Local Authorities and Tax Collection:
Experimental Evidence from Tanzania.

Authors   Francis Mwaijande | Muhajir Kachwamba | Joshua Mwakalikamo
| Diego Shirima

Local Authorities and Tax Collection:
Experimental Evidence from Tanzania

Abstract

Property tax is a potential revenue source in developing countries but contributes little to total tax revenue. Evidence indicates that property tax contributes on average less than 1% of GDP in developing countries and below 0.5% of GDP for African countries. This situation is no different in Tanzania than in other developing countries. Although many studies have examined the use of text messages reminders to influence tax compliance, we employed an RCT strategy to study the additional effect of involvement of local authorities to increase compliance with payment of property taxes. Participants were randomly allocated to three treatment arms and a control group using a big-stick randomization method which led to a final sample of 668 local government leaders and 21,328 taxpayers. The first treatment arm involved text messages reminders with a threat of fines, and the second arm combined the first-arm treatment with an additional threat to involve local leaders in the tax-collection process. The third arm combined the first-arm treatment with an appeal from local leaders for help in increasing tax compliance. Results indicate that, in all treatment arms, regression coefficients show positive impact and are significant at 1%. Furthermore, when the coefficient of the first treatment are compared to the third treatment, the coefficient of the third treatment arm revealed a 2.2 percentage-point increase in payment for all taxpayers. These results suggest that the involvement of local government leaders triggered an additional effect in compliance relative to the standard text messages reminder alone.

Key words: Local Government Leaders, property taxpayers, Compliance, Influence

JEL Classification: E62; H3; H26; H71; O38.

Authors

Francis Mwaijande
Mzumbe University
Dar Es Salaam, Tanzania
mwaijandef@gmail.com

Muhajir Kachwamba
MASSA Institute of Social Sciences Research
Dar es Salaam, Tanzania
makachwamba@gmail.com

Joshua Mwakalikamo
MASSA Institute of Social Science Research
Dar es Salaam, Tanzania
joshua.mwakalikamo@googlemail.com

Diego Shirima
MASSA Institute of Social Science Research
Dar es Salaam, Tanzania
diegosb23@gmail.com

Table of Contents

List of Tables

I.   Introduction

Property tax is a potential source of revenue in developing countries but has been shown to contribute little to total tax revenue. Evidence from groundbreaking literature such as Ali, Fjeldstad, and Katera (2017) has shown that property tax contributes, on average, less than 1% of GDP in developing countries and below 0.5% of GDP for African countries. Similarly, Bahl (2009) reported that, although property tax remained at the top of the agenda in most developing and transitional countries, its contribution was as low as 4% of total tax revenue. Weak property-tax-collection measures in developing countries has led to eagerness among policy makers to increase the contribution of property taxes to GDP and to total revenues (Ali, Fjeldstad & Katera, 2017). The Tanzanian context is no different: property tax is a potential tax base, but its contribution to total tax revenues is limited (Ali, Fjeldstad & Katera, 2018). In particular, property tax in Tanzania is normally confined to buildings located in urban and semi-urban areas.

During the 1998 process of decentralization and local government reform in Tanzania, property taxes were first collected by local authorities. Subsequently, the responsibility was shifted to the Tanzanian Revenue Authority. In 2014, the government again assigned the role to local authorities before shifting the responsibility back to the Tanzanian Revenue Authority in 2016 (Ali, Fjeldstad & Katera, 2018). Despite being closer to the property taxpayers, local authorities faced administrative and other constraints (Kelly & Musunu, 2000; McCluskey & Franzsen, 2005; Fjeldstad & Heggstad, 2012). For example, in financial year 2015/2016, many local authorities had attained compliance of less than 30% of targeted property-tax revenue. In this context, compliance with property-tax payment has remained a critical problem in Tanzania and requires innovative solutions. We designed an intervention based on the theoretical and empirical literature to address this policy issue.

The objective and motivation of our study was to establish to what extent leaders in local government could be leveraged to increase property-tax collection in the context of a developing country. Specifically, we examined these questions: Can local leaders help increase tax collection by their own actions? and Will taxpayers comply with (or without) an additional threat of enforcement from the tax authority? To

address these questions, we designed an RCT experiment with three treatment arms leveraged on contact details and tax-liability information for taxpayers and contact details for local government leaders. We relied on administrative data from the Tanzanian Revenue Authority and taxpayer information from street local government leaders or village local government leaders in the Simiyu and Shinyanga regions (local government leaders in Tanzania are designated as "street local government leaders" for urban districts and "village local government leaders" for rural districts).

We examined the effect of messaging strategies and involvement of local leaders/authorities to increase tax collection in Tanzania. A big-stick randomization method was used to assign subjects into treatment and control groups at the local-government-leader or cluster level. The final draw led to a sample size of 668 local government leaders and 21,328 taxpayers. The first treatment arm (T1) involved a text messages reminder with a threat of fine, which is standard in tax-compliance literature. The second treatment arm (T2) combined the first-arm treatment with an additional threat of involvement of local leaders in tax collection. The third arm (T3) combined the first-arm treatment with a request for help to increase tax compliance directly from local leaders. Apart from reminder text messages, phone calls were also made in the third arm (T3) asking local government leaders for cooperation in the collection of property tax within their administrative areas. At the empirical level, we used these three treatment arms to measure outcomes from different interventions to gauge their effect on compliance with payment of property taxes with the payment of property taxes, our primary outcome variable of interest compliance with payment of property taxes.

While we acknowledge the increasing number of field experiments that involve reminder text messages sent via mobile phone on increasing tax compliance (Garcia et al., 2019; Mascagni, Nell & Monkam, 2017), only one recent study (Collin et al., 2018) examined the question in the context of Tanzania. Furthermore, no studies have examined the synergy of reminder text messages combined with the role of local government leaders in promoting compliance with payment of property taxes in Tanzania. Because local chiefs are able to monitor local residents and have more access to information regarding residents and their properties, the literature shows that they collect property taxes more efficiently than do central government agents (Balán et al.,

2020; Ali, Fjeldstad & Katera, 2017). For example, in a study conducted in the Democratic Republic of Congo, Balán et al. (2020) reported that chiefs involved in tax collection achieved a 3.3 percentage-point higher tax compliance than did state collectors. In this context, we took advantage of local administrative structures in which local government leaders have historically been and remain potential administrative units for the handling of development matters in the general community (Sambaiga, 2018; Cross, 2013). Our intervention profits from this network of local leaders by introducing an innovation vis a vis the standard literature, whereby instead of just sending reminder text messages to randomly selected property taxpayers alone; we also sent text messages and made phone calls to a randomly selected local government leaders who led small groups of people in their respective streets or villages and are knowledgeable of properties within their territories.

Results indicate that, in all treatment arms, the regression coefficients show positive impact and are significant at 1%. The regression coefficients in Models 1 and 3 in Table 5 indicate that, without controls, the intervention increased payment by 6 percent point for all taxpayers and 7 percent point for text-message recipients only. With controls in Models 2 and 4 of Table 5, the intervention increased payment by 6.6 percent point for all taxpayers and 7.4 percent for text messages recipient only. Therefore, these results suggest that, without control variables, all taxpayers have a 6-percentage point higher probability of having paid their 2020-2021 property taxes than taxpayers in the control group. Compared to the regression coefficient of the first treatment (T1), the coefficient of the second treatment arm (T2) revealed a 0.5 percentage point change higher in payment status for all taxpayers and text-message recipients when control variables are included. These results suggest that, reminder text messages with threat of involvement of a local government leader increased compliance than reminder text messages alone by 7 percent point increase. This difference in value of payment status between treatment one (T1) and treatment two (T2) is interpreted as additional effect of a threat of involvement of a local government leader in tax collection. When the regression coefficient of the first treatment (T1) in Column 1 of Table 5 are compared to the same Column for third treatment (T3), the coefficient of the third treatment arm (T3) revealed a 2.2 percentage point increase in payment status for all taxpayers. Furthermore, our results indicate that the actions of

local government leaders matter in property-tax collection. These results suggest that actual involvement of a local government leader triggered an additional effect in compliance relative to the standard reminder text messages alone.

Our study contributes to two broader lines of the literature on tax compliance. The first is the body of literature that relies on the nudge theory of behavioral economics to examine the role of mobile-phone text-message reminders in increasing tax compliance in RCTs (Antinyan & Asatryan, 2020). The second is another stream of literature that documents the significant role of local chiefs in property-tax collection (Balán et al., 2020). The detailed sources on these two broader streams of literature are presented in Section III. Our work adds two additional experimental treatments to these approaches.

II. Context

Property tax is one potential tax base in Tanzania but has so far contributed little to total tax revenue. In Tanzania, property tax is levied on individual residential property whether used for housing or business in urban and semi-urban areas and excludes property used for public services such as hospitals, churches, and mosques. Property tax is levied as an annual flat rate in each fiscal year, and penalties may be imposed for late payment.

In efforts to enhance property-tax collection, the Tanzanian government has several times centralized or decentralized the administrative governance of property-tax collection. Despite these changes, property tax compliance has not substantially improved. This situation indicates that improving property-tax collection in Tanzania should be a priority for financing the country's development agenda and calls for policy makers to capitalize on options to increase property-tax revenue in Tanzania.

In this experiment, we focused on property-tax non-compliers using administrative data from the Tanzanian Revenue Authority. Our RCT experiment used administrative data from the Simiyu and Shinyanga Regions and was implemented in close collaboration with local government authorities and the Tanzanian Revenue

Authority. In our study, we specifically sent reminder text messages with threat of fines and added a component of a local leader's involvement in the collection of property tax. In doing so, we do not only examine the effect of reminder text messages with threat of fines; but also examined the effect of threat of local leaders' involvement in property-tax collection. In this view, our study tests the degree of compliance when text messages are directly sent to individual property taxpayers on one hand; and when contacting local leaders asking them to enforce that property owners in their territories comply. Our full intervention and treatment arms are described in detail under Section IV.

III. Conceptual Framework

Compliance to property tax payment is a requirement by Tanzanian Local Government Rating Act, [CAP 289] Law, which requires all property owners to pay property tax. However, there has been high non-compliance to property tax payment as required by the law. Previous studies (Mascagni, Nell & Monkam, 2017; Hallsworth et al., 2017; Collin et al., 2018) have reported that reminder letters and or messages have impact on compliance. Reminder text messages in RCTs have been applied as intervention policy options in such sectors as health (Bracken et al., 2019), education (Burland & Owen, 2021), agriculture (Fabregas et al., 2019), and tax (Garcia et al., 2019; Mascagni, Nell & Monkam, 2017).

Our experiment builds on the same line of literature that has examined the effect of Mobile Phone Reminder Text Messages on Compliance with payment of property taxes in Tanzania using Randomized Control Trials (RCT) to generate evidence on what works to increase property-tax compliance. Evidence from meta-analysis suggests that on average deterrence text messages interventions with potential penalties improve the level of compliance (Antinyan & Asatryan, 2020). On the other hand, our study also builds on another stream of literature which documents the role of local chiefs in promoting property-tax collection (Balán et al., 2020, Ali, Fjeldstad & Katera, 2017).

Therefore, our conceptual framework was built from the nudge theory of behavioral economics, whereby deterrent text messages and threats of local leader follow-up would induce property taxpayers to comply. To induce the feeling that a taxpayer was being monitored by authorities and, thus, to increase potential compliance, deterrent text messages addressed property taxpayers by name and included a threat of fines for non-compliance. This type of message, standard in the literature, is our true baseline. While we compared tax payments from recipients of this message with those in the control group who received no messages, we expected a positive and significant effect (Antinyan & Asatryan, 2020). We therefore formulated our first hypothesis as follows;

H1: Property taxpayers who receive reminder messages containing threat of fines in the treatment group comply more than taxpayers in the control group.

The originality in our approach is that we added two variations to this standard message, both related to the threat that a local leader would follow up on missed tax payments. Evidence from developing countries suggests that local chiefs play a significant role in enhancing tax collection (see Ali, Fjeldstad & Katera, 2017). In addition, a study from Democratic Republic of Congo (Balán et al., 2020) reported that local chiefs enhanced compliance with the payment of property taxes by 3.3 percentage points, which increased revenue by 43% more than did interventions by state agents. Based on this premise, we formulated the second and third hypotheses as follows:

H2: Property taxpayers who receive reminder messages and threat of a local leader action for follow up comply more than those who receive reminder messages alone

H3: Property taxpayers who receive reminder messages and (potentially) an actual threat from a local leader who was asked to help yield the highest compliance

Our main outcome variable of interest is compliance measured in terms of compliance rate and secondary outcome is improved revenue collection from property tax.

IV. Experimental Design, Data and Empirical Strategy

4.1 Experimental Design

To implement the experiment, we initially identified all property taxpayers who had not paid their taxes before the start of the intervention and defined them as eligible subjects. Participants were then allocated into treatment and control groups through big-stick re-randomization at the local-government-leader or cluster level. The experimental design consists of one control arm and three treatment arms described as:

- **Treatment 1 (T1):** First treatment arm involved text messages reminder with a threat of fine.

- **Treatment 2 (T2):** The second treatment arm involved text messages reminder with both a threat of fine and a threat of involvement of local leaders.

- **Treatment 3 (T3):** The third arm involved text messages reminder with both a threat of fine and an actual request for local leaders' involvement in the tax collection process via text messages and phone calls to the leaders

- **Control group (T0):** taxpayers and leaders in the control group clusters did not receive any kind of communication.

Figure 1: Message Scripts Sent to Property Taxpayers and Local Government Leaders

T0	T0-Neither SMS reminder nor Mjumbe will be involved in tax collection
T1	T1-BASIC SMS for Taxpayers in Treatment 1 and Treatment 3 (control group receives nothing)
SMS Content	Dear [**NAME**]**,** Pay property tax for your building No **[BRN]**, located at **[STREET NAME]** before June 30, 2021 amount of TZS **[AMOUNT].** NON-PAYMENT IMPLIES FINES AND SANCTIONS FROM TANZANIA REVENUE AUTHORITY
T2	T2- SMS for Taxpayers in Treatment 2 (basic T1 SMS+ threat of Mjumbe action)
SMS Content	Dear **[NAME],** Pay property tax for your building No **[BRN]**, located at **[STREET NAME]** before June 30, 2021 amount of TZS **[AMOUNT].** NON-PAYMENT IMPLIES FINES AND SANCTIONS FROM TANZANIA REVENUE AUTHORITY. YOUR AREA'S MJUMBE, **[MJUMBE NAME]**, WILL HELP TRA IN COLLECTING THIS TAX
T3	SMS for Mjumbe (only Treatment 3 – mjumbes in control group and Treatments 1 and 2 receive nothing)
SMS Content	Dear **X,** please inform property owners in your area to pay property taxes before June 30 2021. NON-PAYMENT IMPLIES FINES AND SANCTIONS FROM TANZANIA REVENUE AUTHORITY.

Source: Authors' calculations.

Figure 1 shows that the first treatment group received messages that addressed the taxpayer by name, address, and amount owed. The closing line was the threat of fine in accordance with the law. The second treatment group received a similar text message but with the addition of a local government leader's name to indicate that she or he would help the authority to collect the required amount.

The third treatment group was different from the others: text messages were sent to local government leaders to remind them to deliver a threatening message to non-compliant property taxpayers residing in their areas. Apart from text messages, two waves of phone calls to local government leaders were made from the revenue authority requesting their cooperation in collecting property taxes in their administrative areas. The phone calls also informed local government leaders about an incentive: a certificate of recognition for their participation in the collection of property taxes in the country. In order to establish the experimental outcome, we made calls to some local government leaders in treatment two (T2) and asked them to remind taxpayers in their administrative areas to comply. The intervention began on 3 May 2021 and was completed on 30 June 2021. Figure 4 provides information about timeline of the intervention

At the empirical level, our strategy was to measure outcomes from different interventions to gauge the effect of text message reminders and local community leaders' involvement in increasing compliance with payment of property taxes. In the first treatment arm (T1), we compared compliance in T1 and control group (T0) and measured the effect of sending a text messages reminder containing a threat of fine. In the second treatment arm (T2), we compared T2 and T1 and measured the additional effect of adding a threat of action by a local government leader. Finally, in the third treatment arm (T3), we compared T3 and T1 and measured the additional effect of adding a request for action by a local government leader to the threat of fine. All messages were designed as originating with the tax authority.

4.2   The Randomization Process

A big-stick randomization approach was used to allocate participants into treatment and control group at the cluster or local-government-leader level, following the recommendations of such workers as McKenzie and Bruhn (2009), Bruhn and McKenzie (2008), and Soares and Wu (1983). Randomization and multiple draws of the treatment-control allocation were also made to select a draw with an acceptable (low) degree of unbalance across important covariates. Before participants were randomly assigned to respective experimental arms, an analysis of a baseline balance was performed on selected variables (see Table 3). The baseline-balance analysis aided in collecting information on the experimental sample which was used to check the balance of observed characteristics before the intervention. In this view, the baseline-balance analysis allowed us to check the balance of observable sample characteristics before the start of the intervention to ensure that each treatment arm was identical to the control group. Section 4.2.4 provides detailed information regarding baseline balance.

4.2.1.1   Data

We used administrative data as explained in Section 4.2.3. Data were collected from the final sample described in Section 4.2.2 and guided by the experimental design shown

in Section 4.1. Our final data set consisted of 668 local leaders and 21,328 taxpayers. Both baseline and end line data were analyzed as explained in Sections 4.2.3 and 4.2.4. Figure 3 summarizes the data-management process from baseline to endline.

4.2.1.2   Sample

As stated before, our randomization strategy led to allocation of participants in the treatment and control group at the local-government-leader or cluster level. The final draw led to the following allocation: Treatment arm 1 (5,696), Treatment arm 2 (5,012), Treatment arm 3 (5,347) and Control (5,273). Eventually, the final sample size was 668 local government leaders and 21,327 taxpayers. The full description of how this sample size was arrived, the verification exercises and data cleaning processes is given in Appendix Figure 2. 2. Appendix Figure 1 describes the process of assigning eligible participants into treatment and control groups at the level of local-government-leader clusters. Appendix Table 1 describes the sample size transition from the initial to final implementation stages.

4.2.1.3   Administrative Data

We used administrative data from the Tanzanian Revenue Authority, including a list of property taxpayers in four districts: Bariadi Town Council, Busega District, Kahama Town Council, and Shinyanga Municipal Area for the 2018/2019 to 2020/2021 period. After data cleaning, our sample included 21,328 taxpayers and 668 local government leaders. The key variables included in the database were names, payment, phone numbers, and location of taxpayers. As stated in the preceding section, several steps were taken to manage quality of administrative data. The sample of 21,328 was made up of property taxpayers who had not paid their taxes before the start of the intervention.

We subsequently sent four waves of text messages to 16,055 taxpayers and two rounds of phone calls to 166 local government leaders, continuing to monitor changes in compliance within the database after every wave of text messages and phone calls. We requested upload of data of our sampled database from the Tanzanian Revenue Authority two weeks after each wave of text messages and at the end of the month. We considered 30 June 2021 to be the end date of the intervention because this date marks the end of

the fiscal year.

The first wave of text messages was sent on 3 May 2021, the second on 24 May 2021, the third on 7 June 2021, and the fourth on 21 June 2021. A total of 32,450 text messages were sent in each wave (1-4). Phone calls to local leaders were placed on May 24th (first wave) with a second and final wave on 14 June 2021. A total of 166 calls were made for every round of phone calls to local government leaders. Further, we learned from the baseline information that there had been a tendency in previous years for payments to arrive after the official deadline. We therefore decided to send the fifth wave of text messages after the official deadline to examine whether taxpayers had a tendency to comply after the deadline (in 2021, however, there was no deadline extension). We also took note of variations in the delivery status of text messages in each wave as a result of such factors as network problems, network traffic, and offline mobile phones. Table 2 summarizes the delivery status of text messages for each wave.

4.2.2   Baseline Balance

In the analysis of baseline balance, we selected such important variables as gender, residential payment status for financial years 2019-20 and 2018-2019, payment before deadline, amount paid, and outstanding amounts for the same periods. Table 3 shows mean differences between treatment and control groups. The results of the joint F-test indicate no statistically significant mean difference of gender, residential status, payment status, payment before deadline, amount paid, or outstanding amounts between control and treatment groups.

Therefore, balance was achieved following randomization, assuring us that none of the treatment arms was different from the control group. This evidence suggests that subjects in the control and treatment groups were similar in their observable characteristics before the start of the intervention, so much so that any difference observed after the intervention could be confidently associated with intervention impact.

4.3   Empirical Strategy

In order to match our theoretical and empirical domains, we employed a combination of empirical strategies to analyze the effect of interventions on property-tax-

payment compliance, our primary outcome variable. We measured compliance using payment status and amount paid. Payment status was an outcome variable measured as a binary (yes/no), while amount paid was an outcome variable measured as continuous.

We therefore estimated the first model of payment status using a linear probability regression model. In the case of both residential and business properties, taxes are paid on single properties and, as a result, the only known value would be zero for the lower bound while the upper bound would be practically impossible to know. We therefore considered these variables to be censored variables and used a Tobit regression model, an approach widely used in tax field experiments for similar reasons (see, for example, Mascagni, Nell & Monkam, 2017; and Alm & McClellan, 2012).

We also tested significant mean differences in treatments in all three hypotheses for the two outcome variables (i.e., T1-T2 and T1-T3). Furthermore, we followed the strategy of Bérgolo et al. (2021), according to which the outcome variable is the amount paid. We then estimated the log-linear model (Poisson regression) for easy interpretation of the estimated effect as semi-elasticity. These alternative estimation methods were also checked for robustness.

These empirical analytical methods helped, first, to test the effects of on tax-payment compliance of sending a text-message reminder containing a threat of fine (T1). Second, they allowed us to capture the effect of adding an actual request for local government leader action to the threat of fine (T2) vs. treatment one (T1). Third, they made it possible for us to compare the outcomes of the third treatment (T3) against those of the first treatment (T1). Furthermore, when we compared Treatment 2 to Treatment 1, we were "netting out" the effect of the pure reminder/fine threat message and testing whether the threat of a local government leader's involvement in the process increased compliance (i.e., whether the threat of local government leader involvement was credible and induced behavior change). When comparing Treatment 3 to Treatment 1, we were, in turn, testing whether local leaders actually helped with the enforcement of tax-payment compliance.

V. Results

In this section, results are presented based on both Tobit and binary estimated regressions for the two outcomes: amount paid and payment status. Table 5 and 6 show results for the two outcome variables based on our randomization and treatment arms protocol. Regression models in both outcome variables were are estimated with and without control variables for all taxpayers and for text message recipients only (excluding those who did not get text messages because of network problems or offline mobile phones). Table 4 presents average amount of tax paid for treatment and control groups. Table 5 summarizes results for binary regression, and Table 6 presents results of the Tobit regression. We also estimated the Poisson regression for a robustness check. Furthermore, our descriptive analysis indicates that the majority of property taxpayers (61%) received the text messages sent in each wave (See Table 9), and about 35% paid after the fourth and last wave (see Table 8). Also see Figure 6a, which shows the average amount paid in the experimental groups and 6b, which illustrates the percentage of payment in the experimental groups.

In our first hypothesis (property taxpayers who received reminder messages containing threat of fines in the treatment group would comply more than taxpayers in the control group), our interest was to estimate compliance between taxpayers in the first treatment arm (T1) and taxpayers in the control group. In the second and third hypotheses, we compared compliance in treatment arm one (T1), two (T2), and three (T3), thereby netting out the additional effect of the threat of local government leader action and the actual involvement of a local government leader.

5.1 Effect of Interventions on Payment Status

Results of our first outcome variable (payment status) are presented in Table 5. We present results of each treatment arm for all taxpayers with and without controls and text-message recipients only. For the first treatment arm (T1), our results indicate that the intervention had an impact in Models 1 to 4. The regression coefficients for all taxpayers and text-message recipients only, with and without controls, are significant at 1%. Specifically, the regression coefficients in Model 1 and 3 in Table 5 indicate that, without controls, the intervention increased payment by 6 percent point for all

taxpayers and seven percentage point for text-message recipients only. With controls, the intervention increased payment by 6.6 percent point for all taxpayers and 7.4 percent point for text messages recipient only. Therefore, these results suggest that, without control variables, all taxpayers have a six percentage point higher probability of having paid their 2020-2021 property taxes than taxpayers in the control group. Similarly, when control variables are included, all taxpayers had a 6.6 percentage point higher probability of having paid their 2020-2021 property taxes than their counterpart taxpayers in the control group.

For treatment arm two (T2), results show significant regression coefficients in all columns, and all coefficients are statistically significant at 1%. Compared to the regression coefficient of the first treatment (T1), the coefficient of the second treatment arm (T2) revealed a 0.5 percentage point increase in payment status for all taxpayers and text-message recipients when control variables were included. These results suggest that reminder text messages combined with the threat of involvement of a local government leader increased compliance more than did reminder text messages (a seven percentage-point increase). This difference in the value of payments between treatment one (T1) and treatment two (T2) is interpreted as an additional effect of the threat to involve a local government leader in tax collection.

Regarding the third treatment arm (T3), results in Table 5 indicate positive and significant coefficients in all models. The coefficients are significant at 1% indicating that sending reminder text messages followed by actual involvement of local leaders increased tax compliance. Our interest in the third hypothesis was to find out the additional effect of actual involvement of a local government leader to the standard reminder text messages. When the regression coefficient of the first treatment (T1) in Column 1 of Table 5 are compared to the same Column for third treatment (T3), the coefficient of the third treatment arm (T3) revealed a 0.14 percentage point change higher in payment status for all taxpayers. These results suggest that actual involvement of a local government leader had an additional effect of 2.2 percentage point increase in compliance higher than the standard reminder text messages alone though this difference was not statistically significant.

5.2   Effect of Interventions on Amount Paid

The results in Table 6 show the estimated impact of the intervention on amount of tax paid. The first model (Column 1) in Table 6 includes all taxpayers in the treatment arm regardless of whether the participant received a text message at least once. The coefficients for treatment one (T1) are significant in all models with and without controls. Thus, the results of the first model in Table 6 show that intervention increased the amount paid by 22,998 Tanzanian shillings compared to the control group. The coefficient was statistically significant at 1%. This further suggests that reminder text messages combined with a threat of fine have a positive impact on compliance with payment of property taxes. At the same time, the results of the fourth model regarding participants who received text messages indicate an estimated coefficient of 26,348 Tanzanian shillings (statistically significant at 1%) indicating that reminder text messages increased the amount paid by treated taxpayers compared to taxpayers in the control group.

With regard to the second treatment (T2), our results show that the estimated regression coefficients for Models 1 and 4 are 26,365 Tanzanian shillings for all property taxpayers and 26,455 Tanzanian shillings for text-message recipients only. The coefficients are both statistically significant at 1%. Compared to the regression coefficient of the first treatment (T1), the coefficient of the second treatment arm (T2) revealed a difference of 107 and 2,836 Tanzanian shillings in amount paid for text-message recipients with and without control variables, respectively. These results suggest that reminder text messages with threat of involvement of a local government leader increased compliance more than did reminder text messages alone. The additional 2,836 Tanzanian shillings paid between treatment one (T1) and treatment two (T2) were interpreted as the effect of a threat to involve a local government leader in tax collection.

For the third treatment arm (T3), our results indicate positive and significant coefficients in all models. The coefficients are significant at 1% indicating that sending reminder text messages followed by actual involvement of local leaders increased tax compliance. Our interest in the third hypothesis, however, was to find out what effect actual involvement of a local government leader added to the standard text-message

reminders. Compared to the regression coefficient of the first treatment (T1) in Column 4 of Table 6, the coefficient of the third treatment arm (T3) in the same column revealed a higher coefficient of 812 Tanzanian shillings in amount paid for text-message recipients. These results suggest that actual involvement of a local government leader triggered an additional effect in compliance relative to standard reminder text messages alone, though this difference was not statistically significant.

Results of the Poisson regression are presented in Table 7. Estimates in Column 1 to 4 of Table 7 indicate that all three interventions had an economically significant effect on payments. Specifically, the coefficient of the first treatment arm in Column 1 is positive and highly statistically significant, showing that reminder text messages with a threat of fine increased property-tax payments by 1.098%. According to the interpretation strategy of Bérgolo et al. (2021), this coefficient is also economically significant. In Tanzania, the growth rate of property-tax revenues had declined to about 21% and 3% in fiscal years 2016-2017 and 2017-2018, respectively (Chegere et al., 2020). Though the tax is not necessarily comparable, it provides a reference point against previous performance: the 1.098% increase in the amount of property taxes paid means that revenue from property tax grew five times compared to fiscal year 2016-2017 and thirty-seven times compared to the 2017-2018 fiscal year.

VI.   Conclusions and Policy Implications

Increasing compliance with payment of property taxes is an important goal for tax authorities and policy makers. Developing countries such as Tanzania are embarking on ways to increase the tax revenues that are required to finance socioeconomic development and delivery of public services. One means for increasing government revenues is sending text-message reminders to property taxpayers. This study sought evidence regarding whether the use of text-message reminders and direct intervention by local community leaders increased compliance with payment of property taxes in Tanzania. Our results indicate that text-message reminders with a threat of fine did increase compliance and that, in all treatment arms, the regression coefficients showed positive effects and were significant at 1%.

Regarding our hypothesis that property taxpayers who received reminder messages and (potentially) an actual action from a local leader would increase their compliance, our experimental results show that, when the regression coefficient of the first treatment (T1) in Column 1 of Table 5 is compared to the same Column for third treatment (T3), the coefficient of the third treatment arm (T3) revealed a 2.2 percentage point increase in payments for all taxpayers. Similarly, compared to the regression coefficient of the first treatment (T1) in Column 4 of Table 6, the coefficient of the third treatment arm (T3) in the same column revealed a higher coefficient of 812 Tanzanian shillings in amount paid for text-message recipients. These results suggest that actual involvement of a local government leader triggered an additional effect in compliance relative to the standard reminder text messages alone, though this difference was not statistically significant. Based on our experiment results, we therefore conclude that developing countries including Tanzania can increase property-tax-payment compliance using combined text messages text reminders and local community leaders as was the case in the Balán et al. (2020) study in the Democratic Republic of Congo and in Collin et al., 2018).

Our results indicate that, although we did not find a statistically significant difference in regression coefficients of Treatment 1 (T1) and Treatment 3 (T3), the actions of local government leaders do matter in property-tax collection. The question that needs to be further addressed is whether action is prompted by the threat of involvement or by actual involvement of a local government leader. We addressed this question with two arguments based on policy, political acceptability, and sustainability.

First, local government authorities have always been unhappy in those periods when the collection mandate has shifted from them to the Tanzanian Revenue Authority (Fjeldstad, Ali & Katera, 2019). According to Chegere et al. (2020), the shift in collection responsibilities between central and local government regimes has always followed heated debates in parliament and lobbying by such stakeholders as the Association of Local Government Authorities in Tanzania. Second, we argue that threat from a local government leader must be real if it is also to be credible and sustainable. If it is not, taxpayers may feel deceived in the long run. The cornerstone of a successful property-tax system is a properly updated property-tax database, and we argue that sending reminder text messages is effective when the message is delivered to the

individual actually responsible for paying property tax and to the correct address. All these require a credible property-tax registry created with the input of local government leaders.

In terms of policy implications, our results suggest that untapped revenue from property tax can be enhanced using low-cost strategies. The tax authority can intelligently capitalize on the high penetration of mobile phones to send reminder text messages and can increase compliance by following those reminders with action by local community leaders. Text reminders followed by direct action by local community leaders minimizes friction between central government and local community entities regarding who has the authority to collect property taxes. In our context, both the Tanzanian Revenue Authority (representing central government) and local government leaders (representing community authority) were involved in the sending of text messages.

On the other hand, local government leaders are directly visible to property taxpayers and can be effectively used in follow-ups. Likewise, local government leaders are knowledgeable in identifying property owners, property use, and location. We therefore recommend that local government leaders be seen as key to enhancing compliance with the payment of property taxes as well as in maintaining a credible property-taxpayers' database. A strategic partnership between central government officials and local government authorities should therefore be combined with assignment of roles based on capacity and comparative advantage.

References

Ali, M., Fjeldstad, O.-H., and Katera, L. (2018). Property Owners' Knowledge and Attitudes Towards Property Taxation in Tanzania. Christian Michelsen Institute (CMI) Insight, number 1 (August), p.1-12. Availabale at https://www.cmi.no/publications/file/6612-property-owners-knowledge-and-attitudes-towards.pdf.

Ali, M., Fjeldstad, O.-H., and Katera, L. (2017). Property Taxation in Developing Countries. Christian Michelsen Institute (CMI) Brief, vol. 16 no. 1 (March), p.1-4. Bergen, Norway Available at https://www.cmi.no/publications/file/6167-property-taxation-in-developing-countries.pdf

Alm, J. and McClellan, C. (2012). Tax Morale and Tax Compliance from the Firm's Perspective. *KYKLOS, 65*(1), 1-17.

Antinyan, A. and Asatryan, Z. (2020). Nudging for Tax Compliance: A Meta-Analysis. ZEW-Centre for European Economic Research Discussion Paper, 19-055. Mannheim, Germany: ZEW.

Bahl, R. (2009). Property Tax Reform in Developing and Transition Countries. United States Agency for International Development. Washington, DC: USAID. Available at http://pdf.usaid.gov/pdf_docs/PNADW480.pdf.

Balán, P., Bergeron, A., Tourek, G., and Weigel, J. L. (2020). Local Elites as State Capacity: How City Chiefs Use Local Information to Increase Tax Compliance in the D. R. Congo. Available at https://tarc.exeter.ac.uk/media/universityofexeter/businessschool/documents/centres/tarc/events/seminars/Jonathan_Weigel_Local_Elites_as_State_Capacity_20210201.pdf.

Bérgolo, M. L., Ceni, R., Cruces, G., Giaccobasso, M., and Perez-Truglia, R. (2021). Tax Audits As Scarecrows: Evidence from a Large-Scale Field Experiment (No. W23631). National Bureau of Economic Research. Cambridge, MA: NBER. Available at https://www.nber.org/papers/w23631.

Bracken, K., Keech, A., Hague, W., Kirby, A., Robledo, P. K., Allan, C., and Conway, A. (2019). Telephone Call Reminders Did Not Increase Screening Uptake More Than SMS Reminders: A Recruitment Study within a Trial. *Journal of Clinical Epidemiology*, *112*, 45-52. Available at https://www.sciencedirect.com/science/article/pii/S0895435619301313.

Bruhn, M. and McKenzie, D. (2008). In Pursuit of Balance: Randomization in Practice in Development Field Experiments. Policy Research Working Paper No. 4752. Washington, DC: The World Bank. Available at http://hdl.handle.net/10986/6910.

Burland, E. and Owen, S. (2021). Text Message Intervention for Student Engagement. American Economics Association RCT Registry. Available at https://doi.org/10.1257/rct.7231-1.0.

Chegere, M., Ruhinduka, R. D., Pantaleo, I., and Martin, G. (2020). Assessment of the Impact of Institutional Reforms on Mobilization of Property Tax Revenue. *AfricaPortal.org.* Available at https://www.africaportal.org/publications/assessment-impact-institutional-reforms-mobilization-property-tax-revenue.

Collin, M., Di Maro, V., Evans, D. K., and Manang, F. (2018).Using Reminders And Nudges To Increase Property Tax Compliance in Dar es Salaam. Washington, DC: The World Bank Group. Available at

http://documents.worldbank.org/curated/en/713421593550828169/Using-Reminders-and-Nudges-to-Increase-Property-Tax-Compliance-in-Dar-es-Salaam.

Cross, C. (2013). *Community Policing Through Local Collective Action in Tanzania: Sungusungu to Ulinzi Shirikishi.* Unpublished doctoral dissertation, University of Sussex.

Fabregas, R., Kremer, M., Lowes, M., On, R., and Zane, G. (2019). SMS-Extension and Farmer Behavior: Lessons From Six RCTS in East Africa. Available at https://www.atai-research.org/wp-content/uploads/2020/05/textfarmers1.pdf.

Fjeldstad, O.-H., Ali, M., and Katera, Lucas (2019). Policy Implementation Under Stress: Central-Local Government Relations in Property Tax Administration in Tanzania. *Journal of Financial Management of Property and Construction, 26*(2), 129-147.

Fjeldstad, O.-H. and Heggstad, K. (2012). Local Government Revenue Mobilisation in Anglophone Africa. International Centre for Tax and Development Working Paper 7. Brighton, UK: ICTD. Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2408608.

Garcia, S. M., Argueta, J. C. A., Morales, O. T., and Chin, A. C. (2019). Evaluating the Impact of Text Message Reminders on Tax Compliance: Final Project Report. Behavioral Insights Team/Guatemalan Tax Authority (SAT). London, UK: BIT. Available at https://www.bi.team/wp-content/uploads/2019/11/Guatemala-6-TR-Encourage-timely-declaration-of-tax-1.pdf.

Hallsworth, M., List, J. A., Metcalfe, R. D., and Vlae, I. (2017). The Behavioralist as Tax Collector: Using Natural Field Experiments to Enhance Tax Compliance. *Journal of Public Economics*, *148*. Available at https://doi.org/10.1016/j.jpubeco.2017.02.003.

Mascagni, G., Nell, C., and Monkam, N. (2017). One Size Does Not Fit All: A Field Experiment on the Drivers of Tax Compliance and Delivery Methods in Rwanda. International Centre for Tax and Development Working Paper 58. Brighton, UK: ICTD. Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3120363.

McCluskey, W. and Franzsen, R. (2005). An Evaluation of the Property Tax in Tanzania: An Untapped Fiscal Resource or Administrative Headache. *Property Management, 23*(1), 43-69. Available at https://www.emerald.com/insight/content/doi/10.1108/02637470510580589/full/html.

McKenzie, D. and Bruhn, M. (2009). In Pursuit of Balance: Randomization in Practice in Development Field Experiments. *American Economic Journal: Applied Economics, 1*. 200-232. Available at https://www.researchgate.net/publication/46554233_In_Pursuit_of_Balance_Randomization_in_Practice_in_Development_Field_Experiments.

Kelly, R. and Musunu, Z. (2000). Implementing Property Tax Reform in Tanzania. Working Paper WP00RK1. Cambridge, MA: Lincoln Institute of Land Policy. Available at https://www.lincolninst.edu/sites/default/files/pubfiles/81_KellyMusunu00.pdf.

Sambaiga, R. F. (2018). Changing Images of Nyumba Kumi In Tanzania: Implications for Youth Engagement in Countering Violence at Community Level. *The African Review, 45*, 49-74. Available at https://journals.udsm.ac.tz/index.php/ar/article/view/2231.

Soares, J. F. and Wu, C. F. (1983) Some Restricted Randomization Rules in Sequential Designs. *Communications in Statistics-Theory and Methods, 12*(17), 2017-2034.

Appendix 1: List of Tables

Table 1: Sample Size Transition from the Initial to Final (Implementation) Stage

Variable name	Initial stage	Implementation stage
Property Taxpayers	50,476	21,328
Local Leaders	865	668

Source: Authors' calculations.

Table 2: Number and Percentage of Messages Delivered/Undelivered and Phone Calls Made

Waves	Date	Delivered		Undelivered	
		Number	**Percent**	**Number**	**Percent**
Text messages Wave 1	30 May 2021	13,314	83.78	2,578	16.22
Text messages Wave 2	24 May 2021	11,579	72.17	4,466	27.84
Text messages Wave 3	1 June 2021	12,689	79.08	3,356	20.91
Text messages Wave 4	21 June 2021	11,116	69.24	4,939	30.76
Phone Wave 1	24-27 May 2021	132	79.52	34	20.48
Phone Wave 2	14-17 June 2021	138	83.13	28	16.87

Source: Authors' calculations.

Table 3: Baseline Balance Check Across Experimental Groups

	(1)	(2)	(3)	(4)	F-test
	Control Group	Treatment Group 1	Treatment Group 2	Treatment Group 3	for joint
Variable	Mean/SE	Mean/SE	Mean/SE	Mean/SE	orthogonality
Women	0.232	0.235	0.22	0.235	0.491
	[0.008]	[0.010]	[0.008]	[0.009]	
Residential	0.975	0.965	0.973	0.975	0.575
	[0.006]	[0.006]	[0.004]	[0.004]	
Status if paid in FY 2018/2019	0.238	0.261	0.268	0.215	0.192
	[0.020]	[0.016]	[0.017]	[0.021]	
Payment before deadline in FY 2018/2019	0.955	0.946	0.94	0.949	0.886
	[0.010]	[0.015]	[0.018]	[0.014]	
Amount paid in FY 2018/2019	16076.28	17439.27	16582.08	17490.16	0.721
	[813.809]	[1067.931]	[737.961]	[1597.764]	
Amount paid in FY 2019/2020	22986.02	24434.33	22874.6	19810.17	0.301
	[2362.555]	[2867.718]	[2405.653]	[1209.393]	
Outstanding amount in FY 2019/2020	36262.3	33406.08	37822.06	32490.16	0.842
	[7443.115]	[3095.704]	[4828.273]	[4795.613]	
N	5,273	5,696	5,012	5,347	

The values displayed for t-tests are the differences in the means across the groups. Standard errors are clustered at the local-government-leader variable. ***, **, and * indicate significance at the 1%, 5%, and 10% level. Source: Authors' calculations.

Table 4: Average of Amount Paid by Taxpayers between Control and Treatment Groups

	All sample	Control	Treatment Group 1	Treatment Group 2	Treatment Group 3
Number of taxpayers in group	21,328	5,273	5,696	5,012	5,347
Number of taxpayers who paid by Wave 4	2,045	235	613	614	583
% who paid pre-treatment by Wave 4	10%	4%	11%	12%	11%
Average amount paid by Wave 4 (including zeroes)	1,877	751	2,253	2,330	2,171
Average amount paid by Wave 4 (only if payment>0)	19,183	16,862	20,937	19,023	19,911

Source: Authors' calculations.

Table 5: Binary Regression Showing a Linear Probability of Payment Status

VARIABLES	(1) ALL with no control	(2) ALL with control	(3) text-message recipients no control	(4) text-message recipients with control
Treatment 1	0.0631***	0.0662***	0.0729***	0.0742***
	(0.0134)	(0.0114)	(0.0146)	(0.0123)
Treatment 2	0.0795***	0.0709***	0.0880***	0.0768***
	(0.0137)	(0.0129)	(0.0143)	(0.0135)
Treatment 3	0.0645***	0.0689***	0.0744***	0.0769***
	(0.0102)	(0.0133)	(0.0107)	(0.0143)
Constant	0.0446***	0.0214**	0.0446***	0.0220**
	(0.00493)	(0.00868)	(0.00493)	(0.00917)
Observations	21,218	21,218	19,168	19,168
R-squared	0.011	0.083	0.014	0.086
test T1=T2	0.358	0.767	0.430	0.875
test T1=T3	0.927	0.867	0.930	0.881
test T1=T2=T3	0.571	0.956	0.657	0.984

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Source: Authors' calculations.

Table 6: Tobit Regression: Impact of Three Treatments on Tax Amount Paid

VARIABLES	(1) ALL with no control	(2) ALL with control	(3) text-message recipients no control	(4) text-message recipients with control
Treatment 1	22,998***	24,262***	25,407***	26,348***
	(2,430)	(2,584)	(2,600)	(2,747)
Treatment 2	26,365***	24,983***	28,243***	26,455***
	(2,534)	(2,564)	(2,690)	(2,698)
Treatment 3	23,055***	25,168***	25,379***	27,160***
	(2,389)	(2,560)	(2,543)	(2,708)
Constant	-86,149***	-92,839***	-85,979***	-92,505***
	(6,154)	(6,727)	(6,366)	(6,929)
Observations	21,218	21,218	19,168	19,168
test T1=T2	0.0337	0.664	0.0878	0.951
test T1=T3	0.971	0.588	0.986	0.640
test T1=T2=T3	0.0547	0.850	0.145	0.876

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Source: Authors' calculations.

Table 7: Poisson Regressions: Impact of Three Treatments on Payment Amounts

VARIABLES	(1) ALL with no control	(2) ALL with control	(3) text-message recipients no control	(4) text-message recipients with control
Treatment 1	1.098***	1.146***	1.191***	1.233***
	(0.128)	(0.128)	(0.130)	(0.130)
Treatment 2	1.147***	1.093***	1.221***	1.162***
	(0.127)	(0.128)	(0.129)	(0.130)
Treatment 3	1.061***	1.068***	1.143***	1.142***
	(0.126)	(0.126)	(0.127)	(0.127)
Constant	6.622***	6.697***	6.622***	6.706***
	(0.104)	(0.120)	(0.104)	(0.120)
Observations	21,218	21,218	19,168	19,168
test T1=T2	0.640	0.613	0.783	0.520
test T1=T3	0.717	0.459	0.652	0.408
test T1=T2=T3	0.698	0.754	0.757	0.691

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Source: Authors' calculations.

Table 8: Frequency and Payment Rate (%) in Each Intervention Wave

Payment made after wave	Freq.	Percent
Payment made before first text messages wave	318	15.55
Paid after W1-text messages (3-23 May 2021)	248	12.13
Paid after W2-text messages (24 May-6 June 2021)	401	19.61
Paid after W3-text messages (7-20 June 2021)	361	17.65
Paid after W4-text messages (>20 June 2021)	717	35.06
Total	2,045	100

Source: Authors' calculations.

**Table 9: Number of Text Messages Received by Taxpayers in the Treatment Group**

| text messages Recipient	Frequency	Percent
Received 0 text messages	2058	12.82%
Received 1 text messages	1039	6.47%
Received 2 text messages	966	6.02%
Received 3 text messages	2241	13.96%
Received 4 text messages	9751	60.73%
Total	**16055**	**100%**

Source: Authors' calculations.

D

Appendix 2: List of Figures

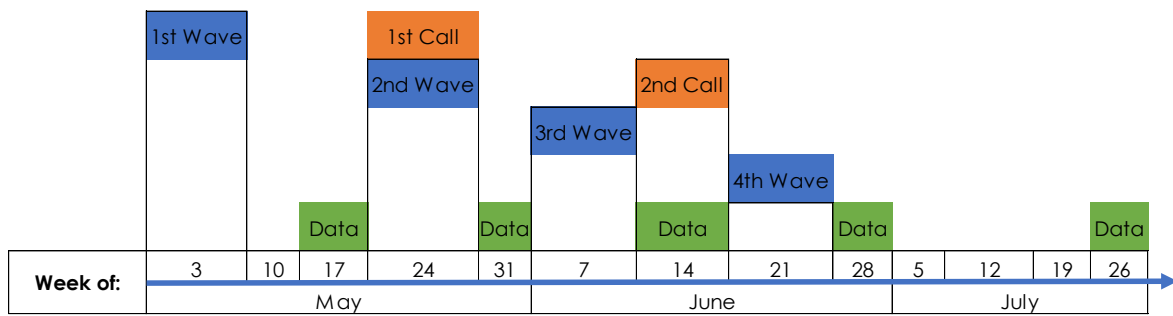**Figure 2: Big-Stick Randomization Used to Allocate Subjects into T And C at Cluster (Local Government Leader)) Level**
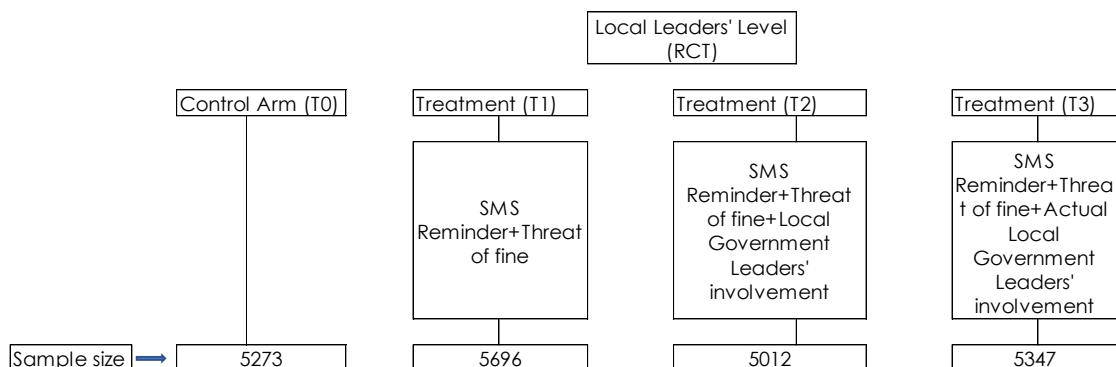
Source: Authors' calculations.

Figure 3: Data-Management Process from Baseline to Endline
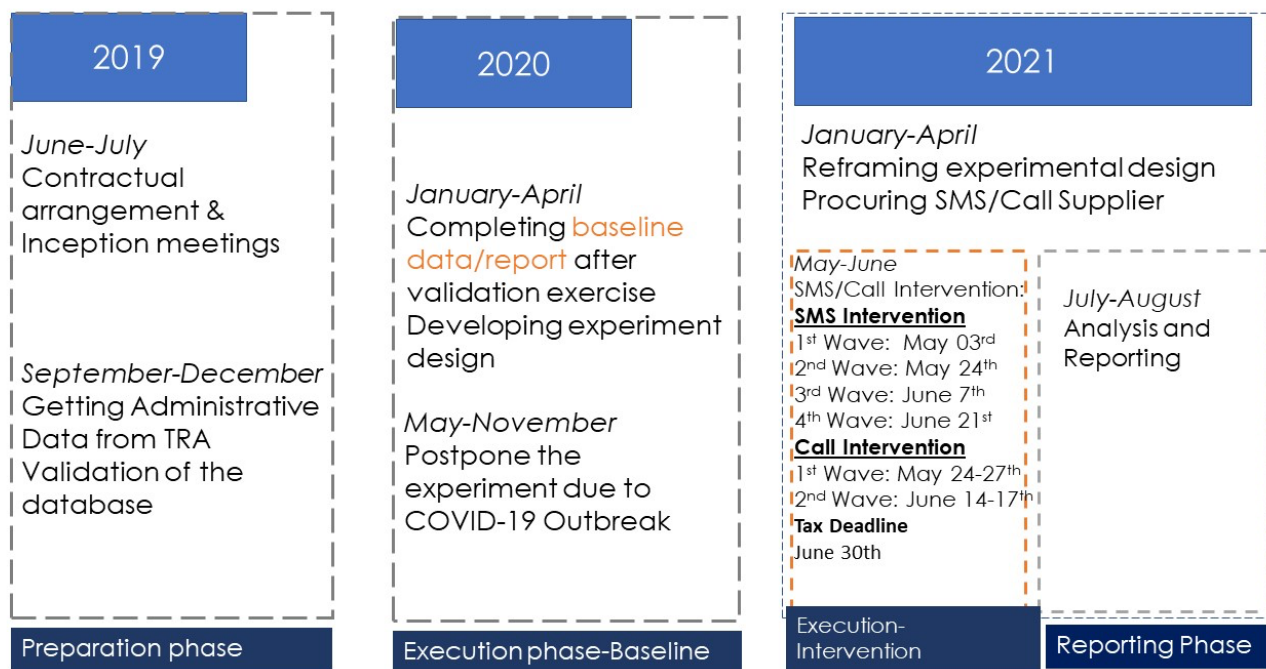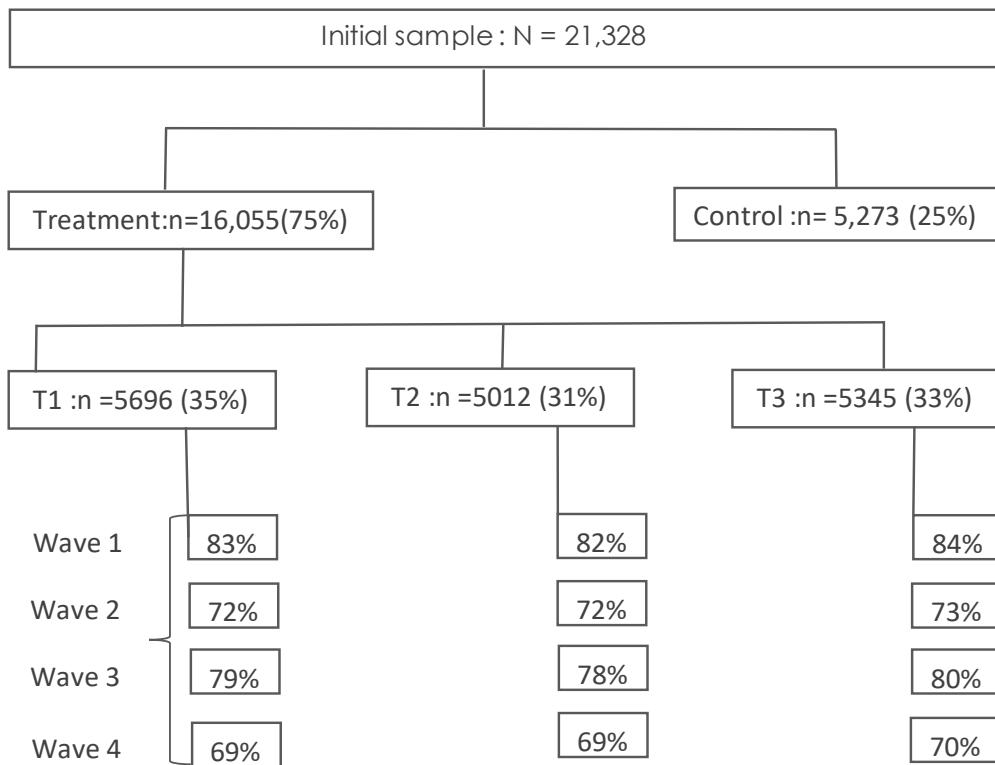

Source: Authors' calculations.

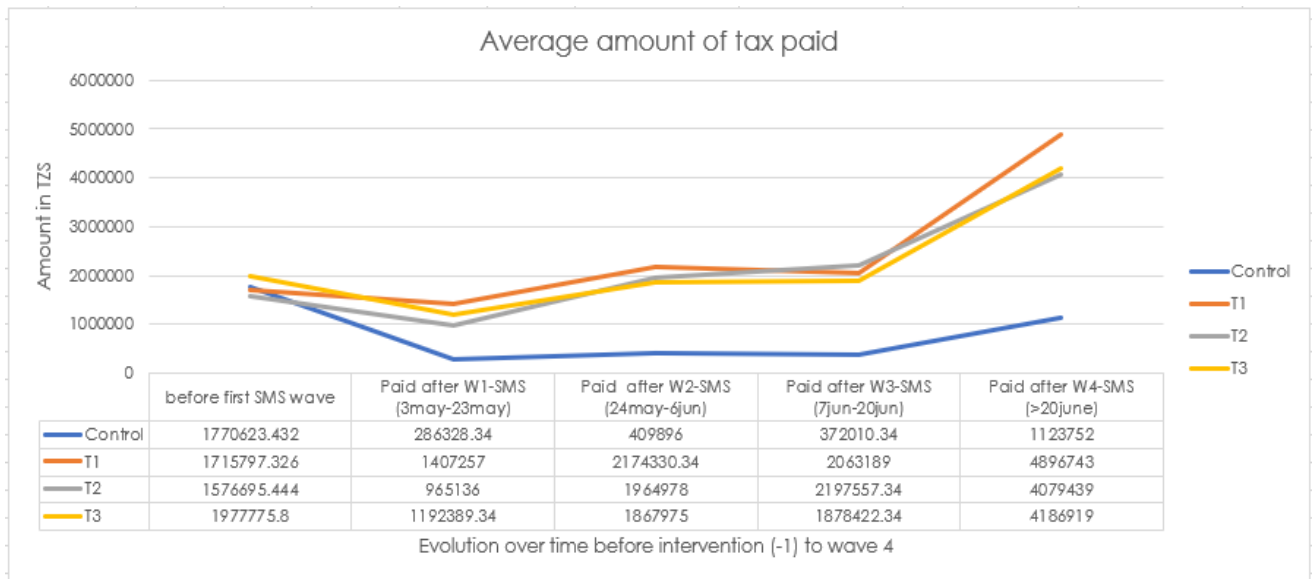## Figure 4: Timeline of the Intervention

Source: Authors' calculations.

Figure 5: Text Message Delivery Rate by Wave

Source: Authors' calculations.

Figure 6a: Average Amount Paid by Experimental Groups over Study Period

Average amount of tax paid

	before first SMS wave	Paid after W1-SMS (3may-23may)	Paid after W2-SMS (24may-6jun)	Paid after W3-SMS (7jun-20jun)	Paid after W4-SMS (>20june)
Control	1770623.432	286328.34	409896	372010.34	1123752
T1	1715797.326	1407257	2174330.34	2063189	4896743
T2	1576695.444	965136	1964978	2197557.34	4079439
T3	1977775.8	1192389.34	1867975	1878422.34	4186919

Evolution over time before intervention (-1) to wave 4

Source: Authors' calculations.

Figure 6b: Percentage of Payment by Experimental Groups over Study Period

Percentage of payment made

	before first SMS wave	Paid after W1-SMS (3may-23may)	Paid after W2-SMS (24may-6jun)	Paid after W3-SMS (7jun-20jun)	Paid after W4-SMS (>20june)
Control	1.38%	0.46%	0.59%	0.53%	1.50%
T1	1.33%	1.44%	2.21%	1.90%	3.88%
T2	1.78%	1.44%	2.63%	2.39%	4.01%
T3	1.50%	1.31%	2.09%	1.96%	4.04%

Evolution over time before intervention (-1) to wave 4

Source: Authors' calculations.

G
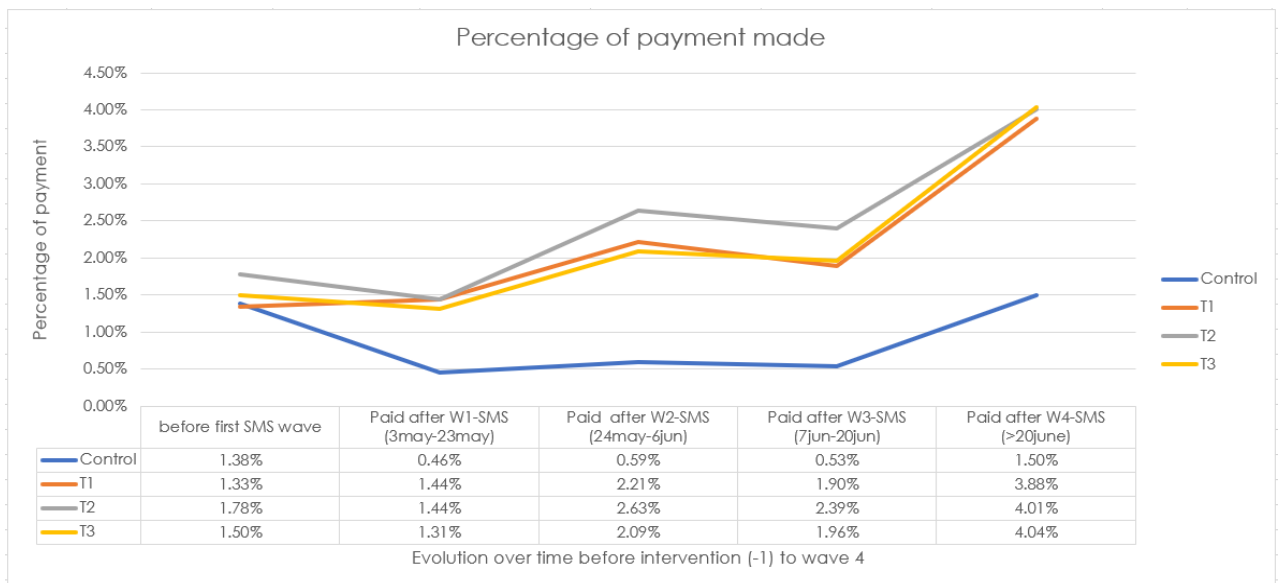
Appendix 3: Data Cleaning and Verification

In the initial stage, researchers assembled an administrative database from the Tanzanian Revenue Authority which was cleaned in three stages: 1) screening to identify and remove duplicates and review by the technical team before further verification in the field; 2) direct field verification of property-taxpayers' addresses, including verifying names and phone numbers of property taxpayers and their local government leaders; and 3) further cleaning following the second stage in order to arrive at a final sample through the introduction of inclusion criteria (availability of local government leader's name and phone number, taxpayers with phone numbers, and taxpayers with more than one property located in different clusters, as well as dropping properties that appeared in areas with few taxpayers).

During the field verification process, the research team visited the four study areas (Bariadi Town Council, Busega District, Kahama Town Council, and Shinyanga Municipal Council). A total of 50,478 taxpayers and 868 local government leaders were verified at the baseline level. Researchers experienced some challenges in the field, including the fact that taxpayers were duplicated in the database and that some taxpayers did not have phone numbers (or had invalid phone numbers). During fieldwork, researchers therefore verified and added missing data, including names and phone numbers. Local government leaders and taxpayers without phone numbers were dropped. Therefore, the final sample size of local government leaders and taxpayers decreased to 668 and 21,328, respectively.