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**The Effect of Carrot and Stick Measures in Fostering Taxpayer Compliance in Tanzania:
Evidence from a Laboratory Experiment**

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Abstract

With the increasing expectation and demand for the government to supply public goods such as water, health, education, and road infrastructure, the pressure to mobilize more domestic revenue in Tanzania cannot be overemphasized. Due to widespread tax evasion, concerted measures are required to foster taxpayer compliance. But how to achieve higher levels of taxpayer compliance with minimum administration costs remains an empirical question to be investigated. This study contributes to that strain by examining the effect of carrot and stick measures on fostering taxpayer compliance. The study used a laboratory experiment design, and was conducted on a sample of 201 undergraduate students from the University of Dar es Salaam. Using a bootstrapped binary logit model, the study found that both carrot and stick measures have a statistically positive effect on taxpayer compliance. However, the effects of these measures on tax compliance were not statistically different, implying that their effects are more or less the same; and that the choice of which measure to use remains largely a matter of choice as affected by the cost of implementation. Available literature suggests that implementation of stick measures in Tanzania is more costly than implementation of carrot measures due to their costs to the government and externalities such as the stress imposed on taxpayers.

Keywords: Carrot measures; stick measures; tax compliance; laboratory experiment, Logistic Regression, Tanzania.

JEL Classification Codes: C13, E62

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1 Introduction

Tanzania, like any other developing country, faces a challenge in mobilizing financial resources for capital formation and meeting public expenditure needs (United Republic of Tanzania, 2021). One of the sustainable ways of dealing with this challenge is by increasing domestic tax revenue. However, the domestic tax base of Tanzania and most African countries is weakened by the wide spread of tax evasion and avoidance (Msafiri *et al.*, 2022). For many years, tax revenue collection in Tanzania has concentrated on raising revenue from a limited number of sources (products and individuals), such as drinks, fuel, cigarettes and tobacco products, value-added tax, and pay-as-you-earn (PAYE) (Mallya, 2011; Collin *et al.*, 2022). However, the current perception amongst the citizens is that these sources are already overtaxed, and the government cannot impose any further taxes in these areas without aggravating the already rising costs of living and sinking the population further into poverty (Stephen, 2014). This implies that the focus should be on how best to expand the existing narrow tax base to enhance revenue collection.

There have been several efforts by the Government of Tanzania to increase tax compliance, nonetheless, the problem of low tax compliance still remains large (Kiunsi, 2021). Some of the efforts made include the introduction of electronic fiscal device (EFD) machines; sensitization workshops and seminars on various tax laws geared at reducing tax evasion; and amnesty on tax arrears interest and penalties. This is evidenced by not only persistently low tax revenue but also a significantly large share of the government's budget financed by foreign sources (United Republic of Tanzania, 2023). Understanding better ways to foster tax compliance in the country remains relevant from both research and policy perspectives (World Bank, 2016).

There is a rich body of literature on the subject matter (Cummings *et al.*, 2005; Casagrande *et al.*, 2015; Zhang *et al.*, 2016; Alm, *et al.* 2017; Fišar *et al.*, 2021). However, there are two key issues that the present study attempts to add to the literature. First, most of these studies have focused on developed countries, and it remains unclear whether the drawn conclusions are equally applicable in a context of a developing country like Tanzania. Second, it remains unknown for a country like Tanzania as for the type of behavioural intervention (carrot¹ or stick²) which works best in inducing compliance and the magnitude of the same. This study was, therefore, set to experimentally assess the impact of carrot (reward) and stick (fine) measures on tax compliance in Tanzania; and compared the impact of stick versus carrot measures on tax compliance in Tanzania.

This paper contributes to the literature in the following ways: First, and probably the main contribution, is the comparison between the effect of carrot and stick interventions on tax compliance in Tanzania. Despite the big number of previous studies on this subject, very few have jointly explored the role of the two types of measures using experimental setups, and to the best of our knowledge, no single study looks into this from the perspective of Tanzania. Behavioural challenges and interventions are, in most cases, dependent on the environmental, operational, and cultural contexts.

¹ Carrot measures of tax compliance refer to means that foster voluntary tax compliance behavior, including reward (Brockmann *et al.*, 2016).

² Stick measures of tax compliance refer to forceful or coercive means of fostering tax compliance behavior (Feld *et al.*, 2006).

Our second contribution is related to the provision of a more robust explanation of the choice between carrot- and stick-based measures of tax compliance. This is due to the argument that, though stick-based measures of tax compliance have long been proposed, surprisingly, there is little evidence explaining higher tax compliance behavior when there are low stick measures (Dulleck *et al.* 2012). Our empirical results indicate that both carrot and stick measures have statistically the same sign (i.e., positive) and magnitude of impact on tax compliance in Tanzania. This implies that the choice between stick and carrot measures of tax compliance does not depend solely on their nature but rather on other aspects, mainly on the cost of using one over the other.

The rest of this paper is organized as follows: Section 2 provides a literature review; Section 3 gives the methodology of the study; Section 4 provides the empirical results; Section 5 provides the conclusion of the study and recommendations.

2 Literature Review

2.1 Theoretical literature

Theories on tax compliance, including the decision whether or not to pay taxes, tend to reflect on the following themes: traditional deterrence, tax morale, fiscal exchange, social influence, comparative treatment, political legitimacy, and routine activity. The major objective of this section, among other things, is to examine in detail each of these theories in turn.

The traditional deterrence approach, also referred to as threat (stick) measures of tax compliance holds that almost nobody wants to pay tax. Therefore, taxes are compulsory payments and unrequited; people are required by law to pay tax, but they cannot expect any direct benefit in return. Yet, people still pay tax and the ideal explanation is that the government forces them. Thus, the entire system of taxation operates under threat measures that threaten tax payers with fines, audits, and criminal punishments (Feld *et al.*, 2006). However, this model has been criticized, specifically for the failure of deterrence factors to explain the majority of tax compliance behaviour, (Alm *et al.*, 1993). Also, the model is stressful to taxpayers and costly to the government (Brockmann *et al.* 2016). Based on the weaknesses of this theory, other approaches have attempted to explain the reasons for paying taxes voluntarily. These theories include tax morale, fiscal exchange, social influence, comparative treatment, and political legitimacy.

Tax morale is associated with various components like moral rules and sentiments, such as norms and guilt; fairness; and the relationship between taxpayer and government (Torgler, 2007). Some define it as intrinsic motivation to pay taxes (Frey 1997; Frey and Feld 2002); some also define tax morale as a shift from deterrence measures to voluntary tax compliance (Pope and McKerchar, 2011). Basically, tax morale is a carrot measure rather than a stick measure. However, tax morale is influenced by perceptions of fairness, trust in the institutions of government, and a range of individual characteristics. Other factors include norms such as procedural justice, trust and belief in the legitimacy of the government, reciprocity, and altruism (Kornhauser, 2007). The tax morale concept was developed to complement deterrence measures in improving tax compliance. Under tax morale, we have concepts such as framing and prospect theory, reciprocity, and rewards.

Framing and prospect theory is the concept of cognitive and affective processes, which is indeed a growing area of research in the tax field. Kornhauser (2007) defined cognitive and affective processes as "unconscious mechanisms that influence a person's perception and response to

information, people, and the environment." Such cognitive processes include framing, which means the way the idea is presented can affect how a person reacts to it. One of the most essential elements of framing for tax compliance research is the prospect theory, which examines how people evaluate and react to risk. Accordingly, people consistently exhibit patterns of risk-averse behaviour in situations involving gains and risk-seeking behaviour in situations involving losses. Literally, this means that when a person is in a position to make a sure gain, they are less willing to take risks, and when they are in a position to make a sure loss, they are more willing to take risks. Researchers have argued the relevance of Prospect Theory for understanding and curtailing evasion behaviour by considering the decision frames of two taxpayers who face, respectively, the prospect of a tax refund or a tax bill after withholding.

The main idea under reciprocity is that an individual will respond to another's act in the same manner in which that person treated them (Kornhauser, 2007). Reciprocity can be influenced by rewards and is believed to increase tax morale. However, reciprocity has two dimensions: vertical reciprocity and horizontal reciprocity; the latter relates to taxpayers and the former to taxpayers and the government or tax authority. Thus, tax compliance will increase in the dimension of vertical reciprocity when the government is perceived as fair (Kornhauser, 2007). In regards to horizontal reciprocity, taxpayers will comply with paying taxes based on their beliefs about the compliance behaviour of other taxpayers (Kornhauser, 2007).

Researchers have tried to solve the weakness of deterrence measures by using positive rewards, which are either material or immaterial. Material rewards usually come in the form of lotteries. For example, local authorities in Peru raffle off cars to incentivize the payment of motor vehicle taxes. Immaterial rewards, on the other hand, aim to increase the sense of ownership among taxpayers by earmarking tax revenues for specific purposes. This is due to the fact that people pay taxes more willingly if they know what they are paying for. Generally, rewards are emotionally attractive.

In addition, the fiscal exchange theory holds that tax compliance increases by providing goods that individuals prefer in an accessible and more efficient manner (Cowell and Gordon, 1988). Thus, people pay taxes because they treasure the goods and services provided by the government, recognizing that their payments are important in financing government activities (Fjeldstad and Semboja, 2001). Thus, the availability of public services may increase the probability of voluntary tax compliance. Therefore, it is logical to assume that taxpayers' behaviours are affected by their level of satisfaction with their terms of trade with the tax authority or government.

The other theory that explains the weakness of the traditional deterrence approach is the social influence theory, that postulates that compliance behaviour is affected by the social norms of an individual's reference group (Snavelly, 1990). These individuals' reference groups include friends, neighbours, and relatives. Therefore, if a taxpayer knows that people important to them evade tax, then the taxpayer's commitment to comply with paying tax is weakened. On the other hand, social influences can also deter evasion behaviour due to fear of the social sanctions imposed once discovered and revealed publicly.

The comparative treatment model also attempts to explain the weakness of the traditional deterrence. The theory portrays that inequalities in the exchange relationship between the

government and taxpayers would result in low compliance behaviour (McKerchar and Evans, 2009). Individuals consider the way the government treats them relative to their fellow citizens; this judgment affects not only their judgment of the state but also the way they view their fellow citizens (D'Arcy, 2011). Therefore, if the state prefers a certain group over others, this colours citizens' relationship with the state and the group receiving the favour (Ali *et al.* 2013).

Another relevant theory is the political legitimacy theory, which points out the other factor that explains why people pay taxes without being forced. The theory holds that tax compliance is influenced by the extent to which citizens trust their government (Kirchler *et al.* 2008). Legitimacy is defined as a belief or trust in the institutions, authorities, and social arrangements to be proper, just, and work for the common good (Ali *et al.* 2013).

Lastly, different from the rest of all theories above, the routine activity theory attempts to explain the occurrence of non-tax compliance. The theory advocates that crime occurs in the presence of three factors: a motivated offender, guardianship, and a suitable target. This is analogous to the presence of a taxpayer likely to evade tax, the presence of poor tax rules and regulations, and poor tax administration systems (Elly, 2015). Thus, tax compliance is closely linked to the realm of crime. Therefore, when these three factors converge in time and space, non-compliance occurs.

2.2 Empirical Literature

Several studies have shown behavioural concepts to be significant determinants of tax compliance. Such behavioural concepts include framing tax morale (Cummings *et al.* 2005), reciprocity and social norms (Doerrenberg and Peichl, 2017), cultural differences (Zhang *et al.* 2016), and behavioural dynamics of information (Mckee *et al.* 2011). Other concepts are media negativity bias, positive inducement and rewards (Carrillo *et al.* 2016), shame effect (Casagrande *et al.* 2015), peer effect, and information (Alm *et al.* 2017).

In addition, numerous studies have used experimental approaches to determine factors that can foster tax compliance. For example, the study by Mahangila (2014) used laboratory experiments and surveys to examine how corporate income tax compliance in Tanzania is impacted by procedural justice, retributive justice, corporate income tax incidence, and the interaction between redistributive and procedural justice. This study found that corporate income tax penalties levied on individuals are more effective than corporate income tax penalties levied on companies. Also, the study found that tax compliance costs are negatively related to tax compliance. In a survey, Mahangila (2014) found that perceptions of redistributive and procedural justice have a significant effect on tax compliance.

Using laboratory experiments and surveys, Cummings *et al.* (2005) examined the effects of tax morale on tax compliance in South Africa and Botswana. It was found that the differences in results were due to the fairness of tax administration, fiscal exchange, and the overall attitude towards the governments. Mascagni *et al.* (2016) studied the effect of messaging (providing information on sanctions) on taxpayers to encourage tax compliance in Rwanda. It was found that information enhances tax compliance in Rwanda. Mattiello (2005) studied the effect of tax amnesty on tax compliance. He used a laboratory experiment with a virtual tax system and real money. He found that the effect of tax amnesty on tax compliance was insignificant. Besides, he found that gender, subject's family environment, and the bomb crater effect had an effect on tax compliance. Djawadi

and Fahr (2013) and Putong *et al.* (2016), using laboratory experiments, found that trust in tax authorities is a crucial factor in voluntary tax compliance.

Gemmell and Ratto (2017) examined the effects of late payment penalties on tax compliance in New Zealand using a field experiment. They found that different penalty information and reductions in penalty rates both resulted in payment overdue and penalties. Bott *et al.* (2019) took advantage of the tax administration in Norway, which mailed a letter to tax subjects with information about how to report foreign income shortly after they had sent their pre-populated tax returns. They found that including a moral appeal in those letters almost doubled the average foreign income reported compared to the base letter without such an appeal. They also found that the effect of a moral appeal is similar in size to the effect of including a sentence showing the perceived probability of detection. Besides, they found that moral appeals and detection probability increase tax compliance in different ways; the former works on the intensive margin by increasing the amount reported by those who report any foreign income, and the latter works on the extensive margin by increasing the share of tax subjects who report any foreign income. Doerrenberg and Peichl (2017) found social norms and reciprocity influencing tax compliance by using a randomized survey experiment.

Generally, the theoretical review shows that tax compliance is influenced by deterrence measures, tax morale such as reciprocity, rewards, and framing, the provision of public goods, social influences, and trust in authorities. These factors have also been ascertained by empirical studies that have evidenced social, economic, psychological, political, and attitudinal factors influencing tax compliance. Only a few studies have examined the effect of using non-deterrence measures to foster tax compliance (Brockmann *et al.*, 2016; Rillstone, 2015). This study examines the influence of carrot measures versus stick measures on tax compliance in Tanzania in a social laboratory experiment setting.

3 Methodology

3.1 Participants

This study used undergraduate students from different colleges of the University of Dar es Salaam in 2019. The use of different colleges allowed us to control the effect of specific academic background on tax compliance. One would, for example, imagine that students from some programmes (e.g., economics and business) would be generally more acquitted (academically) of tax-related issues than those from other programmes (e.g., natural sciences). This study involved 201 students who were involved in both an experiment and a survey. With that sample size, we could detect the effect of treatment of at least 16 percent with a power of 0.8 and a 5 percent significance level.

3.2 Experimental Design

The setting of this experiment resembles earlier tax compliance experiments such as Torgler (2002) with slight modifications. First, participants work for some initial earnings to provide our subjects with income from which tax contributions shall be required. Experimental evidence has shown that money and goods that are earned are more valuable than freely provided experimental money endowments, or at least treated differently (Camerer and Malmendier, 2011).

Once they have earned some money, subjects then decide how much of that earning to declare to the tax authority, which in this study is the Dar es Salam University Student Organization (DARUSO), and then pay taxes on that declared earning. Their tax declaration is subject to random audits. The experiment was conducted in three rounds, to which students were randomly assigned. Our treatments vary in terms of the measures taken to foster compliance. The CONTROL treatment implements no fines (penalty rate), no audit, and a tax rate of 25% of declared earnings. The STICK treatment implements a fine of 100% of evaded tax for dishonest participants, a random audit of 5 percent of participants in this treatment arm, and a tax rate of 25% of declared earnings. Lastly, the CARROT treatment implements a monetary reward of 100% of tax paid to honest participants, a random audit of 5 percent of participants in this treatment arm, and a tax rate of 25% of declared earnings. The Table 1 below shows the summary of treatment arms.

Table 1: Treatment Arms

Treatment	Description
CONTROL	No fine, no audit, 25 % tax of declared earnings
STICK	Fine 100% of evaded tax, audit of 5% of participants, 25 % tax of declared earnings
CARROT	Reward 100% of paid tax, audit of 5% of participants, 25 % tax of declared earning

However, one acclaimed limitation of laboratory-based measures of economic behaviour rests on its low external validity given its reliance on students, who are arguably not necessarily behaving in a similar manner to the actual tax payers in the field. The proposed alternative solution to this is to conduct such experiments in the field with actual economic agents making real tax payment choices (i.e., artefactual field experiments). However, a number of studies have compared results from laboratory experiments and those from field experiments; and have shown that there are statistically no differences in the results obtained (*see*, for example, Alm *et al.* (2017)). In addition, laboratory experiments are relatively less costly and logistically easier to implement compared to field experiments, and there is no a priori argument for the difference in the direction of treatment effects between the two groups.

3.3 Experimental Protocol

The study used advertisements and word of mouth to call on those who were interested among undergraduate students to take part in the experiment and then, randomly assigned them to treatments. After the random selection of participants for different treatment arms, during the experiment day, names were posted at the doors of the respective treatment rooms, and subjects only entered the rooms where they were assigned. Participants were guided by a research assistant to the rooms regardless of whether they were familiar with the environment.

To conduct the experiment, participants were given the instructions of the experiment (which were also read aloud to them by the experimenter); and were allowed to ask any question pertaining to the experiment to make sure that they thoroughly understood the rules of the game. The experiment took no more than 2 hours. Regarding the order between experiment and survey, experiment began

followed by survey to ensure that there is no prejudgment or contamination of ideas from the survey to the experiment.

To ensure privacy, each experimental round for both the treatment and control groups was conducted separately in one of three different rooms. In the first room, subjects were given ten questions to earn flexible earnings; the maximum earning was 10,000 TZS and the lowest was 0 TZS. In the second room, subjects declared their earnings to a different person from the student government association, who did not know how much the subject earned. Then tax was deducted according to the amount declared to be earned by the subject, whether it was a true earning or not. In the third room, 5% of the subjects from each of the two treatments were audited or checked for compliance to determine whether they should be fined or receive a monetary reward, with the exception of those in the control group. The subject was classified as compliant if they declared the true earnings, and the audit was conducted on a random sample of 5 percent of subjects. Lastly, in the fourth room, payments were made by converting the tokens participants had to Tanzania shillings, adhering to the exchange rate of 1 token being equivalent to Tsh 1,000, and after receiving their payments, they were required to sign a form for our sponsor verifications. In addition to this, there was a Tsh 2, 000 that was equally given to all participants as a show-up fee and was not subjected to tax declaration.

3.4 Post Experiment Survey

We collected additional information from the students (subjects) involved in the experiments just after the experiments were conducted through questionnaires. This information on behavioural traits, demography, and risk could not be obtained by experiment alone.

3.5 Model Specification and Estimation Technique

Based on empirical literature, the study adopted the variables that were significant determinants of tax compliance (Zhang *et al.*, 2016; Doerrenberg & Peichl, 2017; Alm *et al.*, 2017; Castro and Scartascini, 2013; Carrillo *et al.*, 2016; Brockmann *et al.*, 2016). The study estimated the following models:

$$P(\text{Tax compliance} = 1|x) = \beta_0 + \beta_1 \text{stick}_1 + \beta_2 \text{carrot}_2 + \epsilon_i \quad (1)$$

$$P(\text{Tax compliance} = 1|x) = \beta_0 + \beta_1 \text{stick}_1 + \beta_2 \text{carrot}_2 + \beta_3 \text{knowledge}_3 + \beta_4 \text{Fairness}_4 + \beta_5 \text{Income from other sources}_5 + \beta_6 \text{Student Loan}_6 + \beta_7 \text{Fine history}_7 + \beta_8 \text{Tax evasion history}_8 + \beta_9 \text{Business ownership history}_9 + \beta_{10} \text{Religiosity}_{10} + \beta_{11} \text{Gender}_{11} + \beta_{12} \text{Age}_{12} + \beta_{13} \text{UDBS dummy}_{13} + \beta_{14} \text{COET dummy}_{14} + \epsilon_i \quad (2)$$

Where:

ϵ_i = Error term.

The first model (1) above uses independent variables (a stick and a carrot) to help calculate the mean value of the control group. The binary dependent variable takes a value of 1, if there is tax compliance, and a value of 0, if there is no tax compliance.

The second model (2) includes dummies for the college students attend (the University of Dar es Salaam Business School (UDBS), the College of Engineering and Technology (COET), and the

College of Social Sciences (COSS) as the base category). The model also includes stick, carrot, and control variables such as fairness, knowledge, income from other sources, student loan, fine history, tax evasion history, business ownership history, religiosity, gender, and age.

The bootstrapped logistic model was used to estimate the two aforementioned models. The study utilized a logistic model since the dependent variable was binary; and using ordinary least squares would generate heteroskedasticity, nonsensical probability values that are less than 0 and more than 1, and a linearity problem (Wooldridge, 2012). As logistic regression has large sample properties, the study used bootstrapping to resample and increase the sample size, resulting in consistent estimates. To check for the statistical difference between the effects of the stick and carrot measures on tax compliance, the Wald test was used.

4 Results and Discussion

The results of our study are organized along the following lines: We start with a balancing check and descriptive analysis, and then we estimate our model and make interpretations.

4.1 Balancing Check

We had 201 participants from different colleges at the University of Dar es Salaam, specifically 67 participants in each arm. Our random allocation to the three treatments seems to have been successful. Out of 10 comparisons, only knowledge was significantly different between the control and treatment arms at the 5 percent significance level. Table 2 below shows the balance check.

Table 2: Balance Check

Variables	(A) Stick	(B) Carrot	(C) Control	(C-A) (t-test)	(C-B) (t-test)
Age (years)	22.313 (0.17)	21.88 (0.16)	21.91 (0.15)	-0.40*	0.03
Gender (Male =1)	0.28 (0.06)	0.31 (0.06)	0.24 (0.05)	-0.04	-0.07
Religiosity (number of prayer sessions per week)	3.28 (0.83)	2.73 (0.87)	3.12 (0.88)	-0.16	0.39
Business Ownership history (YES=1)	0.54 (0.06)	0.45 (0.06)	0.54 (0.06)	0.00	0.09
Tax evasion history (YES=1)	0.27 (0.05)	0.22 (0.05)	0.24 (0.05)	-0.03	0.01
Fine history (YES=1)	0.01 (0.01)	0.03 (0.02)	0.03 (0.02)	0.01	0.00
Student loan (YES=1)	55.52 (5.62)	47.57 (5.46)	56.90 (5.56)	1.37	9.33
Income from other sources (TZS per month)	94537.31 (10967.11)	104921.6 (17547.31)	90029.85 (10622.22)	-4507.46	-14891.75
Fairness in fund use 0 if poor 1 if somehow 2 if good 3 if excellent	0.99 (0.10)	1.07 (0.09)	1.21 (0.09)	0.22*	0.13
Knowledge	6.25 (0.20)	6.55 (0.21)	7.19 (0.22)	0.94***	0.64**

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

As depicted in Table 2 above, the randomization assignment to different treatment arms has worked, and therefore, we do not worry about unobserved heterogeneity such as religiosity, altruism, and knowledge that may have an effect on tax compliance behaviour.

4.2 Descriptive Analysis

We looked at tax compliance levels—those people who complied with taxes paid the exact amount required at different treatment arms. In the CONTROL, 35 participants out of 67 complied with taxes. In the STICK treatment, 52 participants out of 67 complied with taxes. Lastly, in the CARROT treatment, 59 participants out of 67 complied with taxes. Both CARROT and STICK result in higher tax compliance levels than in CONTROL. Tax compliance levels were the highest in the CARROT treatment. This is depicted in Table 3 below.

Table 3: Distribution of tax compliant by treatment

Treatment	observations	tax compliant	Probability of Tax Compliance
CONTROL	67	35	52.24%
STICK	67	52	77.61%
CARROT	67	59	88.06%

Table 3 provides an overview of the tax compliance in the three treatments. In general, we find that 72.64% of our entire sample complies with taxes. Only 52.24% of the participants in CONTROL comply with taxes. Therefore, it is clear that both carrot and stick affect tax compliance positively, as they have higher percentage points than the control. The empirical question is which one influences tax compliance better than the other. Regression analysis answers this question, and its results can be generalized, unlike descriptive statistics.

4.3 Logistic Regression Results

The multicollinearity test—pairwise correlation—was conducted first, and the relationship between all of the variables was less than 0.8, suggesting that there is no multicollinearity. Thereafter, because of a small sample size we have, the bootstrapped logit regression was run with 999 replications and robust standard errors. Then, marginal effects were computed and presented in Table 4. Column (1) of Table 4 presents results for the model (1) without control variables, and Column (2) presents the results for the model (2) with control variables.

Table 4: Marginal Effects of Tax Compliance

VARIABLES	(1)	(2)
	Tax compliance mfx (dy/dx)	Tax compliance mfx (dy/dx)
stick	0.194*** (0.0611)	0.193** (0.0988)
carrot	0.299*** (0.0561)	0.378*** (0.1058)
knowledge		-0.4313 (0.0306)
Fairness: <i>somehow</i>		-0.0635 (0.1181)
<i>good</i>		0.1029 (0.0980)
<i>excellent</i>		0.1195 (0.1159)
Income from other sources		7.56e-07 (6.28e-07)
Student Loan		0.0014 (0.0012)
Fine History		-0.0534 (0.2214)
Tax Evasion History		-0.0527 (0.1341)
Business Ownership History		0.0853 (0.0965)
Religiosity		-0.0017 (0.0083)
Gender		0.1539 (0.0992)
Age		0.0397 (0.0316)
UDBS dummy		-0.3026*** (0.1042)
COET dummy		-0.1162 (0.1049)
Observations	201	201

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

From the two models, model (1) and model (2), stick is found to be statistically significant at the 5 percent significance level. The result for model (1) reveals that, other things being equal, those in the stick treatment have a 19-percentage point higher probability of complying with tax relative to those in the control group. For the model (2), other things being equal, those in the stick treatment have 19-percentage point higher probability of complying with tax relative to those in the control group. This is consistent with Elly (2015), Beale *et al.* (2016), Manual & Xin (2016), Dwenger *et al.* (2015), and Daniel & Pablo (2013). This is partly explained by the stick measures, which obliged taxpayers to pay tax or else face a fine.

From the two models, carrot is found statistically significant at the 1 percent significance level. The result for model (1) reveals that, other things being equal, those in the carrot treatment have a 30-percentage point higher probability of complying with tax relative to those in the control group. For the model (2), other things being equal, those in the carrot treatment have a 38-percentage point higher probability of complying with tax relative to the control group. This is consistent with studies such as Brockmann *et al.* (2016), Carrillo *et al.* (2016), Fatas *et al.* (2015). The reason for this may be due to the attractiveness of the reward to the taxpayers, which tends to outweigh the probability of winning the jackpot.

In both models, the Wald test is performed to check if there is a statistical difference between the effect of the stick measure and carrot measure on tax compliance. The null hypothesis of the test is that there is no difference between the stick measure and the carrot measure on tax compliance. In the model (1), Chi-squared is 1.95 with a probability of Chi-squared 0.1626 that is insignificant at the 5 percent significance level, and therefore we fail to reject the null hypothesis. Thus, there is no statistical difference between the carrot and stick measures of tax compliance. In the model (2), Chi-squared is 2.49 with a probability of Chi-squared 0.1142 that is insignificant at the 5 percent significance level, and therefore we fail to reject the null hypothesis. Thus, there is no statistical difference between the carrot and stick measures of tax compliance. Carrot measures and stick measures aim at the same effect of increasing tax compliance, so their effect on tax compliance being statistically not different has no problem.

Except for the college effect, the rest of the control variables were not significant in increasing compliance. The UDBS dummy is found to be negative and statistically significant. Other things being equal, those in the UDBS have a 33-percentage point lower probability of complying with tax relative to those in the COSS. This suggests that academic background has an effect on tax compliance. This may be because students from UDBS are more strategic and more likely to have business knowledge than other students from COSS. Therefore, of the two models, it is better to use model (2), which has controlled for the UDBS dummy, which turns out to be significant, and reveals that academic background matters in tax compliance, which is not captured in the model (1). Thus, this study bases its conclusion and policy implications on the second model.

5 Conclusion and Policy Implications

This study used experimental and survey data to examine the influence of carrot versus stick measures on tax compliance. The study employed a bootstrapped logit model to analyze the effects of factors influencing tax compliance. The stick measure and carrot measure are found to be statistically significant factors that influence tax compliance. The stick measure was found to be a causal factor in tax compliance, as it increased the probability of tax compliance by 18 percentage

points compared to the control group. Also, the carrot measure was found to be a causal factor in tax compliance, as it increased the probability of tax compliance by 31 percentage points as compared to the control group. In addition, there is no statistical difference between the influence of stick measures (fines) and carrot measures (rewards) on tax compliance in Tanzania. This suggests that the choice between carrot measures and stick measures depends on cost analysis.

We point out policy implications for our study; that the choice between carrot and stick measures of tax compliance depends mainly on costs; the one with the lowest cost should be selected over the other. However, literature has shown stick measures have costs such as negative externalities to the taxpayers (stresses to taxpayers), costly to the government, and the bomb crater effect (the effect of not complying with tax after an audit, perhaps due to repair of the loss of penalty), and carrot measures have costs such as the cost of implementing carrots. Therefore, the study recommends that the choice of government tax enforcement measure, whether carrot- or stick-based, should rely on cost; the one with the minimum cost should be chosen. However, literature suggests stick measures are costly in Tanzania as compared to carrot measures (Masanja, 2019). This may be due to their costs to the government to implement auditing, monitoring, jail sentences, and other externalities they impose on tax payers, such as stress.

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