in model (2) and (3). We include amount of debt, station and taxpayer_type in model (4) (5) and (6).

Table B.7: **Round 1 Payment Outcomes Relative to no Email Group**

	(1)	(2)	(3)	(4)	(5)	(6)
Group	**Pooled**	Individuals	Firms	**Pooled**	Individuals	Firms
Infomation	0.024***	0.011***	0.042***	0.023***	0.011***	0.041***
	(0.003)	(0.002)	(0.005)	(0.003)	(0.002)	(0.005)
Payment plan	0.023***	0.008***	0.044***	0.022***	0.008***	0.043***
	(0.003)	(0.002)	(0.005)	(0.003)	(0.002)	(0.005)
Social Norm	0.024***	0.011***	0.042***	0.023***	0.010***	0.041***
	(0.003)	(0.002)	(0.005)	(0.003)	(0.002)	(0.005)
Deterrence	0.031***	0.019***	0.048***	0.030***	0.018***	0.047***
	(0.003)	(0.002)	(0.005)	(0.003)	(0.002)	(0.005)
Firm				0.057***		
				(0.002)		
Constant	0.023***	0.009***	0.045***	-0.002	0.012***	0.038***
	(0.002)	(0.002)	(0.004)	(0.003)	(0.002)	(0.005)
Tax Office Controls	No	No	No	Yes	Yes	Yes
Observations	40,584	23,881	16,703	40,584	23,881	16,703

Standard errors in parentheses ** $p < 0.05$, *** $p < 0.01$

Notes: In the table we present payment outcomes for the three rounds relative to no email group from OLS estimates. Our dependent variable is the proportion paid to account for the imbalance in the sample between payers and non payers. We construct one variable that captures takers in each round. Column (1) is the pooled model with individuals and firms followed by decomposed outcomes in model (2) and (3). We include amount of debt, station and taxpayer_type in model (4) (5) and (6).

Table B.8: **Round 2 Payment Outcomes Relative to no Email Group**

	(1)	(2)	(3)	(4)	(5)	(6)
Group	**Pooled**	Individuals	Firms	**Pooled**	Individuals	Firms
Information	0.023***	0.010***	0.043***	0.023***	0.009***	0.043***
	(0.002)	(0.002)	(0.005)	(0.002)	(0.002)	(0.005)
Payment plan	0.024***	0.007***	0.049***	0.023***	0.007***	0.048***
	(0.002)	(0.002)	(0.005)	(0.002)	(0.002)	(0.005)
Social Norm	0.024***	0.010***	0.045***	0.023***	0.010***	0.044***
	(0.002)	(0.002)	(0.005)	(0.002)	(0.002)	(0.005)
Deterrence	0.030***	0.015***	0.053***	0.030***	0.015***	0.052***
	(0.002)	(0.002)	(0.005)	(0.002)	(0.002)	(0.005)
Firm				0.045***		
				(0.002)		
Constant	0.013***	0.005***	0.025***	-0.006***	0.007***	0.019***
	(0.002)	(0.001)	(0.003)	(0.002)	(0.002)	(0.005)
Tax Office Controls	No	No	No	Yes	Yes	Yes
Observations	38,658	23,372	15,286	38,658	23,372	15,286

Standard errors in parentheses ** $p < 0.05$, *** $p < 0.01$

Notes: In the table we present payment outcomes for the three rounds relative to no email group from OLS estimates. Our dependent variable is the proportion paid to account for the imbalance in the sample between payers and non payers. We construct one variable that captures takers in each round. Column (1) is the pooled model with individuals and firms followed by decomposed outcomes in model (2) and (3). We include amount of debt, station and taxpayer_type in model (4) (5) and (6).

Table B.9: **Round 3 Payment Outcomes Relative to no Email Group**

	(1)	(2)	(3)	(4)	(5)	(6)
Group	**Pooled**	Individuals	Firms	**Pooled**	Individuals	Firms
Payment plan -Info	0.010***	0.004	0.022***	0.011***	0.004	0.022***
	(0.003)	(0.002)	(0.006)	(0.003)	(0.002)	(0.006)
Social-Info	0.012***	0.007***	0.021***	0.012***	0.007***	0.021***
	(0.003)	(0.002)	(0.005)	(0.002)	(0.002)	(0.005)
Deterrence-Info	0.014***	0.009***	0.022***	0.014***	0.009***	0.023***
	(0.003)	(0.002)	(0.006)	(0.002)	(0.002)	(0.005)
Info-Payment plan	0.012***	0.008***	0.021***	0.013***	0.008***	0.021***
	(0.002)	(0.002)	(0.005)	(0.002)	(0.002)	(0.005)
Social-Payment plan	0.011***	0.005**	0.023***	0.012***	0.005**	0.023***
	(0.003)	(0.002)	(0.006)	(0.003)	(0.002)	(0.006)
Deterrence-Payment plan	0.018***	0.012***	0.029***	0.019***	0.012***	0.030***
	(0.003)	(0.002)	(0.006)	(0.002)	(0.002)	(0.006)
Info-Social	0.008***	0.005**	0.014***	0.009***	0.005**	0.014***
	(0.002)	(0.002)	(0.005)	(0.002)	(0.002)	(0.005)
Payment plan -Social	0.015***	0.008***	0.027***	0.015***	0.008***	0.028***
	(0.003)	(0.002)	(0.006)	(0.002)	(0.002)	(0.006)
Deterrence-Social	0.018***	0.011***	0.032***	0.019***	0.011***	0.032***
	(0.003)	(0.002)	(0.006)	(0.003)	(0.002)	(0.006)
Info-Deterrence	0.016***	0.011***	0.025***	0.016***	0.011***	0.025***
	(0.002)	(0.002)	(0.005)	(0.002)	(0.002)	(0.005)
Payment plan -Deterrence	0.010***	0.005**	0.019***	0.010***	0.005**	0.020***
	(0.003)	(0.002)	(0.006)	(0.002)	(0.002)	(0.006)
Social-Deterrence	0.015***	0.010***	0.025***	0.016***	0.010***	0.025***
	(0.003)	(0.002)	(0.006)	(0.003)	(0.002)	(0.006)
Firm				0.019***		
Constant	0.005***	0.002	0.011***	-0.004**	0.002	0.006
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.003)
Tax Office Controls	No	No	No	Yes	Yes	Yes
Observations	33,551	21,391	12,160	33,551	21,391	12,160

Standard errors in parentheses ** $p < 0.05$, *** $p < 0.01$

Notes: In the table we present payment outcomes for the three rounds relative to no email group from OLS estimates. Our dependent variable is the proportion paid to account for the imbalance in the sample between payers and non payers. We construct one variable that captures takers in each round. Column (1) is the pooled model with individuals and firms followed by decomposed outcomes in model (2) and (3). We include amount of debt, station and taxpayer_type in model (4) (5) and (6).

Table B.10: **Effects on Uptake in Round 1 Relative to Information Treatment**

	(1)	(2)	(3)	(4)	(5)	(6)
Group	**Pooled**	Individuals	Firms	**Pooled**	Individuals	Firms
Payment plan	-0.001	-0.004	0.005	-0.001	-0.004	0.005
	(0.003)	(0.003)	(0.007)	(0.003)	(0.003)	(0.007)
Social Norm	0.003	-0.003	0.010	0.002	-0.003	0.010
	(0.003)	(0.003)	(0.007)	(0.003)	(0.003)	(0.007)
Deterrence	-0.001	0.001	-0.001	0.001	0.001	-0.001
	(0.003)	(0.003)	(0.007)	(0.003)	(0.003)	(0.007)
Firms				0.053***		
				(0.003)		
ln_taxdebt				0.006***	0.001	0.011***
				(0.001)	(0.001)	(0.001)
Tax Office Controls	No	No	No	Yes	Yes	Yes
Observations	31,784	18,677	13,107	31,784	18,677	13,107

Standard errors in parentheses ** $p < 0.05$, *** $p < 0.01$

Notes: In the table we provide treatment outcomes on uptake relative to information treatment group from probit estimates. Column (1) is the pooled model with individuals and firms followed by decomposed outcomes in model (2) and (3). We include amount of debt, station and taxpayer_type in model (4) (5) and (6).

Table B.11: **Effects on Uptake in Round 2 Relative to Information Treatment**

	(1)	(2)	(3)	(4)	(5)	(6)
Group	**Pooled**	Individuals	Firms	**Pooled**	Individuals	Firms
Payment plan	0.002	0.001	0.004	0.002	0.001	0.004
	(0.003)	(0.002)	(0.006)	(0.003)	(0.002)	(0.006)
Social Norm	0.003	0.001	0.006	0.003	0.001	0.006
	(0.003)	(0.002)	(0.006)	(0.003)	(0.002)	(0.006)
Deterrence	0.006**	0.005**	0.008	0.006**	0.005**	0.008
	(0.003)	(0.002)	(0.006)	(0.003)	(0.002)	(0.006)
Firms				0.034***		
				(0.002)		
ln_taxdebt				0.003***	-0.000	0.006***
				(0.001)	(0.001)	(0.001)
Tax Office Controls	No	No	No	Yes	Yes	Yes
Observations	30,219	18,251	11,968	30,219	18,251	11,968

Standard errors in parentheses ** $p < 0.05$, *** $p < 0.01$

Notes: In the table we provide treatment outcomes on uptake relative to information treatment group from probit estimates. Column (1) is the pooled model with individuals and firms followed by decomposed outcomes in model (2) and (3). We include amount of debt, station and taxpayer_type in model (4) (5) and (6).

Table B.12: **Effects on Uptake in Round 3 Relative to Information Treatment**

	(1)	(2)	(3)	(4)	(5)	(6)
Group	**Pooled**	Individuals	Firms	**Pooled**	Individuals	Firms
Payment plan	0.002	0.001	0.004	0.002	0.001	0.004
	(0.003)	(0.002)	(0.006)	(0.003)	(0.002)	(0.006)
Social Norm	0.003	0.001	0.006	0.003	0.001	0.006
	(0.003)	(0.002)	(0.006)	(0.003)	(0.002)	(0.006)
Deterrence	0.006**	0.005**	0.008	0.006**	0.005**	0.008
	(0.003)	(0.002)	(0.006)	(0.003)	(0.002)	(0.006)
Firms				0.034***		
				(0.002)		
ln_taxdebt				0.003***	-0.000	0.006***
				(0.001)	(0.001)	(0.001)
Tax Office Controls	No	No	No	Yes	Yes	Yes
Observations	30,219	18,251	11,968	30,219	18,251	11,968

Standard errors in parentheses ** $p < 0.05$, *** $p < 0.01$

Notes: The table indicates the message intervention treatment effects with and without control variables from probit estimates.In column 1 and 4 we have estimates from the pooled model whereas column 2,3,5 and 6 are decomposed results for individuals and firms. The control group and east of Nairobi are reference groups

Table B.13: **Round 1 Payment Outcomes Relative to Information Treatment**

	(1)	(2)	(3)	(4)	(5)	(6)
Group	**Pooled**	Individuals	Firms	**Pooled**	Individuals	Firms
Payment plan	-0.001	-0.003	0.002	-0.001	-0.003	0.002
	(0.003)	(0.003)	(0.006)	(0.003)	(0.003)	(0.006)
Social Norm	0.000	-0.000	0.000	-0.000	-0.000	-0.000
	(0.003)	(0.003)	(0.006)	(0.003)	(0.003)	(0.006)
Deterrence	0.007**	0.008***	0.006	0.007**	0.008***	0.006
	(0.003)	(0.003)	(0.006)	(0.003)	(0.003)	(0.006)
Firms				0.063***		
				(0.002)		
Constant	0.047***	0.020***	0.087***	0.018***	0.021***	0.077***
	(0.002)	(0.002)	(0.004)	(0.003)	(0.003)	(0.005)
Tax Office Controls	No	No	No	Yes	Yes	Yes
Observations	31784	18677	13107	31784	18677	13107

Standard errors in parentheses ** $p < 0.05$, *** $p < 0.01$

Notes: In the table we present payment outcomes for the three rounds relative to no email group from OLS estimates. Our dependent variable is the proportion paid to account for the imbalance in the sample between payers and non payers. We construct one variable that captures takers in each round. Column (1) is the pooled model with individuals and firms followed by decomposed outcomes in model (2) and (3). We include amount of debt, station and taxpayer_type in model (4) (5) and (6).

Table B.14: **Round 2 Payment Outcomes Relative to Information Treatment**

	(1)	(2)	(3)	(4)	(5)	(6)
Group	**Pooled**	Individuals	Firms	**Pooled**	Individuals	Firms
Payment plan	0.001	-0.003	0.006	0.001	-0.003	0.005
	(0.003)	(0.002)	(0.006)	(0.003)	(0.002)	(0.005)
Social Norm	0.001	0.000	0.002	0.001	0.000	0.001
	(0.003)	(0.002)	(0.006)	(0.003)	(0.002)	(0.005)
Deterrence	0.007***	0.006***	0.010	0.007***	0.006***	0.009
	(0.003)	(0.002)	(0.006)	(0.003)	(0.002)	(0.005)
Firm				0.052***		
				(0.002)		
Constant	0.036***	0.014***	0.069***	0.013***	0.016***	0.060***
	(0.002)	(0.002)	(0.004)	(0.003)	(0.002)	(0.005)
Tax Office Controls	No	No	No	Yes	Yes	Yes
Observations	30219	18251	11968	30219	18251	11968

Standard errors in parentheses ** $p < 0.05$, *** $p < 0.01$

Notes: In the table we present payment outcomes in round 2 for the three rounds relative to no email group from OLS estimates. Our dependent variable is the proportion paid to account for the imbalance in the sample between payers and non payers. We construct one variable that captures takers in each round. Column (1) is the pooled model with individuals and firms followed by decomposed outcomes in model (2) and (3). We include amount of debt, station and taxpayer_type in model (4) (5) and (6).

Table B.15: **Round 3 Payment Outcomes Relative to Information Treatment**

	(1)	(2)	(3)	(4)	(5)	(6)
Group	**Pooled**	Individuals	Firms	**Pooled**	Individuals	Firms
Social-Info	0.001	0.003	-0.001	0.002	0.003	-0.000
	(0.003)	(0.003)	(0.008)	(0.003)	(0.003)	(0.008)
Deterrence-Info	0.003	0.005	0.000	0.004	0.005	0.001
	(0.003)	(0.003)	(0.008)	(0.003)	(0.003)	(0.008)
Info-Payment plan	0.002	0.004	-0.001	0.002	0.004	-0.000
	(0.003)	(0.003)	(0.008)	(0.003)	(0.003)	(0.008)
Social-Payment plan	0.001	0.001	0.001	0.001	0.001	0.002
	(0.004)	(0.003)	(0.008)	(0.003)	(0.003)	(0.008)
Deterrence-Payment plan	0.008**	0.008**	0.007	0.008**	0.008**	0.008
	(0.003)	(0.003)	(0.008)	(0.003)	(0.003)	(0.008)
Info-Social	-0.003	0.001	-0.008	-0.002	0.001	-0.008
	(0.003)	(0.003)	(0.008)	(0.003)	(0.003)	(0.008)
Payment plan -Social	0.004	0.004	0.006	0.004	0.004	0.006
	(0.003)	(0.003)	(0.008)	(0.003)	(0.003)	(0.008)
Deterrence-Social	0.008**	0.007	0.010	0.008**	0.007**	0.011
	(0.004)	(0.003)	(0.008)	(0.003)	(0.003)	(0.008)
Info-Deterrence	0.006	0.007**	0.004	0.005	0.007**	0.003
	(0.003)	(0.003)	(0.008)	(0.003)	(0.003)	(0.007)
Payment plan -Deterrence	-0.001	0.001	-0.003	-0.001	0.001	-0.002
	(0.003)	(0.003)	(0.008)	(0.003)	(0.003)	(0.008)
Social-Deterrence	0.005	0.005	0.003	0.005	0.005	0.003
	(0.004)	(0.003)	(0.008)	(0.003)	(0.003)	(0.008)
Firm				0.022***		
				(0.002)		
Constant	0.016***	0.006***	0.033***	0.005	0.007**	0.026***
	(0.002)	(0.002)	(0.005)	(0.003)	(0.003)	(0.006)
Tax Office Controls	No	No	No	Yes	Yes	Yes
Observations	25,304	16,311	8,993	25,304	16,311	8,993

Standard errors in parentheses ** $p < 0.05$, *** $p < 0.01$

Notes: In the table we present payment outcomes for the three rounds relative to no email group from OLS estimates. Our dependent variable is the proportion paid to account for the imbalance in the sample between payers and non payers. We construct one variable that captures takers in each round. Column (1) is the pooled model with individuals and firms followed by decomposed outcomes in model (2) and (3). We include amount of debt, station and taxpayer_type in model (4) (5) and (6).