ICTD

Working Paper 145

Visual Nudges: How Deterrence and Equity Shape Tax Compliance Attitudes and Behaviour in Rwanda

Fabrizio Santoro and Giulia Mascagni

August 2022

BILL & MELINDA GATES foundation
Norad
UKaid from the British people
institute of development studies

ICTD Working Paper 145

Visual Nudges: How Deterrence and Equity Shape Tax Compliance Attitudes and Behaviour in Rwanda

Fabrizio Santoro and Giulia Mascagni

August 2022

Visual Nudges: How Deterrence and Equity Shape Tax Compliance Attitudes and Behaviour in Rwanda
Fabrizio Santoro and Giulia Mascagni
ICTD Working Paper 145
First published by the Institute of Development Studies in August 2022

ISBN: [978-1-80470-024-2]
DOI: 10.19088/ICTD.2022.011

Available from:
The International Centre for Tax and Development at the Institute of Development Studies, Brighton BN1 9RE, UK
Tel: +44 (0) 1273 606261
Email: info@ictd.ac
Web: www.ictd.ac/publication
Twitter: @ICTDTax
Facebook: www.facebook.com/ICTDtax

IDS is a charitable company limited by guarantee and registered in England
Charity Registration Number 306371
Charitable Company Number 877338

Visual Nudges: How Deterrence and Equity Shape Tax Compliance Attitudes and Behaviour in Rwanda

Fabrizio Santoro and Giulia Mascagni

Summary

The empirical evidence on the drivers of compliance is expanding quickly, but there is less evidence from low-income countries. Mass-media communication channels are a cheap option that budget-constrained revenue administrations can use to communicate with taxpayers. However, very little is known about the effectiveness of such tools in improving compliance. This paper starts to address this gap by testing the impact of two short animated videos on tax matters – one focusing on deterrence and the other on equity – that were used in a survey experiment. Using a unique dataset of survey and administrative data from Rwandan taxpayers, we are able to measure the impact on compliance perceptions and behaviour. We document two significant results. First, both videos are effective in improving perceptions around enforcement and equity. Second, only the deterrence video translates into more tax being remitted – the equity appeal fails to raise more revenue. We investigate the mechanisms behind this response, and show that prior behaviour of taxpayers might explain the different responses to our deterrence and equity treatments. Our intervention is highly cost-effective and easily scalable.

Keywords: survey experiment, taxation, tax morale, tax compliance.

Fabrizio Santoro is a Research Fellow at the Institute of Development Studies and at the International Centre for Tax and Development.

Giulia Mascagni is a Research Fellow at the Institute of Development Studies and Research Director of the International Centre for Tax and Development.

Contents

Tables

Figures

Acknowledgements

This paper was prepared in close collaboration with the Rwanda Revenue Authority's (RRA's) Research and Risk teams, particularly Denis Mukama, Gadi Munyentwali, Adrian Bizumugabe, Sam Kabera, Naphtal Hakizimana and Kieran Byrne. They have provided invaluable guidance and feedback throughout the project, from the design of the questionnaire to the interpretation of results. We are very grateful for their continued engagement, support and insights. Special thanks go to RRA's senior management for the high-level support they have provided to our research. We would also like to acknowledge the excellent support we received from Vanguard Economics in collecting data. In particular, we are grateful to Yves Nsegyumva, Benjamin Binshi and Winnie Kalisa for their support in the implementation of the survey and translation of the video content. The final version of the paper was prepared with support and feedback from ICTD's team. The videos were produced by Stephanie Lenz and Rhiannon McCluskey.

Acronyms

CIT	Corporate income tax
FGD	Focus group discussion
ICTD	International Centre for Tax and Development
ITT	Intention-to-treat
LATE	Local average treatment effects
LIC	Low-income country
PIT	Personal income tax
RCT	Randomised controlled trial
RRA	Rwanda Revenue Authority
VAT	Value added tax

Introduction

The empirical literature on tax compliance has expanded rapidly in the past decade, largely thanks to the increased accessibility of administrative data from taxpayer records (Slemrod 2019). Part of this literature has focused on large-scale field experiments using messages sent by the tax administration to raise taxpayer compliance (Mascagni 2018; Atinyan and Asatryan 2019). However, low-income countries (LICs) remain largely under-represented in this literature, with only two studies conducting such experiments in Africa – or any other low-income country (Mascagni and Nell 2021; Shimeles, Gurara and Woldeyes 2017). Understanding what pushes taxpayers to comply is particularly important in LICs, where evasion is more widespread and financing gaps are larger than in higher-income countries (Besley and Persson 2013; IMF 2019). This situation has been further exacerbated during the Covid-19 pandemic (Bachas, Brockmeyer and Semelet 2020; IMF 2020). Rwanda, the country under study, is no exception (Lees, Mascagni and Santoro 2020; Mascagni and Lees 2021). It is therefore urgent and relevant to understand the drivers of taxpayer compliance in an LIC context, and what revenue administrations can do to leverage them. While some evidence is emerging, there remain knowledge gaps relating to both perceptions, such as the credibility of enforcement and role of tax morale, and behaviour, such as underreporting and the probability of filing declarations. In addition, we still do not know much about how taxpayer perceptions translate into actual compliance behaviour (Onu and Oats 2016).

This paper contributes to these broad questions by providing evidence from a survey experiment where over 2,000 small and medium firms were exposed to two information videos – two-minute-long animated films on tax, focusing respectively on deterrence and equity. The two treatment messages refer to the two main determinants of compliance in the literature: deterrence (Allingham and Sandmo 1972) and tax morale (Luttmer and Singhal 2014).[1] The videos were administered by the research team, and not by the revenue authority. We targeted income taxpayers filing for corporate (CIT) or personal income tax (PIT) – either companies or individual firms. Focusing on income taxpayers is particularly relevant for both research and policy, given that they are directly responsible for self-declaring their income for tax purposes, and are more subject to tax evasion. To this end, our sample includes firms who are registered but fail to submit declarations (non-filers), those who file declarations reporting zero in all fields (nil-filers), and those reporting some positive level of income (actives). These three categories are widespread in LICs, but the literature often focuses exclusively on the latter (Mascagni, Santoro, Mukama, Karangwa and Hakizimana 2020; Santoro, Groening, Mdluli and Mbongeni 2020). We evaluate the impact of the videos using a unique dataset that combines survey and administrative data, thus allowing us to explore their effects on both perceptions and real behaviour. Allocation to one of the treatment groups, each corresponding to one video, or the control group, which received no intervention, is randomised, thus allowing for a clean identification of impact.

We find three key sets of results. First, the deterrence video affects the perceived probability of detection, as expected. More surprisingly, we also find a crowding-out effect on perceptions of the fairness of the tax system, in line with the compliance literature (Feld and Frey 2002; Ariel 2012; Santoro *et al*. 2020). These impacts on perceptions are accompanied by large and significant shifts in behaviour, as taxpayers allocated to the deterrence treatment significantly decrease their probability of nil-filing and increase the amount of self-reported tax liability. Such impacts on behaviour are sizeable and larger than those usually measured in nudge experiments.

[1] For the latter, among the many different components, we selected equity with a nod to fiscal exchange, as we thought it was more pertinent to the Rwandan context and easier to communicate through a video.

Second, the equity video significantly affects perceptions around progressivity. After watching it, taxpayers are more aware that higher-income people pay more tax than lower-income ones, an issue that is clearly explained in the video. However, the equity treatment reduces the broader perceptions around fairness, beyond the narrow issue of progressivity. Partly explained by this contradictory effect, the equity treatment has no impact on any of our outcomes related to actual taxpaying behaviour. This null result is in line with more mixed findings on moral appeals in the literature, compared to results on deterrence (Mascagni 2018; Atinyan and Asatryan 2019).

Third, we attempt to link our results on perceptions and behaviour by exploring the role of priors in affecting how taxpayers react differently to the two treatment videos. We find suggestive evidence that priors, measured as relevant perceptions at baseline, play some role in explaining our results on behaviour. While the deterrence treatment only changes behaviour for those with 'good' perceptions at baseline, the equity one is ineffective on all groups.

A key element of innovation in our study is the use of animated videos to deliver messages about tax compliance. To the best of our knowledge, videos have not been used to deliver tax appeals before in LICs, or hardly any other context.[2] However, video experiments have been used in other strands of literature – for example, to understand intimate partner violence (Green, Wilke and Cooper 2020), gender bias (Pietri, Moss-Racusin, Dovidio, Guha, Roussos, Brescoll and Handelsman 2017), education (Fiorella, van Gog, Hoogerheide, and Mayer 2017), and perceptions toward stigmatised groups (Ortiz and Harwood 2007; Mazziotta, Mummendey and Wright 2011). Educational entertainment initiatives have been tested in the topics of corruption (Blair, Karim and Morse 2019), HIV (Banerjee, La Ferrara and Orozco-Olvera 2019), and ethnic conflict (Paluck and Green 2009). However, evidence on video experiments on tax beliefs and behaviour is virtually non-existent.

Our analysis directly contributes to the empirical literature on tax compliance and development, particularly to the literature on tax experiments, in three ways.[3] The first one, as mentioned above, is the use of videos as a new way to deliver messages that are very similar to the treatments used in this type of study. Existing studies either focused on one method of delivery, usually physical letters, but also SMS or emails, or tested differences between them (Ortega and Scartascini 2016; Mascagni and Nell 2021). Our study differs from the typical tax nudge experiment – not only because the method of delivery is different, but also, crucially, because it is not delivered directly by the revenue authority. We are aligned with this literature because we target real taxpayers and study real behavioural responses, alongside perceptions. The second contribution is to expand the LIC perspective in this literature. Most available tax experiments come from high-income countries[4] and Latin America.[5] Evidence from Africa is almost non-existent, with the exception of Shimeles *et al.* (2017), Mascagni and Nell (2021) and (Santoro *et al*. 2020). The third contribution is to measure the effects of the videos on both tax beliefs and actual behaviour, while the vast majority of the tax experiment literature focuses on reporting decisions only,[6] lacking

---

2 An example of a video experiment on tax from high-income countries is McGraw and Scholz (1991).

3 For a more complete review than we can provide here, see Hallsworth (2014); Mascagni (2018); Atinyan and Asatryan (2019).

4 Tax nudge studies blossomed in Europe (Torgler 2004; Hasseldine, Hite, James and Toumi 2007; Kleven, Knudsen, Kreiner, Pedersen and Saez 2011; Fellner, Sausgruber and Traxler 2013; Bott, Cappelen and Sørensen 2014; De Neve, Imbert, Spinnewijn, Tsankova and Luts 2019), Australia (Wenzel and Taylor 2004; Biddle, Fels and Sinning 2017), and USA (Slemrod, Blumenthal and Christian 2001; Chirico, Inman, Loeffler, MacDonald and Sieg 2016; Meiselman 2018).

5 See Del Carpio (2014); Pomeranz (2015); Kettle, Hernandez, Ruda and Sanders (2016); Carrillo, Pomeranz and Singhal (2017); Brockmeyer, Smith, Hernandez and Kettle (2019).

6 Even with respect to our filing outcomes, we diverge from most tax nudge studies as we study impacts both at the extensive (probability to file) and intensive margin (tax amounts). Most of the literature focuses on positive filers, while

information on attitudes and perceptions from survey data. As a key contribution, we are able to draw some linkages between perceptions and behaviour, an aspect often neglected by the tax nudge literature.

Beyond the literature on taxation, this paper also contributes to the literature using survey experiments by providing an analysis on tax in a LIC context. There have not been many survey experiments on tax in Africa – with the exception of African countries being included in cross-country survey experiments (Sjoberg, Mellon, Peixoto, Hemker and Tsai 2019; Hoy and Mager 2021). The majority of studies come from high-income countries (Doerrenberg and Peichl 2018; Fisman, Gladstone, Kuziemko and Naidu 2020; Stantcheva 2020) and Latin America (Ortega, Ronconi and Sanguineeti 2016; Flores-Macias 2018). In the case of Stantcheva (2020), educational videos are tested, communicating different information around tax policies in the US – the only example of visual nudges in the tax literature (in a high-income country) produced so far. Additional studies looked at topics which are separate but still related to tax, such as preferences for income redistribution (Cruces, Perez-Truglia and Tetaz 2013) and trust in government (Alessandro, Cardinale Lagomarsino, Scartascini, Streb and Torrealday 2021; Acemoglu, Cheema, Khwaja and Robinson 2020; Khan, Nasim, Shaukat and Stegmann 2021).

More importantly, our study adds to previous survey experiments by making a direct link with behaviour, going beyond the analysis of impact on perceptions that the typical survey experiment focuses on. By definition, survey experiments are often able to capture immediate changes in attitudes after the implementation of the experiment, usually gathered with a final survey module. While we also do that, thus aligning our study to this literature, we also observe impacts on actual filing behaviour a few weeks after the treatment. In doing so, we contribute to ongoing methodological debate on how tax perceptions translate into compliance behaviour, as reviewed in Onu and Oats (2016).[7]

Last, but not least, our analysis is highly relevant for policymakers, especially in LIC contexts. Revenue administrations around the world already engage in a wide variety of communication, sensitisation, and educational campaigns aiming to improve taxpayer compliance (Mascagni and Santoro 2018). Covid-19 has made remote engagement with taxpayers through social and traditional media even more relevant, in the context of a general shift from face-to-face to online interventions. Our findings provide the first evidence of the effectiveness of video messages on compliance perceptions and behaviour. Importantly, these videos are relatively cheap to produce (about USD 6,000), as they are animated, and they are easily scalable. They also seem to be cost-effective, with a cost-benefit ratio of 1:15 and extra revenue gains amounting to RWF 96 mln (USD 95,000). Our survey data suggests that taxpayers would welcome more engagement on tax matters with social media and TV, both of which could be used to disseminate video messages. Our analysis provides some guidance to policymakers in Rwanda, and in LICs more generally, about the effectiveness of these videos – and whether they can be expected to change actual behaviour and, crucially, increase revenue. Our findings on the relevance of priors suggest that more in-depth interventions are needed to shift perceptions and behaviours with equity, especially for those taxpayers with poor intrinsic motivation. Deterrence results in more immediate reactions.

---

few papers study non-filing (Kettle *et al*. 2016; Brockmeyer *et al*. 2019; Meiselman 2018; Santoro *et al*. 2020) or nil-filing (Mascagni *et al*. 2020; Santoro and Mdluli 2019).

[7] Elffers, Weigel and Hessing (1987) find that there are significant differences between actual tax evasion, as derived from tax audits of 700 Dutch taxpayers, and survey responses. Likewise, Hessing, Elffers and Weigel (1988) find no correlation between self-reports and documented compliance status with the Dutch tax authorities.

In what follows, we start by describing the Rwandan context in section 1, while we present the research design in section 2. Section 3 discusses our key results on shifts in perceptions and filing behaviour. Section 4 concludes.

1 Context: tax compliance in Rwanda

Rwanda faces many of the common challenges that tax administrations grapple with in low-income countries, including widespread evasion, a large informal sector, and an economy mainly based on agriculture. Like many other revenue authorities, the Rwanda Revenue Authority (RRA) has been addressing these challenges with a mix of enforcement (audits and checks), facilitation (e.g. treating taxpayers as customers, and education campaigns), and the promotion of professionalism and trust in the revenue administration. Despite these efforts, and the good reputation that the RRA enjoys amongst its African peers (Schreiber 2018), the country's tax-to-GDP ratio remains slightly below the average for sub-Saharan African countries (14.4 per cent in 2018, as opposed to 15.4 per cent) but above the average for LICs (13.1 per cent).[8]

The RRA has been very active in encouraging taxpayers' voluntary compliance with various sensitisation and educational initiatives and campaigns. Perhaps the one with the widest reach is the Taxpayer Appreciation Day, which is a series of events aimed at appreciating and highlighting the contribution of 'good' taxpayers to the public budget and to national development more broadly. Other initiatives include a taxpayer education programme for new taxpayers; seminars dedicated to specific groups, such as firms operating in certain sectors, or businesswomen; tax clubs in schools where students are educated in tax matters from an early age; and various communications with taxpayers via SMS or social media, especially around key deadlines in the taxpaying process (Mascagni and Nell 2021; Mascagni, Santoro and Mukama 2019; Mascagni and Santoro 2018).

While there is some evidence that such friendly approaches to increase compliance are effective, much still remains unknown about which of the wide variety of RRA initiatives work. For example, previous research has shown that friendly reminders of declaration deadlines can improve compliance by 55 per cent (Mascagni and Nell 2021), while a taxpayer education programme organised by the RRA for new taxpayers increased their probability of submitting a declaration by 30 per cent (Mascagni *et al*. 2019). However, no evidence is currently available on the use of videos to communicate with taxpayers, despite them being particularly suitable for both social media and TV, both of which are used extensively by taxpayers. Our survey reveals that the great majority of small firms we interviewed use social media and watch TV.[9] Despite being widespread, these media are rarely used for interaction with the RRA. Only 12 per cent use social media and 24 per cent use TV to get information on taxes. However, our respondents indicate that they would prefer to use them to interact with the RRA more than they currently do.[10] Our research is particularly policy relevant, as the videos we evaluate could be used to fill this gap in communications between the RRA and taxpayers.

It is particularly urgent to conduct such studies on income taxes, where the compliance gap is larger than for other taxes (Kleven *et al*. 2011; Mascagni, Monkam and Nell 2016). The main tax types in Rwanda in 2019, as a share of total revenue, were: value added tax (VAT,

[8] Source: ICTD/UNU-WIDER Government Revenue Dataset. Figures refer to tax revenue, not total revenue (including non-tax revenue).

[9] Only 24 per cent and 26 per cent of our sample, respectively, reported never using social media or TV.

[10] Forty-two per cent indicated TV as a preferred channel of communication on tax matters, and 26 per cent indicated social media, both figures being higher than the actual reported usage for tax information.

33 per cent), pay-as-you earn taxes on employment income (PAYE, 24 per cent), corporate and personal income taxes (CIT and PIT, 20 per cent) and excises (11 per cent), as reported in Rwanda Revenue Authority (2020). In this paper, we particularly focus on PIT and CIT, which in this context are both taxes on business profits.

More specifically, both taxes are levied on firms: PIT on non-incorporated businesses, and CIT on corporations.[11] For both tax types, taxpayers can either pay under the full reporting regime, the 'real regime' where full books of accounts are required, or under simplified regimes (the 'lump-sum' and 'flat amount' regimes) for firms below a certain threshold.[12] While the PIT real regime follows a progressive rate schedule, CIT is levied at a flat rate of 30 per cent.[13] For both tax types, the tax period starts on 1 January and ends on 31 December, while declarations are due by 31 March of the following year. CIT taxpayers are typically larger than PIT ones, being generally more sophisticated organisations that rely less on one individual businessperson. Most corporations pay according to the real regime, as they would be too large to qualify for the simplified ones.

The compliance challenge on PIT and CIT, as for other tax types, is multifaceted. It has to do with both culture and perceptions (credibility of enforcement, perceptions around the equity of the tax system) and behaviour – both of which we explore in this paper. There are at least three dimensions of compliance behaviour that we can observe in administrative data in Rwanda – all three are common in other LICs. The first is related to whether registered taxpayers file a declaration. Although they must do so, many of them do not – especially new taxpayers (Santoro 2021; Moore 2020; Mascagni *et al*. 2019; Ligomeka 2019). We label these firms non-filers. Second, even when taxpayers do declare, their returns might not provide any information, and no tax revenue, to the revenue authority. This is the case of nil-filers, who report zero in all fields of their declaration (zero income, zero tax). Nil-filing is widespread both in Rwanda and other LICs (Mascagni *et al*. 2020; Santoro and Mdluli 2019; Almunia, Gerard, Hjort, Knebelmann, Nakyambadde, Raisaro and Tian 2017; Mascagni and Mengistu 2018). Third, even when taxpayers do file declarations with positive values of income and, usually, tax (active taxpayers), they might under-report their income and tax liabilities.[14] Since all three non-compliance behaviours are common in LICs, including Rwanda, it is important to take them into account to gain a full view on compliance effects and challenges.

2 Data, methods and research design

2.1 Overview of research design

Against the background of section 1, the overarching aim of our analysis is to explore innovative ways of communicating with taxpayers to improve compliance, which can fill a gap in existing RRA initiatives. More specifically, we focus on the use of videos, which we test in a survey experiment setting but which could be replicated and scaled up through social or traditional media. We designed two videos that focus respectively on deterrence and on

[11] CIT and PIT payers might also remit VAT, if they are above the relevant threshold, and PAYE, if they have employees – as well as other taxes at the national and sub-national level.

[12] Small enterprises (turnover between RWF 12 million and RWF 50 million per tax period) are subject to a lump-sum tax of 3 per cent of turnover. Micro-enterprises generating a turnover of more than RWF 2 million and less than RWF 12 million are required to pay a flat amount between RWF 60,000 and RWF 300,000, depending on income (RRA 2017: Articles 11 and 12). The approximate rate of exchange to USD is USD1 for RWF 1,000.

[13] The PIT real regime progressive tax schedule is as follows: turnover below RWF 360,000 is exempted from taxation; between RWF 360,001 and RWF 1,200,000 is taxed at 20 per cent; higher incomes are taxed at 30 per cent.

[14] In the latter category we also have taxpayers who declare a positive amount of income but pay no tax because their costs are larger than their income, thus putting them in a loss position.

equity. We then embedded these videos into our survey, similar to a survey experiment design.[15] Respondents were randomly assigned to one of three equally-sized groups: those assigned to the two treatment groups watched one of the two videos, while those in the control group received no intervention. This makes our empirical strategy straightforward, as the evaluation is set up as a randomised controlled trial (RCT). Most of the survey data was collected before the videos were shown. We asked a few questions after showing the videos to assess their impact on a selected number of variables capturing compliance perceptions and attitudes.

Crucially, our survey data is matched with administrative data for the full sample of respondents. For each we can also observe compliance behaviour, along the dimensions outlined in section 1, in addition to perceptions and attitudes. Since the survey (and watching the video) took place during the declaration period, we can expect it to affect actual compliance behaviour. This unique dataset allows us to also explore the mechanisms through which changes in perceptions might translate into actual compliance behaviour. In the next few sections we describe our data, methods and research design in more detail.

2.2 Data

Our analysis uses a unique dataset combining survey and administrative data.[16] The key advantage of this combined dataset is that it allows us to observe both perceptions and behaviour, addressing the shortcomings that studies based only on either type of data typically have. Survey-based studies can be very informative for exploring and explaining taxpayers' views about tax compliance. However, they are often unable to make the link with actual taxpaying behaviour, which is particularly relevant for policy. The literature is still undecided on whether perceptions and attitudes translate into real behaviour or not (Elffers *et al*. 1987; Hessing *et al*. 1988; Onu and Oats 2016; Santoro 2021).

Studies based exclusively on administrative data can analyse real taxpaying behaviour, but are often unable to explore mechanisms that explain any observed changes in behaviour. For example, Mascagni and Nell (2021) conduct a typical nudging field experiment and find mixed results on the effectiveness of messages focused on fiscal exchange (making a link between tax payments and public services). Based only on administrative data, they are unable to fully explain these results, thus leaving some open questions for further research.[17] Our results, combining survey data on perceptions with administrative data on behaviour, can shed light on this kind of open question – in addition to directly testing the effectiveness of our intervention, which is the core aim of our analysis.

More specifically, we use the survey data to evaluate our intervention's impact on attitudes and perceptions, and the administrative data to evaluate the impact on various dimensions of compliance behaviour. Importantly, we are able to unambiguously link survey responses and tax returns for each taxpayer in the sample through the use of unique identifiers. In the next few paragraphs we describe in more detail the two components of our combined dataset: administrative and survey data.

---

15 By implication, the videos were not shown in the presence of RRA officials, but were administered by enumerators from an independent survey company.

16 The combination of survey and administrative data is becoming more common in the public finance literature. Other studies include Santoro (2021) in Eswatini: Mascagni *et al*. (2019) in Rwanda; Del Carpio (2014) in Peru; Bergolo, Ceni, Cruces, Giaccobasso and Perez-Truglia (2019) in Uruguay; Lefebvre, Pestieau, Riedl and Villeval (2015) in France, Belgium and the Netherlands; Fellner *et al*. (2013) in Austria; and De Neve *et al*. (2019) in Belgium.

17 More specifically, Mascagni and Nell (2021) find that fiscal exchange messages are only significant in some specifications, and, even when they are, they don't seem to have any additional effect to being a simple reminder. They also highlight how this type of message was only effective when it was delivered by SMS, which did not include a graph summarising public expenditure. This raised questions as to whether additional information contained in the graph might have had an adverse effect.

2.2.1 Administrative data from tax returns

Administrative data includes information that taxpayers submit to RRA with their CIT or PIT tax declarations. It typically includes income (total sales), expenses, and the tax liability for a given fiscal year. A few other variables are available, such as location and some imperfect information on sectors. This is why matching these data with our survey provides an opportunity to observe a much larger set of demographic and business characteristics that would otherwise not be available. We have CIT-PIT returns for the population of registered taxpayers for the period 2013–2019, which provide information on filing behaviour. Amongst all the data available, our analysis only uses records for taxpayers that are also selected to take part in our survey, in which our video experiment is embedded.

The declarations dataset allows us to measure the impact of our video intervention on tax filing behaviour, which we can observe in the returns for tax year 2019 that are filed by 31 March 2020 – after the survey and the video experiment took place. To gain a full view on compliance behaviour, we check the effectiveness of the video on three outcomes: non-filing, nil-filing, and the amount of tax liability, as anticipated in section 1. Section 2.4 describes more precisely the variables we use to capture these three outcomes of interest.

In addition to the declarations dataset, we also use the taxpayers' registry, which contains information on all the taxpayers registered with the RRA – whether they file a declaration or not. This is the dataset we use as a basis for sampling taxpayers to take part in our survey. Since we are interested in observing all three compliance behaviours, we selected our sample to include all three types of taxpayers: non-filers, nil-filers and active taxpayers. To do so, we matched the registry for 2018, which is the last year with full records before the survey and intervention were carried out, with declarations data for the same year.[18] This allowed us to identify the compliance status of each taxpayer in the registry, for fiscal year 2018. This combined data reveal that 61 per cent of CIT/PIT taxpayers in the registry failed to file their declarations – thus being non-filers. Among those who filed, 47 per cent filed nil-declarations, while the rest are active taxpayers. The data reveals that failure to file is a bigger problem for smaller, individual businesses registered for PIT (74 per cent as opposed to 39 per cent of CIT ones), while nil-filing is more prominent in CIT businesses (55 per cent as opposed to 35 per cent of PIT ones). On top of this, informality – businesses operating fully outside the RRA's radar – still represents a significantly high share of GDP (36 per cent according to Schneider and Medina (2018)). This is, however, something we cannot observe in our administrative dataset, which only includes firms that are registered with the RRA.

2.2.2 Rwanda National Taxpayer Survey

The Rwanda National Taxpayer Survey was conducted in January and February 2020 on a sample of 2,023 small and medium firms registered with the RRA.[19] Importantly, the survey (and the video experiment embedded in it) took place during the income tax declaration period for fiscal year 2019, for which declarations were due between 1 January and 31 March 2020. Our sample was randomly selected from the RRA registry, which includes all firms that registered for income tax in Rwanda, and it focuses on small and medium firms in particular.[20] The survey is nationally representative of all provinces of Rwanda, although we

---

[18] The survey took place during the declaration period for fiscal year 2019, so declarations for 2019 were not yet available when we selected the sample to be surveyed. Each taxpayer in the administrative data (registry or declarations) has a unique identifier that is consistent across all datasets, and is used to merge the administrative and survey data.

[19] Interviews were carried out by enumerators from an independent survey company, Vanguard Economics, in person, and lasted for about 45 minutes on average. The survey protocol was strictly followed, and taxpayers had to provide informed consent before starting the interview. Data collection and entry were accompanied by back-checks and other validation procedures, consistent with best practice.

[20] Sample selection followed a stratified randomisation algorithm. Strata variables used are (i) an indicator for being a CIT taxpayer, (ii) an indicator for being registered for VAT, and (iii) taxpayer size (micro, small, medium).

selected a number of districts to facilitate logistics.[21] Consistently, 62 per cent of the sample is based in the capital city, Kigali, while the remaining 38 per cent is located in the provinces. Appendix Figure A1 plots the location of the survey sample across the country.

The survey questionnaire includes the following key modules: (i) demographics, (ii) business characteristics, (iii) risk aversion, (iv) tax knowledge, (v) satisfaction with public services, (vi) interactions with RRA, (vii) overall tax burden, (viii) baseline tax compliance attitudes and perceptions, (ix) video experiments, (x) endline attitudes and perceptions. The questionnaire is designed to capture key perceptions of interest, particularly those related to deterrence and equity, both before (baseline) and after (endline) the video viewing. However, since all questions were asked in the same short interview, we avoided asking exactly the same ones before and after the video. Instead, we included slightly different variations of questions capturing the same aspect before and after the video (see section 2.4 and Appendix Table A2).

To check for possible biases in survey responses, we included three list experiments that test the validity of respondents' answers on three potentially sensitive topics: income underreporting, the fairness of the tax system and the professionalism of RRA staff. We then compare the results from the list experiments with more direct questions on these topics. We do not find any evidence of significant bias in responses to these questions, as discussed in Appendix A, which confirms the good quality of our survey data.[22]

As anticipated in section 2.2.1, our survey sample includes all three categories of taxpayers that we observe in the RRA registry: non-filers, nil-filers and active taxpayers. However, we oversampled the latter group, since this is the one for which we have more information in the administrative dataset (for the other two categories declarations are either not available or contain no information). We therefore randomly sampled the three groups separately, to obtain the following composition: 23 per cent are non-filers, 25 per cent are nil-filers, and the majority, 52 per cent, are active taxpayers. This heterogeneity in compliance behaviour allows us to observe multiple dimensions of taxpayers' behavioural response, and to check whether these different groups respond differently to the intervention.

Surveyed firms are registered either as corporations (25 per cent), thus subject to corporate income tax (CIT),[23] or as unincorporated firms or sole proprietorships (75 per cent), thus subject to personal income tax (PIT). This is fully in line with the focus on small taxpayers, who are more likely to be registered for PIT than for CIT.

Appendix Table A1 reports some additional descriptive statistics on our sample. It is worth highlighting here that, consistently with our sampling strategy, firms in our sample display many of the characteristics that we would expect from small firms. The majority (54 per cent) have no paid employees, while about a third have fewer than five employees. Average monthly sales are about USD 6,000, although the median is unexpectedly much lower (USD 207) and there is a lot of variation across our sample.[24] Relatedly, education and tax knowledge are quite low in our sample: on average, respondents only responded correctly to 44 per cent of questions in our tax knowledge module, which included basic questions about

---

21 We included firms registered in 20 out of 30 districts in Rwanda, while the ten that were dropped are the smallest districts. The surveyed districts are: Bugesera, Gasabo, Gatsibo, Gicumbi, Huye, Kamonyi, Karongi, Kayonza, Kicukiro, Muhanga, Musanze, Nyagatare, Nyamasheke, Nyanza, Nyarugenge, Rubavu, Ruhango, Rusizi, Rwamagana, Nyamagabe.

22 For a similar use of list experiments in tax studies, see Fergusson, Molina and Robinson 2020.

23 In the case of CIT payers, in 59 per cent of the cases we interviewed the owner of the company, or the chief executive/general manager (18.5 per cent), an internal accountant (11 per cent), or a shareholder (6 per cent), etc.

24 Appendix Figure A2 displays the distribution of reported sales by taxpayer categories (i.e. nil-filers, non-filers and active taxpayers). Active taxpayers have a much larger volume of sales than others, as expected. However, it is striking to see that even non-filers and nil-filers report positive income. This suggests that some non-filers and nil-filers might either be evading or misunderstanding their reporting obligations (see Santoro 2021; Mascagni *et al*. 2020).

the Rwandan tax system (such as what is the tax rate, which reporting regime are respondents subject to). This figure is lower for smaller PIT taxpayers. This low level of knowledge means that our videos might be particularly relevant and useful in providing new information to respondents. Also consistent with small firm size, the large majority of taxpayers (78 per cent) manage tax matters by themselves, while only 19 per cent use the services of a tax accountant. This might facilitate the video's impact on filing behaviour, as the same person who took part in the survey, and watched the video, is likely to also prepare a tax declaration shortly after having taken part. Record-keeping is very weak in the sample: only 47 per cent of respondents keep records of accounts, with only half of these using formal accounting books.

2.3 Experimental videos on tax

We included two experimental videos in our survey. After completion of module (viii) on baseline outcomes, 66 per cent (1,329) of the sample was randomly assigned to watch one of two informational videos – either a video on deterrence (656 taxpayers) or a video on equity (673 taxpayers). After watching the video, the final survey module (x) on endline outcomes was implemented. Respondents in the control group were not shown any video and went directly through the final module. Randomisation took place on the spot, through an algorithm embedded in the survey software.[25]

The style and structure of the two videos are the same. They are animated, cartoon-like films, alternating images and words. By taking out the human component (using animated characters rather than actors) we aimed to both reduce the production costs – the production budget was around USD 6,000 – thus helping scalability, and also avoid any emotional reactions that real actors might elicit.[26]

Both videos start with an opening statement or a general appeal on either deterrence or the equity of the tax system, with a particular focus on progressivity. Illustratively, for the former, the statement is 'It is important to file your taxes correctly and on time', so to avoid strict penalties. For the latter it is 'Do you know where tax revenue in Rwanda comes from?', followed by an explanation that the majority of revenue comes from large and medium-sized taxpayers, who contribute over 70 per cent of the total.

The videos then offer concrete examples on the relevant topic by telling hypothetical stories of fellow taxpayers/businesspeople that the taxpayer could easily relate to. For example, the video on deterrence clearly spells out the sanctions applicable in cases of underreporting or failure to declare. The one on equity includes information about progressive rate structures, showing how large taxpayers pay according to a higher rate than smaller ones, and provides concrete examples of the public services funded by taxes, such as education, health, housing development and security, which are accessible to the most vulnerable in society thanks to tax revenue.

After these real-life examples, the videos conclude with some final considerations that bring the taxpayer's attention back to the high-level concepts of deterrence or equity. The deterrence video concludes with this statement: 'Please, file your tax returns on time and correctly to avoid penalties and fines, and make sure to report all your costs so that you pay the right amount of tax', and suggests the main channels through which to reach the RRA for

[25] As shown in Appendix Tables A3 and A4, the randomisation worked smoothly and the three groups are comparable both in terms of respondent characteristics and, importantly for the robustness of our findings, in terms of tax attitudes and perceptions.

[26] The video has been designed and produced by staff at the International Centre for Tax and Development, at no cost for the RRA. The only costs incurred in the context of the project refer to hiring speakers to reproduce the messages in three languages, as well as to secure a suitable sound recording system. This amounted to USD 900 in total.

help.[27] The equity video's conclusion includes the fact that the more tax is collected, the more resources the government has to develop the country and improve the quality of life of all Rwandans, regardless of how much they contributed.[28] Each of the videos is clearly related to the broader literature on the drivers of tax compliance. The deterrence video makes the financial consequences of misreporting salient, which are thought to increase compliance according to the neoclassical model of tax evasion (Allingham and Sandmo 1972; Sandmo 2005; Slemrod 2019). The equity video aims to increase the sense of equity of the tax system, clarifying its progressive nature, as well as stressing the link between paying taxes and contributing to public service provision for all (Cowell and Gordon 1988; Falkinger 1988; Luttmer and Singhal 2014; Prichard, Custers, Dom, Davenport and Roscitt 2019).

Both videos were produced in three languages: English, French and Kinyarwanda, the three main languages used in Rwanda. There were repeated interactions with the RRA during the production of the video to find the clearest wording and most effective editing in each language. We also organised focus group discussions (FGD) before fielding the survey, in which the videos were shown to randomly selected taxpayers in Kigali. Input received from FGD participants significantly improved the effectiveness of the videos' content – especially in terms of humanising the animated characters in the video as much as possible, and making sure that the broad statements were clear. During the survey, respondents saw the video in the presence of an enumerator, who made sure they were watching it. After the viewing, we asked respondents whether they understood the content. A large majority of them (91 per cent) report having understood the message.

2.4 Outcomes of interest

We evaluate the impact of the videos described in section 2.3 on two sets of outcomes: one related to perceptions, and the other to behaviour.

2.4.1 Perceptions

As far as perceptions are concerned, we evaluate the video's effects by using variables that are observed after the video has been shown to respondents (see Appendix Table A2). We have two primary outcomes of interest, which are directly related to the video content. The first one relates to deterrence, and captures perceptions around the probability of being caught evading. More specifically, we use the question 'Imagine a taxpayer is evading taxes, what is the probability that this taxpayer will be selected for audit or review this year regarding their declaration, from 0 per cent to 100 per cent?'. We build a 0–1 dummy variable for the perceived audit likelihood being above the sample median.[29] The second primary outcome of interest relates to perceptions about the progressivity and fairness of the tax system. More specifically, we use an endline question where we ask respondents to choose between the following two statements, which measure the extent of perceived regressivity or progressivity in the system: 1) most taxes are paid by small taxpayers; or 2) those with

---

27 These include the RRA Tax Handbook (https://tax-handbook.rra.gov.rw/), the RRA website, live chat, phone, email, or through social networks.

28 The transcript for both videos is available in Appendix 2, and they are also available to watch online. See https://www.youtube.com/watch?v=1UxFQ57EIq0&feature=youtu.be for video 1 and https://www.youtube.com/watch?v=c5zALgtZTmA& feature=youtu.be for video 2.

29 We believe that taxpayers overestimate the actual audit probability. The average perceived audit likelihood is a strikingly high 92 per cent. Two-thirds of the sample believe the likelihood is 100 per cent – they are sure they would get caught by the RRA if evading. This can be compared, for instance, to the actual probability of having received any type of audit in the previous 12 months, which amounts to 25 per cent. Interestingly, very little difference in perceived probability exists between those audited (92.2 per cent) and those not (91.6 per cent). This not something specific to Rwanda, but has been documented in other contexts, such as Eswatini (Santoro 2021). More generally, this is likely to suggest the existence of computational biases from bounded rationality, as framed in detail by the prospect theory (Kahneman and Tversky 1979; Dhami and al Nowaihi 2007).

higher income pay more than those with lower income.[30] We then build a dummy taking the value of 1 if they choose the second statement, indicating better perceptions about equity.

While we expect each video to affect the outcome most directly related to its content (i.e. detection probability for the deterrence video and progressivity perceptions for the equity video), we also check the videos' impact on all outcomes to capture any effect across outcomes. For example, some studies from the tax experiment literature hypothesise that messages related to tax morale might actually be perceived with an element of deterrence (e.g. Shimeles *et al*. (2017)). In our setting, we can directly test the hypothesis that the equity video might have affected perceptions around the probability of being caught, in addition to those around progressivity.

In addition to these two primary outcomes, we also use all other variables that we can observe at endline to gain a more complete picture of how the videos changed perceptions – even if they are less directly related to their main content. Appendix Table A2 reports all of them in detail, with the relevant questions. We are particularly interested in four of these additional outcomes. The first one is related to perceptions of the RRA's enforcement strategy, built from a question requesting whether taxpayers agree with the statement 'RRA enforcement strategy is too heavy in punishing taxpayers'. The second one is related to more general views on tax fairness, beyond the more specific issue about progressivity. We capture this more general perception with the direct question 'On a scale from 1 to 5, how fair and equitable do you believe that businesses like yours generally perceive the general tax system to be?'. The third one captures perceptions on compliance costs, from the question 'How difficult is it to comply with the tax system?'. Our videos might affect this outcome as they also indicate possible channels of communication to get information from the RRA. Finally, we also construct a variable for unconditional compliance or intrinsic willingness to comply, which features centrally in the literature on tax morale (Luttmer and Singhal 2014) and might be impacted by our treatments. The unconditional compliance outcome is built as a binary variable which takes the value of 1 if respondents think it is never justified to 'Pay cash without getting a receipt so as to avoid paying VAT or other taxes'.

In addition to being considered as additional outcome variables that might be affected by our treatments, we also use them to explore the mechanisms for the impacts we find on behaviour, as reported in section 3.4.

2.4.2 Behaviour

Outcomes on compliance behaviour are derived from RRA administrative data and capture the three dimensions of compliance described in section 1. We observe taxpayer filing behaviour for tax year 2019, as filed in early 2020. As explained in section 2.2.2, the relevant deadline for submitting declarations for that fiscal year is 31 March 2020. We observe all filings submitted up to end of June 2020, to capture those who filed late – up to three months after the deadline. Since the survey was implemented in January and February, at the beginning of the declaration period, the vast majority of taxpayers in the sample had not yet filed when exposed to the video treatments, so that behaviour is also observed post-treatment. As such, we test whether our treatments might have affected taxpayers' actual compliance decision, which was being made around the same time as the intervention.

We are able to observe three key dimensions of compliance, which we can observe for all taxpayers in our sample. First, we consider the extensive margin of compliance, proxied by the probability of filing a return (1 if non-filer, 0 otherwise), conditional on being registered. We then consider the intensive margin of compliance. The second outcome is the probability of nil-filing. This variable takes the value of one if the declaration is nil – including zero in all

[30] Taxpayers could also decide not to agree with either, but this option was not read out to them.

fields or not available at all (i.e. non-filer) – and zero otherwise. Third, we use the amount of tax liability declared, which is set to zero for non-filers and nil-filers while it is a positive number for active taxpayers.

2.5 Empirical framework

The identification strategy is straightforward, as our study is set up as an RCT. We regress our outcomes on video treatment dummies and taxpayer controls. The estimating equation is the following:

$$Y_i = \alpha + \beta_1 Deterrence_i + \beta_2 Equity_i + \theta_i Y_{i0} + X_i\Gamma + \epsilon_i \qquad (1)$$

The outcome Y_i is one of the variables from our two sets of outcomes of interest described in section 2.4, related to perceptions or behaviour and all observed post-treatment for taxpayer *i*. All perception outcomes are defined as binary variables, as well as the variables for non-filing and nil-filing. For these outcomes, equation 1 is estimated through a linear probability model. The analysis on tax amounts, which present excess mass at zero due to non- and nil-filing, requires a tobit model.

Since some taxpayers filed declarations before our survey and experimental videos took place, we cannot expect any effect on behavioural outcomes for this group. When evaluating these outcomes (see section 3.2) we therefore drop 127 taxpayers who filed before being exposed to the treatments – about 10 per cent of taxpayers assigned to the deterrence video and 9 per cent of those in the equity group. Crucially for our identification strategy, the random treatment assignment is orthogonal to early filing (p-value 42 per cent), and hence dropping early filers does not induce any imbalance. For this reason, the samples used for the analysis in sections 3.1 and 3.2 are slightly different.

The variables $Deterrence_i$ and $Equity_i$ in equation 1 indicate which treatment video taxpayer i has been assigned to. Therefore, β_1 and β_2 stand for the intention-to-treat (ITT) estimate of impact of our two treatments. The set of control variables X_i includes the strata used in the randomisation (see section 2.2.2) to assure valid inference (McKenzie 2012) and additional taxpayer-level controls to increase power.[31] The error term ϵ_i is clustered at the taxpayer level and robust to heteroskedasticity. We also include the baseline outcome variable Y_{i0} as a pre-treatment control, which helps reduce the variance of the error term, and thus results in gains in statistical power (McKenzie 2012).[32] To control for the oversampling of active and urban taxpayers explained in section 2.2.2, we also reweight observations to make the sample representative of the broader population of taxpayers.

An additional specification calculates the impact of videos on taxpayers who actually saw them. The vast majority (94 per cent) accepted seeing the videos, but significant differences between them and those refusing emerge (Appendix Table A5). In order to avoid differential take-up affecting our results, we also produce Local Average Treatment Effects (LATE) estimates. LATE coefficients are derived by using an instrumental variable model where the actual exposure to the treatment letter is instrumented by the random assignment to it (Angrist and Pischke 2009). LATE refers to the impact on compliers, which would be larger than the ITT estimates, given the partial video take-up.

---

[31] The controls used in the regressions are the following: being a CIT payer, being located in Kigali, being registered for VAT, gender, age groups, indicator variables for higher education, having a tax accountant, keeping account books and a 1–5 index for attitudes towards risk.

[32] Note that a difference-in-differences estimation would not be possible in our setting because the variables are measured differently at baseline and endline, as reported in Appendix Table A2.

3 Results

3.1 Impact on tax attitudes and perceptions

Main perception outcomes. We start by looking at the videos' impacts on the two primary outcomes: probability of detection and progressivity, as defined in section 2.4 and Appendix Table A2. Columns 1 and 2 of Table 3.1 report results on the first outcome, with and without controls, while columns 3 and 4 report results on the second one.

Our results show that the perceived probability of detection increases by 14 percentage points as a result of the deterrence video. In addition to being statistically significant, this impact is also economically large: given the control mean of 38 per cent, it corresponds to a 37 per cent increase. The coefficient does not change if we add controls and the baseline outcome in column 2. This result confirms that, unsurprisingly, the deterrence video was effective in improving the most relevant outcome on treated taxpayers. Consistently, the deterrence video has no impact on progressivity perceptions (col. 3-4).

Table 3.1 Impact of videos on probability of detection and progressivity

	(1)	(2)	(3)	(4)
	Prob. Detection	Prob. detection	Progressivity	Progressivity
Deterrence	0.14***	0.14***	-0.01	0.00
	(0.05)	(0.05)	(0.04)	(0.04)
Equity	0.06	0.06	0.13***	0.13***
	(0.04)	(0.04)	(0.04)	(0.04)
Baseline Y		0.19***		0.05
		(0.04)		(0.04)
Controls	No	Yes	No	Yes
Control mean	0.380	0.380	0.605	0.605
R-sq.	0.014	0.060	0.019	0.048
F equal test	0.060	0.049	0.000	0.000
Observations	1582	1582	1972	1972

Standard errors in parentheses. $*\ p < 0.10$, $**\ p < 0.05$, $***\ p < 0.01$. Outcome variables are defined in section 2.4 and Appendix Table A2.

The progressivity outcome is significantly affected by the equity video, as expected. As shown in columns 3 and 4 of Table 3.1, it leads to a significant increase of 13 percentage points in perceptions about progressivity. This effect is large, corresponding to a 22 per cent increase with respect to the control mean. This confirms that the message conveyed by the video was clear, as it focused on the progressivity of income taxation (sec. 2.3). As expected, the equity video does not affect the perceived audit probability (col. 1-2).

We also explore differences in impact across three important dimensions in the sample: the type of business, the location and the filing behaviour at baseline. For the first, when

comparing individuals and companies, we show that individuals drive most of the impacts on deterrence and progressivity (Appendix Table A6), albeit the companies' sub-group (which still shows positive coefficients) is rather small in size and therefore less powered to find significant results. For the second, the results show that deterrence is more effective in provinces, where the threat of enforcement may be perceived as more credible, while the equity video does not produce differential impacts according to taxpayers' location (Appendix Table A7). For the last dimension, while the equity video equally impacts non-filers, nil-filers and actives, the deterrence video is ineffective for nil-filers. Interestingly, the equity video increases perceived enforcement for nil-filers and actives (Appendix Table A8). These differences can help explain differential filing responses by filing categories described in section 3.2.

Additional perception outcomes. After having shown that both videos are effective in shaping their relevant outcomes, we now consider additional perceptions and attitudes. Table 3.2 looks at the impact of videos on the additional outcomes described in section 2.4.[33] We can draw five main considerations from these results, relating to the broader impact of our experimental videos.

First, column 1 of Table 3.2 shows that the deterrence video seems to decrease perceptions of the fairness of the tax system (see section 2.4). This significant effect, albeit small, might seem surprising because this video does not touch upon fairness aspects at all, so it was not expected to affect this outcome, either positively or negatively. However, this negative effect would be consistent with the possibility that deterrence messages might backfire or crowd out intrinsic motivation to comply. This pattern has been documented in the broader compliance literature, including an existing field tax experiment in Rwanda (Mascagni and Nell 2021; Slemrod *et al*. 2001; Feld and Frey 2002).

Second, and relatedly: similar to the deterrence video seeming to adversely affect general fairness perceptions, the equity video also yields a negative and significant impact on this outcome (col. 1). Fairness perceptions decrease by 10 percentage points, or about a fifth of the control group mean. This negative result suggests that the equity video's impact is limited to the narrow issue of progressivity, which was a specific focus of this video – but that it failed to improve broader perceptions around fairness in the tax system. A somewhat speculative explanation is that broader perceptions around tax fairness are related to real experiences with the taxpaying process and government-citizen relations. Since the video does not affect these experiences, nor is it accompanied by any actual change (e.g. a new policy improving access to public services), it fails to boost these broader perceptions – although the key message about progressivity is internalised by respondents, as confirmed by the results presented in Table 3.1.

Third, the outcome related to perceptions on the severity of the RRA's enforcement strategy allows us to make an interesting link between deterrence and equity. While the deterrence video does not affect this outcome, the equity one does – and significantly so (col. 2). Taxpayers assigned to the equity video become less likely to see enforcement actions as being too heavy. This could be explained by the fact that these taxpayers come to value the importance of income taxes more for their progressive nature, and might therefore be more inclined to accept a greater level of enforcement from the authority.[34]

---

[33] None of the impacts on perceptions documented here are affected by heterogenous take-up of the treatment. Appendix Tables A9 and A10 report LATE estimates, which are very consistent with the ITT ones shown above.

[34] This impact, and the one on fairness, are the only two estimates that retain their high significance once controlled for the family-wise error rate when performing multiple hypothesis tests, through a Westfall-Young approach (Westfall and Young 1993).

Fourth, neither video seems to have a significant effect on perceptions around complexity and compliance costs: both the ease of dealing with tax affairs and the ease of getting in touch with the RRA (respectively, columns 3 and 4 of Table 3.2). This might not be surprising, as these aspects were only briefly mentioned in the videos, but they were not the main focus of any of them.

Finally, no change is produced by any of the videos on our indicator for unconditional compliance (*Never justify*). This null result resonates with the fact that while the videos shaped the specific perceptions they are more directly addressing – the probability of detection and progressivity – they are ineffective in affecting broader, more general attitudes towards compliance.

As a further set of results, we aim to better explain the puzzling findings on fairness. First, Appendix Table A16 shows impact estimates by splitting the sample according to prior perceptions – dividing it between those with low and those with high perceptions of fairness. Interestingly, the negative impact of the deterrence video on fairness is totally due to the subgroup with high fairness perceptions at baseline (col. 2). This probably suggests that these taxpayers updated their conception of fairness after better understanding the penalty structure for non-compliance, which they might consider too strict. At the same time, the negative effect of the equity video on fairness affects both subgroups, with a stronger effect, again, on those with higher priors.

Second, Appendix Table A17 splits the sample by size. The equity video stresses the progressive nature of the income tax rate, and hence it is prudent to check its impact on subgroups of different sizes, as they would differently appreciate the progressive rate and, hence, adjust their fairness considerations. If anything, Table A17 indicates that the backfiring effect of the equity video is totally attributable to smaller taxpayers (col. 1), despite them being characterised by a lower tax rate. Despite the video making this aspect clear, smaller taxpayers are negatively updating their fairness perception, probably due to a misunderstanding of the tax structure or a disappointment reaction around the disclosed tax rate structure, as they probably underestimated their tax burden. Lastly, it is again this sub-group which drives the crowding-out effect on fairness of the deterrence video, even if only weakly significantly so (col. 1).

Table 3.2 Impact of videos on additional perceptions

	(1)	(2)	(3)	(4)	(5)
	Fairness	Heavy RRA	Ease of compliance	Ease of contact	Never justify
Deterrence	-0.09**	-0.05	0.02	0.01	0.02
	(0.04)	(0.03)	(0.04)	(0.04)	(0.03)
Equity	-0.10***	-0.09***	0.07*	-0.05	0.00
	(0.04)	(0.03)	(0.04)	(0.04)	(0.03)
Baseline Y	0.17***	-0.07**	0.29***	-	0.28***
	(0.04)	(0.03)	(0.03)	-	(0.04)
Controls	Yes	Yes	Yes	Yes	Yes
Control Mean	0.496	0.815	0.451	0.530	0.888
R-sq.	0.060	0.038	0.095	0.023	0.119
F Equal Test	0.021	0.293	0.235	0.192	0.703
Observations	1953	1911	1958	1953	1965

Standard errors in parentheses. $* p < 0.10$, $** p < 0.05$, $*** p < 0.01$. Outcome variables are defined in section 2.4 and Appendix Table A2.

3.2 Impact on compliance behaviour

Impacts After having measured the impact on tax perceptions, we now turn to estimating any causal change in taxpayers' actual behaviour. Table 3.3 reports the estimated treatment effects on behavioural outcomes, as defined in section 3.4.[35] Columns 1 and 2 consider the probability of filing a return, which indicates the extensive margin of compliance conditional on being registered. Results show that the treatments are not affecting the extensive margin of compliance – non-filing (columns 1-2 of Table 3.3). This suggests that the filing decision is not easily shaped by short communications, either centred around deterrence or equity. This could be explained by the fact that more intense interventions, such as tax trainings (Mascagni *et al*. 2019), may be needed to nudge taxpayers into filing.

Columns 3 and 4 of Table 3.3 focus on the probability of filing zero, including both non- and nil-filers, while the last two columns look at the tax amount remitted. These results show that the deterrence video in particular has a weak significant impact on the two outcomes related to the intensive margin, especially so when controls are added. It reduces the extent of nil-filing by 4 percentage points (column 4), or 8 per cent of the control group mean, and increases tax due by 1.89 logs, or 40 per cent (column 6). Although the coefficients are only significant at the 10 per cent level, these estimates suggest an economically large impact of the deterrence video. This effect is consistent with the significant increase in the perceived probability of detection we document in section 3.1. Despite any possible backfiring effect on

[35] As for perceptions, our results do not change when we instrument actual exposure to the videos with the random assignment to it – so to control for heterogenous video take-up. LATE estimates are reported in Appendix Table A11. If anything, impact estimates on log tax improve with statistical precision.

fairness and fiscal exchange, the impact on the probability of being caught seems to translate into better compliance behaviour for those that file a declaration, while it has no impact on the probability of submitting one. The large and significant results of deterrence on behaviour are in line with findings from the literature, where interventions focused on enforcement often yield large effects (Castro and Scartascini 2013; Basri, Felix, Hanna and Olken 2019; Mascagni and Nell 2021; Mascagni, Mengistu and Woldeyes 2021).

Table 3.3 Impact of videos on filing behaviour

	(1)	(2)	(3)	(4)	(5)	(6)
	Non-filing	Non-filing	Nil-filing	Nil-filing	Tax (Log)	Tax (Log)
Deterrence	-0.01	-0.02	-0.03	-0.04*	1.93	1.89*
	(0.03)	(0.03)	(0.03)	(0.02)	(1.27)	(1.05)
Equity	-0.00	0.02	-0.02	0.00	1.04	0.17
	(0.03)	(0.03)	(0.02)	(0.02)	(1.28)	(1.07)
Controls	No	Yes	No	Yes	No	Yes
Control mean	0.337	0.337	0.520	0.520	4.725	4.725
R-sq.	0.000	0.209	0.001	0.216	-	-
F equal test	0.926	0.272	0.623	0.096	0.504	0.117
Observations	1896	1896	1896	1896	1885	1885

Standard errors in parentheses. $*\ p < 0.10$, $**\ p < 0.05$, $***\ p < 0.01$. Outcome variables are defined in section 2.4 and Appendix Table A2.

It is striking to observe in Table 3.3 that the equity video has no impact on any of the behavioural outcomes, in line with more mixed findings on moral appeals in the general literature (Mascagni 2018; Atinyan and Asatryan 2019). While this might be surprising, given the significant effects we document in section 3.1, the null effects are consistent with the fact that the equity video deteriorates general perceptions on fairness. In the next section, we attempt to provide some explanations around why deterrence improves compliance, but equity does not.

Benchmarking to tax nudge studies With the evidence here produced, we can benchmark the impacts of an innovative communication strategy to the broader literature on nudges to taxpayers. Focusing on behaviours – as the existing literature mostly looked at filing outcomes – our study confirms the higher power of deterrent threats in improving compliance, as compared to non-deterrent appeals. As documented in the review of over 40 randomised controlled trials in Atinyan and Asatryan (2019), deterrence nudges are much more effective than non-deterrence ones in curbing evasion. However, the impacts of the deterrence video measured in this study are higher (40 per cent) than the average treatment effect in the literature (from 5 to 15 percentage points).

We can also compare such findings with the existing thin evidence from Africa. Interestingly, the increase in tax liability we document here is in line with a much more intensive and costly nudge – a notice delivered through in-person visits in Ethiopia, which boosts recipients' tax payable by 38 per cent (Shimeles *et al*. 2017). When considering standard, letter-based, nudges, we find very limited support for deterrence motives improving compliance. In Eswatini, for instance, deterrence is just as effective as soft nudges, and for non-filers only

(Santoro *et al*. 2020), while, in Rwanda, deterrence is never impactful (Mascagni and Nell 2021). In Rwanda, nudges providing reminders on filing deadlines and explaining how public services are funded are sizeably effective – around a 55 per cent increase, more than the video impacts measured in this study – on tax liabilities (Mascagni and Nell 2021). Always in Rwanda, alternative communication strategies, such as in-person trainings on the tax system delivered to new registrations, significantly improve filing probability (a sizeable 56 per cent increase) but do not increase tax declared (Mascagni *et al*. 2019). When considering even more intense – and, again, expensive – interventions, tax audits in Rwanda, impact magnitudes are smaller than those found for the deterrent video. Kitsogiannis, Salvadori, Karangwa and Mukamana (2021) show that tax audits increase reported tax liabilities by about 12 per cent in the year after receiving the audit.

Heterogeneity Also in this case, we disaggregate the analysis by three key dimensions – type of business, location and filing behaviour – to understand heterogeneity in response. When we split the sample by CIT/PIT category, we obtain insignificant results, thus suggesting that the overall impact in Table 3.3 is not driven by a specific sub-group (Appendix Table A12). When location is considered, evidence is rather mixed – suggesting a positive impact of deterrence on nil-filing in Kigali, where, at the same time, taxpayers nudged with the equity video backfire and are more likely to fail to file. When considering filing behaviour at baseline, Appendix Table A14 shows that active taxpayers are the ones reacting across the three different filing outcomes. This finding is promising, as it indicates that those taxpayers who are likely to remit more taxes (the average log tax of active controls is much larger than non-filers' and nil-filers') respond more significantly to the videos.

Cost-benefit analysis A back of the envelope calculation indicates that the video experiment is highly cost-effective. Production costs have been relatively marginal, as the videos have been produced in-house, and the only main cost incurred, of about USD 1,000, relates to translation and voice recording. Based on similar communication tools we produced in other contexts we estimate that a communication and graphic design company in Africa would charge around USD 6,000 for the production of the two videos.

When it comes to the extra revenue generated by the experiment, we consider the impact estimates on tax declared from Table 3.3. The increase in tax is about 40 per cent over the control group mean (col. 6). With control taxpayers declaring about USD 365 each, the extra gain from each taxpayer is about USD 145. We then calculate the revenue gains by multiplying the individual gain by the number of taxpayers, 656, in that deterrence arm, the ones responding to the video. By doing this, we obtain an estimate of the revenue gain due to the deterrence video compared with the no-video control group. This estimate shows that the video experiment led to additional tax revenue of about USD 96,000. In this sense, the benefits far outweigh the production costs, resulting in a cost-benefit ratio of about 1:15.

3.3 The role of prior perceptions

As highlighted in section 3.2, our analysis of behavioural outcomes leaves some unanswered questions about the different impact that the two videos have on actual compliance behaviour and, more specifically, the null effect of the equity video – given some similar impact on perceptions. In this section, we therefore provide some additional results to explore the linkages between our results on perceptions and those on behaviour, which might shed light on those questions.

More specifically, we exploit our data on the level of perceptions ex-ante, before our video intervention. Taxpayers' prior perceptions of the tax system could play a significant role in explaining the difference in ex-post changes. We already controlled for baseline outcomes by including them in our main specification (section 2.5). Now we re-run our main specification by splitting the sample into two groups, depending on whether taxpayers had a low or high

perception for a particular aspect of the tax system. We define low and high prior perceptions by considering the baseline variables described in Appendix Table A2. For instance, a high (low) perceived deterrence would indicate a perceived audit likelihood above median, as measured before the video experiment. Results are reported in Table 3.4, where L and H indicate low/weak and high/strong baseline perceptions, respectively. The dependent variables are either nil-filing or tax amount (respectively in panels A and B), as these are the ones for which we would like to explore differences in the impact between deterrence and equity interventions.[36] Two sets of results emerge.

First, the deterrence video seems to be particularly effective for those who already have high perceptions on some key variables considered at baseline, namely: the probability of detection, fairness, and unconditional compliance. These results indicate that deterrence interventions become more effective in shaping behaviour when combined with positive prior perceptions. This is true for both outcomes of nil-filing (panel A) and tax remitted (panel B).

Second, we still find no significant effect of equity on any of the behavioural outcomes, even once we explore these results by subgroups. The fact that deterrence is only effective on those with 'good' baseline perceptions, while equity is not, might suggest that the deterrence is more effective in unlocking a response in presence of good priors, while equity is not enough.

Against this evidence, we present two further pieces of descriptive statistics that might shed some light on this null result. The first one is reported in Appendix Table A18, which measures the impact on perceptions by splitting the sample by low/high unconditional compliance at baseline. Columns 3 and 4 suggest that the equity video's positive impact on perceived progressivity is entirely driven by taxpayers with high unconditional compliance attitudes at baseline.[37]

The second piece of descriptive evidence consists in understanding the profiles of these two different subgroups and mapping the differences in compliance between those with high and low unconditional compliance attitudes. Appendix Table A19 summarises t-tests results when comparing the two groups. Taxpayers with high unconditional compliance are, indeed, more likely to be active filers and less likely to fail to file. Also, they are more likely to be older taxpayers, managing companies, better equipped in book-keeping and with a lower risk attitude. These taxpayers are driving the positive impact of the equity video on the corresponding outcomes (Table A18) – indicating that they might be already quite compliant to begin with, hence the limited change in behaviour. However, the puzzle remains as they are also more likely to be affected by the deterrence video and, in turn, improve their filing behaviour.

In conclusion, the results presented in this section are certainly indicative that prior perceptions, as captured by baseline perceptions, play some role in shaping our interventions' impact on behaviour. However, they do not fully explain why equity does not have any impact on compliance behaviour while deterrence does, despite affecting taxpayers with similar good priors. As shown in section 3.1, a possible explanation is that the equity video only marginally affected respondents' knowledge about progressivity, without shifting broader perceptions on fairness and fiscal exchange – which thus prevented it from changing behaviour. It might also be that, despite affecting the perceived probability of detection right after the video, this effect did not last as long as the one of the deterrence video, which stressed sanctions and punishment for evasion much more aggressively. While these

[36] For completeness, we report the same results for non-filing in Appendix Table A15.

[37] On a different note, it is worth mentioning that the backfiring effect of the deterrence video on perceived equity is attributable to taxpayers with low tax morale at baseline, suggesting caution in targeting with threat appeals those taxpayers least willing to comply.

explanations are plausible, they are very speculative, and we cannot fully test them with our data.

Table 3.4 Impact of videos on nil-filing and tax amount by baseline subgroups

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Det. L	Det. H	Equity L	Equity H	Fairness L	Fairness H	UC L	UC H
				Panel A: impacts on nil-filing				
Deterrence	-0.00	-0.07**	-0.05	-0.03	-0.00	-0.06**	-0.02	-0.05**
	(0.03)	(0.03)	(0.05)	(0.02)	(0.03)	(0.03)	(0.05)	(0.02)
Equity	0.04	-0.04	-0.02	0.01	0.02	-0.01	-0.06	0.01
	(0.03)	(0.03)	(0.04)	(0.02)	(0.04)	(0.03)	(0.06)	(0.02)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control Y	0.509	0.527	0.503	0.525	0.573	0.496	0.586	0.511
R-sq.	0.246	0.217	0.397	0.172	0.188	0.241	0.346	0.202
F Joint Test	0.222	0.063	0.548	0.268	0.811	0.113	0.613	0.051
Obs.	722	1174	423	1473	563	1333	270	1626
			Panel B:	*impacts on*	*log tax*	*amount*		
Deterrence	0.92	2.52*	3.33	1.37	-0.05	2.65**	0.16	2.33**
	(1.73)	(1.31)	(2.06)	(1.21)	(2.08)	(1.19)	(0.49)	(1.14)
Equity	-1.87	1.50	0.93	-0.16	-3.21	1.27	-0.20	0.35
	(1.82)	(1.31)	(1.90)	(1.26)	(2.41)	(1.17)	(0.54)	(1.16)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control Y	4.837	4.652	5.171	4.598	3.866	5.130	4.321	4.784
F Joint Test	0.311	0.154	0.259	0.396	0.334	0.085	0.771	0.098
Obs.	717	1168	419	1466	562	1323	270	1615

Standard errors in parentheses. $* p < 0.10$, $** p < 0.05$, $*** p < 0.01$. Outcome variables are defined in section 3.4 and Appendix Table A2.

4 Conclusions

In this paper, we tested the effectiveness of a cheap, easily scalable communication intervention on tax matters: a two-minute-long animated video on tax. On the one hand, we find that the deterrence video increases both the perceived probability of detection and actual compliance behaviour, while it seems to have a backfiring effect on perceptions around fairness. Remarkably, the impact on behaviour is sizeable and much larger than what is found in the tax nudge literature. On the other, the equity video improves perceptions around progressivity, but equally worsens more general views of fairness. In contrast to the deterrence video, we find no impact of this treatment on actual behaviour. In section 3.4 we attempt to shed some light on these questions by showing that prior perceptions matter when explaining behavioural impacts, although more research is certainly needed on this aspect.

Our study has a few limitations. First, we are unable to track shifts in attitudes over time. In spring 2020, the Covid-19 pandemic affected Rwanda and has significantly affected perceptions and attitudes, as shown in Mascagni and Santoro (2021). While our results on perceptions are not affected by the pandemic (no Covid-19 case was confirmed in Rwanda until over a month after our survey ended), any data collected after infections started spreading in Rwanda would be affected by it – as the pandemic hit Rwanda while declarations for the fiscal year analysed here (2019) were being filed. A separate study, using the same sample, shows that the crisis might have yielded a significant increase in compliance amongst some taxpayers (Mascagni and Santoro 2021). However, as we are comparing outcomes across groups that are randomly selected, our results should not be affected by the pandemic, which affected everyone equally.[38]

Due to the considerations above, it is difficult to measure whether the video effects persist over time. On the one hand, it is true that the measurement of endline perceptions took place just after the survey, hence the impacts we find are highly short-term. On the other, it is also true that we document positive impacts on filing, which took place several weeks after the intervention, suggesting that communication nudges might persist over time. More research is needed to understand how the frequency of communication inputs may improve compliance. Existing knowledge from nudge studies hints at very short-lived effects (Shimeles *et al*. 2017; Mascagni and Nell 2021) with the exception of more intense interventions (Mascagni *et al*. 2019).

Second, we are aware that experimenter demand effects can be at play, especially when asking follow-up questions that are similar in nature to those before the treatment, although we tried to structure them differently.[39] Taxpayers are virtually made to watch the videos, and they probably could not be sure that they had not been singled out in some way. In this sense, the deterrent effect we measure could be an upper-bound estimate of the real effect.

Third, we are aware that the lack of a placebo treatment implies a less clean design. Due to budget constraints, we could not afford to survey more respondents to allocate to this placebo treatment. Also, we are unsure what a placebo neutral video would look like.

The policy relevance of our findings is immediate. As explained in the introduction, the RRA, like many other tax administrations in Africa, is investing heavily in mass communication campaigns, employing more and more innovative delivery channels. The videos evaluated in

[38] Mascagni and Santoro (2021) find a significant impact of Covid-related tax relief (a postponement of the filing deadline) on tax remitted for fiscal year 2019. However, tax relief is orthogonal to the treatment assignment, both when we consider treatment 1 (p-value of 82 per cent) and treatment 2 (54 per cent). Hence, the exposure to the Covid crisis is unlikely to produce any bias in our results.

[39] The survey tool is available on request.

this paper could easily be replicated on TV or through social media, on which the RRA already has a strong presence and which taxpayers would like to use more for tax information (see section 1).[40] Also, the experiment is highly cost-effective, considering the limited production costs of about USD 6,000 and the large impact on revenue, amounting to an extra USD 96,000 (RWF 95 mln). The resulting cost-benefit ratio is about 1:15.

At the same time, the evidence produced in this study suggests some caution in replicating the same video content on a broader scale. An important policy lesson is that communication appeals could easily backfire, crowding-out important intrinsic motivations to comply, such as fairness considerations. The tax administration should be careful in designing such appeals, especially given the fact that specific subgroups of taxpayers – such as those with poorer attitudes – are not responding. Importantly, such taxpayers have worse filing outcomes and therefore a higher revenue potential for the tax agency.

Finally, and importantly, the null result of the equity video on behaviour does not necessarily imply that moral appeals are not effective in shaping behaviour more generally than the specific intervention tested here. An important caveat of our intervention is that it provided information on equity and progressivity, but it did not come with any actual policy change on any of these aspects. It is quite plausible that taxpayers' broader perceptions about fairness and fiscal exchange are shaped more by real interaction with tax officials and the government more generally, rather than by a short informational video with no actual change to substantiate the key messages. More research is certainly needed in this area.

[40] Consistent with this experiment (videos were shown by an independent research team), broadcasting the videos on TV or social media would provide a setting in which the presence of the RRA would not be obvious and messages would not be delivered in a personalised way that might represent an element of deterrence to taxpayers (like letters, SMS or personal visits).

Appendices

Appendix A List experiment

List experiments or item-count techniques provide a less obtrusive way of asking sensitive questions. The respondent is asked to indicate the number of items on a list of behaviours they engage in or agree with – they are asked to report the total number of items and not to indicate which specific item they agree with. The experiment consists in providing some respondents with a list that contains a set of items which are by design not controversial, and randomly assigning other respondents to a list with an additional sensitive item. By measuring the difference in the number of items selected by the two groups of respondents, one can estimate the level of support for or incidence of the sensitive item within the sample (Imai 2011). In the survey we also ask the sensitive questions directly, and thus are able to compare how the list experiments perform in revealing true answers.

As far as income underreporting is concerned, the findings of the list experiment are generally inconclusive. The non-sensitive item list included *I met a client or business partner in person*, *I have travelled out of Rwanda for business*, *I did NOT use my phone to make business calls* and *all my clients are based in Rwanda*. In the latter list, the sensitive item added was *I did not report all my sales in my tax return*. The results do not show any increase in self-reported tax evasion between the count in the non-sensitive item list (1.76) and the sensitive item list (1.74). The only subgroup who shows an increase in the outcome is the nil-filers one, even though the increase is small (5 per cent) and not statistically significant. All the other sub-groups, such as PIT/CIT, gender and location, do not show any change in item counts when the sensitive item is added.

When considering fairness, the non-sensitive item list included *I am proud to be a Rwandan citizen*, *it is easy to file taxes*, *I do NOT know any other trader/businessman* and *it is pretty hard to understand the tax system*. Results show an increase in the item count when the sensitive item (*the tax system is unfair*) is added to the non-sensitive item list, from 1.99 to 2.18. That means that about 20 per cent of the sample thinks that the tax system is unfair. However, this result is slightly lower than what emerged from the direct question. This means that there seems to be no bias on the taxpayers' side in reporting unfairness. Some groups experience a more prominent disclosure of unfairness perceptions, such as CIT (24 per cent), taxpayers outside of Kigali (26 per cent), male taxpayers (23 per cent) and actives (23 per cent). Surprisingly enough, non-filers are the least likely to believe that the system is unfair (8 per cent).

Regarding trust in and perceived professionalism of the RRA, we included an additional list experiment. The non-sensitive list was the same as the one above, while the sensitive item was *sometimes RRA officials are incompetent/unprofessional*. Results show that about 24 per cent of the sample believe that the RRA is unprofessional – a slightly higher percentage than for the indicator on trust, but in line with the results on the incidence of bribes. We find a higher incidence of this perception for CIT (24 per cent), outside of Kigali (27 per cent), male taxpayers (23 per cent) and nil-filers (29 per cent). The latter in particular is in line with the greater distrust that nil-filers have towards the RRA. While perceptions of professionalism and trust are generally good in Rwanda, even in the list experiment, there is some scope for improvement in this area as a sizeable minority of taxpayers view the RRA as unprofessional.

Appendix B Video transcripts

B1 Video 1 – Deterrence

It is important to file your taxes correctly and on time. Here are some examples of cases that are common across Rwanda:

Amahoro is a sole trader registered for income tax in Huye. She has been operating this year but, when the deadline for declaring her income tax arrives on March 31, she forgets to file her return. Now, Amahoro risks being charged for non-filing according to the income tax law. In this case, Amahoro will be charged a penalty of RWF 100K, 300K or 500K for non-filing depending on her annual turnover. In addition, a penalty for late declaration ranging from 20 per cent to 60 per cent of the tax due and an interest rate of 1.5 per cent is applied to every month of delay.

John is a businessman in Kigali. He files his income tax return on time, but does not declare all his income, which results in a lower amount of tax to pay. Did you know that there are penalties for misreporting as well? If found out, John will be charged a fine ranging from 10 per cent to 20 per cent of the understatement, depending on the size of the understatement. In addition, John must pay 1.5 per cent of the undeclared amount in interest for each month of delay.

Now, let's see what happens to Angelique, another trader from Rubavu. When filing her tax return, she does not include all her expenses. By failing to report all her costs, she ends up paying a higher amount of tax than she should. To learn how to file correctly and pay the right amount, Angelique can consult the RRA or ask a tax accountant for help. Better book-keeping practices will also help her keep track of all her expenditure throughout the year so she doesn't end up having to pay more than she needs to again.

These cases are very common across Rwanda. Please, file your tax returns on time and correctly to avoid penalties and fines, and make sure to report all your costs so that you pay the right amount of tax!

You can check the RRA Tax Handbook for more information [https://tax-handbook.rra.gov.rw/]. If you have any questions, visit the RRA website and go to the Contact us page. You can get in touch via live chat, phone, email, or through social networks.

B.2 Video 2 – Equity

Do you know where tax revenue in Rwanda comes from? The majority comes from large and medium-sized taxpayers, who contribute over 70 per cent of total tax revenue.

This is because Rwanda's tax system is structured so that richer taxpayers are taxed at a higher rate. Small taxpayers contribute too, but because their income is lower, they have a lower tax rate and therefore pay less tax. This makes the tax system fair, as citizens contribute according to their means, and it makes society more equitable.

Now, do you know how tax revenue is spent in Rwanda? Taxes pay for the government to function and deliver public goods and services to Rwandans, such as education, health, housing development, transport infrastructure, and security.

RWF 131.5 billion of tax revenue is spent on public order and safety, including the operation of the police force.

Based on a Gallup World Poll, Rwanda is one of the countries in the world where citizens feel the most safe, with the same score in the Law and Order Index as Belgium and New Zealand. Rwandans report feeling much more safe walking alone at night where they live, being robbed or assaulted far less often, and feeling more confident in their local police force than citizens of neighbouring countries (show scores: Rwanda 83, Tanzania 77, Kenya 70, Uganda 62).

RWF 232.5 billion of tax revenue is spent on health. This helps ensure that Rwandans can access treatment when they get injured or sick.

For example, Lucie is Ubuhede 1. If her son gets sick and needs medication or hospitalisation, the cost of her Mutuelle de Sante contributions are funded by the government.

While she may have to pay a small fee, 90 per cent of her son's costs in the hospital will be covered by the government with tax revenues.

RWF 278 billion of tax revenue is spent on education.

RWF 131.8 billion is spent on housing development and community amenities like water supply.

As you can see, the government uses tax revenue to provide public goods and services that all Rwandans need.

The more tax that is collected, the more resources the government has to develop the country and improve Rwandans' quality of life.

Everyone benefits from this, no matter how much tax they pay, so these public services are especially beneficial for the poor.

That is what tax is all about: everyone pays according to their capacity, and everyone benefits from the taxes collected in the form of public goods and services.

Appendix C Figures

Figure A1 Sample location

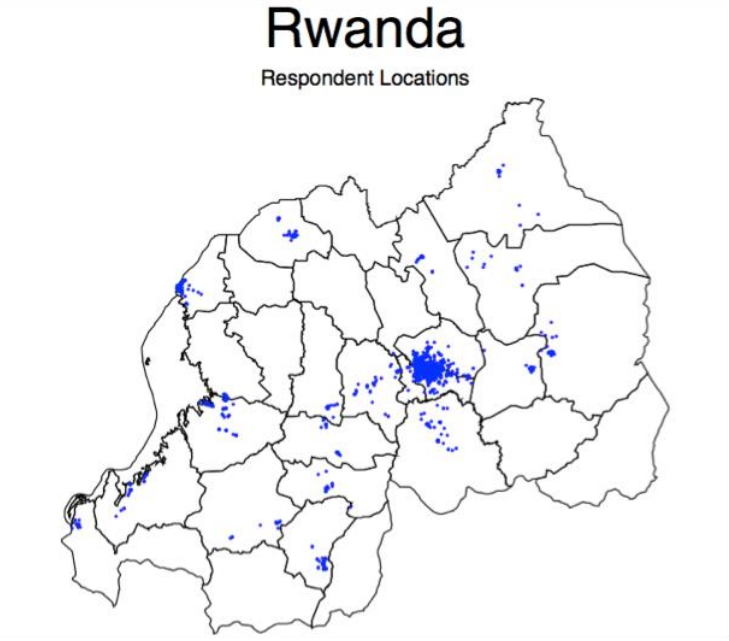
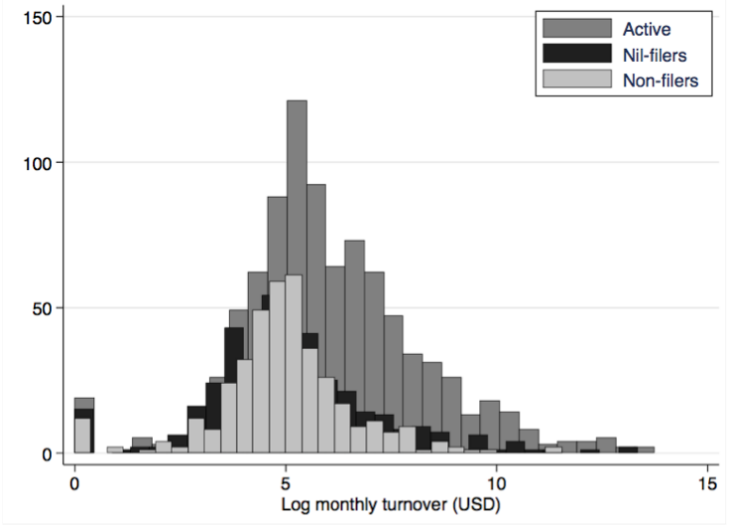


Figure A2 Log monthly turnover and taxpayer categories



Appendix D Tables

Table A1 Sample summary statistics at baseline

	N	Mean	SD	Min	Max
Active	2023	0.52	0.50	0.00	1.00
Nil-filer	2023	0.25	0.43	0.00	1.00
Non-filer	2023	0.23	0.42	0.00	1.00
PIT	2023	0.75	0.43	0.00	1.00
CIT	2023	0.25	0.43	0.00	1.00
Kigali	2023	0.62	0.48	0.00	1.00
VAT reg.	2023	0.20	0.40	0.00	1.00
Female	2023	0.34	0.48	0.00	1.00
Age group	2018	3.30	1.03	1.00	7.00
Educ. level	1967	5.13	2.32	1.00	8.00
Rwandan	2023	0.97	0.18	0.00	1.00
No social media	2023	0.24	0.43	0.00	1.00
No TV	2023	0.26	0.44	0.00	1.00
Owner	2023	0.82	0.39	0.00	1.00
Operative	2023	0.87	0.34	0.00	1.00
Tax accountant	2023	0.19	0.39	0.00	1.00
Hours on tax	1811	4.01	8.23	0.00	80.00
Has EBM	2023	0.12	0.32	0.00	1.00
Info from RRA	2023	0.53	0.50	0.00	1.00
Books	2023	0.46	0.50	0.00	1.00
Emails	2023	0.17	0.38	0.00	1.00
Bank	2023	0.32	0.47	0.00	1.00
Trade	2023	0.67	0.47	0.00	1.00
No employees	2018	0.54	0.50	0.00	1.00
Monthly sales USD	1655	5,947	44,645	0.00	932,923
N	2023				

Table A2 Variables description

Variable	Survey question	Description	Value
Prob. of detection endline	Imagine a taxpayer is evading taxes, what is the probability that this taxpayer will be selected for audit or review this year regarding their declaration, from 0% to 100%?	=1 if above median	45%
Prob. of detection baseline	If a taxpayer in Rwanda fails to submit a return, what is the likelihood that RRA will catch him, from 0% to 100%?	=1 if p=100%	67%
Heavy enforcement endline	Please tell me if you totally agree, somewhat agree, somewhat disagree, or totally disagree with the following statement: RRA enforcement strategy is too heavy in punishing taxpayers	=1 if totally/somewhat agree	77%
Easy to comply endline	How difficult is it to comply with the tax system?	=1 if very/somewhat easy	46%
Easy to comply baseline	What do you think about the general difficulty you have in complying with formal taxes?	=1 if very/somewhat easy	39%
Easy to contact RRA endline	How difficult is it to get in touch with RRA in order to get assistance with taxes?	=1 if very/somewhat easy	52%
Progressivity endline	Which of the following statements is closest to your view? Statement 1: most taxes are paid by small taxpayers; Statement 2: those with higher income pay more than those with lower income	=1 if yes to statement 2	65%
Progressivity baseline	According to you, how much do the richest taxpayers pay in terms of taxes?	=1 if more than small taxpayers	79.5%
Unfairness endline	On a scale from 1, very unfair, to 5, very fair, how fair and equitable do you believe that business like yours generally perceive the general tax system to be?	= 1 if very/somewhat unfair	28%
Unfairness baseline	According to you, is the following statement true or false: The tax system is unfair	= 1 if true	17%
Never justify endline	Please tell me for following statement whether you think it can always be justified, never be justified, or something in between. The range goes from 1 (never justified) to 5 (always justified): Paying cash with no receipt so as to avoid paying VAT or other taxes	= 1 if never justify	89%
Never justify baseline	Please tell me for following statement whether you think it can always be justified, never be justified, or something in between. The range goes from 1 (never justified) to 5 (always justified): Some people not paying the taxes on their income	= 1 if never justify	85%

Table A3 Mean differences by video assignment

	(1) No video		(2) Deterrence/complexity		(3) Equity/reciprocity		T-test difference		
Variable	N	Mean/SE	N	Mean/SE	N	Mean/SE	(1)-(2)	(1)-(3)	(2)-(3)
Active	694		656		673		-0.033	0.000	0.033
		0.513		0.546		0.513			
		(0.019)		(0.019)		(0.019)			
Nil-filer	694	0.246	656	0.239	673	0.262	0.007	-0.015	-0.022
		(0.016)		(0.017)		(0.017)			
Non-filer	694	0.241	656	0.215	673	0.226	0.026	0.015	-0.011
		(0.016)		(0.016)		(0.016)			
PIT	694	0.752	656	0.761	673	0.741	-0.009	0.011	0.019
		(0.016)		(0.017)		(0.017)			
CIT	694	0.248	656	0.239	673	0.259	0.009	-0.011	-0.019
		(0.016)		(0.017)		(0.017)			
Kigali	694	0.628	656	0.639	673	0.605	-0.010	0.023	0.034
		(0.018)		(0.019)		(0.019)			
VAT reg.	694	0.187	656	0.200	673	0.221	-0.012	-0.034	-0.022
		(0.015)		(0.016)		(0.016)			
Female	694	0.353	656	0.326	673	0.351	0.027	0.002	-0.024
		(0.018)		(0.018)		(0.018)			
Age group	694	3.298	655	3.293	669	3.321	0.005	-0.023	-0.028
		(0.038)		(0.040)		(0.041)			
Educ. level	680	5.159	636	5.050	651	5.174	0.109	-0.015	-0.123
		(0.090)		(0.089)		(0.092)			
Rwandan	694	0.971	656	0.966	673	0.967	0.005	0.004	-0.001
		(0.006)		(0.007)		(0.007)			
No social media	694	0.226	656	0.227	673	0.262	-0.001	-0.035	-0.034
		(0.016)		(0.016)		(0.017)			
TV watching freq.	693	3.059	652	3.064	673	3.030	-0.005	0.029	0.035
		(0.060)		(0.061)		(0.061)			
Owner	694	0.795	656	0.840	673	0.811	-0.045**	-0.016	0.029
		(0.015)		(0.014)		(0.015)			
Operative	694	0.853	656	0.867	673	0.878	-0.014	-0.025	-0.011
		(0.013)		(0.013)		(0.013)			
Tax accountant	694	0.179	656	0.186	673	0.192	-0.007	-0.013	-0.006
		(0.015)		(0.015)		(0.015)			
Hours on tax	621	3.739	590	4.185	600	4.125	-0.446	-0.386	0.060
		(0.313)		(0.346)		(0.347)			
Has EBM	694	0.112	656	0.111	673	0.123	0.001	-0.011	-0.012
		(0.012)		(0.012)		(0.013)			
Info from RRA	694	0.522	656	0.495	673	0.566	0.026	-0.045*	-0.071***
		(0.019)		(0.020)		(0.019)			
Books	694	0.488	656	0.439	673	0.455	0.049*	0.034	-0.016
		(0.019)		(0.019)		(0.019)			

Emails	672	0.167	640	0.167	662	0.198	-0.001	-0.031	-0.031
		(0.014)		(0.015)		(0.015)			
Bank	694	0.330	656	0.302	673	0.316	0.028	0.013	-0.015
		(0.018)		(0.018)		(0.018)			
Trade	694	0.666	656	0.675	673	0.670	-0.010	-0.004	0.005
		(0.018)		(0.018)		(0.018)			
No employees	692	0.559	655	0.544	671	0.526	0.016	0.033	0.017
		(0.019)		(0.019)		(0.019)			
Monthly sales USD	559	7511.164	539	3244.550	557	6993.547	4266.614*	517.618	-3748.997
		(2194.334)		(915.104)		(2234.361)			

Notes: The value displayed for t-tests are the differences in the means across the groups. ***, **, and * indicate significance at the 1, 5, and 10 per cent critical level.

Table A4 Mean differences by video assignment

	(1)		(2)		(3)				T-test
	No video		Deterrence/complexity		Equity/reciprocity				difference
Variable	N	Mean/SE	N	Mean/SE	N	Mean/SE	(1)-(2)	(1)-(3)	(2)-(3)
Never justify	694	1.216	656	1.316	673	1.273	-0.099**	-0.057	0.042
		(0.025)		(0.032)		(0.030)			
Prob. of detection	634	91.235	603	92.048	624	92.085	-0.813	-0.850	-0.037
		(0.704)		(0.648)		(0.683)			
Trust in RRA	679	1.739	645	1.743	660	1.665	-0.003	0.074	0.077
		(0.035)		(0.035)		(0.034)			
Bribe in audit	694	0.256	656	0.232	673	0.211	0.025	0.045**	0.021
		(0.017)		(0.016)		(0.016)			
Services satisf.	694	4.268	656	4.192	673	4.239	0.076**	0.028	-0.048
		(0.025)		(0.027)		(0.028)			
Fiscal exchange	686	0.198	649	0.211	666	0.179	-0.013	0.020	0.032
		(0.015)		(0.016)		(0.015)			
Unfairness	655	0.276	622	0.270	638	0.226	0.006	0.051**	0.044*
		(0.017)		(0.018)		(0.017)			
Progressivity	679	0.794	640	0.817	658	0.775	-0.023	0.019	0.042*
		(0.016)		(0.015)		(0.016)			

Notes: The value displayed for t-tests are the differences in the means across the groups. ***, **, and * indicate significance at the 1, 5, and 10 per cent critical level.

Table A5 Mean differences by video take-up

	Refused		Tookup		
	Mean	Obs.	Mean	Obs.	Difference
Active	0.42	86	0.54	1243	-0.12**
Nil-filer	0.45	86	0.24	1243	0.22***
Non-filer	0.13	86	0.23	1243	-0.10**
PIT	0.64	86	0.76	1243	-0.12**
CIT	0.36	86	0.24	1243	0.12**
Kigali	0.72	86	0.61	1243	0.11**
VAT reg.	0.28	86	0.21	1243	0.07
Female	0.31	86	0.34	1243	-0.03
Age group	3.24	86	3.31	1238	-0.07
Educ. level	6.43	81	5.02	1206	1.41***
Rwandan	0.94	86	0.97	1243	-0.03
No social media	0.12	86	0.25	1243	-0.14***
TV watching freq.	2.98	85	3.05	1240	-0.08
Owner	0.64	86	0.84	1243	-0.20***
Operative	0.85	86	0.87	1243	-0.03
Tax accountant	0.26	86	0.18	1243	0.07
Hours on tax	4.48	66	4.14	1124	0.35
Has EBM	0.19	86	0.11	1243	0.07**
Info from RRA	0.56	86	0.53	1243	0.03
Books	0.52	86	0.44	1243	0.08
Emails	0.35	83	0.17	1219	0.18***
Bank	0.43	86	0.30	1243	0.13**
Trade	0.53	86	0.68	1243	-0.15***
No employees	0.42	86	0.54	1240	-0.12**
Monthly sales USD	10092.57	61	4858.52	1035	5234.05
N	1329				

Standard errors in parentheses. $*\ p < 0.10$, $**\ p < 0.05$, $***\ p < 0.01$. Outcome variables are defined in section 2.4 and Appendix Table A2.

Table A6 Impacts of videos on prob. of detection and progressivity

	(1)	(2)	(3)	(4)
	Det. PIT	Det. CIT	Prog. PIT	Prog. CIT
Deterrence	0.16***	0.09	0.01	-0.01
	(0.05)	(0.08)	(0.04)	(0.07)
Equity	0.08	0.00	0.14***	0.07
	(0.05)	(0.08)	(0.04)	(0.07)
Controls	Yes	Yes	Yes	Yes
Control Y	0.354	0.457	0.614	0.576
R-sq.	0.036	0.049	0.049	0.052
F Equal Test	0.093	0.249	0.001	0.253
Obs.	1179	403	1483	489

Standard errors in parentheses. $* p < 0.10$, $** p < 0.05$, $*** p < 0.01$. Outcome variables are defined in section 2.4 and Appendix Table A2.

Table A7 Impacts of videos on prob. of detection and progressivity

	(1)	(2)	(3)	(4)
	Det. Kigali	Det. provinces	Prog. Kigali	Prog. provinces
Deterrence	0.09*	0.19***	-0.01	0.03
	(0.05)	(0.07)	(0.05)	(0.06)
Equity	0.04	0.09	0.13***	0.14**
	(0.05)	(0.07)	(0.04)	(0.06)
Controls	Yes	Yes	Yes	Yes
Control Y	0.354	0.457	0.614	0.576
R-sq.	0.022	0.060	0.038	0.073
F Equal Test	0.343	0.140	0.001	0.040
Obs.	985	597	1224	748

Standard errors in parentheses. $* p < 0.10$, $** p < 0.05$, $*** p < 0.01$. Outcome variables are defined in section 2.4 and Appendix Table A2.

Table A8 Impacts of videos on prob. of detection and progressivity

	(1)	(2)	(3)	(4)	(5)	(6)
	Det. non-F	Det. nil-F	Det. active	Prog. non-F	Prog. nil-F	Prog. active
Deterrence	0.17**	0.09	0.13***	-0.02	0.09	0.01
	(0.07)	(0.06)	(0.04)	(0.06)	(0.06)	(0.04)
Equity	0.03	0.18***	0.10**	0.14**	0.17***	0.11***
	(0.07)	(0.06)	(0.04)	(0.06)	(0.05)	(0.04)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Control Y	0.385	0.347	0.394	0.620	0.538	0.629
R-sq.	0.049	0.041	0.030	0.061	0.064	0.045
F Equal Test	0.031	0.174	0.447	0.006	0.123	0.004
Obs.	364	383	835	451	489	1032

Standard errors in parentheses. $*p < 0.10$, $**p < 0.05$, $***p < 0.01$. Outcome variables are defined in section 2.4 and Appendix Table A2.

Table A9 Impacts of videos on main perceptions – LATE

	(1)	(2)	(3)	(4)
	Prob. detection	Prob. detection	Progressivity	Progressivity
Deterrence	0.15***	0.15***	-0.01	0.00
	(0.05)	(0.05)	(0.04)	(0.04)
Equity	0.06	0.06	0.14***	0.14***
	(0.05)	(0.04)	(0.04)	(0.04)
Controls	No	Yes	No	Yes
Baseline Y	No	Yes	No	Yes
Control Mean	0.380	0.380	0.451	0.451
R-sq.	0.010	0.056	0.020	0.049
F-stat				
Observations	1582	1582	1972	1972

Standard errors in parentheses. $*p < 0.10$, $**p < 0.05$, $***p < 0.01$. Outcome variables are defined in section 3.4 and Appendix Table A2.

Table A10 Impacts of videos on additional perceptions – LATE

	(1)	(2)	(3)	(4)	(5)
	Fairness	Heavy RRA	Ease of compliance	Ease of contact	Never justify
Deterrence	-0.09**	-0.06	0.02	0.01	0.02
	(0.04)	(0.03)	(0.04)	(0.04)	(0.03)
Equity	-0.11***	-0.10***	0.07*	-0.05	0.00
	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)
Controls	Yes	Yes	Yes	Yes	Yes
Baseline Y	Yes	Yes	Yes	No	Yes
Control Mean	0.496	0.815	0.451	0.530	0.888
R-sq.	0.058	0.037	0.096	0.023	0.119
Observations	1953	1911	1958	1953	1965

Standard errors in parentheses. $*p < 0.10$, $**p < 0.05$, $***p < 0.01$. Outcome variables are defined in section 2.4 and Appendix Table A2.

Table A11 Impacts of videos on filing behaviour – LATE

	(1)	(2)	(3)	(4)	(5)	(6)
	Non-filing	Non-filing	Nil-filing	Nil-filing	Tax (log)	Tax (log)
Deterrence	-0.01	-0.02	-0.03	-0.04*	0.40	0.45**
	(0.03)	(0.03)	(0.03)	(0.02)	(0.26)	(0.22)
Equity	-0.00	0.02	-0.02	0.00	0.22	0.01
	(0.03)	(0.03)	(0.03)	(0.02)	(0.26)	(0.22)
Controls	No	Yes	No	Yes	No	Yes
Control Mean	0.337	0.337	0.520	0.520	4.725	4.725
R-sq.	0.001	0.210	0.001	0.216	0.001	0.214
Observations	1896	1896	1896	1896	1885	1885

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

Table A12 Impacts of videos on filing behaviour

	(1)	(2)	(3)	(4)	(5)	(6)
	Non-filing PIT	Non-filing CIT	Nil-filing PIT	Nil-filing CIT	Tax PIT	Tax CIT
Deterrence	-0.01	-0.11	-0.03	-0.09	1.75	2.22
	(0.03)	(0.07)	(0.02)	(0.06)	(1.32)	(1.55)
Equity	0.03	-0.10	0.01	-0.05	0.20	-0.46
	(0.03)	(0.07)	(0.02)	(0.06)	(1.37)	(1.53)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Control Mean	0.414	0.105	0.586	0.320	3.988	7.056
R-sq.	0.087	0.305	0.091	0.393		
F Joint Test	0.483	0.233	0.293	0.310	0.362	0.188
Observations	1422	474	1422	474	1422	463

Standard errors in parentheses. $* p < 0.10$, $** p < 0.05$, $*** p < 0.01$. Outcome variables are defined in section 2.4 and Appendix Table A2.

Table A13 Impacts of videos on filing behaviour

	(1)	(2)	(3)	(4)	(5)	(6)
	Non-F Kigali	Non-F provinces	Nil-F Kigali	Nil-F provinces	Tax Kigali	Tax provinces
Deterrence	-0.01	-0.02	-0.05*	-0.03	1.89	1.94
	(0.03)	(0.04)	(0.03)	(0.03)	(1.25)	(1.69)
Equity	0.06*	-0.03	0.03	-0.03	-1.56	1.83
	(0.03)	(0.04)	(0.02)	(0.04)	(1.28)	(1.71)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Control Mean	0.326	0.357	0.534	0.496	4.783	4.626
R-sq.	0.259	0.164	0.295	0.156		
F Joint Test	0.044	0.812	0.021	0.614	0.027	0.432
Observations	1169	727	1169	727	1166	719

Standard errors in parentheses. $* p < 0.10$, $** p < 0.05$, $*** p < 0.01$. Outcome variables are defined in section 2.4 and Appendix Table A2.

Table A14 Impacts of videos on filing behaviour

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Non-filing			Nil-filing			Tax amount	
	Non-filers	Nil-filers	Actives	Non-filers	Nil-filers	Actives	Non-filers	Nil-filers	Actives
Deterrence	-0.00	0.04	-0.05**	-0.02	0.02	-0.06**	16.50*	-3.57	1.04**
	(0.03)	(0.05)	(0.02)	(0.02)	(0.04)	(0.03)	(9.54)	(3.18)	(0.52)
Equity	0.00	0.07	-0.03	-0.02	0.04	-0.02	10.94	-2.93	0.61
	(0.03)	(0.05)	(0.02)	(0.02)	(0.04)	(0.03)	(11.22)	(2.98)	(0.55)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control Y	0.940	0.246	0.098	0.988	0.819	0.157	0.066	1.668	8.452
R-sq.	0.062	0.084	0.044	0.105	0.136	0.054			
F Joint Test	0.987	0.362	0.073	0.417	0.646	0.071	0.132	0.453	0.141
Observations	455	441	1000	455	441	1000	455	441	989

Standard errors in parentheses. $* p < 0.10$, $** p < 0.05$, $*** p < 0.01$. Outcome variables are defined in section 2.4 and Appendix Table A2.

Table A15 Impacts of videos on non-filing by baseline subgroups

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Det. L	Det. H	Equity L	Equity H	Fairness L	Fairness H	UC L	UC H
Deterrence	-0.01	-0.02	-0.07	-0.00	0.04	-0.04	0.05	-0.03
	(0.04)	(0.04)	(0.07)	(0.03)	(0.05)	(0.04)	(0.07)	(0.03)
Equity	0.05	-0.02	-0.02	0.03	0.05	-0.00	0.00	0.02
	(0.04)	(0.04)	(0.05)	(0.03)	(0.05)	(0.03)	(0.07)	(0.03)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control Y	0.366	0.318	0.303	0.347	0.395	0.310	0.356	0.334
R-sq.	0.223	0.215	0.356	0.173	0.160	0.243	0.291	0.205
F Joint Test	0.246	0.775	0.542	0.597	0.566	0.376	0.701	0.244
Obs.	722	1174	423	1473	563	1333	270	1626

Standard errors in parentheses. $* p < 0.10$, $** p < 0.05$, $*** p < 0.01$. Outcome variables are defined in section 2.4 and Appendix Table A2.

Table A16 Impacts of videos on fairness perception by prior perceptions

	(1)	(2)
	Fairness low	Fairness high
Deterrence	0.02	-0.14***
	(0.07)	(0.05)
Equity	-0.12*	-0.10**
	(0.06)	(0.05)
Controls	Yes	Yes
Control Mean	0.337	0.568
R-sq.	0.066	0.042
F Equal Test	0.073	0.012
Observations	575	1378

Standard errors in parentheses. $* p < 0.10$, $** p < 0.05$, $*** p < 0.01$. Outcome variables are defined in section 2.4 and Appendix Table A2.

Table A17 Impacts of videos on fairness perception by size groups

	(1)	(2)
	Sales below median	Sales above median
Deterrence	-0.12*	-0.02
	(0.06)	(0.06)
Equity	-0.18***	-0.03
	(0.06)	(0.06)
Controls	Yes	Yes
Baseline outcome	Yes	Yes
Control Mean	0.460	0.498
R-sq.	0.094	0.069
F Equal Test	0.375	0.864
Observations	760	843

Standard errors in parentheses. $* p < 0.10$, $** p < 0.05$, $*** p < 0.01$.
Outcome variables are defined in section 2.4 and Appendix Table A2.

Table A18 Impact on perceptions by low (L) or high (H) unconditional compliance at baseline

	(1)	(2)	(3)	(4)
	Prob. detection		Progressivity	
	Low UC	High UC	Low UC	High UC
Deterrence	0.10	0.16***	-0.17**	0.03
	(0.11)	(0.05)	(0.09)	(0.04)
Equity	0.10	0.04	-0.02	0.16***
	(0.12)	(0.05)	(0.09)	(0.04)
Controls	Yes	Yes	Yes	Yes
Control Y	0.323	0.388	0.675	0.595
R-sq.	0.118	0.030	0.087	0.046
F Equal Test	0.985	0.021	0.077	0.002
Obs.	233	1349	293	1679

Standard errors in parentheses. $*\ p < 0.10$, $**\ p < 0.05$, $***\ p < 0.01$. Outcome variables are defined in section 2.4 and Appendix Table A2.

Table A19 Mean differences by low and high unconditional compliance at baseline

	Low		High		
	Mean	Obs.	Mean	Obs.	Difference
Active	0.44	297	0.54	1726	-0.09***
Nil-filer	0.26	297	0.25	1726	0.01
Non-filer	0.30	297	0.22	1726	0.08***
CIT	0.19	297	0.26	1726	-0.07***
Kigali	0.67	297	0.62	1726	0.06*
VAT reg.	0.19	297	0.20	1726	-0.01
Female	0.35	297	0.34	1726	0.01
Age group	3.18	296	3.33	1722	-0.15**
High education	0.36	289	0.37	1678	-0.02
Tax accountant	0.18	297	0.19	1726	-0.01
Books	0.41	297	0.47	1726	-0.06**
Risk attitude	2.24	296	1.89	1725	0.36***
No employees	0.56	296	0.54	1722	0.02
Monthly sales USD	2624.67	225	6470.21	1430	-3845.54
N	2023				

Standard errors in parentheses. $*\ p < 0.10$, $**\ p < 0.05$, $***\ p < 0.01$. Outcome variables are defined in section 2.4 and Appendix Table A2.

References

Acemoglu, D., Cheema, A., Khwaja, A. and Robinson, J. (2020) 'Trust in State and Nonstate Actors: Evidence from Dispute Resolution in Pakistan', *Journal of Political Economy* 128.8

Alessandro, M., Cardinale Lagomarsino, B., Scartascini, C., Streb, J. and Torrealday, J. (2021) 'Transparency and Trust in Government. Evidence from a Survey Experiment', *World Development* 138.105223

Allingham, M.G. and Sandmo, A. (1972) 'Income Tax Evasion: A Theoretical Analysis', *Journal of Public Economics* 1.3–4: 323–338

Almunia, M., Gerard, F., Hjort, J., Knebelmann, J., Nakyambadde, D., Raisaro, C. and Tian, L. (2017) *An Analysis of Discrepancies in Tax Declarations Submitted Under Value-added Tax in Uganda. Final Report S-43312-UGA-1,* International Growth Centre

Angrist, J.D. and J.-S. Pischke (2009) *Mostly Harmless Econometrics: An Empiricist's Companion*, 1st ed., Princeton University Press

Ariel, B. (2012) 'Deterrence and Moral Persuasion Effects on Corporate Tax Compliance: Findings from a Randomized Controlled Trial', *Criminology* 50.1: 27–69

Atinyan, A. and Asatryan, Z. (2019) *Nudging for Tax Compliance: A MetaAnalysis.* Discussion Paper 19-055, ZEW – Leibniz Centre for European Economic Research

Bachas, P., Brockmeyer, A. and Semelet, C. (2020) *The Impact of COVID-19 on Formal Firms: Micro Tax Data Simulations Across Countries*, Policy Research Working Paper 9437, World Bank Group

Banerjee, A., La Ferrara, E. and Orozco-Olvera, V.H. (2019) *The Entertaining Way to Behavioral Change: Fighting HIV with MTV*, Policy Research Working Paper 8998, Washington, DC: World Bank

Basri, M.C., Felix, M., Hanna, R. and Olken, B.A (2019) *Tax Administration vs. Tax Rates: Evidence from Corporate Taxation in Indonesia*, Working Paper 26150, National Bureau of Economic Research

Bergolo, M., Ceni, R., Cruces, G., Giaccobasso, M. and Perez-Truglia, R. (2019) *Tax Audits as Scarecrows. Evidence from a Large-Scale Field Experiment*, IZA Discussion Papers 12335, Institute of Labor Economics (IZA)

Besley, T. and Persson, T. (2013) 'Taxation and Development', in A. Auerbach, R. Chetty, M. Feldstein and E. Saez (eds), *Handbook of Public Economi*cs, Volume 5, Amsterdam: North-Holland: 51–110

Biddle, N., Fels, K. and Sinning, M. (2017) *Behavioral Insights and Business Taxation: Evidence from Two Randomized Controlled Trials*, IZA Discussion Papers 10795, Institute of Labor Economics (IZA)

Blair, R., Karim, S. and Morse, B. (2019) 'Establishing the Rule of Law in Weak and War-torn States: Evidence from a Field Experiment with the Liberian National Police', *American Political Science Review* 113.3: 641–657

Bott, K., Cappelen, A.W. and Sørensen, E.Ø. (2014) *You've Got Mail: A Randomised Field Experiment on Tax Evasion*, Discussion Paper 26/2014, Department of Economics, Norwegian School of Economics

Brockmeyer, A., Smith, S., Hernandez, M. and Kettle, S. (2019) 'Casting a Wider Tax Net: Experimental Evidence from Costa Rica', *American Economic Journal: Economic Policy* 11.3: 55–87

Carrillo, P., Pomeranz, D. and Singhal, M. (2017) 'Dodging the Taxman: Firm Misreporting and Limits to Tax Enforcement', *American Economic Journal: Applied Economics* 9.2: 144–64

Castro, L. and Scartascini, C. (2013) 'Tax Compliance and Enforcement in the Pampas: Evidence from a Field Experiment', *Journal of Economic Behavior and Organization* 116: 65–82

Chirico, M., Inman, R.P., Loeffler, C., MacDonald, J. and Sieg, H. (2016) 'An Experimental Evaluation of Notification Strategies to Increase Property Tax Compliance: Free-Riding in the City of Brotherly Love', *Tax Policy and the Economy* 30: 129–161

Cowell, F. and Gordon, J. (1988) 'Unwillingness to Pay', *Journal of Public Economics* 36: 305–321

Cruces, G., Perez-Truglia, R. and Tetaz, M. (2013) 'Biased Perceptions of Income Distribution and Preferences for Redistribution: Evidence from a Survey Experiment', *Journal of Public Economics* 98: 100–112

De Neve, J.-E., Imbert, C., Spinnewijn, J., Tsankova, T. and Luts, M. (2019) *How to Improve Tax Compliance? Evidence from Population-wide Experiments in Belgium*, Working Paper, University of Warwick

Del Carpio, L. (2014) 'Are the Neighbors Cheating? Evidence from a Social Norm Experiment on Property Taxes in Peru', mimeo, INSEAD

Dhami, S. and al Nowaihi, A. (2007) 'Why Do People Pay Taxes? Prospect Theory Versus Expected Utility Theory', *Journal of Economic Behavior and Organization* 64.1: 171–92

Doerrenberg, P. and Peichl, A. (2018) *Tax Morale and the Role of Social Norms and Reciprocity: Evidence from a Randomized Survey Experiment*, IZA Discussion Papers 11714, Institute of Labor Economics (IZA)

Elffers, H., Weigel, R.H. and Hessing, D.J. (1987) 'The Consequences of Different Strategies for Measuring Tax Evasion Behavior', *Journal of Economic Psychology* 8.3: 311–337

Falkinger, J. (1988) 'Tax Evasion and Equity: A Theoretical Analysis', *Public Finance* 43: 388–395

Feld, L.P. and Frey, S.B. (2002) *Deterrence and Morale in Taxation: An Empirical Analysis*, CESifo Working Paper 760, Munich: CESifo

Fellner, G., Sausgruber, R. and Traxler, C. (2013) 'Testing Enforcement Strategies in the Field: Legal Threat, Moral Appeal and Social Information', *Journal of the European Economic Association* 11.3

Fergusson, L., Molina, C.A. and Robinson, J.A. (2020) *The Weak State Trap*, Working Paper 25, Documentos CEDE 018248, Universidad de los Andes, Facultad de Economía, CEDE

Fiorella, L., van Gog, T., Hoogerheide, V. and Mayer, R.E. (2017) 'It's All a Matter of Perspective: Viewing First-Person Video Modeling Examples Promotes Learning of an Assembly Task', *Journal of Educational Psychology* 109.5: 653–665

Fisman, R., Gladstone, K., Kuziemko, I. and Naidu, S. (2020) 'Do Americans Want to Tax Wealth? Evidence from Online Surveys', *Journal of Public Economics* 188

Flores-Macias, G. (2018) 'Building Support for Taxation in Developing Countries: Experimental Evidence from Mexico', *World Development* 105: 13–24

Green, D.P., Wilke, A.M. and Cooper, J. (2020) 'Countering Violence Against Women by Encouraging Disclosure: A Mass Media Experiment in Rural Uganda', *Comparative Political Studies* 53.14: 2283–2320

Hallsworth, M. (2014) 'The Use of Field Experiments to Increase Tax Compliance', *Oxford Review of Economic Policy* 30.4: 658–679

Hasseldine, J., Hite, P.A., James, S. and Toumi, M. (2007) 'Persuasive Communications: Tax Compliance Enforcement Strategies for Sole Proprietors', *Contemporary Accounting Research* 24.1

Hessing, D.J., Elffers, H. and Weigel, R.H. (1988) Exploring the Limits of Self-reports and Reasoned Action: An Investigation of the Psychology of Tax Evasion Behavior', *Journal of Personality and Social Psychology* 54.3: 405–413

Hoy, C. and Mager, F. (2021) 'Why Are Relatively Poor People Not More Supportive of Redistribution? Evidence from a Randomized Survey Experiment across Ten Countries' *American Economic Journal: Economic Policy* 13.4: 299–328

Imai, K. (2011) 'Multivariate Regression Analysis for the Item Count Technique', *Journal of the American Statistical Association* 106.494: 407–416

IMF (2020) *Sub-Saharan Africa: A Difficult Road to Recovery*, Regional Economic Outlook, International Monetary Fund

IMF (2019) *Fiscal Policy and Development: Human, Social, and Physical Investments for the SDGs*, Technical Report, IMF Policy Paper, Washington DC

Kahneman, D. and Tversky, A. (1979) 'Prospect Theory: An Analysis of Decision under Risk', *Econometrica* 47.2: 263–92

Kettle, S., Hernandez, M.A., Ruda, S. and Sanders, M. (2016) *Behavioral Interventions in Tax Compliance: Evidence from Guatemala*, Policy Research Working Paper WPS 7690, Washington, D.C.: World Bank Group

Khan, A., Nasim, S., Shaukat, M. and Stegmann, A. (2021) 'Building Trust in the State with Information: Evidence from Urban Punjab', *Journal of Public Economics* 202: 104494

Kotsogiannis, C., Salvadori, L., Karangwa, J. and Mukamana, T. (2021) *Do Tax Audits Have a Dynamic Impact? Evidence from Corporate Income Tax Administrative Data*, TARC Discussion Paper 035-21, Exeter: Tax Administration Research Centre

Kleven, H.J., Knudsen, M.B., Kreiner, C.T., Pedersen, S. and Saez, E. (2011) 'Unwilling or Unable to Cheat? Evidence From a Tax Audit Experiment in Denmark', *Econometrica* 79.3: 651–692

Lees, A., Mascagni, G. and Santoro, F. (2020) *Simulating the Impact of COVID-19 on Formal Firms in Rwanda*, MTI Practice Notes 9J, World Bank

Lefebvre, M., Pestieau, P., Riedl, A. and Villeval, M.C. (2015) 'Tax Evasion and Social Information: An Experiment in Belgium, France, and the Netherlands', *International Tax and Public Finance* 22.3: 401–425

Ligomeka, W. (2019) *Assessing the Performance of African Tax Administrations: A Malawian Puzzle*, African Tax Administration Paper 14, Brighton: Institute of Development Studies

Luttmer, E. and Singhal, M. (2014) 'Tax Morale', *Journal of Economic Perspectives* 28.4: 149–68

Mascagni, G. (2018) 'From the Lab to the Field: A Review of Tax Experiments', *Journal of Economic Surveys* 32.2: 273–301

Mascagni, G. and Lees, A. (2021) *Using Administrative Data to Assess the Impact of the Pandemic in Low-income Countries: An Application with VAT Data in Rwanda*, African Tax Administration Paper 22, Brighton: Institute of Development Studies

Mascagni, G. and Mengistu, A. (2018) 'The Corporate Tax Burden in Ethiopia: Evidence from Anonymised Tax Returns', *Development Policy Review* 37.53: O248–O273

Mascagni, G. and Nell, C. (2021) 'Tax Compliance in Rwanda: Evidence from a Field Message Experiment', *Economic Development and Cultural Change* 69.2

Mascagni, G. and Santoro, F. (2018) *What is the Role of Taxpayer Education in Africa?* African Tax Administration Paper 1, Brighton: Institute of Development Studies

Mascagni, G. and Santoro, F. (2021) *The Tax Side of the Pandemic: Compliance Shifts and Options to Fund Recovery in Rwanda*, ICTD Working Paper 129, Brighton: Institute of Development Studies

Mascagni, G., Mengistu, A.T. and Woldeyes, F.B. (2021) 'Can ICTs Increase Tax Compliance? Evidence on Taxpayer Responses to Technological Innovation in Ethiopia', *Journal of Economic Behavior Organization* 189: 172–193

Mascagni, G., Monkam, N. and Nell, C. (2016) *Unlocking the Potential of Administrative Data in Africa: Tax Compliance and Progressivity in Rwanda*, ICTD Working Paper 56, Brighton: Institute of Development Studies

Mascagni, G., Santoro, F. and Mukama, D. (2019) *Teach to Comply? Evidence from a Taxpayer Education Programme in Rwanda*, Working Paper 91, Brighton: Institute of Development Studies

Mascagni, G., Santoro, F., Mukama, D., Karangwa, J. and Hakizimana, N. (2020) *Active Ghosts: Nil-filing in Rwanda*, Working Paper 106, Brighton: Institute of Development Studies

Mazziotta, A., Mummendey, A. and Wright, S. (2011) 'Vicarious Inter-group Contact Effects: Applying Social-cognitive Theory to Intergroup Contact Research', *Group Processes and Intergroup Relations* 14: 255–274

McGraw, K.M. and Scholz, J.T. (1991) 'Appeals to Civic Virtue versus Attention to Self Interest: Effects on Tax Compliance', *Law and Society Review* 25.3: 471–498

McKenzie, D. (2012) 'Beyond Baseline and Follow-up: The Case for More T in Experiments', *Journal of Development Economics* 99.2: 210–221

Meiselman, B.S. (2018) 'Ghostbusting in Detroit: Evidence on Nonfilers from a Controlled Field Experiment', *Journal of Public Economics* 158: 180–193

Moore, M. (2020) *What is Wrong with African Tax Administration?* Working Paper 111, Brighton: Institute of Development Studies

Onu, D. and Oats, L. (2016) 'The Role of Social Norms in Tax Compliance: Theoretical Overview and Practical Implications', *Journal of Tax Administration* 1.1

Ortega, D. and Scartascini, C. (2016) 'Don't Blame the Messenger: A Field Experiment on Delivery Methods for Increasing Tax Compliance', mimeo, Inter-American Development Bank

Ortega, D., Ronconi, L. and Sanguineeti, P. (2016) 'Reciprocity and Willingness to Pay Taxes: Evidence from a Survey Experiment in Latin America', *Economia* 16.2: 55–87

Ortiz, M. and Harwood, J. (2007) 'A Social Cognitive Theory Approach to the Effects of Mediated Intergroup Contact on Intergroup Attitude', *Journal of Broadcasting and Electronic Media* 51: 615–631

Paluck, E. and Green, D. (2009) 'Prejudice Reduction: What Works? A Review and Assessment of Research and Practice', *Annual Review of Psychology* 60: 339–367

Pietri, E.S., Moss-Racusin, C.A., Dovidio, J.F, Guha, D., Roussos, G., Brescoll, V.L. and Handelsman, J. (2017) 'Using Video to Increase Gender Bias Literacy toward Women in Science', *Psychology of Women Quarterly* 41: 175–196

Pomeranz, D. (2015) 'No Taxation Without Information: Deterrence and Self-enforcement in the Value Added Tax', *American Economic Review* 105.8: 2539–69

Prichard, W., Custers, A., Dom, R., Davenport, S. and Roscitt, M. (2019) *Innovations in Tax Compliance - Conceptual Framework*, Policy Research Working Paper 9032, World Bank Group

Rwanda Revenue Authority (2020) *Annual Activity Report 2019/20*, Technical report, Rwanda Revenue Authority

Rwanda Revenue Authority (2017) *Compilation of Fiscal Laws and Regulations in Use in Rwanda*, Rwanda Revenue Authority

Sandmo, A. (2005) 'The Theory of Tax Evasion: A Retrospective View', *National Tax Journal* LVIII.4

Santoro, F. (2021) ‘To File or Not to File? Another Dimension of Non-compliance: The Eswatini Taxpayer Survey’, *Journal of Behavioural and Experimental Economics* 95

Santoro, F. and Mdluli, W. (2019) *Nil-filing in Eswatini: Should the Revenue Administration Be Concerned?* African Tax Administration Paper 6, Brighton: Institute of Development Studies

Santoro, F., Groening, E., Mdluli, W. and Mbongeni, S. (2020) *How to Best Nudge Taxpayers? The Impact of a Tailored Letter Experiment in Eswatini*, ICTD Working Paper 112, Brighton: Institute of Development Studies

Schneider, F. and Medina, L. (2018) *Shadow Economies Around the World: What Did We Learn Over the Last 20 Years?* Working Paper 18/17, IMF

Schreiber, L.A. (2018) *The Foundation for Reconstruction: Building the Rwanda Revenue Authority, 2001-2017*, Technical Report, Innovations for Successful Societies, Princeton University

Shimeles, A., Gurara, D.Z. and Woldeyes, F. (2017) ‘Taxman’s Dilemma: Coercion or Persuasion? Evidence from a Randomized Field Experiment in Ethiopia’, *American Economic Review* 107.5: 420–24

Sjoberg, F., Mellon, J., Peixoto, T., Hemker, J. and Tsai, L. (2019) ‘Voice and Punishment: A Global Survey Experiment on Tax Morale’, Policy Research Working Paper 8855, World Bank

Slemrod, J. (2019) ‘Tax Compliance and Enforcement’, *Journal of Economic Literature* 57.4: 904–954

Slemrod, J., Blumenthal, M. and Christian, C. (2001) ‘Taxpayer Response to an Increased Probability of Audit: Evidence from a Controlled Experiment in Minnesota’, *Journal of Public Economics* 79.3: 455–483

Stantcheva, S. (2020) *Understanding Tax Policy: How Do People Reason?* Working Paper 27699, National Bureau of Economic Research

Torgler, B. (2004) ‘Moral Suasion: An Alternative Tax Policy Strategy? Evidence from a Controlled Field Experiment in Switzerland’, *Economics of Governance* 5.3: 235–253

Wenzel, M. and Taylor, N. (2004) ‘An Experimental Evaluation of Tax-reporting Schedules: A Case of Evidence-based Tax Administration’, *Journal of Public Economics* 88: 2785–2799

Westfall, P. and Young, S. (1993) *Resampling-based Multiple Testing: Examples and Methods for p-value Adjustment*, John Wiley and Sons, Inc