

The influence of reciprocity nudges on tax compliance in South Africa: evidence from an experimental study

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Abstract

Research on the effects of nudging as a tool to influence tax compliance has provided limited and sometimes inconclusive empirical evidence. Using a mixed methods research design, this study examines the impact of reciprocity nudges (in the form of television advertisements) on taxpayer compliance in South Africa.

Our results show a statistically significant association between exposure to a reciprocity nudge and tax compliance provided that the nudge message contains specified structural and content attributes. It also establishes, *inter alia*, that the timing of the nudge may not be influential. The study extends the current knowledge of how insights from behavioural economics can be incorporated to assist in influencing tax compliance, particularly in a developing country setting.

Key words: tax compliance; nudging; reciprocity; message attributes; South Africa

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1. INTRODUCTION

Taxes are an important component of any economy; they play a vital part in the provision of basic public services and goods for the benefit of all citizens of a country. It is for this reason that tax authorities have been tasked by their governments with administering the tax system which entails, amongst other responsibilities, increasing the overall levels of tax compliance.¹ This has become an increasingly important responsibility in light of the dependence of many economies on tax revenues and the continuous search by some African countries for solutions to the need for reduced dependence on foreign aid, and is likely to become even more important as a result of the impact of COVID-19 on already stretched government resources.

In seeking to increase levels of tax compliance, tax authorities have widely implemented traditional enforcement strategies such as tax audits and penalties (McKerchar & Evans, 2009). These enforcement strategies are, however, both costly and time consuming (Kirchler, Hoelzl & Wahl, 2008). As a result, tax authorities have begun to turn their attention towards identifying and promoting alternative non-enforcement strategies to encourage tax compliance.

These alternative strategies are wide-ranging and include measures which seek to change the behaviour of taxpayers by making them more inclined to comply with their tax obligations. This article explores one of those alternative strategies, namely the effect of communicating reciprocity messages as a ‘nudge’ to encourage tax compliance.

‘Nudging’ (Thaler & Sunstein, 2009) has become a policy tool used by governments across many areas, including healthcare, consumer behaviour, education (Antinyan & Asatryan, 2020) and increasingly taxation, to encourage or discourage certain behaviours amongst citizens. Although the term nudging has been brought to the forefront in recent years through the work of Thaler and Sunstein (2009), earlier tax compliance studies conducted by researchers including Blumenthal, Christian and Slemrod (2001), Hasseldine et al. (2007) and Wenzel (2001) would nowadays be classified as ‘nudging’ studies.

‘Reciprocity’ nudges refer to nudges using beliefs about the use of resources by the government (Castro & Scartascini, 2015, p. 66). They can be contrasted with other forms of nudges used in promoting aspects of tax compliance, such as social norm nudges and deterrence nudges. Social norm nudges refer to nudge messages about tax compliance behaviour of others and deterrence nudges refer to nudge messages which emphasize traditional determinants of compliance, such as audit probabilities and penalty rates. Social norm nudges and deterrence nudges are excluded from this article as most studies on tax nudging have focused on these types of nudge. However, existing studies provide limited and contradictory evidence regarding the effectiveness of reciprocity nudge messages (Mascagni, 2018).

Blumenthal et al. (2001) found that using reciprocity messages as nudges had no significant effect. In contrast, Hasseldine et al. (2007) found a significant effect on tax compliance. Furthermore, the literature appears to lack evidence of the effects of the

¹ In simple terms, tax compliance can be taken to mean compliance by a taxpayer with the obligations imposed by the tax system.

time lag between the communication of a nudge message and the compliance decision. Nudge messages may decay over time if overlaid with distractions prior to making a tax compliance decision. This article, therefore, addresses this problem by testing the effects of time lag, by using the manner in which messages are ordered as a proxy for time lag.

Given the current interest of scholars and governments in nudging and the move by some African revenue authorities (such as the South African Revenue Service (SARS) and the Botswana Unified Revenue Service) towards using advertising campaigns as both an education tool and as a tool to communicate reciprocity messages, this article aims to shed light on the effectiveness of communicating such messages in multicultural developing countries, such as South Africa.

To meet the research objective of this study, a laboratory-based experiment is employed. We also conduct an analysis of structural and content attributes of 12 reciprocity nudge messages (in the form of television advertisements) and select two of those messages for the purpose of designing the laboratory-based experiment.

This study contributes to the literature as it improves the understanding of using reciprocity messages as a nudge to improve tax compliance in a developing country. The study also contributes to the literature as it focuses on the effectiveness of reciprocity nudge messages using audiovisual media (in the form of television advertisements) as a mode of delivery, in contrast to previous studies which have focused on the use of paper letters mailed to taxpayers. The study further contributes by focusing upon the key role played by the structural and content attributes of the message in determining the effectiveness of a nudge. There are also important considerations that were identified in this research that could be useful to revenue authorities or policy-makers, particularly those in developing countries. As choice architects, with reference to the context in which individuals make tax compliance decisions, it is important that revenue authorities and policy-makers give careful thought to how tax nudges are designed to ensure that such messages are successful. This study provides a comprehensive view by using mixed methods to examine the design aspect and also the cause-and-effect aspect of nudge messages. Finally, Behavioural Insights Team (2019) highlighted the importance of timing of nudge messages and noted that the same message conveyed at different times can lead to differences in the success of the message in encouraging tax compliance behaviour. The current study adds to this body of knowledge by considering the time related effects.

Overall, the results provide clear evidence that reciprocity nudge messages can positively influence tax compliance behaviour. A reciprocity nudge message that contains the greatest number of structural and content attributes of effective messages is found to have a statistically significant positive influence on tax compliance. This highlights the importance of designing nudge messages that have the appropriate structural and content attributes which capture the attention of the target audience.

The remainder of this article is organised as follows: section 2 provides a brief review of the literature, focusing upon how reciprocity nudges designed to promote tax compliance have been used and the results which have been obtained. Section 3 details the research method applied in this study. Section 4 provides results and discussion and section 5 sets out the conclusions, implications and limitations of the study.

2. LITERATURE REVIEW

Research has consistently shown that individual behaviour is affected by a wide range of factors, such as those that stem from group considerations such as, for example, social norms, altruism, reciprocity, trust, tax morale, shame and guilt (Alm, 2019). It has also established that people's beliefs can be influenced by providing them with information regarding norms (Castro & Scartascini, 2015). The use of messages, whether delivered through letters, television or other media, to encourage taxpayers to comply with their share of taxes can be seen as nudging taxpayers in the 'right' direction, namely to complying with their tax obligations.

There has been a steady increase in the number of studies that have involved sending taxpayers messages that may have a positive influence on tax compliance (Ariel, 2012; Cyan, Koumpias & Martinez-Vazquez, 2017; Fellner, Sausgruber & Traxler, 2013; Gallego & Ortega, 2022; Koumpias & Martinez-Vazquez, 2019; Ortega & Scartascini, 2015). Studies that have focused specifically on sending reciprocity messages include those of Ariel (2012); Blumenthal et al. (2001); Bott et al. (2020); Castro and Scartascini (2015); Hallsworth et al. (2017), and Mascagni and Nell (2022).

Sending taxpayers reciprocity messages as a nudge might improve compliance behaviour by increasing perceived distributional fairness. As noted by Hofmann, Hoelzl and Kirchler (2008), taxpayers' willingness to comply with tax law is likely to be reduced when taxpayers perceive their contribution towards tax revenue as being unbalanced when compared with the goods received from their government. Increasing perceived distributional fairness may have a positive effect on tax compliance intentions and tax compliance attitudes (Verboon & Goslinga, 2009).

Studies that have focused on communicating reciprocity messages have produced inconclusive results. Some (Bott et al., 2020; Ortega & Sanguinetti, 2013) have found a positive influence whilst others (Ariel, 2012; Blumenthal et al., 2001) have found no effect of reciprocity messages on tax compliance behaviour.

Whilst the studies, despite contrasting outcomes, provide insight into the effect of reciprocity nudging on tax compliance, a very limited number of these studies have been conducted in developing countries, particularly in Africa. Context appears to be important when investigating the effectiveness of nudge messages (Chirico et al., 2019). Some of the known studies conducted in an African developing country context regarding the effect of nudge messages on tax compliance behaviour are those by Mascagni and Nell (2022) in Rwanda, Santoro and Mascagni (2022) in Rwanda and Santoro et al. (2020) in Eswatini. Mascagni and Nell (2022) indicated that reciprocity nudge messages were more effective than deterrence messages, contrasting directly with the outcomes of the study by Castro and Scartascini (2015) in Argentina, which found deterrence messages were more effective compared to reciprocity messages. Furthermore, the use of alternative delivery methods (apart from mail letters) has not been extensively tested.

Structural and content attributes of the messages being communicated, as well as the type of public good or service communicated in reciprocity nudge messages, also have not received much attention in this growing body of literature. These often ignored aspects might be the determining factor of whether the nudge message is successful or not in reaching the targeted audience and changing behaviour.

Research shows that delivering a message irrespective of the mode of delivery does not, however, guarantee that the targeted audience will pay attention to the message (Weiss & Tschirhart, 1994). In order to be effective, messages need to draw the attention of the targeted audience. The structural and content attributes of a message have been found to be linked to great attention, memory and liking of a message, all of which are important aspects of an effective message (Morgan et al., 2003).

The nature of the public good or service communicated in the nudge message matters with regard to whether the reciprocity nudge message is likely to be effective or not. Communication of different types of public goods or services may generate different responses to the nudge for different taxpayers. Ali, Fjeldstad and Sjursen (2014) found that taxpayers are more likely to have a tax compliant attitude if they are satisfied with specific public goods or services provided by the government. This supports the view of Oberholzer, de Kock and Walker (2008), who examined the routes of persuasion used by SARS in their advertising appeals. In this study, Oberholzer et al. (2008) found that messages which focused on correctional service (safety), education and tourism had a greater impact on participants compared to other public goods or services communicated in the advertising appeals.

Another area that has not been widely explored is the impact of timing between exposure to a nudge message and tax compliance. Previous research has indicated that the timing of a nudge intervention is an important issue to consider (Behavioural Insights Team, 2014). For example, McGraw and Scholz (1991) found no evidence that normative appeals have an effect on tax compliance behaviour. However, in their study there was a 3-month time lag between the participants' exposure to the nudge treatment and making the actual tax compliance decision. Blumenthal et al. (2001) also found that normative appeals have no significant effect on tax compliance behaviour, although the long time lag between participants' exposure to the nudge treatments and making of the tax compliance decision could have influenced the results observed in the study. Wenzel (2001) also highlighted that a long time lag between participants' exposure to a nudge treatment and making their tax compliance decision is likely to have an impact on the effectiveness of the nudge. Finally, Gillitzer and Sinning's (2018) study is one of a small number of studies that have examined the effects regarding timing of payment reminders on tax compliance behaviour. The study found that although taxpayers who received a reminder letter had a higher probability of paying their debt compared to the control group, varying the timing of the reminders did not have an effect on tax compliance behaviour.

Overall, the current literature on the effects of reciprocity nudges on tax compliance is somewhat inconclusive. Some studies report no effect whilst others report a positive effect on tax compliance. Only a very limited number of these studies have been conducted in developing countries. The use of alternative delivery methods (apart from mail letters) has not been extensively tested. Little attention has been paid to the structure and content of the nudge messages as well as the nature of the reciprocal public good or service that is the subject of the message. Although some studies have acknowledged the importance of considering the timing of nudge messages (Behavioural Insights Team, 2014; Wenzel, 2001), limited studies have addressed this issue. The results of this article thus provide insight into these matters.

Based on the literature reviewed, the following hypotheses are tested in the article:

H₁: *Reciprocity nudges have a significant and positive impact on tax compliance behaviour;*

H₂: *The positive impact of reciprocity nudges on tax compliance is reinforced when the reciprocity nudge is framed using structural and content attributes identified as being most effective and also when the nudge communicates a reciprocal public good or service that resonates with the target audience; and*

H₃: *The timing of the reciprocity nudge influences tax compliance behaviour.*

3. RESEARCH METHOD

The study reported in this article adopted a sequential core mixed methods approach, using an experiment preceded by a content analysis to address the research objectives. Therefore, both qualitative and quantitative data were collected and integrated into a quantitative experimental method. The qualitative content analysis was undertaken in order to determine the necessary structural and content attributes of effective messages delivered using audiovisual media as the mode of delivery. The results of the qualitative content analysis were then used to conduct a quantitative content analysis of 12 SARS videos used in a Touching Lives television campaign in 2012-2013, the results of which were used for the purpose of designing a laboratory experiment to address the hypotheses outlined in section 2.

The Touching Lives campaign was selected as it focused on communicating how taxes have contributed to the provision of public goods or services to ordinary South Africans (reciprocity messages) and at the time of conducting this research, the 12 videos related to this campaign were the only publicly available audiovisual reciprocity nudge messages. Although the campaign was broadcast on television in the 2012-2013 period, the videos were still publicly available, and therefore current, on the SARS YouTube channel. At the time of conducting this research, there was no known publicly available evaluation by SARS of the impact of this campaign on tax compliance behaviour.

3.1 Content analysis

Using a quantitative content analysis process, one video was selected on the basis that it was most likely to have a positive effect on tax compliance behaviour as it contained most of the attributes of an effective message; it also focused on a public service or good which resonated with most South African taxpayers. The second video was selected on the basis that it was least likely to have a positive effect on tax compliance behaviour as it contained the fewest attributes of an effective message and focused on a public service or good that was identified as being unlikely to have an impact on tax compliance. Therefore, two criteria were used to select the reciprocity video messages, namely the structural and content attributes of the video message, as well as the type of public good or service communicated in the video message.

The first criterion (structural and content attributes) was determined through a qualitative content analysis of academic literature designed to identify attributes of an effective message aimed at changing behaviour, particularly when using audiovisual media. The literature analysed was not confined to tax-related literature, as there is limited literature in this area, but included literature from other fields such as health and transportation, where audiovisual messages are often used as a nudge to change behaviour. Table 1 lists the literature analysed in order to identify elements of effective structural and content message attributes.

Table 1: Previous Studies Reviewed

Author	Title	Year published, page range	Discipline
Albertson and Busby	Hearts or minds? Identifying persuasive messages on climate change	2015, pp. 1-9	Climate change
Bator and Cialdini	The application of persuasion theory to the development of effective proenvironmental public service announcements	2000, pp. 527-541	Environmental Conservation
Hoekstra and Wegman	Improving the effectiveness of road safety campaigns: current and new practices	2011, pp. 80-86	Transportation
Holler et al.	Framing of information on the use of public finances, regulatory fit of recipients and tax compliance	2008, pp. 597-611	Taxation
Holtzhausen	Content analysis of roles portrayed by women in advertisements in selected South African media	2010	Marketing
Phillips, Ulleberg and Vaa	Meta-analysis of the effect of road safety campaigns on accidents	2011, pp. 1204-1218	Transportation
Skubisz, Miller, Hinsberg, Kaur and Miller	Tips for former smokers: a content analysis of persuasive message features	2016, pp. 13-20	Health
Syme, Nancarrow and Seligman	The evaluation of information campaigns to promote voluntary household water conservation	2000, pp. 539-578	Water Conservation
Weiss and Tschirhart	Public information campaigns as policy instruments	1994, pp. 82-119	Public policy

Based on this analysis, structural and content attributes were identified as shown in Table 2.

Table 2: Structural and Content Attributes of an Effective Message

Attribute	Description per literature	Nature of attribute
Captures attention	The message should capture attention; the use of colour, movement, visuals, information quantity and music can assist with this.	Structural attribute
New information	The message should emphasise information that is new to the target audience and that is essential for behavioural change.	Content attribute
Evokes emotion	The message should evoke emotion.	Content attribute
Credible source	The message should be communicated by credible spokespersons and organisations.	Content attribute
Goal framing	The message should contain goal framing.	Content attribute
Credible message	The message should be truthful.	Content attribute
Message clarity	The message should be simple and clear so that it is easy to understand.	Content attribute
Message sidedness	This relates to how the message is presented to the audience. The message should be two-sided which means that it should present both the supporting and opposing arguments.	Content attribute
Message efficacy	The message should deal with 'when to' and 'how to' knowledge.	Content attribute
Fits with prior knowledge	The message should expand or elaborate on what the target audience already know.	Content attribute
Directs attention	The message should only raise awareness on some issues and not others, to shift the salience of different aspects of problems, which may lead people to think differently.	Content attribute

The contents of the 12 SARS videos were then analysed to determine whether they contained these attributes. Of the 12 SARS videos analysed for the attributes identified, eight of the videos were ranked as containing the greatest number of attributes for an effective message and four of the videos contained the fewest attributes.

The videos were then analysed by reference to the second criterion (the type of good or service communicated in the message), based upon the work of Oberholzer et al. (2008), who found that SARS messages that focused on correctional service (safety), education and tourism had a greater impact on respondents. Of the eight videos identified as possessing the greatest number of attributes of an effective message, none focused on correctional service or tourism but one of the videos focused on education. Therefore, that video was selected for the purpose of designing the experiment in order to address hypothesis H₂. The video containing the fewest attributes for an effective message was selected from the four 'ineffective' videos in a similar fashion.

As a result of this process, two videos were selected. One video was hypothesised as most likely to have a positive impact on tax compliance behaviour (this was the video

titled *Dreaming Big*) and the other was hypothesised as least likely to have a positive impact on tax compliance behaviour (this was the video titled *A Mother's Love*).

3.2 Laboratory experiment

A laboratory experiment using a post-test design was then conducted with 172 student participants, allocated randomly in more or less equal numbers to one control group and four treatment groups. All group participants watched four television advertisements (which were not tax related)² and were then able to earn income, in the form of Laboratory Currency (LC) which could subsequently be converted to Rand, by answering relatively straightforward closed and factual questions based upon the content of those four videos. The participants in the treatment groups were asked 12 questions related to the four videos and one question related to the treatment video.³ The participants in the control groups were asked 13 questions all related to the four television advertisements. Participants earned 8LC for each correctly answered question in the experiment.⁴

After income was earned, participants were required to declare their income for taxes to be paid to the revenue authority, thus simulating the general environment of a tax reporting system. Participants decided how much of their income to declare (if any). The experiment incorporated an announced probability of being audited and a penalty should a participant be audited and found to have underdeclared their earnings. A tax rate of 31% was charged on earnings, an audit rate of 10% was adopted and a penalty rate was charged of 75% of the earnings that were not declared, all broadly reflecting current South African rates and practice. Refer to Appendix A for the experimental instructions.

The participants in the four treatment groups (but not the control group) also watched one of two additional videos containing the reciprocity message. Two of the treatment groups (Group A1 and Group B1) watched the video identified as containing structural and content attributes considered to be the most effective in influencing tax compliance behaviour (*Dreaming Big*), whilst the other two treatment groups (Group A2 and Group B2) watched the video titled *A Mother's Love* which was considered least effective.

The possible impact of the timing of the nudge was measured by varying the order in which the groups watched the advertisement containing the reciprocity nudge.

Hence Groups A1 and A2 watched the reciprocity nudge advertisement *after* watching the four unrelated advertisements and immediately before making their declaration of earning for tax purposes. Groups B1 and B2 watched the reciprocity nudge advertisement *before* the four unrelated advertisements (with associated questions), after which completion of the tax declaration followed. The purpose of rearranging the order in which participants in Groups B1 and B2 watched the videos was for the four videos (excluding the treatment video) and related questions to serve as distractor tasks.

² The first video was a tourism advertisement, promoting South Africa as a holiday destination. The second video was an insurance advertisement. The third video was a video of a former South African president's speech. The last video was an advertisement for an investment management company.

³ In relation to the treatment video, participants were asked 'What emotion did you feel when watching this video?'

⁴ LCs were converted into Rand at a rate of 1LC = 1ZAR.

All videos were watched in the same session. The distractor tasks were incorporated into the experimental design to distract and thus diminish the memorisation of the reciprocity nudge message that participants in treatment Groups B1 and B2 were exposed to at beginning of the experiment. Effectively, therefore, treatment Groups B1 and B2 experienced a time lag, which was proxied by ordering the treatment video before the four unrelated advertisements, between the nudge and the declaration of income in contrast to treatment Groups A1 and A2, who declared their income immediately after watching the nudge message. Given that memory may diminish with passage of time, it was deemed appropriate to use the ordering of messages as distractor tasks that diminish memorisation thus mimicking the effect of time.

Table 3 and Figures 1 and 2 summarise these arrangements.

Table 3: Treatment Groups

Treatment Group A (with no time lag)	Treatment Group B (with time lag)
<i>Dreaming Big (A1)</i>	<i>Dreaming Big (B1)</i>
<i>A Mother's Love (A2)</i>	<i>A Mother's Love (B2)</i>

Fig. 1: Treatment Groups A1 and A2 (No Time Lag)

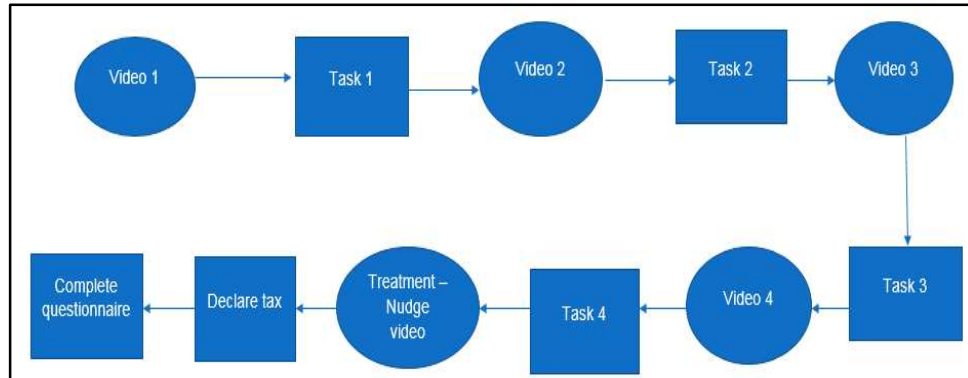
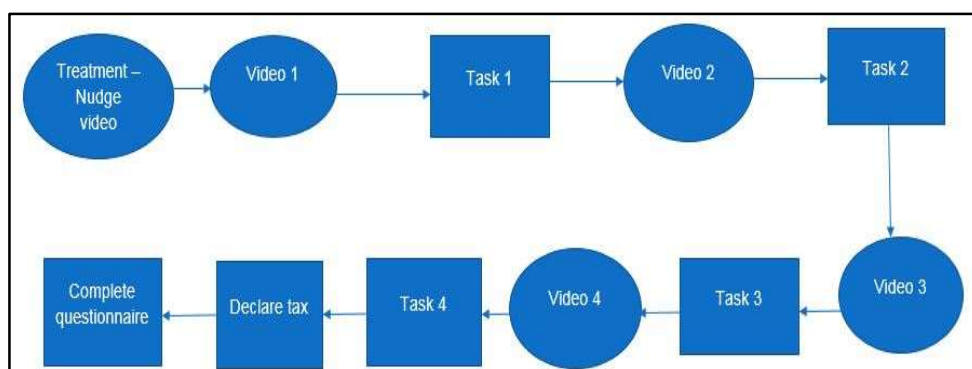


Fig. 2: Treatment Groups B1 and B2 (Time Lag)

The experiment was conducted in computer laboratories using *Qualtrics*. Before commencement with the experimental tasks, participants were informed about the procedures of the experiment. Participants were given assurance about the confidentiality of their responses and that their responses during the experiment would not be observed by the researcher or the assistants. This was communicated in order to limit potential social desirability bias. Participants were not informed that the experiment related to tax compliance, raising the issue of deception. This issue was addressed by debriefing participants on the true nature of the experiment at the completion of the experiment and providing them with an explanation as to why this information was initially withheld (see Appendix B). It was made clear to the participants that their responses would be kept confidential and would be used for research purposes only.

4. RESULTS

In the analysis that follows, descriptive statistics about the participants are summarised followed by presentation, using logistic regressions, of the effect of reciprocity nudge messages on tax compliance behaviour. Results related to timing of reciprocity nudge messages are also considered.

4.1 Descriptive statistics

Table 4 provides a summary of demographic data as well as the income earned by participants in the experiment. Participants were asked to select the age group, out of six categories provided, into which they fell. A majority of the participants (97.7%) were in the 18 to 25 age group, which was to be expected given that university students were targeted for recruitment to the experiment. The remaining 2.3% of the participants fell into the 26 to 35 age group. None of the participants fell into any of the other age group categories. The majority of the participants in the experiment (70.9%) were female compared to males (29.1%). Previous research has found that females tend to be more compliant than males (Bott et al., 2020); however, Ali et al. (2014) found no difference in tax compliance attitudes between South African males and females. Although the results with regard to gender and tax compliance are conflicting, the high representation of females compared to males in our sample may imply a greater prospect of tax compliance. We therefore tested for differences in tax compliance behaviour. Our

results showed no statistically significant differences in tax compliance rates between females and males.

Table 4: Descriptive Statistics

Demographic information	<i>N</i>	Percentage of sample
Age group		
18 to 25	168	97.7
26 to 35	4	2.3
	172	100
Gender		
Female	122	70.9
Male	50	29.1
	172	100
Population group		
Black African	130	75.6
White	33	19.2
Coloured	5	2.9
Indian/Asian	4	2.3
	172	100
Income level		
72LC	4	2.3
80LC	14	8.1
88LC	44	25.6
96LC	69	40.1
104LC	41	23.8
	172	100

Note: LC= laboratory currency

The participants fell into one of four population groups as shown in Table 4. The distribution (in percentages) of the participants across the four population groups broadly corresponds to the characteristics of the South African population group, where the majority of residents are Black African (80.7%), with White, Coloured and Indian/Asian individuals as the minorities (Statistics South Africa, 2019).

The minimum income that a participant could earn from the experiment was zero and the maximum (based upon providing correct answers to 13 questions) was 104LC. Participants earned 8LC for each correctly answered question in the experiment. None of the participants earned less than 72LC and participants were spread over five levels of income (72LC, 80LC, 88LC, 96LC and 104LC).

Participants' attitudes towards tax were measured by asking them to rate their level of agreement or disagreement with the four statements shown in Table 5, measured on a 7-point Likert-type scale. The lowest score (1) indicates that participants strongly agreed with the statement, and the highest score (7) indicates that participants strongly disagreed with the statement.

An exploratory factor analysis with principal axis factoring as an extraction method was conducted to determine whether the participants' responses to these statements could be reduced to one factor described as attitude towards tax. The result of the principal axis factoring was that the attitude towards tax statements could not be reduced to one factor.⁵ Therefore, the four statements were kept as four separate items.

Table 5 shows the minimum, maximum, mean and standard deviation scores related to participants' attitudes towards tax. The wide disparity between the mean score for the first statement and the other three statements was due to the manner in which the statements were phrased. Statement 1 was phrased positively whilst the other statements were phrased negatively.

Table 5: Participants' Attitudes Towards Tax

Number	Statement	Minimum	Maximum	Mean	SD
1	Citizens must pay their taxes to the government in order for our country to develop.	1	5	1.52	0.753
2	Underreporting my income will not hurt society as a whole.	1	7	5.51	1.782
3	The government can find enough resources for development from other sources without having to tax the people.	1	7	5.00	1.522
4	When dissatisfied with the government, it is justifiable to refuse to pay tax to the government.	1	7	5.85	1.474

Table 6 presents the minimum, maximum, mean and standard deviation scores related to participants' perceptions of corruption. This was measured by asking participants to rate their level of agreement with the three statements shown in the second column of Table 6, again measured on a 7-point Likert-type scale where a score of 1 indicates that participants strongly agreed with the statement and a score of 7 indicates strong disagreement.

Principal axis factoring was also conducted to determine whether the participants' responses to these statements could be reduced to one factor, broadly described as the perception of corruption. The result of the principal axis factoring was that the three items could be reduced into one factor.

⁵ Principal axis factoring is an acknowledged exploratory factor analysis extraction method for behavioural constructs such as attitude, while principal component analysis is a technique focused on data reduction (Costello & Osborne, 2005). Principal axis factoring was considered the more appropriate technique to use. The analysis of the statements clearly indicated two factors with two items each. However, as their Cronbach alpha values were lower than 0.6, the four statements were kept as four separate items.

Table 6: Participants' Perceptions of Corruption

Number	Statement	Minimum	Maximum	Mean	SD
1	The level of corruption involving high-level tax officials is high.	1	5	1.76	0.915
2	The level of corruption involving high-level government officials is high.	1	6	1.74	1.001
3	The level of corruption in our country is high.	1	3	1.37	0.572

Tax compliance was measured by conducting a comparative analysis of the income reported by the participants and the income earned in the experiment. The dependent variable, tax compliance, was 0 if a participant reported less than actual income earned and 1 if income was truthfully reported. There were 12 participants whose declared income exceeded the amount earned. These participants were assumed to be compliant.

Table 7 shows the tax compliance rates of participants in the control group versus those in the treatment groups.

The tax compliance rate of participants exposed to the *Dreaming Big* reciprocity nudge message was 88% compared to 78% for participants exposed to the *A Mother's Love* reciprocity nudge message and 71% for participants not exposed to a nudge message. This suggests that those participants who received a reciprocity nudge were more compliant than those who did not.

Table 7: Tax Compliance Rates and Income Declaration Statistics

Control group								
	Tax compliance rates		Income declared			Income that should have been declared		
N	Non-compliant	Compliant	Mean (LC)	Standard Deviation	Sum (LC)	Mean (LC)	Standard Deviation	Sum (LC)
35	28.6%	71.4%	80.31	27.977	2 811	93.26	8.219	3 264
<i>Dreaming Big</i> Treatment Groups (Group A1 and B1)								
	Tax compliance rates		Income declared			Income that should have been declared		
N	Non-compliant	Compliant	Mean (LC)	Standard Deviation	Sum (LC)	Mean (LC)	Standard Deviation	Sum (LC)
67	11.9%	88.1%	90.76	17.369	6 081	93.49	8.025	6 264
<i>A Mother's Love</i> Treatment Groups (Group A2 and B2)								
	Tax compliance rates		Income declared			Income that should have been declared		
N	Non-compliant	Compliant	Mean (LC)	Standard Deviation	Sum (LC)	Mean (LC)	Standard Deviation	Sum (LC)
70	21.4%	78.6%	85.00	27.160	5 950	94.86	7.618	6 640

Table 7 also shows the descriptive statistics for the control group and the treatment groups related to actual versus declared income of participants. The statistics reveal that from a tax revenue collection perspective, exposure to a reciprocity nudge message results in a higher percentage of tax revenue collected compared to non-exposure to a nudge message. Tax revenue collected from participants exposed to a nudge message was 7% higher than that from the control group.⁶ Tax revenue collected from the participants exposed to the reciprocity nudge message containing the greatest number of structural and content attributes of an effective message, which communicated reciprocal public goods or services that resonated with the target audience (*Dreaming Big*), was 11% higher than that from the control group and 7% higher than that from the treatment group exposed to a reciprocity nudge message which was considered least effective. This provides support to our hypotheses.

4.2 Impact of nudge messages

A binomial logistic regression was performed in order to predict the odds of tax compliance behaviour given an individual's exposure to a reciprocity nudge message, gender, income level, population group, attitude towards tax and perception of corruption.

The nature of income in this experiment was such that the income values could only take on 14 certain values (ranging from 0 to 104 in increments of 8), while there were 5 distinct realised values (as shown in Table 4). However, none were excluded based on truncation and none were censored as no set value was used for all values smaller than

⁶ The percentage difference of tax revenue collected between the groups was determined by calculating a percentage of the mean income declared over the mean income that should have been declared. The percentages calculated were then compared to each other.

a certain value or larger than a certain value. Therefore, an ordinary least squares regression or Tobit analysis was not deemed appropriate as the compliance variable could only take on 14 distinct values.

Table 8 shows the results of a hierarchical logistic regression in which the dependent variable is tax compliance, which takes the value of 1 if a participant was compliant and a value of 0 for non-compliant participants. Model 1 indicates the results if the reciprocity nudge messages are used as dummy variables. In Model 2, demographic variables are included and Model 3 takes account of attitudes towards tax and perception of corruption. Age was not included as a predictor in the model as the second age category consisted of only 4 participants (2.3%), with the only other age category comprising the vast bulk of participants (97.7%). Therefore, including the age variable was not deemed to be a scientifically valid predictor.

Table 8: Logistic Regression for Three Models

Variables	Model 1	Model 2	Model 3
<i>A Mother's Love</i> nudge message	.383 (.474) {1.467}	.435 (.487) {1.544}	.493 (.511) {1.639}
<i>Dreaming Big</i> nudge message	1.082** (.531) {2.950}	1.102** (.540) {3.011}	1.136** (.554) {3.115}
Gender		-.569 (.480) {.566}	-.516 (.492) {.597}
Income level		-.016 (.026) {.984}	-.024 (.027) {.976}
Population group: Black African		-.170 (.550) {.844}	-.326 (.595) {.722}
Population group: Coloured		-.312 (1.253) {.732}	-.034 (1.387) {.967}
Population group: Indian/Asian		19.690 (19727.958) ⁷ {331713358.193}	19.859 (19190.900) {421400877.1}
Attitude towards tax (Statement 1)			-.136 (.296) {.873}
Attitude towards tax (Statement 2)			.318*** (.120) {1.374}

⁷ The small group size of this group as well as potential multicollinearity with the reference group (Whites) contributed to the large standard errors.

Variables	Model 1	Model 2	Model 3
Attitude towards tax (Statement 3)			-.163 (.148) {.850}
Attitude towards tax (Statement 4)			-.035 (.149) {.966}
Perception of corruption			.385 (.337) {1.470}

Note: *A Mother's Love* nudge message denotes whether the participant was exposed to this specific nudge message, equal to 1 for participants exposed to this nudge message and 0 for participants who were not. *Dreaming Big* nudge message denotes whether the participant was exposed to this specific nudge message, equal to 1 for participants exposed to this nudge message and 0 for participants who were not. Income level indicates income earned in the experiment; the minimum income that a participant could earn from the experiment was zero and the maximum was 104LC. The four statements related to attitudes towards tax are summarised in Table 5 above. Standard errors in parentheses. Odds ratios in braces. ** Significant at 5%; *** significant at 1%.

A key assumption of using the logistic regression is that of a linear relationship between any continuous independent variables and the logit transformation of the dependent variable. A Box-Tidwell procedure (Box & Tidwell, 1962) was conducted to test whether the continuous independent variables met this assumption. The results of this assessment indicated that none of the interaction terms for the continuous variables were statistically significant at the 5% level; therefore, the linearity assumption was not violated for any of the continuous variables. The Hosmer and Lemeshow test was also conducted for each of the models and showed non-significance (p-value = 1.000 for Model 1; p-value = .888 for Model 2; p-value = .273 for Model 3), indicating that the model fit was adequate. There was no improvement in the cases correctly classified for Model 1 and Model 2. The percentage of cases correctly classified improved from 80.8% to 81.4% for Model 3.

For Model 1, sensitivity was 100%; specificity was .0%; positive predictive value was 80.8%; and negative predictive value was 0%. For Model 2, sensitivity was 100%; specificity was .0%; positive predictive value was 80.8%; and negative predictive value was 0%. For Model 3, sensitivity was 99.3%; specificity was 6.1%; positive predictive value was 81.7%; and negative predictive value was 66.7%.

The analysis therefore shows that exposure to a reciprocity nudge message has a positive effect on tax compliance. However, the association between exposure to a reciprocity nudge message was not found to be statistically significant, thus only partly confirming the first hypothesis (H_1).

In line with the hypothesis, as observed in Model 1 of the regression, there is a statistically significant association between exposure to the reciprocity nudge message containing the greatest number of structural and content attributes of an effective message (*Dreaming Big*) (which communicates a reciprocal public good or services that resonates with the target audience) and tax compliance. The odds ratio indicated that

participants exposed to this reciprocity nudge message were 2.95 times more likely to be compliant than participants in the control group who were not exposed to a reciprocity nudge message.

The inclusion of gender, population group and income level into the model (Model 2) slightly changed the coefficients for both of the reciprocity nudge messages compared to the first model. The positive impact of the reciprocity nudge message containing the greatest number of structural and content attributes of an effective message (*Dreaming Big*) was still statistically significant. The odds ratio indicated that participants exposed to this reciprocity nudge message were roughly three times more likely to be tax compliant than participants in the control group who were not exposed.

Four different statements related to attitudes towards tax and a further variable relating to perceptions of corruption were added for the purposes of Model 3. There was a statistically significant association between Statement 2 of the attitudes towards tax variables and tax compliance. In relation to the statistically significant attitude towards tax variable (Statement 2), compliant participants tended to have positive attitudes towards tax compared to non-compliant participants. Attitude towards tax (Statement 2) indicated that for each unit increase in attitude towards tax, participants were 1.37 times more likely to be tax compliant.

The positive association between the reciprocity nudge message containing the greatest number of structural and content attributes of an effective message (*Dreaming Big*) and tax compliance continued to be statistically significant. The odds ratio indicated that participants exposed to this reciprocity nudge message were just over three times more likely to be tax compliant than participants in the control group who were not exposed to a reciprocity nudge message.

In summary, the results show that exposure to a reciprocity nudge message (whether it contains most of the attributes of an effective message or few of these attributes) has a positive effect on tax compliance behaviour; however, a reciprocity nudge message containing most of the attributes of an effective message is more likely to have a significant effect on tax compliance behaviour compared to one with fewer attributes. These results partly confirm H_1 and confirm H_2 .

4.3 Timing of nudge messages

In order to test whether there was a difference in tax compliance behaviour based on the timing of exposure to a nudge message (the third hypothesis identified above), a Fisher's exact test and a Chi-square test for independence were performed. A Fisher's exact test was used to interpret the results for the video selected as containing the greatest number of attributes of an effective message (*Dreaming Big*), as the data did not meet all the requirements for a Chi-square test for independence to be conducted.⁸ There was an 81.8% compliance rate for participants in the treatment group with no time lag compared to 91.2% in the group that had a time lag. The results showed no statistically significant difference exists ($p\text{-value} = 0.305$).

⁸ The expected value counts were not all greater than five. For this reason, the Fisher's exact test was conducted. The Fisher's exact test is a commonly used test when samples are too small for a Chi-square test for homogeneity (Laerd Statistics, 2016).

For the nudge video selected as containing the fewest attributes (*A Mother's Love*), a Chi-square test for independence was conducted to determine whether there was a difference in the tax compliance behaviour of participants who viewed the reciprocity nudge message immediately before making the tax compliance decision versus those who had a time lag between viewing the video and making the tax compliance decision. Although the results showed that 85.7% of the participants in the treatment group with no time lag were compliant compared to 71.4% in the group that had a time lag, no statistically significant difference was found to exist ($p\text{-value} = 0.145$).

In summary, the results indicated that there was no statistically significant difference in tax compliance behaviour between individuals exposed to a reciprocity nudge message immediately before making a tax compliance decision versus those who have a time lag between exposure to the reciprocity nudge message and making the tax compliance decision. Due to the manner in which time lag was tested, using message ordering, these results are important as they also provide evidence that the level of success of audiovisual nudge messages broadcast on television or online, where they are likely to compete for attention with other advertising, does not diminish when overlaid with other potentially distractive messages. Hence, the third hypothesis (H_3) identified in section 2 was not supported.

5. CONCLUSION

This article has reported upon the effect of reciprocity nudges on tax compliance behaviour in a developing country context. It has focused particularly on whether communicating a reciprocity message related to a public good or service which resonates with taxpayers, and which also contains the greatest number of structural and content attributes of effective messages, has a positive effect on tax compliance behaviour. The findings have revealed that compared to the control group, participants in the treatment groups had a higher rate of tax compliance although the association between exposure to a nudge message and tax compliance was not statistically significant. These findings are similar to those from studies such as Castro and Scartascini (2015), who found that reciprocity nudges have heterogeneous effects based on other factors including, *inter alia*, the level of public goods or services provided. Based on the findings of this study, it is evident that the effectiveness of the reciprocity nudge is contingent upon the structural and content attributes of the nudge message, as well as the type of public good or service communicated.

The results also showed that participants exposed to the nudge which was hypothesised as most likely to be effective were more tax compliant than both those exposed to the less effective treatments and the control group, and significantly so for the latter. This finding also highlights the importance of designing nudge messages that have the appropriate structural and content attributes which capture the attention of the target audience.

Hence, the results point to an important aspect of message content related to the type of public good or service communicated in reciprocity nudge messages. As emphasised by Mascagni (2018), the type of public good or service communicated to taxpayers in these nudge messages matters. Different types of public goods or services may generate different responses to the nudge for different taxpayers. This is also linked to the finding by Ali et al. (2014) that taxpayers are more likely to have a tax compliant attitude if they are satisfied with certain public goods or services provided by the government.

The results have also indicated that there is no significant difference in the tax compliance behaviour of individuals exposed to a nudge message closer to the time of making the tax compliance decision and those who have a time lag between exposure to a nudge message and making the tax compliance decision. These findings are similar to those of Gillitzer and Sinning (2018). Note, however, that the results observed in this article may be accounted for by the different way in which the effect of timing was tested for (and particularly the use of distractor tasks). In field experiments, this aspect can be practically tested by varying the time, by days, weeks or even months. In the current study, however, advertisement videos were used as a proxy for time which could be argued to have influenced the effectiveness of this treatment.

Apart from the limitation related to the manner in which the effects of timing were tested, there are other limitations to this study that need to be taken into account. The first limitation relates to the nature of the (student) participants sampled in this study. Although there has been criticism of the use of students as participants in tax experiments (Choo, Fonseca & Myles, 2016), the researchers were satisfied that it was appropriate to use students as participants given previous research supporting the validity of the use of students as participants in tax research. Alm, Bloomquist and McKee (2017) found no significant difference in tax compliance behaviour of student participants and non-student participants. Furthermore, Alm and McKee (1998, p. 266) state that evidence suggests that there is no difference in the responses of students in experiments when compared to non-student participants; that 'there is no reason to believe that the cognitive processes of students are different from those of "real" people'. Nonetheless, the findings cannot readily be generalised to the broader population of individual income taxpayers given that non-student taxpayers may have different demographic and behavioural characteristics which might affect the results observed in this study. Furthermore, our student sample comprises individuals with post-high school education which may not be representative of individual income taxpayers. Future research could, therefore, be conducted with non-student taxpayers.

Secondly, the study focused on the use of reciprocity nudge messages delivered using audiovisual media and the effectiveness of such nudge messages communicated using other modes of delivery was not investigated. Other forms of delivery, such as the use of social media platforms, radio and billboards, need to be explored further.

Notwithstanding these limitations, the research provides further evidence of the critical role that appropriately crafted reciprocity messages can play in securing greater tax compliance in a developing country setting.

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7. APPENDICES

APPENDIX A: EXPERIMENT – INSTRUCTIONS

Introduction

Thank you for your participation in this experiment. This experiment process will take approximately 60 minutes to complete. The experiment is about participants' memory of advertisements. The researcher is [name removed], who is currently a [position and institution removed].

In this experiment you will be expected to view five videos. We want you to pay attention when viewing each of the videos because after viewing each video you will be required to perform a task which entails answering a few questions related to the video. You will earn laboratory credits, which can be converted to rand at the end of the experiment, for each correct answer. After you have viewed all the videos and answered all the related questions you will be told how many laboratory credits (and hence how many rand) you have earned as a result of your participation. You will then be required to declare your earnings as we need to withhold 31% of your earnings for income tax purposes.

Your participation in the experiment will remain anonymous. The responses you give will be treated as strictly confidential, as you cannot be identified in person based on the responses you give. Your participation in this study is very important to us. You may, however, choose not to participate, and you may also stop participating at any time without any negative consequences. At the end of the experiment, a payment will be made to you based on your total income earned as recorded in the reporting decision sheet, after we have deducted the amount of tax based on the declared income.

Procedural details

On the desktop computer in front of you, there is a folder "participant folder", which contains a word document with a web link to the experiment on *Qualtrics*. Open the link.

At the start of the experiment on *Qualtrics*, you will be required to enter your participant number; then you will be required to view videos and answer questions related to the videos. Please press the "next" button on each page on *Qualtrics* in order to continue to the following page. Note that once you click the "next" button, you cannot go back to the previous page, so please pay attention to what is on the screen before pressing "next".

We use laboratory currency in this experiment and you will earn 8 laboratory currencies (LC) for each question answered correctly. The LC will be converted into rand at the conclusion of the experiment. You will also receive an attendance fee of R36 which will be included in the pay-out amount.

Once you are done with viewing the videos and answering the related questions you will be required to declare your income (score) earned from participating in the experiment. The amount should be declared in laboratory currency that you earned in the experiment. It is your decision on how much of the income earned you would like

to declare. After you have declared your income earned participants will be randomly selected for an audit and if unreported income is found a financial penalty of 75% of the undeclared amount will be imposed. There is a 10% probability that you will be selected for an audit. The computer software will randomly select participants to be audited and check their actual income (score) against the declared income for any unreported income. You will be notified on the computer screen if you have been selected for an audit.

Your decision on the amount of income earned to be declared will affect your total income after tax amount. Accordingly, your total income after tax will depend on your decision on how much of your total earnings to declare, and the probability of audit and penalty rate.

Mathematically, your total income after tax can be calculated as follows:

$$\text{Total income earned} - \text{tax on income declared} - \text{undeclared income} * - \text{penalty} *$$

**These will only apply if you have been selected for an audit and tax evasion is found.*

The final page of the survey experiment will indicate whether you have been audited or not. The income after tax amount (converted into rand), plus the R36 attendance fee, will be yours to keep and will be paid out to you in cash at the end of the experiment.

When you reach the payout page, please ensure that the following procedure is followed:

- Raise your hand so that the assistant can come and give you the participation fee.
- Show the assistant your student card.
- The assistant will write down how much he or she has given you (which should correspond to the payout amount on the computer screen).
- Sign the list next to your name to confirm the amount and that you have received the money.
- You will then receive a debriefing letter.

Please leave all materials on your desk.

Thank you

APPENDIX B: EXPERIMENT – DEBRIEF LETTER

Debriefing

I would like to thank you for taking part in this experiment. You have been told that this study relates to memory and advertisements; however, there is more to this study than what we have told you about so far. Sometimes, in behavioural research, it is necessary to not tell people about the true purpose of the study at the beginning. If we did, it may affect how they respond to the questions asked and to the tasks involved, and this would change the results in ways that may make them invalid. In some studies, we want to get an idea of how people respond to certain situations in their day-to-day lives, and

sometimes, the best way to do this is to not give them all of the details about the purpose of the study.

We told you that this experiment relates to memory and advertisements and we asked you to watch a few videos and answer questions related to each of the videos after you had watched them. However, we were in fact interested in the effect of the SARS video (which may have been one of the videos you watched) on your tax compliance behaviour. There is some research that suggests that messages (or “nudges”) that communicate how taxes are spent on public goods or services (“reciprocity”) might have a positive effect on the tax compliance behaviour of taxpayers. The time lag between seeing such a video and making the tax compliance decision might also have an impact on the effectiveness of the message.

In this study, some participants watched a SARS video at the beginning of the experiment; others saw the video at the end of the experiment; and some did not see a SARS video at all. After watching the videos, you were required to declare the income earned from the experiment, for income tax purposes. This was all done so that we could simulate real-life conditions of tax compliance behaviour. We were interested to see whether watching the SARS video, and the timing of when you watched it, had any impact on the amount of income you declared for tax purposes.

Please note that the details of your participation will be kept entirely private. Any information that you have given as part of the experiment, including the amount of income you declared for tax purposes, will not be divulged to SARS or to any other person. All personal data derived from the study will be aggregated with other participants’ data and will only be reported in aggregate and not in any way that could identify you or any other person.

We hope that you found your experience of participating in this study to be interesting. We are happy to answer any questions that you may have.