Treat - Remind - Repeat! A Natural Field Experiment in a Tax Amnesty Context

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Abstract

In a natural field experiment with randomised controlled trials, tax debtors received three emails from the Kenya Revenue Authority regarding a tax amnesty. The subjects were randomly assigned to five groups one of which was not contacted. Results show that sequencing nudges in subsequent reminders is effective for tax amnesty uptake. Relative to no email control group, we find average effect size of 9 percentage points on uptake. In addition, sequencing of social norms and deterrence reminders lead to a 2.5 percentage points higher uptake regardless of the treatment order. Deterrence nudges are effective for individuals while payment outcomes are significantly high for early takers. Those who take up the amnesty in the first two rounds pay 30 percent more than late takers. This study extends literature on letter studies by focusing on the context of a tax amnesty and introducing sequenced nudges in subsequent reminders.

Key Words: Natural Field Experiment, Tax Delinquency, Tax Amnesty, Nudge Sequencing

JEL Classification: C93, H26, D04

1 Introduction

Tax compliance plays a central role in domestic revenue mobilization, particularly for developing countries, which tend to have a lower tax-to-GDP ratio compared to developed nations. Slemrod (2019) highlights that tax noncompliance creates multiple fiscal challenges, including revenue loss, increased inequality between compliant and noncompliant taxpayers, and higher efficiency costs. Therefore, deliberate efforts to expand the tax base and address noncompliance are indispensable. Governments, through tax administrations, strive to ensure that everyone pays their fair share of taxes to enhance revenue collection.

When a taxpayer is registered for tax purpose, declares an economic activity, files a tax return but fails to pay requisite taxes we refer to them as tax delinquent.[1] Tax delinquency leads to revenue leakage challenges akin to tax avoidance and tax evasion. Whereas tax avoidance and tax evasion have been studied widely, a growing body of literature show tax delinquency as a challenge for both developed and developing countries.

In this regard, various studies have examined strategies to address tax noncompliance, including enforcement mechanisms, public shaming, and partial debt forgiveness. Notable research on tax delinquency includes Hallsworth et al. (2017) on the United Kingdom, Perez-Truglia and Troiano (2018) on the United States, and Gil et al. (2023) on the Dominican Republic. Perez-Truglia and Troiano (2018) highlight that in 2006, tax delinquency accounted for 25 percent of the United States' tax gap. To enhance tax compliance, deterrence measures such as financial penalties are widely employed. However, alternative behavioral interventions, including public disclosure of delinquent taxpayers, structured payment plans, and tax amnesties, are increasingly being utilized. Notably, tax amnesties targeting delinquent taxpayers have been found to be effective in increasing gross revenue collection (Le Borgne & Baer, 2008)

In this study, known tax delinquents in Kenya were offered a temporary tax amnesty for the period September 2023 to June 2024. At that time, the Kenya Revenue Authority (KRA *henceforth*) had in previous years offered five other amnesties, but none of them targeted tax delinquents. The decision to offer the amnesty was motivated by the build-up of nominal tax arrears over the years, despite several policy interventions to tackle the problem.

In particular, both short-term and long-term debt continued to grow and accrue interest.[1] As a result, several tax measures targeted at debtors were implemented with modest impact on reducing tax arrears. For example, the harmonisation of tax procedures in 2015, the introduction of a 5 percent late payment penalty in 2018, and continued elimination of manual processes through automation.[2] Despite these efforts the challenges abound and may suggests that the arrears are due to compliance rather than policy gaps. This amnesty offered a chance for tax delinquents to move to compliance and an immediate revenue collection to the exchequer.

Our study sought to evaluate the effect of behavioural intervention on compliance through tax amnesty uptake and subsequent payment of tax debt. To do this, we partnered with KRA and implemented a randomised controlled trial in a natural field experiment. A total of 43,666 tax delinquents from Nairobi region were randomly assigned to five treatment groups; including a group that received no email communication (control condition), reminder condition, payment plan condition, social norm

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[1] Long-term debt is defined as any tax debt that remains unpaid for more than three years. The interest rate is 1 percent per month culminating to 12 percent per year relative to lending rates that average 18 percent.
[2] These factors are discussed in the background and context section.

condition, and deterrence condition.[3] Our sample consisted of both individuals (59 percent) and firms (41 percent) with outstanding principal debt of over Kshs 100,000 (714 Euros). Using an existing email communication strategy, they received messages that were similar in content but with an additional nudge sentence based on group assignment. The reminder condition group received no additional sentence. In the second round, we sent repeated reminders with the same nudging sentence or lack of it as in the first round to those who did not respond after seventy-one days.[4]

For the third and final round, we changed tactic and sent altered nudge sentences to non-takers in a within subject design.[5]Here, we evaluated the effect of information treatment (reminder condition) relative to the control condition. Overall, 15 percent of treated tax delinquents took up the amnesty and paid a total of Kshs.3.8 billion of the Kshs.54 billion they owed.

The analysis leads us to four key findings. To begin with, tax delinquents are more responsive to sequenced reminders. We observe this when we evaluate uptake outcomes relative to the control condition. Firms had an effect size averaging 14 percentage points and individuals had an average of 8 percentage points. Relative to reminder condition, individuals treated to sequenced reminders of social norms followed by deterrence had significant effects of 2.5 percentage points higher probability of uptake irrespective of the order.

Secondly, deterrence condition is effective for individuals relative to those in the control condition. Our results are consistent for the first and second round with a slight increase in effect size from 0.7 to 0.9 percentage points. On the other hand, firm's uptake was driven by social norms at 1.8 percentage points in the first round with no effects in the second round from any treatment condition relative to the control condition.

Thirdly, information/reminder condition is effective for tax amnesty uptake. When we use the reminder condition as a control group, we find no treatment effects in the first round from all our treatment conditions. In essence, combining information treatment and nudges does not lead to statistically different outcomes on uptake. However, in the second round we find deterrence reminders to be effective for individual sub samples with effect size of 0.5 percentage points.

Lastly, payment outcomes indicate that those who take up the amnesty in the first and second rounds pay more than those who take it in the final round. Compared to the no email control condition, early takers of the amnesty pay 30 percent more. While we find statistically significant effects on payment in these two rounds, we observe no significant payment effects for the late takers. An evaluation of outcomes relative to reminder condition indicates that individuals who take the amnesty in the first round pay on average 18 percent more than those in the control condition. This was mainly driven by individuals treated to deterrence message (24 percent). We find no significant effects for firms in this round. In subsequent rounds, we observe takers to pay much less than those in the control condition despite statistical significance.

This study extends literature on tax amnesties, tax delinquents and message intervention in natural field experiments. Unique to the study are two aspects. First, we evaluate the impact of nudges in the context of an amnesty targeted at known tax delinquents. Assuming these taxpayers' self select into

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[3] The 43,666 sample includes 3,082 tax delinquents whose emails were not delivered. The treated sample including the control group was 40,584.

[4] Tax delinquents received the first round of treatment on 11.12.2023 in a between subject design (each tax delinquent receives only one type of treatment) that included deterrence, social norms, personal benefits and information treatment.

[5] Here, subjects were further divided into twelve groups with four treatment types.

delinquency, the uptake rate is expected to be very modest. None the less, we find positive effects even though enforcement strategies retain status quo post amnesty. Several studies have found amnesties to be effective when accompanied by strict enforcement measures after the lapse of the amnesty period for example Gil et al. (2023), Fellner-Röhling et al. (2009) and Perez-Truglia and Troiano (2018).

We also extend literature on letter studies by introducing nudge sequencing in repeated reminders following non responsiveness. Our finding points to the effectiveness of sequencing. Results from reminders show positive and huge effects for both individuals and firms relative to those in the control condition. We take this as a major contribution following from tax compliance letter studies that mainly use the same nudge for treatment and repeated reminders for a given subject. In addition, we show that combining social norms and deterrence messages for individuals is consistently effective.

Again, we contribute to limited letter studies literature that evaluate behavioural intervention and tax compliance outcomes in sub-Sahara Africa (Mascagni et al., 2017), (Shimeles et al., 2017). Our results are important for choice of communication strategy to the different facets of taxpayers within tax administrations. The rest of the paper is organized as follows; in section 2, we discuss the study context. Section 3 discusses related literature and implied hypothesis. In section 4 we present the experimental design, estimation technique and descriptive statistics. Section 5 discusses results followed by conclusions in section 6.

2 Study Context

Through its economic blueprint the vision 2030, Kenya envisioned a tax to GDP ratio of 23 percent by 2015, it averaged 15.2 percent by Financial Year 2021/22. Although there exists a large informal sector whose activities may not be visible to the tax authority, tax noncompliance costs are high. Specifically, to any Kenyan in the working age population who wishes to enter the formal labor market or engage in formal business. A tax compliance certificate is mandatory when applying for government tenders, jobs in the public sector, or credit facilities in financial institutions.

Tasked with tax and customs collection is the KRA. It is administratively divided into six regions in a country of over 50 million people; an estimated 32 million are in the working age population as of 2022. A little over 17 million are registered for tax purposes and a further smaller proportion of 7.4 million are active in the tax register (GoK, 2022 and KRA, 2023). The law requires everyone registered for tax purpose to file an income tax return by 30th June of every year irrespective of their income status. In case of additional obligations like VAT, excise tax among others, the law provides for due dates on payment and filling requirements.

To collect tax arrears and clean taxpayer ledger, the finance Act 2023 introduced a tax amnesty, from 1st September 2023 to 30th June 2024, which forms the premise of the study. To qualify for full waiver of penalties and interests, outstanding principal tax for periods up to 31st December 2022 were to be paid up within the amnesty window. The tax amnesty focused on all tax types. It was structured to tax periods where tax delinquents could get waivers based on clearing debts of a particular tax period and not the total debt. During the tax amnesty period, KRA engaged on creating awareness through print, electronic, and social media. Specific officers were identified and dedicated to supporting taxpayers and tax officers on any issues related to the tax amnesty.

Known tax debt arises from late payment of taxes when they fall due despite making declaration and filling through the tax system. Due dates for tax payment differ depending on the tax type for which a taxpayer is registered. For instance, VAT is due when an invoice is issued or payment received, whichever comes earlier, and a taxpayer must remit tax due by the 20th day of the subsequent month. Excise duty observes

the same due date as VAT whereas PAYE (payroll tax) is due and payable by the 9th day of the subsequent month. In addition, self-employed persons with tax liability that exceeds Ksh 40,000 are required to pay tax in four installments with the final installment due by 30th June of the following year of income. On the other hand, corporate income tax is payable in four installments depending on the accounting period of a firm. Each installment falls due by the 20th day of the month after a quarter. Failure to observe these due dates leads to a five percent late payment penalty and subsequent interest computed at one percent per month or part of the month when the arrears are settled.

Through the Tax Procedures Act, 2015, penalties for noncompliance and respective enforcement measures to recover unpaid taxes are outlined. Distress orders are the most common enforcement measure, mainly communicated to taxpayers through email. The Act outlines specific penalties and offenses that attract them. Specific to this study, section 83A of the Act penalises a taxpayer who fails to make a tax payment by the stipulated deadline by imposing a five percent penalty of the tax due and payable. Despite the existence of a penalty and enforcement structure, tax debt has been on the rise in nominal terms. Anecdotal evidence suggests that sources of tax debt are multiple.

To begin with, while some taxpayers maybe delinquent by choice, some are genuinely unable to pay taxes when they fall due because of liquidity constraints. These group can comply on other compliance tenets like declaration and filling but not make an actual payment to be fully compliant. On the other hand, tax debt has been attributed to pending bills from government or reconciliation issues where payment is made but the taxpayer ledger is not updated. Besides, low tax administration capacity to enforce has also fueled growth in tax debt and existence of long term debts. In addition, the existence of the option to apply for waiver of penalties and interest on payment of principal tax may have been a loophole exploited by taxpayers. This was repealed through finance Act 2023.

The choice of a tax amnesty to deal with tax delinquency could have been motivated by the outcomes in other jurisdictions. For example, Le Borgne and Baer (2008) assert that the USA has mainly implemented an amnesty to tax delinquents with success in gross revenue collection. It is estimated that 92 percent of the USD 6.6 billion collected in amnesties for the period 1980-2004 came from tax arrears. Other recent field experiments focusing on tax delinquents have also found behavioural interventions targeted at tax delinquents to be successful in enhancing compliance (Hallsworth et al., 2017); (Perez-Truglia and Troiano, 2018); (Gil et al., 2023).

3 Theoretical Literature

We assume a tax revenue maximizing 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 behavior 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 signaled and we expected high uptake of the amnesty.

The tax administration can identify delinquent taxpayers and penalize them for noncompliance but, a tax amnesty provides taxpayers a chance to comply if the benefit accrued is larger than the noncompliance cost. In this scenario, the taxpayer is noncompliant regarding reported income. Even though there may be unobserved tax evasion, we focus on observed delinquency. Malik and Schwab

(1991) argue that applying the logic in the standard tax evasion model to amnesties may imply that without tax administrations' signaling detection of tax evasion, noncompliant taxpayers do not change their behavior and may not take advantage of a tax amnesty. Neither would anticipated subsequent amnesties make them comply. Delinquent taxpayers only take advantage of an amnesty in an adaptive utility framework where a taxpayer envisions the consequences of his choice and maximizes expected utility for instance, waiver of penalties and interests in our case.

A taxpayer also considers prevailing social norms regarding tax noncompliance and evaluates what others may think of him if they became aware of his tax misconduct. Malik and Schwab (1991) therefore assume a taxpayer has two utility functions to consider based on societal norms that consequently determines the compliance choice. Armed with the knowledge of societal disapproval of noncompliance, the taxpayer updates his utility function and his revealed preference. The theory postulates that when a government declares an amnesty after the taxpayer's preference for tax cheats is revealed, the taxpayer problem is to maximize his welfare based on the societal social norms and the amount initially reported as taxable income. Alm and Beck (1993) add that when individuals perceive tax payment as a social norm, amnesties increase compliance and tax collections.

Wenzel (2004) defines social norms as prevalence or acceptance of a given behaviour among a reference group. In this case, it is assumed that compliance is driven by the choice of others within the reference group. If a taxpayer believes that compliance is high in his specific reference group, the likelihood of compliance is high especially if they identify with the group. The social norm message treatment refers to other taxpayers with tax arrears as a reference group against which a tax delinquent takes a decision to comply or not. Studies find evidence that social norms have an important role in establishing tax compliance (Hallsworth et al., 2017); (Del Carpio, 2014); (Kirchler et al., 2014). We therefore inform the subjects that more taxpayers are taking up the amnesty and encourage them to follow suit by pointing them to their 'peers', we hypothesis that this leads to positive outcomes from social norms 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.

3.1 Related Empirical Literature

On behavioural interventions, Antinyan and Asatryan (2019) conduct a meta analysis and find that nudges are effective in enhancing compliance, especially from taxpayers that are delinquent. However, these nudges are less effective in the long run, more so in low-income countries. On the other hand, receiving a letter from tax administration irrespective of its contents has been found to influence compliance (Mascagni et al., 2017) ;(Perez-Truglia and Troiano, 2018). Fellner-Röhling et al. (2009) also alludes to the "alert effect" that arises from receipt of a letter from authorities. To control for this effect, we use the reminder condition that informs tax delinquents about the tax amnesty as a control group besides the non contacted group.

Several studies analyze how tax administrations can adopt social norms in taxpayer communication with the aim of influencing tax compliance behavior (Frey and Torgler, 2007); (Wenzel, 2004); (Slemrod, 2019). While field experiments have found that nudges are insignificant in influencing compliance, Bobek et al. (2013) separates social norms to injunctive and descriptive norms. He finds that these

norms influence tax compliance in unique ways. Similarly, Hallsworth et al. (2017) finds descriptive social norms to be more effective than injunctive norms in enhancing payments of tax debt in the UK. Further, deterrence message interventions have been found to be effective in enhancing tax compliance and are said to be the most effective of messaging interventions (Castro and Scartascini, 2013); (Ortega and Sanguinetti, 2013); (Gil et al., 2023); Ariel (2012). Moreover, Gil et al. (2023) looks at the consequences of tax amnesty for known and unknown debt by analyzing key parameters that inform amnesty outcomes. In collaboration with the Dominican Republic tax authorities, they design a natural field experiment and find that deterrence and prospects of future amnesties significantly influence amnesty outcomes in the short run.

Kleven et al. (2011) evaluates the effect of audit threat through a letter study and finds that deterrence messages enhance tax compliance. Contrary, Ariel (2012) finds no effect on deterrence treatments and backfiring effect on social exchange messages from firms evaluating deductions, tax paid and reported turnover.

To the best of our knowledge, the literature addressing the sequencing effects of nudges is very limited. A study by Ito et al. (2018) explores the impact of moral suasion messages in the context of electricity-saving behavioral interventions. In this study, participants were repeatedly nudged with moral messages encouraging them to save electricity. The study revealed that the impact of the moral messages decreased with repeated exposure over time. However, when the nudges were stopped and then reintroduced after a break, the effect of the nudge returned, demonstrating that the timing of interventions could influence their long-term effectiveness.

This finding suggests that the frequency and timing of nudges can significantly affect how individuals respond to them. While the study focused on electricity savings, the insight that nudges can lose effectiveness with repeated exposure and regain effectiveness when reintroduced after a pause has broader implications. In our experiment, examining the sequencing of nudges is important for understanding whether certain strategies are more effective. This knowledge can help optimize behavioral interventions, especially in contexts like tax compliance, where long-term behavioral change is crucial.

Tax amnesty literature indicates that net benefits accruing from a tax amnesty are ambiguous but more and more economies across the globe are issuing them. An analysis of tax amnesties by (Gil et al., 2023) notes that in the period 2000 – 2022, 184 tax amnesties were issued by 84 countries. 46 of these were offered by the USA between 2010-2022. Critiques observe that actual gains from amnesties are overestimated as they are measured in gross terms (Le Borgne and Baer, 2008). Regardless, an amnesty affords the government an opportunity to get immediate lump sum collections that, if well implemented, are cheaper compared to audits and enforcement. Le Borgne and Baer (2008) conclude that tax amnesties improve horizontal equity and can be efficient and equitable as they ensure that the effective tax rate is close to the statutory rate. Similarly, (Andreoni, 1991) finds that permanent tax amnesties may increase tax system efficiency and taxpayer equity. Contrary opinion postulates that tax amnesties may be an avenue that shifts honest taxpayers to future noncompliance in anticipation of more amnesties (Alm and Beck, 1993).

Other studies find that the partial or full waiver of penalties or interest leads to more tax evasion, hurts compliance, and is horizontally unfair to compliant taxpayers (Langenmayr, 2017); (Le Borgne and Baer, 2008). In addition, observed compliance could stem from the fear of increased enforcement after an amnesty and not purely from the reduction in compliance costs offered by the amnesty. In particular, deterrence messages to taxpayers have positive impact on compliance (Bott et al., 2020); (Gil et al.,

2023); (Hallsworth et al., 2017); (Perez-Truglia and Troiano, 2018); (Holz et al., 2023). Therefore, amnesties may influence evaders to be compliant but may also increase noncompliance in anticipation of future amnesties (Ross and Buckwalter, 2013); (Luitel and Sobel, 2007).

While an amnesty is a quick fix to noncompliance, it does not address the real weakness in the tax system. For instance, weak administration, weak enforcement of law, and complex tax systems make it hard to comply (Le Borgne and Baer, 2008). Indeed, Stella (1989) points out that a temporary amnesty implemented without a real intention to enhance enforcement is detrimental to both future compliance and tax administration credibility. Contrary, analysis by (Gil et al., 2023) indicates that long term compliance is not negatively affected by tax amnesty.

In summary, although in the standard compliance theory it is not optimal to take up an amnesty after a tax noncompliance choice, when a tax administration signals detection compliance becomes an optimal choice (Malik and Schwab, 1991). In this context, after a taxpayer has considered the benefits of an amnesty and the signal of detection, he updates his utility function and decides to take up an amnesty in an adaptive utility framework. Moreover, for long term debt or from social interaction, taxpayers are likely to have formed opinion regarding the power of the tax administration to enforce and whether they can be trusted to enforce post amnesty. This argument on trust ad power as perceived by tax delinquents has been fronted in Kirchler et al. (2008).

Tax amnesties implemented without other accompanying measures in the tax administration do not increase compliance. On the contrary, tax evaders continue to evade taxes if evasion benefits surpass the evasion cost. An amnesty only affects compliance through behavioural intervention, but net effects remain unclear. Nonetheless, it reduces the cost of moving from an evader to a compliant taxpayer. There are mixed results on long term compliance. Some studies find amnesties detrimental to compliance level. Others find heightened short-term compliance, but no effect on long-term tax compliance. Reputational cost associated with tax misconduct may motivate tax delinquents to consider an amnesty. However, tax administrations risk reduced compliance from compliant taxpayers that view amnesties as being unfair.

From the foregoing, we hypothesised that our explicit message treatment on enforcement would have a positive impact on compliance with the amnesty despite the retention of status quo post amnesty. We also assumed the explicit reference to other tax delinquents in our social norm message would encourage compliance. Besides, the personalised appeal to psychological and payment plan benefit was expected to encourage the amnesty uptake and subsequent payment.

4 Experimental Design

The study applied randomised controlled trials in a natural field experiment. The experiment was done in three rounds where emails were sent by the tax administration to sample tax delinquents in Nairobi region. In the first two rounds we apply a between subject design and introduce a within subject design in the third round. The treated sample consisted of 31,784 tax delinquents who were in four groups and contacted through email. This excludes 3,082 tax debtors from across the four groups whose emails were not delivered. An additional 8,800 were in the control condition and received no email from KRA. Of the four groups, one group received a general reminder of the debt and information on the ongoing amnesty; this is the reminder condition. By doing this, we take care of the effect of receiving any message from tax administration regardless of its contents (Perez-Truglia and Troiano, 2018); (Mascagni et al., 2017); (Fellner-Röhling et al., 2009). The other three treatment conditions had a nudge sentence in addition to the reminder on their debt position and amnesty terms. These nudging sentences were bolded for salience and implied payment plan, social norm, or deterrence.

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.

Another treatment condition had a payment plan framed message. Besides extending the benefit of a payment plan to the taxpayer, the message points out the positive psychological benefits that come from being compliant. Loewenstein et al. (2001) indicates that emotions can drive decision making behaviour. We assume the tax debt and frequent demand letters create distress to tax delinquents and they would be motivated to take up the amnesty and pay at their pace or correct their tax ledger in exchange for peace of mind.

In the third and final round, we use a within subject design and sequenced reminders for those who remain non takers. 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, 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 reminder messages in the first and second round. By implementing this design in the second phase, we intended to decipher the behavioural response of a tax delinquents arising from sequencing of nudges in repeated reminders. The research design is represented in figure 1.

Round 1
11.12.2023

Round 2
21.02.2024

Round 3
02.05.2024

Control → Control → Control

Reminder → Reminder → Payment Plan / Social Norm / Deterrence

Payment Plan → Payment Plan → Reminder / Social Norm / Deterrence

Social Norm → Social Norm → Reminder / Payment Plan / Deterrence

Deterrence → Deterrence → Reminder / Payment Plan / Social Norm
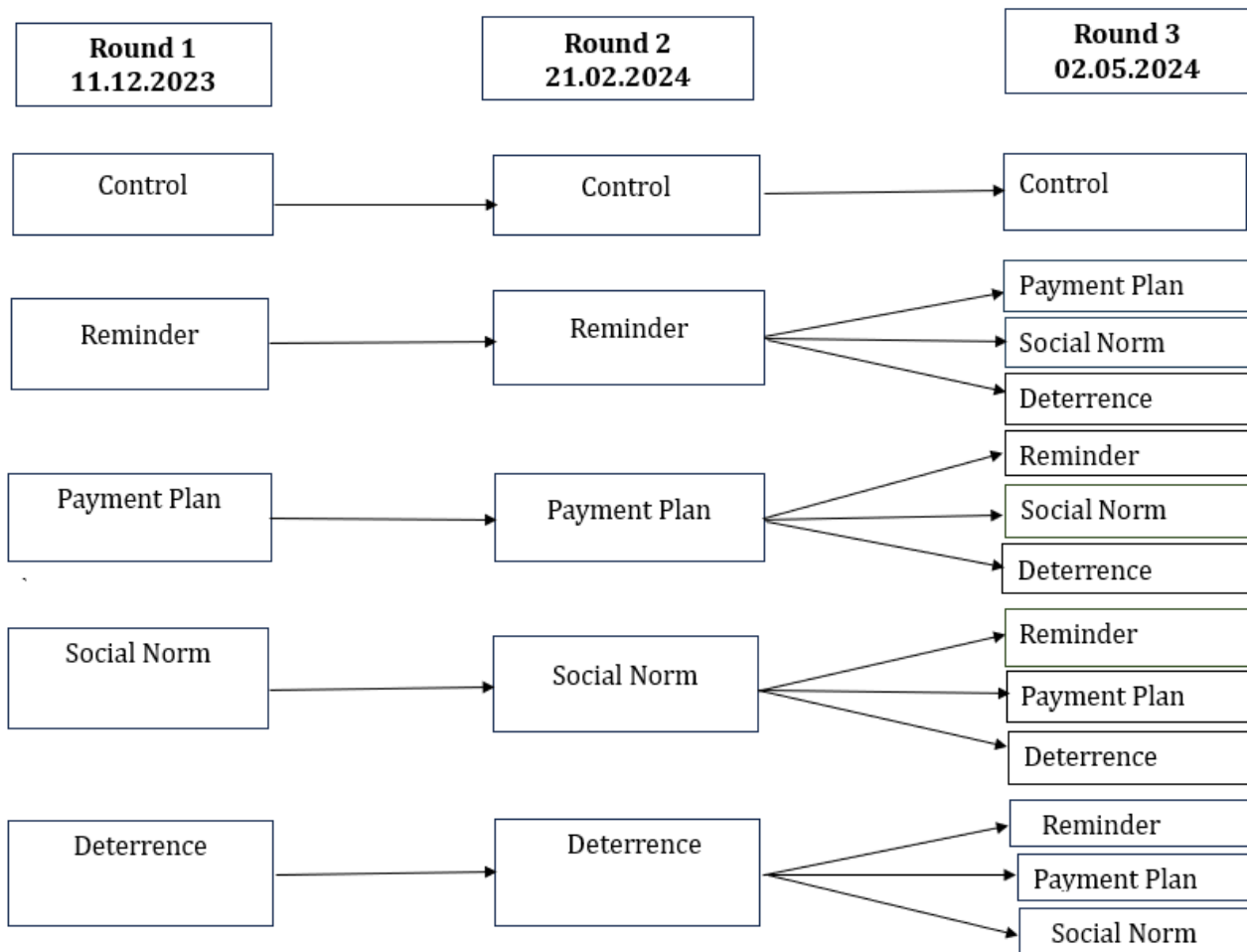
*Figure 1: **Research Design***

In table 1, we present the message intervention and sample sizes per group.

Table 1: Description of Experimental Groups and Treatment

Group	Sample size	Subject Line	Treatment
Control	8800	None	None
Reminder	9,275	Chapa Reset na Tax Amnesty Programme	Notification on tax amnesty
Payment plan	8,537	Enjoy peace of mind with a flexible amnesty payment plan.	We encourage you to apply for a payment plan and experience the peace and freedom that comes with being fully compliant. Apply for amnesty to avoid enforcement.
Social Norm	8,537	Join others with outstanding tax in taking steps to clear your arrears	Don't be left out! More and more taxpayers with arrears are already taking advantage of the amnesty. Apply today.
Deterrence	8,537	Apply for Amnesty now to avoid enforcement	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.

4.1 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. Taxpayers are randomly assigned to four treatment conditions and a control group through stratified sampling. The exclusion criteria were 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.

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 of individuals and firms. From the baseline data, most taxpayers 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. Random assignment to treatment groups was based on stratum's drawn from the outstanding principal tax that ranged from Kshs. 100 thousand (704 Euros) to Kshs. 76 million (535,211 euros).

In the sequenced treatment phase, assignment path is based on the response from the first email received. based on the tax debt, the four groups were balanced, and the test is presented in the appendix. We do not conduct further random assignments along the sequencing process but randomly assigned nontakers within groups to three subgroups totaling twelve groups. 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.

4.2 Estimation Technique

We estimate the impact of behavioural intervention in messaging taxpayers on amnesty uptake and subsequent payment of tax arrears. In this case, 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 estimate the likelihood of a taxpayer taking up an amnesty based on the treatment they were exposed to. The probability model estimated in measuring tax amnesty uptake conditional on the treatment is specified as:

$$Pr_{ij} (y|t=1) = \alpha_0 + \beta_1 T_1{}^{Reminder} + \beta_2 T_2{}^{Benefit} + \beta_3 T_3{}^{socialnorm} + \beta_4 T_4{}^{Deterrence} + \delta_1 T_i{}^{station} + \delta_2 T_i{}^{taxpayer\ type} + \varepsilon_0$$

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 control, benefit, social norm, and deterrence treatments, respectively. γ_1 and γ_2 are marginal effects for the tax office station and taxpayer type, respectively, whereas ε_0 is the error term.

To evaluate subsequent payment of tax debt by amnesty takers we estimated an ordinary regression model represented as:

$$Payment\_ij = \alpha_0 + \beta_1 T_1{}^{Reminder} + \beta_2 T_2{}^{Benefit} + \beta_3 T_3{}^{socialnorm} + \beta_4 T_4{}^{Deterrence} + \delta_1 T_i{}^{station} + \delta_2 T_i{}^{taxpayer\ type} + \mu_0$$

For the dependent variable (*payment_ij*), we use the proportion of the amount paid relative to the amount owed. This helps us to standardize 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. Whereas μ_0 is the error term.

For the sequencing of the nudges, 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 dynamic social norm message in the third round compared to another taxpayer who received the

deterrence treatment in the first two rounds but received a benefit message in the third round.

4.3 Descriptive statistics

4.3.1 Email Outcomes, Uptake and Payment in Each Round of Treatment

On average each of the four groups that received email communication had 24 percent of the subjects drawn from each tax service office. The sample mean of the outstanding debt for this group was Kshs. 4.1 million whereas the mean per treatment group ranged from Kshs 4.3 million to Kshs 3.8 million. The median tax debt was Kshs 468,270 indicating that fifty percent of the debt falls below this amount. At the same time, we observe high variability of debt with a standard deviation of Kshs 27.6 million.[6] This is presented in appendix table 11.

Of the 43,666 sampled tax debtors, emails were sent to 34,794 in the first round, out of which 91 percent (31,712) were delivered while the rest were undelivered. In subsequent rounds of treatment, we exclude taxpayers whose emails were undelivered in the first round. Of the delivered emails, 69 percent were opened in the first round of treatment, 30 percent in the second round and 28 percent in the third round. Our assumption is that all emails delivered were tantamount to a successful treatment based on the communication that starts from the subject line. Without weighting for the difference in the sample size for the control groups, the take up rate in the first round is 5.2 percent but declines to 3.4 percent in the second round and further increases to 12.2 percent in third and final round.

Perhaps the observed trend in uptake implies that the first point of treatment is strong in pushing tax delinquents to act on their outstanding debt. Despite the take up rate in the first round being only 5.4 percent, we observe that 76 percent of the emails delivered were opened by the recipients. Not only that but, the uptake accounts for thirty percent of the overall uptake by sampled taxpayers. The uptake rate in the second round reduces by over half the number of uptakes in the first round and the corresponding rate of emails read continuous to decline in the subsequent rounds (See Appendix Table *12*).

In table 2, we evaluate the uptake, nominal payment outcomes and proportions of payment in each of the three rounds. Six thousand and two tax delinquents took up the amnesty including 695 who were from the control condition. Overall, they owed a total of Kshs 54 billion and paid Kshs 3.8 billion by the end of the tax amnesty an equivalent of 7.1 percent of the debt. The outstanding debt for tax delinquents who took up the amnesty in the first round amounted to Kshs 19.2 billion out of which Kshs 1.7 billion was paid by the end of the amnesty. In the second round, tax delinquents who took up the amnesty owed the revenue authority Kshs 12.7 billion and paid up Kshs 824 million of the debt by the end of the amnesty. Takers in the third round had outstanding debt of Kshs 21.6 billion and paid Kshs 1.3 billion by the end of the amnesty.

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[6] 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.

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

	Group	Sample	Count of Uptake	Tax Debt Kshs.	Amount Paid Kshs.	Proportion Paid
	Control	8,800	361	3,228,161,754	424,475,271	13.1%
	Reminder	8,442	409	3,737,367,288	434,292,938	11.6%
	Benefit	7,784	377	3,574,171,714	212,250,243	5.9%
Round 1	Social norm	7,764	401	3,006,166,177	250,171,562	8.3%
	Deterrence	7,794	378	5,714,432,450	360,748,921	6.3%
	Grand Total	**40,584**	**1,926**	**19,260,299,383**	**1,681,938,935**	**8.7%**
	Control	8,439	192	3,026,983,517	101,381,541	3.3%
	Reminder	8,032	213	2,658,373,123	132,405,236	5.0%
	Benefit	7,407	214	1,958,904,525	263,835,688	13.5%
Round 2	Social norm	7,364	221	1,795,441,236	130,938,951	7.3%
	Deterrence	7,416	242	3,235,180,454	195,265,735	6.0%
	Grand Total	**38,658**	**1,082**	**12,674,882,855**	**823,827,151**	**6.5%**
Group in Round 1-2	**Group in Round 3**					
	Control	8,608	142	*430,177,955*	*43,669,257*	*10.2%*
	Benefit Oriented	2,265	249	2,344,330,791	169,653,353	7.2%
Reminder	Social norm	2,278	258	1,799,358,985	66,578,074	3.7%
	Deterrence	2,261	271	4,119,565,896	115,569,306	2.8%
	Reminder	2,041	229	2,204,226,988	104,149,270	4.7%
Benefit	Social norm	2,066	233	1,118,968,746	61,933,219	5.5%
	Deterrence	2,060	199	1,033,971,456	108,818,049	10.5%
	Reminder	2,065	233	1,269,752,297	91,749,831	7.2%
Social norm	Benefit Oriented	2,044	217	1,946,594,761	63,200,569	3.2%
	Deterrence	2,047	255	1,111,256,049	70,078,664	6.3%
	Reminder	2,079	229	2,199,489,252	198,481,471	9.0%
Deterrence	Benefit Oriented	2,065	224	976,387,215	86,056,278	8.8%
	Social norm	2,033	254	1,107,314,736	121,974,098	11.0%
	Grand Total	**33,912**	**2,993**	**21,661,395,127**	**1,301,911,439**	**6.0%**

Note: In this table we exclude those who were sampled but not treated, this means their emails were undelivered. Round 1 is the start of the treatment for sampled tax debtors. The 1,927 taxpayers who took up the amnesty had an outstanding debt of Kshs 19.2 billion but only 8.7 percent of the debt was paid up by the end of the experiment. In the second round, 1,082 tax debtors took up the amnesty and owed a total of Kshs 12.7 billion but paid 6.5 percent of the debt by the end of the experiment. In the sequenced reminders round, a total of 2,993 tax debtors took up the amnesty in this phase. Of the Kshs 21.6 billion tax debt owed by these tax delinquents Kshs 1.3 billion was paid by the end of the experiment.

5 Results

In this section, we discuss treatment outcomes relative to two sets of control groups. First, we present the treatment effects relative to the non contacted control group. In this case, we can observe the effects of just informing tax delinquents as well as information combined with treatment. In the second part, we evaluate treatment effects relative to a control group that receives an information treatment. It is therefore possible to report the treatment effects net of information treatment. In both instances, we evaluate payment outcomes at the end of the amnesty period.

5.1 Effects of Nudges on Uptake and Payment Relative to Control Condition

5.1.1 Treatment Effects on Uptake

In table 3 we present results on uptake from the first round of treatment. In addition to information about the amnesty, three sub samples received a nudge sentence in the email communication. We evaluate the outcomes relative to a no email control group. The result indicates that all four treatment conditions are statistically significant in the pooled models (column 1 and 4) with varying outcomes in the decomposed models (column 2 and 3 without controls and 4 and 5 with controls). Social norms have the highest effect size of 1.1 percentage points relative to the control condition. This effect is mainly driven by firms which report a 1.8 percentage points higher probability of uptake relative to the firms in the control group with and without controls. On the other hand, we observe statistically significant

but smaller effects from individuals treated to social norms at 0.5 percentage points relative to the control group.

From the reminder condition, we find statistically significant effects in the pooled models. However, this effect is attributed to individuals who on average have a 0.8 percentage points more likelihood of uptake when treated to information compared to individuals who receive no communication. This could be explained by the fact that individuals have less contact with the tax administration morose if they only have income tax obligation. In most cases, firms would have VAT obligation resulting in monthly contact with the tax administration unlike individuals who file once in a year. As a result, firms are likely to be more aware about the amnesty.

Personalised benefit that included a payment plan had the same effect size as receiving information about the tax amnesty. We observe statistically significant effects of 0.8 percentage points in the pooled model compared to those in the control group. None the less, in the decomposed model, we find that effects are driven by firms at 1.1 percentage points relative to the control group. Firms are likely to be taking advantage of the payment plans due to the level of debt they hold or are cautious about financial constraints from one off huge payment.

Similarly, deterrence messages are found to be effective for individual subsample who have a 0.9 percentage points higher likelihood of uptake relative to the no email group. This is in line with previous literature which has found deterrence messages to be effective for individuals for example Gil et al. (2023), Antinyan and Asatryan (2019). In general, we find firms to have a 5.1 percentage points probability of taking the amnesty relative to individuals. At the same time, firms with huge debts were more likely to take the amnesty by 1.3 percentage points relative to those with smaller debts in the control group. This may be attributed to the financial gains arising from waivers of penalty and interest that would be higher for huge debts.

Table 3: **Treatment Effects from the First Round Relative to Control Condition**

	(1)	(2)	(3)	(4)	(5)	(6)
Uptake	**Pooled**	Individuals	Firms	**Pooled**	Individuals	Firms
Reminder condition	0.008***	0.008***	0.009	0.009***	0.008***	0.008
	(0.003)	(0.003)	(0.007)	(0.003)	(0.003)	(0.007)
Payment plan	0.008**	0.004	0.012	0.007**	0.004	0.011
	(0.003)	(0.003)	(0.007)	(0.003)	(0.003)	(0.007)
Social Norm	0.011***	0.005**	0.018***	0.010***	0.005	0.017**
	(0.003)	(0.003)	(0.007)	(0.003)	(0.003)	(0.007)
Deterrence	0.007**	0.009***	0.004	0.007**	0.008***	0.004
	(0.003)	(0.003)	(0.007)	(0.003)	(0.003)	(0.007)
Taxpayer type				0.051***		
				(0.002)		
ln_tax debt				0.006***	0.001	0.013***
				(0.001)	(0.001)	(0.001)
Tax Office Controls	No	No	No	Yes	Yes	Yes
Observations	39,778	23,818	15,960	39,778	23,818	15,960

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

Note: 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).

Those tax delinquents who had not signed up for the amnesty seventy one days after treatment received a repeated reminder with the same email content as in the first round. We present the outcomes in table 4. From the results, deterrence reminders lead to increased effect size in comparison to the first round. In addition, all treatment conditions are economically and statistically significant. Individuals who received deterrence reminders had a 0.9 percentage points higher likelihood of uptake relative to

individuals in the control condition (0.07 in the first round). Similarly, payment plan and social norm reminders led to 0.5 percentage points higher likelihood of uptake for individuals compared to the control condition (see column 2 and 3). The effect from the reminder condition is halved from the first round.

In contrast, reminders had no statistically significant effects on firms. Like in the first round, we find that firms are more likely to take up the amnesty than individuals with effect size of 3.3 percentage points. On the same breadth, firms who have a higher debt have a 0.7 percentage points more likelihood of taking the amnesty. The results in this round are like those in the first round albeit with smaller effects in comparison to what we observe in the first round.

Table 4: **Treatment Effects from the Second Round Relative to Control Condition**

	(1)	(2)	(3)	(4)	(5)	(6)
Uptake	**Pooled**	Individuals	Firms	**Pooled**	Individuals	Firms
Reminder Condition	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**	0.007	0.006**	0.005**	0.006
	(0.003)	(0.002)	(0.006)	(0.002)	(0.002)	(0.006)
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	0.009***	0.009***	0.008	0.009***	0.009***	0.008
	(0.003)	(0.002)	(0.006)	(0.003)	(0.002)	(0.006)
Taxpayer type				0.033***		
				(0.002)		
ln_tax debt				0.003***	0.000	0.007***
				(0.001)	(0.001)	(0.001)
Tax Office Controls	No	No	No	Yes	Yes	Yes
Observations	37,967	23,312	14,655	37,967	23,312	14,655

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

Note: 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).

In table 5, we show the effect of altering the treatment to say, from reminder condition in the first two rounds to payment plan, social norm or deterrence. Here we find significant treatment effects of over 10 percentage points for any combination of sequences relative to no email group. Both individuals and firms demonstrate statistically significant effects when estimates are decomposed. A combination of deterrence reminders with any other treatment condition leads to strong positive effects from both firms and individuals. However stronger effects of over 10 percentage points are consistently reported by firms. This could be drawn from the interaction that firms have had with previous debts where agency notices may have been affected leading to financial constraints.[7]

From these finding, we argue that when reminders convey the same information, they may not be as effective as altering the nudge in the communication. This is clearly demonstrated when comparison is made to the second round where reminders of the same effect are sent, and treatment effects decline except for deterrence. It is however interesting to observe that seventy four days after the second reminder, altering the message results in treatment effects that average 14 percentage points for firms relative to the control group in all sub samples. On the other hand, individuals have effect sizes of 8 percentage points on average relative to those in the control group.

Some of the combinations with significant effects include social norms and deterrence treatment conditions. Here, the probability of uptake is 9 percentage points higher for individuals and 14

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[7] Agency notices are one of the enforcement measures used by the tax administration where third parties like banks are instructed to freeze funds related to the tax delinquent firm.

percentage points for firms relative to the control group, irrespective of what treatment comes first. Moving from harsh (deterrence) to reminder treatment is still found to be statistically significant albeit with modestly less effect size of 8 to 12 percentage points for individuals and firms respectively. In comparison, when tax delinquents are informed and then treated to deterrence messages, the effect remains the same for individuals but increases for firms to 14 percentage points relative to the control group. Finally, when reminder sequencing consists of soft messages to include social norms and payment plans, we find significant effects that are on average less than the foregoing (See Table 5).

Table 5: **Reminder Treatment Effects from the Third Round Relative to Control Condition**

Uptake	(1) **Pooled**	(2) Individuals	(3) Firms	(4) **Pooled**	(5) Individuals	(6) Firms
Benefit- Reminder	0.091***	0.064***	0.141***	0.091***	0.064***	0.142***
	(0.007)	(0.007)	(0.015)	(0.007)	(0.007)	(0.015)
Social- Reminder	0.094***	0.076***	0.129***	0.096***	0.077***	0.131***
	(0.007)	(0.008)	(0.014)	(0.007)	(0.008)	(0.014)
Deterrence- Reminder	0.090***	0.077***	0.117***	0.093***	0.077***	0.122***
	(0.007)	(0.008)	(0.014)	(0.007)	(0.008)	(0.014)
Reminder - Payment plan	0.090***	0.078***	0.116***	0.092***	0.077***	0.117***
	(0.007)	(0.007)	(0.013)	(0.007)	(0.007)	(0.013)
Social- Payment plan	0.088***	0.069***	0.126***	0.088***	0.069***	0.123***
	(0.007)	(0.007)	(0.014)	(0.007)	(0.007)	(0.014)
Deterrence- Payment plan	0.092***	0.065***	0.145***	0.093***	0.065***	0.146***
	(0.007)	(0.007)	(0.015)	(0.007)	(0.007)	(0.015)
Reminder -Social	0.093***	0.076***	0.127***	0.093***	0.075***	0.125***
	(0.007)	(0.007)	(0.014)	(0.007)	(0.007)	(0.013)
Payment plan-Social	0.094***	0.073***	0.135***	0.094***	0.072***	0.134***
	(0.007)	(0.008)	(0.014)	(0.007)	(0.007)	(0.014)
Deterrence-Social	0.107***	0.089***	0.144***	0.108***	0.088***	0.143***
	(0.008)	(0.008)	(0.015)	(0.007)	(0.008)	(0.015)
Reminder -Deterrence	0.098***	0.076***	0.143***	0.099***	0.075***	0.142***
	(0.007)	(0.007)	(0.014)	(0.007)	(0.007)	(0.014)
Benefit-Deterrence	0.079***	0.058***	0.122***	0.080***	0.058***	0.121***
	(0.007)	(0.007)	(0.014)	(0.007)	(0.007)	(0.014)
Social-Deterrence	0.107***	0.089***	0.142***	0.107***	0.089***	0.139***
	(0.007)	(0.008)	(0.015)	(0.007)	(0.008)	(0.014)
ln_tax debt				0.013***	0.013***	0.014***
				(0.001)	(0.001)	(0.002)
Taxpayer type				0.056***		
				(0.003)		
Tax Office Controls	No	No	No	Yes	Yes	Yes
Observations	33,000	21,338	11,662	33,000	21,338	11,662

*Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$*

Note: 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).

5.1.2 Treatment Effects on Payment Relative to Control Condition

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. Since these tax debtors had close to seven months to enjoy the temporary amnesty by the start of our experiment, we evaluate payment outcomes at the end of the amnesty period. In doing this, we use an ordinary regression and evaluate the payment outcomes based on final proportion of payment relative to the tax debt but considering the round of uptake.

The results are presented in table 6. Compared to the control group that received no email, those who took up the tax amnesty in the first round paid 30 percent of their debts on average by the end of the

amnesty (see column 1). When the payment outcomes are decomposed to firms and individuals, we still find significant and substantial differences in payment outcomes relative to the control condition. Firms that received personalised benefit and social norm treatments had 31 and 32 percent higher payment outcomes respectively than those who received no communication.

On the other hand, individuals were driven by deterrence treatment where they paid 33 percent more than the control condition. Just like in the first round of uptake, it appears firms are driven by social norms while individuals are driven by deterrence message treatments in the tax amnesty uptake and payment. The outcomes on personalised benefits that included payment plans are also in line with expectations which implies that firms may prefer payments over time to avoid or adjust to financial constraints. Similarly, information treatment is effective for both firms and individuals with firms paying 30 percent while individuals pay 23 percent more than the reference group at the end of the amnesty.

In the second round, those who took up the amnesty from the second round had statistically significant and positive payment outcomes. It is however interesting to observe that firms who sign up in this round paid more than those who signed up in the first round. For example, firms who were treated to personalised benefits paid 52 percent more than those in the control group. They were followed by those who received information reminders at 46 percent and deterrence at 43 percent, social norm recipients had 30 percent more payments than those in the control condition.

On the contrary, Individuals in this round of reminders paid much less than those who took up in the first round. Those who received deterrence, social norms, personalised benefit and information reminders paid 7, 6, 3 and 4 percent more than the control group respectively. Deterrence and social norm treatments are still observed to have greater effects for individuals despite the small magnitudes compared to the first round. Overall, firms have 8 percentage points more payments than individuals whereas those in the control group paid 2.8 percent of their outstanding debts mainly driven by firms at 5.6 percent. We find no statistically significant payment outcomes for those who took the amnesty in the third round.

Table 6: **Payment Outcomes Relative to Control Condition**

Payment	(1) **Pooled**	(2) Individuals	(3) Firms	(4) **Pooled**	(5) Individuals	(6) Firms
Reminder Condition	0.290***	0.228***	0.299***	0.251***	0.228***	0.280***
	(0.038)	(0.014)	(0.073)	(0.038)	(0.014)	(0.073)
Payment plan	0.318***	0.249***	0.321***	0.270***	0.249***	0.300***
	(0.040)	(0.016)	(0.074)	(0.040)	(0.016)	(0.074)
Social Norm	0.306***	0.249***	0.305***	0.256***	0.249***	0.281***
	(0.039)	(0.015)	(0.071)	(0.039)	(0.015)	(0.071)
Deterrence	0.302***	0.326***	0.272***	0.256***	0.324***	0.242***
	(0.041)	(0.014)	(0.078)	(0.040)	(0.014)	(0.077)
Reminder_2	0.300***	0.044***	0.455***	0.272***	0.043***	0.439***
	(0.023)	(0.007)	(0.047)	(0.023)	(0.007)	(0.047)
Payment plan_2	0.333***	0.032***	0.526***	0.302***	0.032***	0.502***
	(0.023)	(0.007)	(0.048)	(0.023)	(0.007)	(0.047)
Social Norm_2	0.210***	0.059***	0.295***	0.178***	0.059***	0.274***
	(0.023)	(0.007)	(0.048)	(0.023)	(0.007)	(0.048)
Deterrence_2	0.287***	0.066***	0.427***	0.255***	0.066***	0.402***
	(0.023)	(0.007)	(0.048)	(0.023)	(0.007)	(0.048)
Benefit-Reminder	-0.012	-0.004	-0.022	-0.006	-0.004	-0.016
	(0.018)	(0.005)	(0.048)	(0.018)	(0.005)	(0.047)
Social- Reminder	-0.012	-0.002	-0.024	-0.004	-0.002	-0.016
	(0.018)	(0.005)	(0.048)	(0.018)	(0.005)	(0.048)
Deterrence- Reminder	-0.008	0.002	-0.019	-0.000	0.002	-0.013
	(0.018)	(0.005)	(0.048)	(0.018)	(0.005)	(0.047)
Reminder -Payment plan	-0.010	-0.001	-0.020	-0.002	-0.001	-0.013
	(0.018)	(0.004)	(0.046)	(0.018)	(0.004)	(0.046)
Social- Payment plan	-0.003	0.003	-0.006	0.004	0.003	-0.003
	(0.018)	(0.005)	(0.048)	(0.018)	(0.005)	(0.048)
Deterrence- Payment plan	-0.002	0.004	-0.006	0.006	0.004	0.000
	(0.018)	(0.005)	(0.047)	(0.018)	(0.005)	(0.047)
Reminder -Social	-0.013	-0.004	-0.023	-0.007	-0.004	-0.021
	(0.018)	(0.004)	(0.046)	(0.018)	(0.004)	(0.046)
Benefit-Social	-0.003	0.005	-0.010	0.003	0.004	-0.007
	(0.018)	(0.005)	(0.048)	(0.018)	(0.005)	(0.047)
Deterrence-Social	0.027	0.003	0.081	0.034	0.003	0.084
	(0.018)	(0.005)	(0.048)	(0.018)	(0.005)	(0.048)
Reminder -Deterrence	0.002	0.004	0.005	0.008	0.003	0.010
	(0.018)	(0.004)	(0.046)	(0.018)	(0.004)	(0.046)
Payment plan -Deterrence	-0.012	-0.004	-0.020	-0.005	-0.004	-0.015
	(0.018)	(0.005)	(0.048)	(0.018)	(0.005)	(0.048)
Social-Deterrence	0.002	0.002	0.009	0.008	0.002	0.012
	(0.018)	(0.005)	(0.048)	(0.018)	(0.005)	(0.048)
Firms				0.077***		
				(0.008)		
Tax Office Controls	No	No	No	Yes	Yes	Yes
Constant	0.028***	0.010***	0.056***	-0.013	0.013***	0.032
Observations	39,778	23,818	15,960	39,778	23,818	15,960

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

Note: 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).

5.2 Effects of Nudges on Uptake and Payment Relative to Reminder Condition

5.2.1 Treatment Effects on Uptake

In this section, we evaluate treatment effects on the tax amnesty uptake relative to a control group that receives reminder treatment. The effects we report are net of the effects of receiving a notification besides the salient sentence in the other treatment conditions (Fellner-Röhling et al., 2009). From the first round of treatment, our analysis indicates that all the treatment conditions did not have statistically significant effects on uptake. However, firms are more likely to take up the amnesty by 5.2 percentage points relative to individuals. At the same time, firms with large debts have a

1.3 percentage points higher likelihood of uptake in comparison to those who receive information treatment. We present the results of treatment outcomes in table 7.

Table 7: **Treatment Effects from the First Round Relative to Reminder Condition**

	(1)	(2)	(3)	(4)	(5)	(6)
Uptake	**Pooled**	Individuals	Firms	**Pooled**	Individuals	Firms
Payment plan	-0.001	-0.004	0.003	-0.002	-0.004	0.003
	(0.003)	(0.003)	(0.007)	(0.003)	(0.003)	(0.007)
Social Norm	0.003	-0.003	0.010	0.001	-0.003	0.008
	(0.003)	(0.003)	(0.007)	(0.003)	(0.003)	(0.007)
Deterrence	-0.002	0.000	-0.005	-0.001	0.000	-0.004
	(0.003)	(0.003)	(0.007)	(0.003)	(0.003)	(0.007)
Taxpayer type				0.052***		
				(0.003)		
ln_taxdebt				0.006***	0.001	0.013***
				(0.001)	(0.001)	(0.002)
Tax Office Controls	No	No	No	Yes	Yes	Yes
Observations	31,153	18,632	12,521	31,153	18,632	12,521

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

Note: 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).

In the second round where, reminders were sent to non takers deterrence message treatment is found to be statistically important for individuals. These subsample of tax delinquents have an effect size of 0.5 percentage points higher likelihood of uptake relative to individuals in the control group. Apart from the deterrence treatment, we find firms to have more uptake likelihood in comparison to individuals amounting to 3.3 percentage points. Further, firms with huge debts have a 0.6 percentage points higher probability of uptake. This result is consistent with what we observe in the first round of the no email comparison group where we observed reminders in the second round to have decreasing magnitudes of effects for firms and debt levels (*see table 8*).

Concerning the third round, we analyse the effects of sequencing the reminders to those who fail to take up the amnesty in the first and second round. The results are in table 9. From the results we find that the combination of deterrence and social norm treatments are effective for individual subsample irrespective of the sequence the effect size is 2.5 percentage points higher uptake relative to the control group. Firms in this round are found to be more likely to take the amnesty by 7 percentage points relative to the control group. On the other hand, both individuals and firms with higher debts pay 17 and 20 percentage points more than those in the information treatment. The rest of the sequences have no statistically significant outcomes.

Table 8: **Treatment Effects from the Second Round Relative to Reminder Condition**

Uptake	(1) Pooled	(2) Individuals	(3) Firms	(4) Pooled	(5) Individuals	(6) Firms
Payment plan	0.002	0.001	0.004	0.002	0.001	0.003
	(0.003)	(0.002)	(0.006)	(0.003)	(0.002)	(0.006)
Social Norm	0.004	0.001	0.007	0.003	0.001	0.006
	(0.003)	(0.002)	(0.006)	(0.003)	(0.002)	(0.006)
Deterrence	0.005	0.005**	0.005	0.006**	0.005**	0.006
	(0.003)	(0.002)	(0.006)	(0.003)	(0.002)	(0.006)
Taxpayer type				0.033***		
				(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	29,677	18,209	11,468	29,677	18,209	11,468

Standard errors in parentheses   ** $p < 0.05$, *** $p < 0.01$
Note: 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 9: **Treatment Effects from the Third Round Relative to Reminder Condition**

Uptake	(1) Pooled	(2) Individuals	(3) Firms	(4) Pooled	(5) Individuals	(6) Firms
Social- Reminder	0.003	0.012	-0.013	0.005	0.013	-0.012
	(0.010)	(0.010)	(0.020)	(0.010)	(0.010)	(0.020)
Deterrence- Reminder	-0.001	0.013	-0.024	0.002	0.013	-0.020
	(0.010)	(0.010)	(0.020)	(0.010)	(0.010)	(0.019)
Reminder -Benefit	-0.001	0.014	-0.026	0.001	0.013	-0.025
	(0.010)	(0.010)	(0.019)	(0.009)	(0.010)	(0.019)
Social-Benefit	-0.003	0.004	-0.015	-0.003	0.005	-0.019
	(0.010)	(0.010)	(0.020)	(0.010)	(0.010)	(0.020)
Deterrence-Benefit	0.001	0.001	0.003	0.002	0.001	0.004
	(0.010)	(0.010)	(0.020)	(0.010)	(0.010)	(0.020)
Reminder -Social	0.003	0.012	-0.013	0.002	0.011	-0.017
	(0.010)	(0.010)	(0.019)	(0.009)	(0.010)	(0.019)
Benefit-Social	0.004	0.009	-0.005	0.003	0.008	-0.008
	(0.010)	(0.010)	(0.020)	(0.010)	(0.010)	(0.020)
Deterrence-Social	0.017	0.025**	0.004	0.017	0.024**	0.002
	(0.010)	(0.011)	(0.020)	(0.010)	(0.011)	(0.020)
Reminder -Deterrence	0.008	0.012	0.002	0.008	0.012	-0.000
	(0.010)	(0.010)	(0.020)	(0.009)	(0.010)	(0.019)
Benefit-Deterrence	-0.011	-0.006	-0.019	-0.011	-0.006	-0.021
	(0.010)	(0.010)	(0.020)	(0.009)	(0.010)	(0.019)
Social-Deterrence	0.017	0.025**	0.002	0.016	0.025**	-0.002
	(0.010)	(0.011)	(0.020)	(0.010)	(0.011)	(0.020)
ln_taxdebt				0.018***	0.017***	0.020***
				(0.002)	(0.002)	(0.003)
Taxpayer type				0.066***		
				(0.004)		
Tax Office Controls	No	No	No	Yes	Yes	Yes
Observations	24,892	16,275	8,617	24,892	16,275	8,617

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

5.2.2 Treatment Effects on Payment Relative to Reminder Condition

In this section, we evaluate the payment outcomes based on the round when the tax delinquent took up the amnesty. We use the proportion paid as our dependent variable and estimate an OLS regression. Our results indicate that Individuals who took up the amnesty in the first round paid 18 percent more than those in the control group on average. At the same time, individuals who receive deterrence messages pay 24 percent more relative to those with information treatment. We see no treatment effects on payment for firms in the first and second round. However, in all our sequencing groups in the third round, we find statistically significant effects with negative coefficients. The control group with information treatment paid 33 percent more than those treated. Firms in the information control group drove the effect by paying 47 percent more than the treated. The results are presented in table 10.

Table 10: **Payment Outcomes Relative to Reminder Condition**

Payment	(1) Pooled	(2) Individuals	(3) Firms	(4) Pooled	(5) Individuals	(6) Firms
Payment plan	0.020	0.166***	-0.091	0.000	0.166***	-0.096
	(0.049)	(0.017)	(0.090)	(0.049)	(0.017)	(0.089)
Social Norm	0.007	0.167***	-0.108	-0.014	0.167***	-0.116
	(0.047)	(0.017)	(0.087)	(0.047)	(0.017)	(0.087)
Deterrence	0.004	0.243***	-0.140	-0.014	0.242***	-0.157
	(0.049)	(0.016)	(0.093)	(0.049)	(0.016)	(0.093)
Reminder_2	0.035	-0.049***	0.112	0.034	-0.049***	0.104
	(0.032)	(0.009)	(0.063)	(0.032)	(0.009)	(0.063)
Payment plan_2	-0.088***	-0.024**	-0.117	-0.090***	-0.024**	-0.123
	(0.032)	(0.010)	(0.064)	(0.032)	(0.010)	(0.063)
Social Norm_2	-0.011	-0.011	0.012	-0.012	-0.011	0.002
	(0.032)	(0.009)	(0.064)	(0.032)	(0.009)	(0.063)
Deterrence_2	-0.311***	-0.087***	-0.435***	-0.267***	-0.086***	-0.407***
	(0.028)	(0.008)	(0.064)	(0.028)	(0.008)	(0.063)
Pay_plan -Reminder	-0.310***	-0.085***	-0.436***	-0.265***	-0.084***	-0.407***
	(0.028)	(0.008)	(0.064)	(0.028)	(0.008)	(0.064)
Social- Reminder	-0.306***	-0.082***	-0.431***	-0.262***	-0.081***	-0.403***
	(0.028)	(0.008)	(0.064)	(0.028)	(0.008)	(0.064)
Deterrence- Reminder	-0.308***	-0.083***	-0.432***	-0.262***	-0.083***	-0.402***
	(0.027)	(0.008)	(0.062)	(0.027)	(0.008)	(0.062)
Reminder -Pay_plan	-0.301***	-0.080***	-0.418***	-0.257***	-0.080***	-0.394***
	(0.028)	(0.008)	(0.064)	(0.028)	(0.008)	(0.064)
Social- Pay_plan	-0.300***	-0.079***	-0.418***	-0.256***	-0.079***	-0.390***
	(0.028)	(0.008)	(0.064)	(0.028)	(0.008)	(0.063)
Deterrence-Pay_plan	-0.312***	-0.087***	-0.437***	-0.269***	-0.086***	-0.413***
	(0.027)	(0.008)	(0.062)	(0.027)	(0.008)	(0.062)
Reminder -Social	-0.302***	-0.079***	-0.423***	-0.259***	-0.079***	-0.399***
	(0.028)	(0.008)	(0.064)	(0.028)	(0.008)	(0.063)
Pay_plan -Social	-0.271***	-0.081***	-0.332***	-0.228***	-0.080***	-0.306***
	(0.028)	(0.008)	(0.064)	(0.028)	(0.008)	(0.064)
Deterrence-Social	-0.297***	-0.080***	-0.407***	-0.253***	-0.080***	-0.380***
	(0.027)	(0.008)	(0.062)	(0.027)	(0.008)	(0.062)
Reminder -Deterrence	-0.310***	-0.087***	-0.432***	-0.266***	-0.086***	-0.405***
	(0.028)	(0.008)	(0.064)	(0.028)	(0.008)	(0.064)
Pay_plan -Deterrence	-0.297***	-0.081***	-0.405***	-0.254***	-0.081***	-0.380***
	(0.028)	(0.008)	(0.064)	(0.028)	(0.008)	(0.063)
Tax Office Controls	No	No	No	Yes	Yes	Yes
Constant	0.327***	0.093***	0.468***	0.241***	0.093***	0.416***
Observations	31,153	18,632	12,521	31,153	18,632	12,521

*Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$*
Note: 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 nonpayers. 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).

6 Discussion

Emailing Outcomes. Our study rides on the standard procedure at the Kenya Revenue Authority where Emails are a regular means of communication to taxpayers. Tax delinquents automatically receive emailed demand letter if they remain in a debt position for more than seven days. The amnesty period offered an opportunity to make further communication besides the demand letters to persuade and inform them to clear known outstanding tax debt. Although not part of our research question, the emailing outcomes offer interesting insights that are unique in each of the three treatment rounds. First when the emails are sent out on the 11th of December 2023, of the 91 percent delivered emails, 69 percent were opened/read but the readership drops drastically in the subsequent round to 30 percent and further down in the last round to 28 percent.

Since our treatment starts from the subject line of the email, we infer that tax delinquents are intentionally nonresponsive to email communication from the tax authority. We note that over half of these tax delinquents who read our email in the first round did not pay attention to it in the subsequent rounds. These could signal several 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 contents from the subject line and assumed 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 noncompliance behaviour which is socially uncommon in this context.

Literature suggests that communication avenue is important in driving message effectiveness (Ortega and Scartascini, 2020). Emails have been found to be more effective than letters but less effective than personalised attention in Colombia. While this may be impossible administratively, Mascagni et al. (2017) find SMS's to be even more effective than emails in the Rwanda context. The mere fact that over 99 percent of our emails are delivered in each round indicates efficiency. However, we observe the effectiveness to decline in subsequent reminders which could imply employing a mixed communication strategy. It should be noted that communication to the sampled taxpayers was limited to our email correspondence. However, tax debts are managed at the tax office level, and there is considerable heterogeneity in the taxpayer management strategies that have been established.

Tax Amnesty Uptake and Payment. In this study, the tax amnesty uptake is evaluated based on two distinct control groups. The first control group receives no communication throughout the study period; control condition. The second control group receives information treatment on the ongoing tax amnesty; reminder condition. The other three sub samples receive a nudge sentence in addition to the information about the amnesty. We evaluate uptake in each of the three treatment rounds but analyse payment outcomes at the end of the tax amnesty.

To begin with, we analyse outcomes in comparison to the no email control group. Our finding on uptake in the first round indicate statistically significant results in all treatment conditions. The strongest effects are from social norms driven by firms which report a 1.8 percentage points higher uptake relative to the control group. On the other hand, individual's uptake is observed to be driven by deterrence treatment relative to the control group at 0.9 percentage point. Although, sending reminders seventy-one days from the first treatment results in statistically important outcomes, this is only driven by individuals. Despite positive effects in the pooled estimates, a decomposition of the estimates shows that all the four treatment conditions only drive uptake for individuals (see table 4). Generally, deterrence reminders remain the strong driver of uptake for individuals followed by social norm and

information reminders relative to the no email group. Studies for instance Gil et al. (2023), find that individuals only join an amnesty through deterrence messages. Mascagni et al. (2017) finds deterrence messages to be generally ineffective for Rwanda but argues that small taxpayers remain responsive to deterrence messages. Other studies that find deterrence messages to be effective are Fellner-Röhling et al. (2009) and Shimeles et al. (2017), Fellner-Röhling et al. (2009). The small effects from deterrence and lack of it for firms could be attributed to the text of the law instituting the amnesty that retained status quo in enforcement post amnesty.

In the third round, we introduced sequencing by altering the treatment received by non takers at this point. Of the twelve disaggregated groups, we find that all sequenced groups had statistically significant outcomes on payment for both individuals and firms. Whereas we observe effects of more than ten percentage points relative to the control condition, firms drive these effects with effect sizes of up to 15 percentage points. The study finds that firms that receive a sequence of information, social norms followed by deterrence treatment, they record higher effects size averaging 14 percentage points relative to the control condition. We also observe that moving from deterrence to social norm or personalised benefits has on average similar effect size as the foregoing. On the other hand, individuals have effects of up to 9 percentage points relative to the no email group.

When individuals receive a sequence of deterrence and social norms messages, we find them to have the highest response rate on uptake. Despite the order of the sequence, the effect size is the same. In the pooled model, a combination of social norms and deterrence messages irrespective of what comes first leads to statistically significant outcomes. By decomposing the estimates, we find that individuals drive the effect by 2.4 percentage points compared to the reference group. The finding is consistent with literature on the role of social norms and deterrence messages on compliance (Hallsworth et al., 2017), (Gil et al., 2023), (Mascagni et al., 2017).

Whereas literature has put forth deterrence messages to be effective because of the implied economic/financial costs social norms have been argued to be effective when taxpayers are pointed to a reference group. Further, firms that receive deterrence messages before or after any other treatment pay more than those who receive any other combination of our behaviourial message intervention. This could be explained by the fact that these firms may have been exposed to agency notices in the past and are cautious about being enforced.8

Secondly, the control group that receives information treatment provides us results net off information/notification effects and are smaller than those of the no email control condition (Antinyan and Asatryan, 2019). In the first round, we find no treatment effects in all three message interventions. In the second round where tax delinquents are reminded with the same message, only individuals who receive deterrence messages have statistically significant effects that are consistent in magnitude to the first round. On the sequencing of reminders, we find that combining social norms and deterrence treatment is effective. A combination of social norms and deterrence messages irrespective of what comes first leads to statistically significant outcomes. By decomposing the estimates, we find that individuals drive the effect by 2.4 percentage points compared to the reference group. The finding is consistent with literature on the role of social norms and deterrence messages on compliance (Hallsworth et al., 2017); (Gil et al., 2023), (Mascagni et al., 2017). Whereas literature has put forth deterrence messages to be effective because of the implied economic/financial costs social norms have been argued to be effective when taxpayers are pointed to a reference group.

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8 Agency notices through banks are commonly employed as an enforcement measure. In essence, banks are instructed to freeze funds in the account affecting working capital to therefore compelling a tax delinquent to settle tax arrears.

Third, when we evaluate payment outcomes at the end of the study period, we find that those who took up the amnesty in the first and second round paid 30 percent more than those in the no email group. In both rounds, firms paid more than individuals. In this case, firms that received information and personalised benefit reminders paid 46 and 53 percent respectively relative to the control group. On the contrary, those who took the amnesty in the third round had no statistically significant payment outcomes. Whereas literature on sequencing of nudges is scarce we argue that a change of communication details is effective for both firms and individuals.

At the same time, information reminders lead to more payment by firms. We also observe that payment plans are important for firms and lead to higher payments of 52 percent more than the control group. Deterrence reminders have high effects on payment (43 percent) and could be associated with prior dealings between firms and the tax administration. When we evaluate outcomes relative to the reminder control condition, we find that combination of information and nudges only lead to higher payment outcomes for individuals who are early takers but not firms. This is consistent with the uptake outcomes where reminder condition treatment drove uptake for individuals more than firms. In addition, the net effects imply that informing tax delinquents about their tax arrears is effective for payment especially for those who take up the amnesty at its inception.

Overall, we find the amount of outstanding principal tax to be statistically important in determining tax amnesty uptake. Indeed, the higher the tax debt the higher the cost saving in terms of accrued interest and penalty. Nevertheless, the tax administration is organized in a way that taxpayers are domiciled in specific tax stations. In some instances, we find this attribute to be important in explaining tax amnesty uptake but particularly for firms in MTO, recall this is a tax office with firms only. This may imply that the relationship management for firms is more structured and effective compared to that of tax stations with mixed taxpayer types. Nonetheless, firms are registered for a number of taxes that may necessitate frequent contact with the tax system making them more informed. For instance, if they have VAT obligation filling is done monthly unlike for individuals who only file a return once a year. Our results speak to findings by Gil et al. (2023) who find strong response from firms as opposed to individuals. The study also finds nudges to be more effective for large taxpayers which maybe the case here when we compare firms and individuals. In the Kenyan context tax compliance is important for access to credit and for a chance to trade with government.

6.1 Conclusion

We leveraged on an ongoing tax amnesty targeting tax delinquents to evaluate the effects of nudges on uptake and debt payment. From our finding, we conclude that reminders have significant effects both economically and statistically. We reach this conclusion when we compare our treatment outcomes to a no email control group and find significant effects sizes for both uptake and payment. Moreover, repeated reminders with deterrence nudges are found to be statistically significant for individuals relative to information reminders and the control condition. Although information reminders have significant effects, our finding suggests that it is more effective to sequence nudges in repeated reminders when communicating to both firms and individuals. When repeated reminders carry the same nudge or information, we only observe effects for individuals, but sequencing of nudges leads to significantly large treatment outcomes for all taxpayer types.

In addition, the point of taking up an amnesty is important for payment outcomes. We observe that those who take up the amnesty earlier in the experiment pay 30 percent more on average relative to the control group. Non the less, when we evaluate payment outcomes relative to reminder condition as a control group, it is only effective for individuals who are reported to pay 16 percent more. This

means 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 literature and can be adopted in a wide range of jurisdictions. In particular, the sequencing of nudges in reminders is an effective strategy that we found effective in driving tax amnesty uptake. Given the modest costs of large scale emailing compared to enforcement, the design can be adopted beyond tax delinquency contexts.

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7 Appendix

Table 11: Sample Size and Tax Office Distribution by Group

Group	Control	Benefit	Social Norm	Deterrence	Total
Sample size	9,275	8,537	8,537	8,537	34,866
Tax Office					
North of Nairobi	2,212 (27.3%)	1,914 (23.6%)	2,022 (25%)	1,954 (24.1%)	8,102
East of Nairobi	1,865 (26.8%)	1,680 (24.2%)	1,733 (24.9%)	1,657 (23.8%)	6,935
West of Nairobi	3,689 (26.1%)	3,518 (24.1%)	3,388 (24.0%)	3,518 (24.9%)	14,113
South of Nairobi	1,312 (26.3%)	1,241 (24.9%)	1,200 (24.1%)	1,220 (24.5%)	4,973
Medium Tax Office	197 (25.8%)	184 (24.1%)	194 (25.4%)	188 (24.6%)	763
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

Note: 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 12: Email Campaign Results by Group and Round

Group	Emails Sent	Emails Delivered	Emails Undelivered	Emails Forwarded	Emails Opened	Uptake	Uptake Rate (%)
Round 1							
Reminder	9,266	8,428	830	54	5,946	426	5.2%
Benefit	8,500	7,748	750	72	5,995	387	5.1%
Social Norm	8,517	7,743	766	51	5,243	411	5.4%
Deterrent	8,511	7,893	736	97	6,828	389	5.1%
Total	**34,794**	**31,712**	**3,082**	**274**	**24,012**	**1,613**	**5.2%**
Round 2							
Control	7,083	6,893	230	54	2,071	215	3.0%
Benefit	6,457	6,287	192	88	1,840	224	3.5%
Social Norm	6,435	6,257	182	62	1,811	224	3.5%
Deterrent	6,483	6,321	171	77	2,067	249	3.8%
Total	**26,458**	**25,758**	**775**	**281**	**7,789**	**912**	**3.4%**
Round 3							
Control	6,129	5,953	176	45	1,652	716	12.0%
Benefit	6,308	6,124	184	42	1,533	720	11.8%
Social Norm	6,328	6,122	206	29	1,653	767	12.5%
Deterrent	6,307	6,105	202	101	1,867	754	12.4%
Total	**25,072**	**24,304**	**768**	**217**	**6,705**	**2,957**	**12.2%**

Note: Emails were sent to 34,794 tax delinquents from Nairobi region. In our analysis we exclude undelivered emails. They were equally distributed to the three treatment conditions (8,537 each) and the control group had more taxpayers (9,275). In the first round, emails were sent to 99.7 percent of the sample out of which 89.4 percent were delivered, 77.1 percent opened/read, and 11 percent were undelivered. At the end of the first round, 6,457 taxpayers had taken up the amnesty.

7.1 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 you 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 you 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 you 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
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UNIVERSITÄT
WIEN VIENNA
UNIVERSITY OF
ECONOMICS
AND BUSINESS

EQUIS AACSB AMBA

Gayline Vuluku, Dep Economics

15 Dec 2023

Ethics review result for Research Project WU-RP-2023-055

Dear Gayline,

The WU Ethics board reviewed your submission for research project
WU-RP-2023-055, titled

"Behavioural Intervention in a Tax Amnesty to Tax Debtors: A Natural Field Experiment".

Ethical approval has been **granted**.

With kind regards

Ben Greiner
WU Ethics Board

Appendix 2: Ethical Approval