

# Tax Compliance of SMEs: Pre-analysis plan

Philipp Doerrenberg\*

Jan Schmitz†

August 20, 2017

## Abstract

We present the design and pre-analysis plan for a randomized control trial evaluating the effects of randomized audit threats and moral appeals on tax compliance of small and medium sized firms in Bulgaria. True audit probabilities are randomly varied between treatments and communicated to the firms. In addition, we employ treatments in which firms receive mailings highlighting the importance of taxes and specifying the purpose of tax money. Similar to the treatments with varying audit probabilities, we also manipulate the strength of the moral appeals to taxpayers. We benchmark our findings in the different treatments against a control group which receives a neutral mail from the tax authorities.

---

\*ZEW Mannheim, CESifo and IZA. L7, 1, D-68161 Mannheim, doerrenberg@zew.de.

†ETH Zürich and University of Lausanne, CLD D 10.1, Clausiusstrasse 37, CH-8092 Zürich, schmitz@econ.gess.ethz.ch.

# 1 Motivation and summary

This document describes the design and the pre-analysis plan for a field experiment aimed at evaluating the effects of randomized audit threats and appeals to morals and reciprocity on tax compliance in the Republic of Bulgaria.

The study is conducted in collaboration with the National Revenue Service (NRA), i.e., the tax authorities in the Republic of Bulgaria. The broader goal of the study is to analyze how tax compliance of small and medium-sized firms (SMEs) and self-employed taxpayers in Bulgaria is affected by different probabilities of being subject to a tax audit. Further, the study aims at studying how SMEs and self-employed taxpayers increase tax compliance as a response to different forms of moral appeals that invoke feelings of reciprocity.

The study will be conducted between July and December 2017 (or January/February 2018—depending on the capabilities of the NRA) as a randomized control trial (RCT) in collaboration with the Bulgarian tax authorities. 172.172 SMEs and self-employed taxpayers have been randomly divided into an untreated control group and three main treatment groups. In the first treatment group - the treated control group -, taxpayers receive a neutral mail informing about the website of the Bulgarian tax authorities which contains valuable instruction on how to file taxes correctly. In the second treatment group - the audit group -, the probability with which a taxpayer will be subject to an audit in the upcoming month is communicated to the taxpayer by mail. In the third treatment group - the moral appeals group -, taxpayers receive a mail informing them about the moral obligation to pay taxes as well as what taxes are used for. In all treatments, taxpayers receive the same information as in the treated control group but the content of the mailings is extended to either include information about the true audit probability or information about the moral obligation to pay taxes and what taxes are used for (content invoking reciprocity). The two main treatment groups - audit group and moral appeals group - consist of several subgroups in which the audit probability and the strength of the morale appeal are varied; see below for detailed descriptions of all treatment groups.

Because tax evasion is a major problem – not only in Bulgaria – , the tax authorities and we are interested in identifying the optimal and most cost effective audit probability (from the whole possible set between 0% and 100%). Specifically, in six sub-treatment groups we introduce individual firm specific audit probabilities of 0%, 1%, 10%, 40%, 60%, 100% and inform taxpayers about their individual probability to be audited. We further introduce one treatment with an ambiguous positive audit probability (of 1%) where taxpayers are not informed about the exact probability and only that the probability is positive. Additionally, since audits are costly, the tax authorities are also interested in how effective moral appeals to pay taxes work in comparison to an officially announced probability of receiving an audit. Therefore, we want to use tools from behavioral economics that have proven to effectively increase cooperation such as, e.g., inducing an increased feeling of reciprocity through moral messages. Precisely, we have four sub-treatments using moral appeals. In one treatment, we invoke weak reciprocity. In another treatment, we invoke strong reciprocity indicating what taxes are used for. In the third moral appeal treatment we directly address the taxpayer and mention that the taxpayer benefits from services and infrastructure paid for by tax money. In the fourth treatment using moral appeals the mail is accompanied by a graphical example (i.e., a picture of a playground for children) of tax spendings. We then aim at testing how well these moral messages work in increasing tax compliance compared to an announced audit.

The aim of the RCT is to compare the tax-compliance response of firms across treatment groups. For this purpose, we particularly study (monthly reported) VAT payments and social security payments of SMEs for their employees across firms in the treatment groups.

All interventions have been prepared in collaboration with the tax authorities. The interventions take into account the capabilities and interests of the NRA. The NRA, however, will communicate and interact with the taxpayers. The researchers will not have any contact with the taxpayers. All mailings that taxpayers receive will be sent by the tax authorities.

Taxpayers in the untreated control group will not be subject to any intervention. However, some taxpayers in the this group will be invited to voluntarily fill in a questionnaire and state their perceived probability of receiving an audit and how immoral they think tax evasion is. This survey will - depending on the response rate - inform us about the underlying belief about the probability of receiving an audit and the underlying immorality of cheating on tax returns in the population of SMEs in Bulgaria. However, the survey is mainly independent from the experiment presented here. Therefore, we will not specify the details of the survey in more detail here. Firms in the survey, however, will be excluded from the sample as they maybe behave differently because of filling in a tax (and honesty) related questionnaire.

The NRA started to send the treatment mails in July 2017, but at the date of submission of this pre-analysis plan, we do not have access to any post-experiment data. We will only receive post-experiment data (on monthly tax payments) for firms after the announced audits have been performed by the NRA (likely January 2018 - depending on the capabilities of the NRA). We have to formally request the data from the NRA after the experiment. To verify that we have to officially request the data and that we do not have access to any post-experiment data at the time of release of this pre-analysis plan, we will provide the official data request when submitting the paper for publication to a journal. This procedure is also specified in the cooperation agreement with the Bulgarian tax authority. The cooperation agreement and a first data request (which we sent to request pre-experiment data for the randomization process) are available from the authors upon request.

This document is organized as follows. Section 2 describes the treatment interventions. Section 3 describes the sample size and randomization process. Section 4 outlines our main behavioral predictions. Section 5 details our empirical strategy.

## 2 Treatment interventions

Our main treatments can be subdivided into 13 treatments and one survey interventions. Below, we provide a detailed description of the treatment mailings in English. The messages have been translated into Bulgarian and checked for correctness by the NRA. We, the researchers, suggested the content of the mailings in accordance with the capabilities and interests of the tax authorities. In all treatments, taxpayers receive the same message as in the control treatment (T2). The content of the mailings is augmented depending on the specific treatment intervention. We present the English translation of the treatment mails.<sup>1</sup>

### **T1: Untreated control group**

SMEs in the untreated control group will not receive any mailings and will not be subject to any intervention.

### **T2: Control group: “basic message” – Neutral mailing with basic information**

SMEs in the control group receive the following information by mail:

---

<sup>1</sup>Treatment mails in Bulgarian are available upon request.

*Dear taxpayer,*

*We wish to make your payment of taxes and social insurance contributions as convenient as possible. In this regard, we would like to make you aware of our website (link to website included) where you find much information relating to your tax payments and social insurance contributions. We hope you find our online appearance useful.*

*Yours sincerely,*

*SIGNATURE*

### **T3-T9: Audit treatments**

SMEs in the audit group receive the different information by mail. The content of the mails depends on the probability with which a SME will be subject to an audit (0%-100%). In one treatment (the ambiguity treatment), the probability is not specified but it is indicated to the taxpayers that the probability of being subject to an audit is positive. The treatment messages are as follows:

#### **T3: Ambiguity**

*Dear taxpayer,*

*We wish to make your payment of taxes and social insurance contributions as convenient as possible. In this regard, we would like to make you aware of our website (link to website included) where you find much information relating to your tax payments and social insurance contributions. We hope you find our online appearance useful.*

*We would also like to remind you that the NRA takes steps and measures such as audits to ensure an effective tax collection.*

*In this context, the NRA has randomly selected a group of taxpayers – including you – for a special investigation. There is a chance that taxpayers in this group will be subject to an audit during the next months.*

*Yours sincerely,*

*SIGNATURE*

#### **T4: No audit-Probability 0%**

*Dear taxpayer,*

*We wish to make your payment of taxes and social insurance contributions as convenient as possible. In this regard, we would like to make you aware of our website (link to website included) where you find much information relating to your tax payments and social insurance contributions. We hope you find our online appearance useful.*

*We would also like to remind you that the NRA takes steps and measures such as audits to ensure an effective tax collection.*

*In this context, the NRA has randomly selected a group of taxpayers – including you – not to be*

*subject to any special investigation. Taxpayers in this group will not be subject to any purposeful audit during the next months.*

*Yours sincerely,*

*SIGNATURE*

**T5-T8: Audit-Probability 1%-60%**

*Dear taxpayer,*

*We wish to make your payment of taxes and social insurance contributions as convenient as possible. In this regard, we would like to make you aware of our website (link to website included) where you find much information relating to your tax payments and social insurance contributions. We hope you find our online appearance useful.*

*We would also like to remind you that the NRA takes steps and measures such as audits to ensure an effective tax collection.*

*In this context, the NRA has randomly selected a group of taxpayers – including you – for a special investigation. **X out of 100 taxpayers in this group will randomly be selected to be subject to an audit during the next months.** In other words, there is a **X% probability** that you will be audited.*

*Yours sincerely,*

*SIGNATURE*

Where  $X \in \{1, 10, 40, 60\}$ , depending on the firm specific individual audit probability in the respective treatment.

**T9: Audit-Probability 100%**

*Dear taxpayer,*

*We wish to make your payment of taxes and social insurance contributions as convenient as possible. In this regard, we would like to make you aware of our website (link to website included) where you find much information relating to your tax payments and social insurance contributions. We hope you find our online appearance useful.*

*We would also like to remind you that the NRA takes steps and measures such as audits to ensure an effective tax collection.*

*In this context, the NRA has randomly selected a group of taxpayers – including you – for a special investigation. **Every taxpayer in this group will be subject to an audit during the next months.** In other words, there is a **100% probability** that you will be audited.*

*Yours sincerely,*

*SIGNATURE*

**T10-T13: Moral appeals treatments**

To give taxpayers a feeling that their tax money is purposefully spent and that they themselves benefit from the public services and infrastructure financed by taxes, i.e., invoke a feeling of reciprocity, we introduce four treatments using moral appeals.

#### **T10: Weak reciprocity**

*Dear taxpayer,*

*We wish to make your payment of taxes and social insurance contributions as convenient as possible. In this regard, we would like to make you aware of our website (link to website included) where you find much information relating to your tax payments and social insurance contributions. We hope you find our online appearance useful.*

*We would also like to remind you that paying taxes and social insurance contributions is a civic duty. Taxes and social security contributions are necessary to maintain and finance publicly provided public goods and services for you and everybody in Bulgaria.*

*Yours sincerely,*

*SIGNATURE*

#### **T11: Strong reciprocity**

*Dear taxpayer,*

*You use public transportation? You use roads and public services such as health care? You have benefited from public education? Then you know that these goods and services require funding!*

*We wish to make your payment of taxes and social insurance contributions as convenient as possible. In this regard, we would like to make you aware of our website (link to website included) where you find much information relating to your tax payments and social insurance contributions. We hope you find our online appearance useful.*

*We would also like to remind you that paying taxes and social insurance contributions is a civic duty. Taxes and social security contributions are necessary to maintain and finance publicly provided public goods and services for you and everybody in Bulgaria.*

*Yours sincerely,*

*SIGNATURE*

#### **T12: Strong reciprocity – directly addressed to taxpayer**

*Dear taxpayer,*

*You use public transportation? You use roads and public services such as health care? You have benefited from public education? Then you know that these goods and services require funding!*

*We wish to make your payment of taxes and social insurance contributions as convenient as possible. In this regard, we would like to make you aware of our website (link to website included) where you find much information relating to your tax payments and social insurance contributions. We hope*

*you find our online appearance useful.*

*We would also like to remind you that paying taxes and social insurance contributions is a civic duty. Taxes and social security contributions are necessary to maintain and finance publicly provided public goods and services for you and everybody in Bulgaria. Without your tax payments and social insurance contributions, we are not able to maintain, for example, public schools, kindergartens, hospitals and the social insurance system.*

*Yours sincerely,*

*SIGNATURE*

### **T13: Strong reciprocity – directly addressed to taxpayer plus picture**

*Dear taxpayer,*

*You use public transportation? You use roads and public services such as health care? You have benefited from public education? Then you know that these goods and services require funding!*

*We wish to make your payment of taxes and social insurance contributions as convenient as possible. In this regard, we would like to make you aware of our website (link to website included) where you find much information relating to your tax payments and social insurance contributions. We hope you find our online appearance useful.*

*We would also like to remind you that paying taxes and social insurance contributions is a civic duty. Taxes and social security contributions are necessary to maintain and finance publicly provided public goods and services for you and everybody in Bulgaria. Without your tax payments and social insurance contributions, we are not able to maintain, for example, public schools, kindergartens, hospitals and the social insurance system. Consider the attached picture! It shows an example of a tax-financed playground for children.*

*Yours sincerely,*

*SIGNATURE*

### **T14: Survey group**

Lastly, a fraction of untreated taxpayers will be invited to participate in a survey. Taxpayers who receive an invitation to the survey will not be part of the experiment and receive any other treatment mailings. The survey will be conducted on Qualtrics. The invitation to the survey will also be sent by the tax authorities. The mail will include a link to the survey. While we do not have access to the mailing addresses the tax authorities do not learn which firms filled in the survey. In the survey, taxpayers will be asked about their belief about the probability to be audited by the tax authorities. Furthermore, the survey includes questions about the morality/immorality of evading taxes .

## **3 Data, randomization strategy and allocation to treatments**

We study self employed and SMEs. We are therefore interested in changes in monthly VAT payments and monthly social security payments for employees subsequent to sending out the treatment mails.

To randomly allocate SMEs and self employed taxpayers into the different treatments, the tax authorities provided us with data from 172.172 SMEs and self employed for the year 2016 (i.e., pre-experiment data). Specifically, we received anonymized information about taxpayers' monthly VAT payments, monthly social security payments for workers and firm size. Thus, while the tax authority interacts with the taxpayers, i.e., sends out mailing, performs audits and collects the data, we, the researchers, performed the randomization process taking into account the capabilities and interests of the tax authorities, i.e., number of audits that can be performed and number of mailings that can be sent out.

Precisely, the tax authorities allow us to send out 68.200 mailings and are willing to perform 2210 audits.<sup>2</sup> Importantly, these audits will be performed anyway and therefore do not increase nor decrease the overall likelihood of a firm in the sample to be audited in Bulgaria compared to 2016.

Moreover, to cover the range of audit probabilities the tax authorities are interested in, we are able to assign 5000 SMEs and self employed to the ambiguity treatment, 5200 firms to the 1% audit probability treatment, 5000 firms to the 10% audit probability treatment, 2000 firms to the 40% audit probability treatment, 1180 firms to the 60% audit probability treatment and 10.000 firms to the control group, and 10.000 firms to each of the moral appeals treatments and 10.000 firms to the survey group. We are limited by strategical considerations and manpower restrictions of the tax authorities to only include 100 taxpayers in the 0% audit treatment and 100 firms in the 100% audit treatment (treatment 4 and 9).

Given these considerations and restrictions and in light of our goal to have comparable firms in each treatment group, we randomized as follows. First, we ranked taxpayers according to mean VAT payments in the year 2016 in ascending order. Second, we divided the taxpayers in deciles; that is, we created 10 groups where the first group consisted of the 10% taxpayers with the largest VAT payments and the 10th group consisted of the 10% taxpayers with the lowest VAT payments. Third, within each decile we randomly assigned a number to each firm and ranked firms within each decile by this random number. Fourth, based on this random ranking in each decile, we assigned the taxpayers to treatment groups by assigning  $n/10$  firms to treatment group  $X$ , where  $X$  is one of the treatment groups and  $n$  is the total number of firms we intended to assign to group  $X$ . Since we do this within each decile, we in total assigned  $10 \times n/10 = n$  firms to group  $X$ .

This procedure ensures that an equal number of taxpayers from each decile is assigned to the respective treatments or control group. Since we want the survey to be comparable to the taxpayers in the treatments and representative for the population of SMEs in Bulgaria, we also included the taxpayers who will be invited to fill in the survey into the randomization process.

Tables 1 - 4 in the Appendix present the means and medians for each outcome variable pre-treatment 2016 (2016 means for Tax Base VAT, Social Security Payments and number of employees) after the randomization process and the number of firms in each treatment.

Using the 2016 data, we checked the success of the randomization process by using linear regressions with each of our main outcome variables as dependent variables and the treatment dummies as regressors. For all outcome variables and regressions the treatment dummies are jointly insignificant and cannot explain the dependent variables.

---

<sup>2</sup>Note that some firms might have invalid mail addresses and therefore, we expect that the actual number of messages will be below the 68.200 planned and sent messages.

## 4 Behavioral predictions

We study several research questions that are of interest for our partners in the tax authority and from an academic perspective. Only little research about the behavior of firms in the context of tax compliance exists (a few examples are Carrillo et al., 2014; DeBacker et al., 2012; Doerrenberg and Schmitz, 2017; Kosonen and Ropponen, 2013; Pomeranz, 2015; Slemrod et al., 2015). We are able to study two aspects of tax compliance using a sample of firms: i) the impact of audit probabilities on reported income, ii) the impact of moral appeals on reported income. The first aspect is rooted in the seminal paper by Allingham and Sandmo (1972), which predicts that higher audits lead to less evasion. The second aspect builds on a more recent behavioral literature and especially compliance work following for example Slemrod et al. (2001).

**Hypothesis 1** (SMEs are rational taxpayers). *All firms in the sample are rational and have a rational belief about audit probabilities. Taxpayers do not react to the basic message treatment nor to the moral appeals treatments. Compared to the control group T2, taxpayers do not react to ambiguous audit probability treatment. There is no information that allows to update their belief. Compared to the control group T2, tax payments increase for high audit probabilities and decrease in the low audit probability treatments. The higher the audit probability, the more tax payments increase compared to the control group.*

Ex-ante, we do not know the underlying belief about the audit probabilities. High audit probabilities can be classified as audit probabilities above the average belief about the likelihood of receiving an audit and low audit probabilities are audit probabilities below the average belief about the likelihood of receiving an audit (we obtain these average beliefs from the survey). If taxpayers are rational, tax compliance in the ambiguous audit treatment should reveal the compliance level that is equivalent to the compliance level at the audit probability equal to the underlying belief about audits.<sup>3</sup> However, if taxpayers are purely rational, their belief should be unaffected from the ambiguous audit treatment since there is no information update. However, there might be a signaling effect that leads to higher tax compliance in the ambiguous audit treatment compared to the control treatment (and compared to the treated and untreated control group). Within the audit probability treatments, tax payments should increase with the audit probability. If the announced audit probability is lower than the prior belief of a firm, tax payments might decrease.

However, hypothesizing that all firms are pure money maximizing rational taxpayers and do not react at all to our non-audit threat treatments seems to be overly cautious and a somewhat unrealistic assumption since also in firms individuals make decisions. While firm decision makers are likely to be more rational than individual taxpayers, also decision makers within firms might be subject to some behavioral biases and may have moral concerns, e.g. social preferences, inequality aversion etc, and/or they might have intrinsic motivations to pay their taxes. Therefore, we present hypotheses also for the case that not all firm taxpayers are purely rational.

**Hypothesis 2** (SMEs also have intrinsic motivations and behavioral biases). *Compared to the control group T2, tax payments increase for high audit probabilities and decrease in the low audit probability treatments. The higher the audit probability, the more tax payments increase compared to the control group. However, taxpayers also react to the moral appeals treatments. Compared to the control group T2, moral appeals have a non-negative effect on tax payments.*

---

<sup>3</sup>We hope that we receive sufficient responses to our survey (T 14) such that we can assess an average belief about the likelihood to be audited. However, this measure is also not perfect. It might vary on the firm level. We therefore also ask for firm characteristics in the survey to get a better estimate. In any case, we unfortunately need to leave open the individual average belief about receiving an audit and therefore, are also unable to specify which audit probability is perceived as high and which audit probability is perceived as low. Variables from the survey might be used to increase precision of estimates in the RCT. However, we will mostly rely on measures excluding insights from the survey (since we cannot assume that the survey data will yield any additional insights).

Compared to the untreated control group, the basic mailing in the treated control group T2 may raise attention to the importance of paying taxes and may work as a signal to the taxpayer that the NRA knows who they are and that they are on the radar. Nevertheless, since our taxpayers are firms who should behave more rationally, they should not react to the basic information treatments as strongly as individuals do (see e.g., Fellner et al., 2013, for evidence of basic letter effects). Nevertheless, we derive hypothesis 3:

**Hypothesis 3** (The effect of a neutral letter to SMEs). *Compared to the untreated control group, any message by the tax authorities has a non-negative effect on tax payments.*

Our moral appeals treatments are designed to invoke a feeling of reciprocity. Informing taxpayers about the morality of paying taxes and also what kind of services and infrastructure is paid for with tax money. The level of reciprocity increases from treatment 10 to treatment 13. Therefore, we derive hypotheses 4 that allow testing for the effects of differently strong moral appeals within the moral appeals treatments:

**Hypothesis 4** (The effect of reciprocity). *Compared to a basic message, a message by the tax authorities containing information about what taxes are used for has a non-negative effect on tax payments. The stronger the moral appeal, the higher the effect on tax compliance. Tax payments increase with the strength of the moral appeals.*

Hypothesis 4 directly follows from the behavioral economics literature showing that individuals reciprocate fair behavior, i.e., reward fair behavior and punish unfair behavior (Fehr et al., 2002) and are conditional cooperators, i.e., contribute if others also contribute (Fischbacher et al., 2001). The treatments 10 to 13 play to these behavioral biases. They highlight what individuals get for their tax payments, i.e., that they are treated fairly as they get a public service/public infrastructure in return. And also highlight that others also contribute. However, the literature studying moral appeals reports ambiguous effects on compliance behavior (Fellner et al., 2013; Slemrod et al., 2001; Torgler, 2004). Even when studied taxpayers are individuals rather than firms who potentially are less reactive to moral messages.

## 5 Estimation strategies

The RCT will be conducted between July and December 2017 (or January/February 2018—depending on the capabilities of the NRA). That is, all treatment mailings and the survey have been administered in July and the required audits in the respective audit treatments will be conducted in the subsequent months. We, the researchers, have not access to the data yet and will receive the experimental data after the audit process is concluded since it is necessary to apply for data access on a case to case basis. We will most likely not get access to the 2017 data before spring 2018.

We are interested in behavioral changes of taxpayers in our treatment groups subsequent to sending out the treatment mailings. Our main outcome variables are the (monthly) reported VAT and social security payments (or the according tax bases) of the firms. We can also look at profits and revenues of firms, which are interrelated with the other outcomes. We have data before and will obtain data for after the treatment intervention. The main control group that we test against will usually be the group that receives neutral letters (T2). We will mainly use the following analyses testing for differences in our main outcome variables (VAT payments and monthly social security payments):

- OLS regressions on the post-experiment levels of the outcome variables on the treatment indicators.
- OLS regressions in a difference-in-differences spirit where we compare the differential evolution of the outcome variables between different months of 2017 across treatment groups.

- OLS regressions in a difference-in-differences spirit where we compare the differential evolution of the outcome variables between 2017 and 2016 across treatment groups.
- We further construct a dummy variable which indicates whether a firm changed its reported tax base significantly (say by more than 10%) between 2016 and 2017 and regress this variable on the treatment indicators.
- We also construct dummy variables for increase in tax base and decrease in tax base and use these as outcome variables.
- To gain precision in the estimates, some OLS regressions will contain control variables (such as firm size).
- We are also interested in percentage changes and run the above regressions with logged outcome variables.
- Non-parametric plotting of the evolution of outcome variables in every month in our data (hence before and after treatment intervention) by group. This also allows us to detect the dynamics and pre-trends of the treatment effects.
- Non-parametric (ranksum and signed rank) tests on the 2017 values of the outcome variables and/or on the within-firm difference between 2017 and 2016.
- We are also interested whether receiving any audit announcement and/or any moral appeal has an effect: we therefore perform the above tests, but use as explanatory variables a dummy indicating that a firm is in one of the audit treatments and a dummy that a firm is in one of the moral treatments.
- We are also interested in heterogeneous effects with respect to different subgroups. We will therefore also perform the above tests for different subgroups like, e.g., firm size, NACE Code, or geographical region.
- To date, it is not clear whether we will receive a sufficient number of survey responses in order to assess an average belief about the probability of being audited. If we are successful in doing so, we have clear and directional hypotheses for audit probabilities above and below the average belief. We will perform one sided test (ranksum) to test for effects of announced audit probabilities above and below the average belief. If we will not be able to obtain information about the underlying belief about the likelihood of being audited, we will perform two sided test. In any case, all test for moral appeal treatments and the basic message treatment will be two-tailed.
- Depending on the result of the survey, we can also regress the outcome variables on the difference between the average belief and the audit probability in the respective group.
- We will also compare behavior of (similar) firms across the ambiguous audit treatment and the different audit treatments to assess how firms with similar characteristics react to an announced audit and to announced audits of high and low probabilities.

## References

- Allingham, M. G. and A. Sandmo (1972). Income tax evasion: A theoretical analysis. *Journal of Public Economics* 1(3-4), 323 – 338.
- Carrillo, P., D. D. Pomeranz, and M. Singhal (2014). Dodging the taxman firm misreporting and limits to tax enforcement. Harvard business school working paper no 15-026.

- DeBacker, J., B. T. Heim, and A. Tran (2012). Importing corruption culture from overseas: Evidence from corporate tax evasion in the united states. *Journal of Financial Economics*. Forthcoming.
- Doerrenberg, P. and J. Schmitz (2017). Tax compliance and information provision a field experiment with small firms. *Journal of Behavioral Economics for Policy* 1(1), 47–54.
- Fehr, E., U. Fischbacher, and S. Gächter (2002). Strong reciprocity, human cooperation, and the enforcement of social norms. *Human nature* 13(1), 1–25.
- Fellner, G., R. Sausgruber, and C. Traxler (2013). Testing enforcement strategies in the field: Threat, moral appeal and social information. *Journal of the European Economic Association* 11(3), 634–660.
- Fischbacher, U., S. Gächter, and E. Fehr (2001). Are people conditionally cooperative? evidence from a public goods experiment. *Economics letters* 71(3), 397–404.
- Kosonen, T. and O. Ropponen (2013). The role of information in tax compliance: Evidence from a natural field experiment. VATT working papers no 48, Helsinki.
- Pomeranz, D. (2015). No taxation without information: Deterrence and self-enforcement in the value added tax. *American Economic Review* 105(8), 2539–69.
- Slemrod, J., M. Blumenthal, and C. Christian (2001). Taxpayer response to an increased probability of audit: evidence from a controlled experiment in minnesota. *Journal of Public Economics* 79(3), 455 – 483.
- Slemrod, J. B., B. Collins, J. L. Hoopes, D. H. Reck, and M. Sebastiani (2015). Does credit-card information reporting improve small-business tax compliance? Available at ssrn: <http://ssrn.com/abstract=2515630>.
- 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.

## A Appendix

Table 1: Pre Experiment Summary Statistics by Treatment - Tax Base: VAT 2016

	Mean	Median	SD	Min	Max	N
Untreated	13816.26	1074.214	330776.8	-2.70e+07	8.34e+07	93592
Control	13440.37	1074.139	123885.9	-2214674	5590514	10000
Ambiguity	13331.57	1075.573	136580.3	-2248015	4238668	5000
Audit 0%	39906.13	1081.124	281735.5	-191475.2	2688329	100
Audit 1%	15210.67	1073.943	172437.8	-1494182	9152965	5200
Audit 10%	12124.22	1074.39	156438.1	-1946216	7900440	5000
Audit 40%	12457.04	1071.4	143871.6	-1563640	4872915	2000
Audit 60%	8568.835	1077.309	142293.8	-2034279	2780574	1180
Audit 100%	10571.21	1044.763	45652.26	-100223.1	377478.5	100
Weak rp	14525.15	1074.932	139153.4	-1898408	6394831	10000
Strong rp	16760.4	1074.273	381546	-5081976	3.46e+07	10000
Strong rp + direct	15613.13	1074.578	189337.4	-3829801	9127764	10000
Strong rp + direct + pic	15460.55	1074.169	214391.5	-4135932	1.45e+07	10000
Survey	16206.06	1074.696	291128.7	-4648591	2.42e+07	10000
Total	14285.69	1074.273	286702.1	-2.70e+07	8.34e+07	172172

Note: Mean, median, standard deviation, minimum and maximum of tax base VAT in 2016 in the different treatments after randomization. N constitutes the number of observations in each treatment.

Table 2: Pre Experiment Summary Statistics by Treatment - Tax Base: All Social Security Payments 2016

	Mean	Median	SD	Min	Max	N
Untreated	6907.08	1518.012	34407.9	0	3421321	83988
Control	6884.824	1515	31275.34	0	1153897	8965
Ambiguity	7016.104	1526.092	47020.72	0	2641252	4463
Audit 0%	5102.944	1605.756	14106.36	0	123857.4	91
Audit 1%	6951.744	1601.038	49905.49	0	3110485	4654
Audit 10%	6244.628	1509.117	27304.95	0	1150884	4484
Audit 40%	6371.882	1448.019	28574.08	0	858528.9	1803
Audit 60%	8670.717	1557.065	37844.59	0	616901.8	1072
Audit 100%	4571.715	1580.973	10978.73	0	74320.6	88
Weak rp	6553.046	1515.639	28748.27	0	1259367	8931
Strong rp	6432.997	1521.87	31391.97	0	1741604	8922
Strong rp + direct	7403.081	1509.202	37857.32	0	1539630	9003
Strong rp + direct + pic	6964.746	1538.466	28081.79	0	879430.2	8933
Survey	6809.522	1526.217	26170.83	0	795282	8939
Total	6873.37	1520.282	33987.56	0	3421321	154336

Note: Mean, median, standard deviation, minimum and maximum of tax base for Social Security Payments in 2016 in the different treatments after randomization. N constitutes the number of observations in each treatment.

Table 3: Pre Experiment Summary Statistics by Treatment - Tax Base: Social Security Payments of Workers 2016

	Mean	Median	SD	Min	Max	N
Untreated	7696.492	1580.219	37381.91	0	3411190	68941
Control	7614.169	1599.147	33481.22	0	1146616	7371
Ambiguity	7845.664	1549.167	51573.97	0	2637858	3663
Audit 0%	5706.452	1623.596	15412.36	274.25	121110.4	70
Audit 1%	7690.924	1671.059	54475.34	0	3098583	3842
Audit 10%	6959.035	1549.176	29907.43	0	1150473	3678
Audit 40%	7157.708	1477.73	30486.64	0	810957.4	1459
Audit 60%	9650.967	1653.598	40775.86	0	612881.9	898
Audit 100%	4940.051	1609.348	11428.66	204	71201.3	74
Weak rp	7256.853	1569.605	31164.42	0	1254173	7376
Strong rp	7114.996	1563.846	34134.16	0	1736364	7320
Strong rp + direct	8312.78	1564.281	41201.35	0	1529508	7377
Strong rp + direct + pic	7776.272	1635	30248.55	0	874265	7308
Survey	7571.805	1600.708	28245.58	0	786296.7	7351
Total	7653.448	1584.731	36912.95	0	3411190	126728

Note: Mean, median, standard deviation, minimum and maximum of tax base for Social Security Payments of Workers in 2016 in the different treatments after randomization. N constitutes the number of observations in each treatment.

Table 4: Pre Experiment Summary Statistics by Treatment - Number of Employees in 2016

	Mean	Median	SD	Min	Max	N
Untreated	1.276554	1	.8240531	1	5	93573
Control	1.26828	1	.8154221	1	5	9997
Ambiguity	1.275	1	.8069109	1	5	5000
Audit 0%	1.161616	1	.6341807	1	5	99
Audit 1%	1.275438	1	.8200514	1	5	5199
Audit 10%	1.259452	1	.7848214	1	5	4999
Audit 40%	1.2505	1	.7848935	1	5	2000
Audit 60%	1.313559	1	.8833504	1	5	1180
Audit 100%	1.23	1	.7895146	1	5	100
Weak rp	1.263853	1	.8002423	1	5	9998
Strong rp	1.259478	1	.7919232	1	5	9997
Strong rp + direct	1.277055	1	.8204009	1	5	9998
Strong rp + direct + pic	1.285514	1	.8317813	1	5	9996
Survey	1.281428	1	.8375837	1	5	9999
Total	1.274459	1	.8195272	1	5	172135

Note: Mean, median, standard deviation, minimum and maximum of employees in 2016 in the different treatments after randomization. N constitutes the number of observations in each treatment.