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# How to Improve Small Firms' Payroll Tax Compliance? Evidence from a Randomized Field Experiment

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**Abstract:** Payroll tax evasion by firms is widespread and threatens the functioning of welfare systems in many countries around the world, yet very little is known about how to combat it. We report results from a large scale RCT testing strategies to improve payroll tax compliance of small firms in a middle-income country. We randomize announced audit probabilities (1%, 10%, 40% or 60%) on the firm level and implement several novel types of moral appeals (varying information on the benefits of tax-financed public goods). Our monthly tax return data show that both deterrence and moral measures significantly improve payroll tax compliance. A high audit probability thereby has a 50% greater impact than moral appeals. An additional treatment with ambiguous audit probability shows that behavioral factors (such as probability neglect) play a minor role for increasing compliance in the deterrence treatments.

**KEYWORDS.** (Payroll) Tax Compliance, Firms, Audits, Moral Appeals, RCT.

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## 1. INTRODUCTION

To safeguard the functioning of society, high levels of tax compliance are important and improving tax compliance is therefore a key objective of governments and tax authorities around the globe (De Neve et al., 2021, Slemrod, 2019, Floyd et al., 2022).<sup>1</sup> Firms play a key role in this context. They remit about 85% of all taxes (Milanez, 2017, Slemrod and Velayudhan, 2018) and they are important for an efficient functioning of third-party reporting (IRS, 2016, Kleven et al., 2011). However, firms, and especially small firms, are very difficult for tax authorities to penetrate (Slemrod, 2019).

The evasion of payroll taxes is particularly challenging to detect. Payroll taxes are a function of employee salaries and employers are responsible for remitting the tax. Payroll tax evasion plausibly occurs through a strategy where employees and the firm collude by agreeing that parts (or sometimes all) of employees' salaries are paid out in cash and remain untaxed. Since employer and employee have an incentive to remain silent about the existence of such "envelope wages" (sometimes also referred to as "payments under the table") and because the transactions are undocumented, the important function of third-party reporting is undermined and payroll tax evasion is hard to break up (Paulus, 2015, Slemrod, 2019, Bjerneby et al., 2021). In addition, payroll tax evasion undermines other tax bases, as it allows employees to underreport their personal income taxes and firms to report lower revenue (which reduces business income tax). Kumler et al. (2020) and Feinmann et al. (2022) are the first academic studies to quantify the size of the problem. They use surveys (in Mexico and Brazil) to document that underreporting of wages is substantial. Despite its importance, literature on payroll tax evasion – and how to fight it – is very scarce.

In this paper, we address this gap in the literature and provide causal evidence on how payroll tax evasion of small firms can be reduced. We conducted a large-scale, pre-registered randomized control trial (RCT) in cooperation with the federal tax authority of Bulgaria (National Revenue Agency, henceforth *NRA*) to explore how strategies that go beyond third-party reporting affect payroll tax compliance of small firms.

Payroll taxes (i.e., social security contributions, henceforth *SSC*) are the country's second most important source of tax revenue (Eurostat, 2022) and non-compliance is believed to be a prevalent problem (with approximately half of all firms estimated to be at risk of engaging in payroll tax evasion; see Williams and Horodnic, 2017 and Section 2.1). Bulgaria is an EU country and belongs to the majority of countries world-wide (108 out of 195) which are classified as middle-income countries by the World Bank. These countries are often characterized by weaker enforcement opportunities compared with developed, high-income, countries and face large challenges related to tax compliance (e.g., Carrillo et al., 2017). Compliance challenges in these countries are presumably linked to the prevalence of cash based transactions (Slemrod and Weber, 2012) and the relevance of small firms. For example, in Bulgaria, firms with less than 10 employees present 92% of all firms (EU Commission, 2019).

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<sup>1</sup>Based on randomized audits, the most reliable approach to estimate evasion, the IRS (2016) reports a tax gap of 406 Billion USD for the US, corresponding to a share of 16.3% of tax liability that will never be remitted.

In our RCT, we study the effectiveness of deterrence and moral appeal strategies for improving payroll tax compliance of small firms. Relying on the universe of VAT-registered small- and medium-sized firms in Bulgaria (about 172,000 firms), we randomly assign firms to three main groups. First, a control group of 10,000 firms which receive a placebo-type message conveying neutral information about the tax filing process. Second, 18,600 firms receive deterrence measures informing about the probability of becoming subject to an audit. The communicated audit probability randomly varies on the firm level and firms receive an audit with a probability of 1%, 10%, 40%, or 60%. Importantly, the tax authority truthfully implemented audits according to the audit probabilities. Third, 40,000 firms randomly receive one of four different moral appeal messages mentioning the role of tax revenue for financing public goods and emphasizing that taxpayers receive something in return for their tax money and social security contributions. The messages vary the intensity with which they appeal to the willingness of taxpayers to cooperate in the ‘fiscal exchange’ situation between taxpayers and the government (Buchanan, 1976) and they are informed by the behavioral economics literature showing that emphasizing individual utility of pro-social behavior and cooperation increases pro-social behavior (e.g., Fisher et al., 1995, Chen et al., 2021). The remaining firms are randomly assigned to either receive an invitation to participate in a survey studying firms’ attitudes and beliefs about tax evasion (10,000 firms) or remain untreated (about 93,000 firms).<sup>2</sup>

Using administrative monthly tax return data provided by the NRA, we show that *both* deterrence messages and moral appeals improve payroll tax compliance relative to the control group. The treatment effect of deterrence treatments stating a high audit probability (of 60%) is thereby approximately 50% larger than in the moral appeal treatment with the highest effect on compliance. The treatment effects of our low audit probability and moral appeal treatments build up in the four months after the intervention, and diminish subsequently. These dynamics suggest that firms in these treatments do not make any permanent changes in response to low threat deterrence measures and moral appeals, but make temporary adjustments in the wake of the treatment reception (e.g., declaration of salaries or registering additional employees for a few months and returning to old habits subsequently). The effects of announcing high audit probabilities (i.e., 40% and 60%) are more persistent, indicating that high threats of deterrence measures have a more sustainable effect on payroll tax compliance of firms. In the context of moral appeals, we find that the simplest form of our cooperation message has the most persistent effect. This finding is potentially the result of a partial reluctance to stronger forms of moral appeals.

Increased tax compliance in the deterrence treatments is potentially driven by the mere threat of an audit *and* a calculus rationale that depends on the specified audit probability. The findings in previous literature such as B ergolo et al. (2023) suggest that firms (in a VAT context) fall victim to probability neglect. This finding is rationalized with

<sup>2</sup>Because spillovers through tax professionals are important (Battaglini et al., 2020, Boning et al., 2020), our main sample consists of 95,508 firms (incl. untreated) that directly communicate with the tax authorities – see the discussion in Section 2.4. Our results are robust to including firms which correspond with the authorities through their tax professional (see Appendix D).

a *risk-as-feelings* notion according to which probabilities are neglected in a situation of fear. To test for probability neglect and risk-as-feelings explicitly (which is not done in existing work), our experiment includes an additional treatment in which we inform the firm that it faces the risk of an audit while leaving the exact audit probability unspecified. Benchmarking this treatment with unspecified audit probability against the treatments with specified probabilities, we find that the specification of large audit probabilities has an incremental effect. This finding is consistent with standard models of deterrence, but inconsistent with probability neglect and risk-as-feelings.

In line with some of the findings in [Holz et al. \(2023\)](#), we show that our treatment effects are mostly driven by the larger firms in our sample (which are still small compared to most firms in OECD countries). We also study heterogeneity with respect to the volatility of pre-experimental tax payments and compliance risk (as estimated by the tax authorities). Firms which are presumed to be more risky and firms which fluctuate more in their pre-experimental tax payments respond more strongly to our treatment interventions. This suggests that our treatment messages are particularly effective among the ‘usual suspects’.

Our experiment substantially boosted payroll tax revenue. A simple back-of-the-envelope cost-benefit analysis that accounts for the costs of the experimental interventions suggests that the experiment generated a return of about USD 298 per deterrence letter and USD 351 per moral appeal letter. Our most successful deterrence treatment stating high audit probabilities generated about USD 764 and the most effective moral treatment generated an increase of payroll taxes of about USD 497 per letter. In total, our experimental interventions triggered an additional payroll tax revenue of USD 10,856,280. To put this number into (a Bulgarian) perspective: the additional revenue generated in our experiment can fund the pensions of 5,210 Bulgarians over one year. Our estimates for the revenue effects are likely to be lower bounds because they do not take into account that higher payroll tax compliance also positively affects income tax bases reported by employees.

We expand the research frontier in that we focus on the evasion decisions of (small) firms and payroll taxes. Literature studying firm tax evasion is generally relatively scarce<sup>3</sup> and (RCT) studies focusing on strategies to improve *payroll* tax compliance are almost non-existent. The few existing compliance RCTs with firms mostly focus on VAT payments ([Bérgolo et al., 2023](#), [Pomeranz, 2015](#)), which is different in nature from payroll taxes.<sup>4</sup> We generally consider work on *firm* compliance to be important even in light of

<sup>3</sup>Indeed, [Slemrod \(2019\)](#) names “The Role of Firms” in the list of “Understudied Empirical Issues” in his recent survey of the tax compliance literature (Section 10.3).

<sup>4</sup> Payroll tax is generally different than other types of firm taxes, because firms face a trade-off in their compliance decision (reporting lower wage costs saves payroll taxes, but is not advantageous for the profit tax burden because unreported wages cannot be deducted from the profit tax base (see our theoretical intuition which is the first to model this trade-off) and because payroll taxes are “benefit taxes” where the contributions paid today affect benefits later received by the workers. We see at least two further specific (interrelated) reasons why payroll tax evasion is likely to be different from VAT evasion. First, collusion of firms and employees to engage in payroll tax evasion undermines the power of third-party reporting, the tool that is widely thought to be the most powerful weapon to fight tax evasion. Second, VAT is distinct from payroll taxation because it features a built-in enforcement system, albeit not being perfect ([Naritomi, 2019](#), [Pomeranz, 2015](#)), due to the paper trail that is usually created.

existing evidence for *individuals* because i) firm decision makers plausibly make different decisions in the work domain than in the private domain (see, e.g., [Cohn et al., 2014, 2017](#)), ii) firm evasion has a different character (for example, because compliant firms reduce their competitiveness relative to non-compliant firms), and iii) firms are important actors in an economy in general and are responsible for remitting taxes.<sup>5</sup>

Generally, the tax compliance literature focusing on *individual* taxpayers has broadly identified two different avenues towards improved compliance (see [Antinyan and Asatryan, 2020](#) for an overview). First, strategies that build on the canonical economics-of-crime model ([Allingham and Sandmo, 1972](#), [Becker, 1968](#)) and which are based on measures of deterrence, such as fines, penalties and audit probabilities (e.g., [De Neve et al., 2021](#), [Dwenger et al., 2016](#), [Kleven et al., 2011](#), [Slemrod et al., 2001](#)). Second, strategies building on the observation that non-pecuniary intrinsic motivations (e.g., civic duty or tax morale) also shape the decision to pay taxes (e.g., [Bott et al., 2020](#), [Fellner et al., 2013](#), [Frimmel et al., 2018](#), [Hallsworth et al., 2017](#), [Luttmer and Singhal, 2014](#), [Torgler, 2004](#), [Zhang et al., 2022](#)). Motivated by these two approaches, our RCT allows us to study the effectiveness of both deterrence and moral appeal measures on firms' compliance.

Although the literature on the effectiveness of moral appeals in improving individual compliance is mixed ([Antinyan and Asatryan, 2020](#)), and although firms are often assumed to be rational profit maximizers ([Friedman, 2007](#)) whose decisions are often made in groups that behave more 'rationally' than individuals ([Charness and Sutter, 2012](#), [Fochmann et al., 2021](#), [Kocher et al., 2020](#)), we are the first to show that moral appeals (which do not affect the rational calculus) can influence corporate tax compliance.<sup>6</sup> A novelty relative to all RCTs featuring moral appeals – including either individual or firm taxpayers – is that we test different moral appeals and vary information about the benefit of paying taxes between treatments. Our findings suggest that simple moral appeals (which stress the importance of public goods) are likely to generate more sustainable and sizable compliance effects than moral appeals that carry more information about the benefit of social security payments and tax money for the individual taxpayer.

<sup>5</sup>[Holz et al. \(2023\)](#) focuses on corporate taxes and individual taxes of the self-employed. Studying the role of public disclosure and exposing taxpayers to reminders that tax evasion is potentially punished with prison sentences, they have a different focus than our paper. Focusing on the Covid-19 pandemic, [Karver et al. \(2022\)](#) study the effect of moral appeals and information about penalties in Albania. We further relate to [Bjerneby et al. \(2021\)](#) who study the impact of randomly performed audits on reported wages in Norway and [Kumler et al. \(2020\)](#) who find that a closer tie between pension benefits and reported wages led to a relative decline in underreporting (both non-RCT settings). Studying enforcement strategies addressing firms, we also relate to papers studying the role of increased third-party reporting and withholding ([Adhikari et al., 2021](#), [Carrillo et al., 2017](#), [Slemrod et al., 2017](#), [Waseem, 2022b](#)), VAT cuts ([Waseem, 2022a](#)), the effect of different ways of delivery of messages ([Boning et al., 2020](#), [Doerrenberg and Schmitz, 2017](#), [Ortega and Scartascini, 2020](#)), the effects of audits ([Lediga et al., 2020](#), [Best et al., 2021](#)), or other papers (non-RCTs) on the effect of public disclosure and shaming ([Dwenger and Treber, 2022](#), [Hoopes et al., 2018](#)). These papers do not consider payroll taxes (with the exception of [Boning et al., 2020](#), [Kumler et al., 2020](#) and [Bjerneby et al., 2021](#)).

<sup>6</sup>We are only aware of the studies by [Bérgolo et al. \(2023\)](#) and [Pomeranz \(2015\)](#) investigating the role of moral appeals for firm tax compliance. Both studies are in a VAT context and they find very little effects on VAT remittances.

This finding helps to inform future RCT designs as well as tax authorities and governments considering the use of moral messages to increase compliance.

With regards to deterrence measures, we add the finding that deterrence measures stating a high audit probability are most effective, suggesting that behavioral factors such as probability neglect seem to play only a minor role in firms' payroll tax compliance in our context. This is in line with standard deterrence theories, yet in contrast to recent findings for firms (in a VAT context) in the compliance literature (Bérgolo et al., 2023). An advantage over most existing compliance studies (for firms and individuals) is our setting with monthly tax declarations and monthly tax return data, which allows us to study the dynamics directly after the intervention as well as over a longer time span. Our dynamic results suggest that yearly data used in other work might mask effects that occur directly after the treatment.

Comparing the cost effectiveness of costly deterrence and low-cost 'soft' measures is a further contribution of our study (De Neve et al., 2021 compare nudges to standard enforcement actions for individual taxpayers; see Chan et al., 2022 for lab evidence). Because of the cost of audits, moral messages directed at firms seem to generate comparably amounts of tax revenue in the months after the intervention. Stark deterrence measures, by contrast, seem to be more persistent. Depending on the objective and time horizon of enforcement strategies, tax authorities may make use of our findings when designing campaigns to boost tax revenue and increase compliance.

## 2. THE FIELD EXPERIMENT AND DATA

### 2.1 *Institutional Context*

Our RCT took place in Bulgaria, a post-communist country in southeastern Europe. With a GDP per capita of USD 8,366 in 2017, it is the poorest member state of the EU and ranks well below the OECD (USD 37,407) and EU (USD 33,024) averages. The World Bank classifies Bulgaria as a middle-income country (LINK). Within the 108 middle-income countries world-wide, Bulgaria is an upper-middle income country (and as such compares to countries like, for example, Brazil, Mexico, Dominican Republic, Thailand or Turkey). Marked by a transition from a centrally planned to a market economy, Bulgaria faces a wide variety of structural challenges that are more pressing than in other EU member states: corruption, informal economy, distrust in public institutions, and weak administration are believed to be serious problems (see OECD, 2021). Our experimental interventions are targeted at small firms who shape Bulgaria's economy. 99% of firms are small- and medium-sized and 92% of the firms have less than ten employees. The most important industry sectors are wholesale and retail trade and manufacturing (EU Commission, 2019).

*Background on Social Security Contributions (SSC).* In our study, we focus on payroll tax evasion by firms. Firms file the majority of taxes in Bulgaria. They are responsible for remitting and withholding corporate income tax, VAT and SSC, as well as personal income taxes for their employees. Bulgaria has a simplified corporate and personal income tax system with low tax rates<sup>7</sup> that enhances the importance of SSC. SSC payments

<sup>7</sup>A flat tax of 10% applies to corporate and personal income. The VAT system is explained in Appendix C.

are the second most important source of tax revenue in Bulgaria (Eurostat, 2022) and account for 30% of total tax revenues which compares to about 8% of the GDP in 2021.

SSC are contributions paid by employees and employers to finance social security benefits (i.e., pension, occupational accident, illness, common disease, maternity, unemployment, and health insurance benefits). The tax rate is around 30% and applies to an employees' gross income.<sup>8</sup> Employers and employees share the tax burden, with employers bearing about two-third of the contributions. Firms have to monthly report their employees' gross income and pass the SSC due on it to the tax authority (no pre-payments or the such). The monthly reported gross income also serves as the basis for calculating the employee's personal income tax.

Payroll tax evasion is a prevalent problem in Bulgaria. The Bulgarian tax authority estimates an annual loss of on average BGN 440 million (about USD 220 million) from payroll tax evasion (Williams and Horodnic, 2017). To evade payroll taxes, employers and employees collude and underreport employees' wages, and employees usually receive part of their salary in cash. These so-called 'envelope wages' are not part of an employee's labor contract and are thus not reported to the tax authority. Both employees and employers have an incentive to remain silent about the existence of envelope wages. While employees escape their share of social security and income tax payments, resulting in higher immediate income, employers benefit from reduced payroll contributions and lower wage costs.<sup>9</sup> This form of underdeclaring work is a widely applied practice in Bulgaria (EU Commission, 2020). The NRA estimates 47% of employers and 58% of employees to be at risk of engaging in underdeclared work (Williams and Horodnic, 2017). In a survey among the Bulgarian population, 15% of respondents reported receiving envelope wages stating the average amount undeclared at 30% (Yang and Williams, 2017).<sup>10</sup>

*Results from a Firm Survey.* To obtain an even better understanding of the institutional context and, specifically, the beliefs and attitudes towards taxes and tax evasion of firms in our sample, we invited 10,000 randomly selected firms, which are comparable to those receiving treatment mailings, to participate in a short survey. The survey was administered by the tax authorities alongside the experimental treatment mailings to ensure that we capture attitudes and beliefs that are in place at the time of the experiment. 1,725 (17.25%) firms responded to the survey invitation and answered at least some of the questions. The survey results reveal that 85% of the small firm respondents state that tax evasion is a problem in Bulgaria. In addition, firms in our survey indicate that about 22% of the revenue is evaded in their industry. Moreover, confirming a rather low compliance rate with payroll taxes, they believe that 23% of the wage bill is not officially declared and thus not subject to SSC (the full results of the survey and the design are presented in Appendix E).

<sup>8</sup>The exact tax rate depends on the industry and an employee's occupation.

<sup>9</sup>Note that payroll tax evasion may reduce future income of employees, i.e., pension payments. Thus, whether evasion of payroll taxes is actually income (and utility) maximizing for the employee in the long run is not clear.

<sup>10</sup>These estimates are lower-bound estimates as surveys tend to underreport sensitive questions.



*Background on activities of the tax authorities.* The NRA regularly conducts tax audits and imposes sanctions. The NRA informed us that they perform about 8,000 full audits and 20,000 checks (a lighter form of an audit which may result in a full audit) each year. During an audit the tax authority looks at all tax and social security liabilities of the relevant period. Detected non-compliant taxpayers are liable to a fine of up to BGN 20,000 (USD 10,000), seizing of assets or imprisonment of up to eight years. The tax authorities collect about BGN 1,000 million (USD 500 million) in unpaid taxes each year and administer fines and sanctions of about BGN 1.3 million (about USD 650,000) a year. In addition, about BGN 300 million (USD 150 million) in interest for unpaid taxes are collected.

## 2.2 Treatments

We implement one baseline (control or placebo) treatment (Section 2.2.1), four treatments appealing to the morale of paying taxes and social security contributions (Section 2.2.2) and five deterrence treatments containing information about a firm's probability of receiving an audit in the following months (Section 2.2.3). All treatment letters (original Bulgarian along with English translation) are shown in Appendix F.

### 2.2.1 Baseline Condition

Our baseline (*Baseline*) mailing acts as the control condition for the moral appeal and deterrence treatments. We implement the baseline mailing because receiving any message by the tax authorities may already affect the behavior of taxpayers (e.g., because it raises awareness of filing taxes or an alert effect where taxpayers develop the feeling to be on the radar of the authorities). Using a group of taxpayers who do not receive any message as control group may report biased results (see [Fellner et al., 2013](#) for similar arguments).

The baseline mailing was neutrally phrased as an informative message by the tax authorities; it provided a link to a government website that is helpful for the tax filing process of SMEs and that includes information about how to facilitate tax payments. The baseline mailing referred to our variables of interest: social security payments and tax payments (including VAT). The mail greeted the taxpayer and was electronically signed by the responsible person within the tax authorities. Importantly, all treatment mailings (moral appeal and deterrence treatments) contained the identical text from the baseline mailing. The main content of the mailing reads as follows:

***Baseline.*** *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 here) where you find much information relating to your tax payments and social insurance contributions. We hope you find our online appearance useful.*

### 2.2.2 Moral Appeals

The mailings in the moral appeal (*Moral*) treatments contained the identical text as the *Baseline*, but additionally included different types of moral appeals to pay taxes and social security contributions. The appeals differ in the intensity with which we emphasize the fiscal exchange between taxpayer and government. That is, our treatments emphasize the taxpayers' benefits from tax-financed public goods and SSC (see [LINK](#) for an overview of social insurance benefits in Bulgaria).

We implemented an appeal to cooperation in the *Cooperation* treatment. In this treatment, we simply mention the benefit of paying taxes for taxpayers. We increased the reference to the benefit from paying taxes in the *Example* treatment which contained the identical text as the *Cooperation* treatment, but additionally provided specific examples of public goods funded with tax money and social security contributions (e.g., roads, health care, education, etc.). In the *Necessity* treatment, the mailing contained the identical text as in the *Example* treatment, but we addressed the taxpayer directly, i.e., by mentioning that the individual firm is important for financing public goods. Finally, the *Picture* treatment was identical to the *Necessity* treatment, but we attached a picture of a tax-financed public good (a playground) to the mailing. Each of the treatments thus only adds one additional layer of information for the taxpayer. In summary, our *Moral* treatments added the following core information to the *Baseline* mailing:

***Cooperation:*** Text from *Baseline* + *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.*

***Example:*** Text from *Cooperation* + *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!*

***Necessity:*** Text from *Example* + *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.*

***Picture:*** Text from *Necessity* + A picture from a tax-financed playground for children.

### 2.2.3 Deterrence Treatments

The deterrence treatments (*Deterrence*) likewise build on the content of the *Baseline* mailing. In addition to the information from *Baseline*, we communicated the individual probability of receiving a tax audit for a firm. The audit probability varied across the different arms of the *Deterrence* treatments. The selected firms were truthfully audited in the months following our treatment mailings. The audits that were performed in the context of our experiment had the character of a 'check', which results in a full audit if anything is detected to be suspicious.

We implemented four treatments with specific audit probabilities: 1% in *Audit 1%*, 10% in *Audit 10%*, 40% in *Audit 40%* and 60% in *Audit 60%*. In addition, we set up one treatment with a positive alas not further specified, and hence ambiguous, individual

audit probability (in *Ambiguous*). The core content of the treatment mailings with a specific audit probability and with the ambiguous audit probability is presented below ( $X\%$  represents the respective audit probability in the different treatments, i.e., 1%, 10%, 40% and 60%).<sup>11</sup>

***Audit 1%, Audit 10%, Audit 40%, Audit 60%:*** Text from *Baseline* + *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.*

***Ambiguous:*** Text from *Baseline* + *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.*

### 2.3 Outcome Variables

Relying on administrative monthly tax return data provided by the NRA, our key outcome variable of interest is the reported firm-level tax base of social security payments (tax base of SSC). We also consider the effect of our treatment interventions on tax base of VAT (see Appendix C for more details on the VAT variable and the corresponding VAT results). In addition to studying the effects of our treatments on the VAT base, we investigate potential spillover effects of treatment-induced SSC adjustments on VAT reporting behavior (see Appendix C).<sup>12</sup> The unit of observation in all analyses is the firm-month. We explore changes in reported tax base of SSC in the period prior to the experiment and the period after the experiment across the treatment interventions.

### 2.4 Experimental Procedure, Randomization, and Sample

The field experiment was designed in collaboration with the NRA in Bulgaria. The experiment was pre-registered on the AEA RCT Registry (RCT ID AEARCTR-0002390). Ethical

<sup>11</sup>Note that we additionally perform two audit treatments (with an announced probability of 0% and 100%) which have no predictive power (because of the limited number of 100 observations in each treatment) but were interesting for the tax authorities from an exploratory point of view.

<sup>12</sup>While we transparently report and discuss VAT results in Appendix C, we focus on SSC payments throughout the paper because the literature on payroll tax evasion of firms is very scarce, whereas there do exist a few papers using RCTs to study VAT evasion (in particular [Bérgolo et al., 2023](#), [Pomeranz, 2015](#)). We acknowledge that this is somewhat different than what we stated in our pre-registration, where we indicated that we study both SSC and VAT (without focus on SSC). However, in light of existing VAT evidence (much of which emerged after our pre-registration), non-existing payroll tax evidence, and because of important differences between these two taxes (e.g., trade-off due to deduction of wage costs in profit tax, paper trail, “benefit tax” character of payroll taxes and other differences in enforcement challenges; see Footnote 4), we believe that an improved understanding of payroll tax evasion deserves the majority of attention in our paper (without embezzling the VAT results).

approval was granted by the University of Lausanne (the home institution of one of the authors during the design phase).

We designed the experiment taking into account the capacities (e.g., for sending the mailings and performing the audits) and practical interests from the tax authorities (e.g., interest for the effect of specific audit probabilities and for moral appeals). For our field experiment the authorities were willing to send out 68,580 mailings, perform 2,210 audits (which would otherwise have been conducted in a non-randomized way) and invite 10,000 firms into a separate and anonymous survey (see above). The number of firms in the different treatment conditions was thus influenced by academic interest and relevance, practical importance and the capacities of the tax authority.

To design the experiment and randomize firm taxpayers into treatments, the NRA provided pseudonomized information about the universe of small and medium sized 172,172 SMEs that are registered for VAT.<sup>13</sup> The data comprises monthly SSC and VAT information, information about the number of employees (in categories), a firm's industry for 2016, 2017 and the beginning of 2018 (until May 2018), and its assigned risk score (between 1 - low-risk and 3 - high-risk). The data was provided in two batches. We received the 2016 data prior to the experiment (to perform the randomization) and received further data after the experiment (to analyse the effects).

We randomly assigned firms based on their 2016 tax data into treatments using blocked randomization. Firms were grouped into deciles based on their tax reporting and then randomly assigned to a treatment within each decile. The treatments were balanced in terms of their 2016 SSC and VAT tax bases (see Appendix D.1 for summary statistics).

40,000 firms were randomly assigned to treatments involving moral appeals. 18,580 firms received deterrence messages and 10,000 served as the control group. Additionally, 10,000 firms were invited to participate in an anonymous survey administered by the research team. To validate the authenticity of the audit probabilities and to avoid deception, the firms receiving an audit in the deterrence treatments were randomly determined. Audit start dates were confirmed by the NRA to ensure proper implementation. Treatment mailings were sent in July 2017. The tax authority communicated with taxpayers and sent treatment mailings using an electronic mail service similar to standard commercial email providers and used for communication with taxpayers.

The design of our experiment assumed direct communication between the tax authority and firms. However, after the treatment mailings were sent, the tax authorities discovered, and pointed out to us, that a total of 76,664 firms provided email addresses which were also used by other firms for communication. This indicates that some firms redirected communication to their tax accountant, leading to spillovers of treatments within the experiment (as shown in the literature; see, e.g., [Battaglini et al., 2020](#), [Bonning et al., 2020](#)) or confusion. Some accountants received multiple mailings with different content, which may have irritated them and reduced the effectiveness of our inter-

<sup>13</sup>There are approximately another 25,000 larger companies in Bulgaria that are VAT registered but that are not in our sample. These are large firms defined as meeting the following three criteria: i) balance sheet value of assets larger BGN 38 million, ii) net sales revenue over BGN 76 million, iii) more than 250 employees or firms for which the NRA did not have financial statements data when they compiled the data set.

ventions. Tax authorities reported second-hand knowledge that some accountants were confused and did not consider the content of the mailings when filing taxes for clients.

We were unaware beforehand that firms may redirect communication to their tax accountant. The experimental design assumed direct communication of the tax authority with firms, even for firms with external or internal tax accountants (although we generally acknowledge the role of tax accountants for firms' compliance). As a matter of fact, if we had known during the design stage that the communication is through tax accountants for some firms, we would not have included these firms in the experiment in order to minimize spillover effects between treatments (and to meet the conventional SUTVA assumption). To avoid these concerns, our main specifications only consider firms that communicate directly with the tax authorities. Practically, we focus on firms which do not use the same email as another firm in their communication with the tax authority. This does not exclude the possibility that some firms still use tax accountants (e.g., 25% of surveyed firms reported having in-house accountants), but ensures that each firm directly receives only one treatment mailing.

Importantly, firms which communicate directly with the authority are equally distributed among treatment groups, maintaining the balance of randomization. We do not find significant pre-experiment differences in reported SSC and VAT tax bases across treatments among the 95,508 firms that communicate directly with the authority. Our main sample has the following number of observations in each treatment arm: *Baseline/Control Group*: 5,540; all *Moral* treatments pooled: 22,268; *Cooperation*: 5,529; *Example*: 5,548; *Necessity*: 5,617; *Picture*: 5,574; all *Audit* treatments pooled: 10,249; *Audit 1%*: 2,908; *Audit 10%*: 2,810; *Audit 40%*: 1,124; *Audit 60%*: 650; ; *Ambiguous*: 2,757 (see Appendix A for more details for our main sample).<sup>14</sup>

Since we were not aware during the design stage that some firms communicate with the authority via a tax accountant, we did not pre-register that the main sample in our paper focuses on firms which communicate directly with the tax authority. To be fully transparent and to show results for the sample that we had pre-registered, we report all our results (including robustness checks) for the extended sample of all firms in our experiment (see Appendix D; also see Section 4 Experimental Results).

### 3. EXPECTED RESULTS

Our analyses focuses on the comparison of *Deterrence* and *Moral* treatments, respectively, with the *Baseline* as control condition, and on the comparison of effects within the *Deterrence* and the *Moral* treatments. In light of their different nature, we do not derive any predictions for a comparison between the *Deterrence* and the *Moral* treatments.

Our moral appeals emphasize (and gradually increase across treatments) the taxpayers' benefit from infrastructure, healthcare, state education and other public goods provided by the state. The *Moral* treatments are thus based on the behavioral economic literature on cooperation (see Chaudhuri, 2011, Ledyard, 1995, for reviews) and reciprocity (Bolton and Ockenfels, 2000, Charness and Rabin, 2002, Fehr and Schmidt, 1999)

<sup>14</sup>We drop one firm with unreasonable reporting behavior in one month (pointing to a data error in this month) from all analyses.

and also connected to literature on gift exchange in the field (Gneezy and List, 2006, Falk, 2007, Kube et al., 2012). Our treatments further relate to recent evidence showing that appealing to cooperation and the individual benefit from pro-social behavior may increase such behavior (List et al., 2021). Our treatments can also be viewed in the context of the ‘fiscal exchange’ paradigm (Buchanan, 1976, Alm and Jackson, 1993, Feld and Frey, 2007, Schaechtele et al., 2022) according to which the government provides public goods and the citizens are willing to pay taxes in exchange for consumption of the public goods.

Firms face a dilemma between honest reporting and tax evasion for maximum profits. Recent literature suggests that the behavior of (at least some) firms may contradict the standard textbook assumption of pure profit-maximization as they seem to make decisions on moral grounds, e.g., by reflecting preferences of their owners (see, e.g., Grieder et al., 2021, Schmitz and Schrader, 2015). They may therefore be responsive to our moral appeals, assuming that some firms (or decision-makers in firms) face moral costs from evasion. Our treatments aim to increase the visibility of these costs and encourage firms that value cooperation to reduce tax evasion and freeriding on public goods funded by taxes.

Our *Deterrence* treatments are inspired by the seminal work of Becker (1968) and Allingham and Sandmo (1972) who mainly focus on pecuniary motivations to pay taxes. Both theories assume that an increase in penalties or the detection probability reduces criminal and dishonest behavior. In our setting, the penalty for evading taxes is held constant, but the probability of detection is varied in the *Deterrence* treatments.<sup>15</sup>

To guide our analysis, we provide a short theoretical intuition to describe taxpayer behavior in the presence of deterrence and moral costs. Our model accounts for the specifics of payroll taxes where firms face a trade-off: Underreporting wages saves payroll taxes, but it is disadvantageous for the profit tax bill because non-reported wages cannot be deducted from the profit tax base. We are not aware of prior literature that explicitly models this payroll tax specific trade-off. The modeling of moral evasion costs is inspired by Bott et al. (2020).

In our model, firms maximize their expected profit. Firms face two type of taxes. A profit tax  $\tau$  (with  $\tau \in [0, 1]$ ) on profits and a payroll tax  $t$  (with  $t \in [0, 1]$ ) which is levied on the firm’s wage costs. The firm has revenues  $R$  and true total wage costs  $W$ . The firm is legally required to pay profit taxes  $\tau$  on profits ( $R - W$ ) and payroll taxes  $t$  on wage costs  $W$ . However, the firm can hide wage costs from the tax authority and total true wage costs consist of reported wages  $F$  and unreported wages  $E$  (i.e.,  $W = F + E$ ). In our data, we see  $F$ , the reported base of the payroll tax (i.e., tax base of SSC). The *perceived* probability of an audit is  $p$  (with  $p \in [0, 1]$ ; see below for more). We assume that revenues  $R$  and true wage costs  $W$  are determined when the firm makes a decision about payroll tax evasion (that is, we do not model the determination of  $R$  and  $W$  and we do not model that the firm can hide revenue  $R$  from the tax authority). When evading, firms may incur

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<sup>15</sup>Our experiment used blocked randomization with equal distribution of firms (and large and small evaders) between treatment conditions, ensuring that firms on average face the same penalty. However, the probability of detection varied across treatments.

subjective moral costs that depend on the extent of evasion:  $s\beta(W - F)^2$  (see below for more interpretation).

If the firm is not audited, payroll tax evasion is not detected and payroll taxes are due on formally reported wages  $F$ . Unreported wages  $E$  cannot be claimed as expenses in the profit tax context and the profit tax base thus is  $(R - F)$ . The firm's profit thus is:  $P^{nc} = (R - W) - \tau(R - F) - tF$  (with  $nc$  indicating the situation with no check by the authority). If the firm is subject to an audit, the tax authority is able to identify the firm's true wage costs. If the firm is caught evading (i.e.,  $F < W$ ), the tax authority charges a penalty which we model as an increase in the applicable tax rates:  $\tau^c$  (with  $\tau^c > \tau$ ) and  $t^c$  (with  $t^c > t$ ). If the firm is audited and no evasion is detected (i.e.,  $F = W$ ), no penalty is charged and the usual tax rates apply (i.e.,  $\tau^c = \tau$  and  $t^c = t$ ). As a result, in the case of an audit, honest firms are better off than evading firms. The firm's profit in the case of an audit is:  $P^c = (R - W) - \tau^c(R - W) - t^cW$  (with  $c$  indicating the situation with check).

Firms thus maximize the following expected payoff function (which includes expected profits and moral costs) with respect to reported wages  $F$ :

$$\begin{aligned} E(\pi) &= pP^c + (1 - p)P^{nc} - s\beta(W - F)^2 \\ &= p\left((R - W) - \tau^c(R - W) - t^cW\right) \\ &\quad + (1 - p)\left((R - W) - \tau(R - F) - tF\right) - s\beta(W - F)^2 \end{aligned}$$

We assume that the perceived audit probability  $p$  consists of two parameters: i) parameter  $a$  (with  $a \in \{0, 1\}$ ) describes if the firm is aware of the possibility of an audit, and ii) parameter  $l$  (with  $l \in [0, 1]$ ) describes the perceived likelihood that such an audit might happen (conditional on audit awareness). Thus,  $p = a \times l$  is zero if the firm is not aware of an audit possibility (because  $a = 0$ ) and  $p = a \times l$  is equal to the perceived likelihood  $l$  if the firm is aware of an audit (because  $a = 1$ ). For simplicity, we assume that firms in the baseline treatment are not aware that an audit might happen (i.e.,  $a = 0$ ).<sup>16</sup> Our deterrence treatments then shift parameter  $a$  from 0 to 1 because they make firms aware that an audit can happen, and they additionally shift  $l$  and reveal the true probability of an audit for a firm.

$s$  (with  $s \in [0, 1]$ ) captures the salience of the subjective moral evading costs and  $\beta \geq 0$  is the weight attached to the moral costs of evasion if the moral costs are salient. We do not expect to manipulate the fundamental weight that is attached to the moral cost,  $\beta$ , through the treatment letters (Bott et al., 2020). Rather, in our moral treatments, we shift the salience  $s$  of the moral costs: the salience is larger in any moral treatment relative to the baseline condition, i.e.  $s(\text{Moral}) > s(\text{Baseline})$ . In addition, salience  $s$  varies between the moral treatments:  $s(\text{Cooperation}) < s(\text{Example}) < s(\text{Necessity}) < s(\text{Picture})$ .

<sup>16</sup>Note that our directional predictions hold when  $a \in [0, 1]$  and assuming that awareness of an audit  $a$  is lower in baseline than in the deterrence treatments.

Maximizing  $E(\pi)$  with respect to formally reported wages  $F$  yields the optimal level of reported wages,  $F^*$ , as a function of true wages:

$$F^* = W - \underbrace{\frac{(1-p)(t-\tau)}{2s\beta}}_{E^*}$$

The right term,  $E^*$ , describes the optimal underreported (evaded) amount of wage costs (recall:  $W = F + E$ ). The firm underreports wages (i.e.,  $E^* > 0$  and thus  $F^* < W$ ) if the profit tax  $\tau$  is smaller than the payroll tax  $t$  (in this case,  $E^*$  is greater than zero). This finding occurs as a result of the previously described trade-off: underreported wages save payroll taxes, but they cannot be deducted from the profit tax base and therefore increase the due amount of profit taxes. In a situation in which profit taxes are higher than payroll taxes, reporting and deducting the true wage costs is advantageous. In the case of Bulgaria, firms have an incentive to underreport wages, because all profits (for both corporations and pass-through firms) are subject to a tax of 10%, whereas the payroll tax is 30% and the legal share of employers in this is 2/3.

The remaining parts of the expression for  $F^*$  are intuitive as well: as the perceived audit probability  $p$  increases, reported income increases ( $E^* = 0$  and  $F^* = W$  for  $p = 1$ ). Similarly, as the salience of the moral costs  $s$  increases, reported income increases ( $E^*$  decreases as  $s$  increases).

Our deterrence and moral treatments increase  $p$  and  $s$ , respectively. It is easy to see that these treatment induced shifts increase reported wages  $F$  and move reported wages towards true wages  $W$ , thus increasing tax honesty ( $\frac{\delta F^*}{\delta p} > 0$  and  $\frac{\delta F^*}{\delta s} > 0$ ). That is, we expect the tax base of the payroll tax  $F$  to increase through the treatment manipulations.

*Expected Result for Moral Treatments:* Given the differences in  $s$  between treatments, we hypothesize that the observed payroll tax base ( $F$ ) is lowest in the *Baseline* condition and highest in the *Picture* condition.

*Expected Result for Deterrence Treatments:* Since  $p = 0$  in the *Baseline* group, and  $p > 0$  in any *Deterrence* group, we hypothesize that the observed payroll tax base ( $F$ ) in the *Baseline* condition is lower than in any of the *Deterrence* conditions. In addition, we hypothesize that the reported tax base will be the higher, the higher the audit probability  $l$  that we communicate to firms in the audit letters, i.e., lowest tax base in the *Audit 1%* treatment and highest tax base in the *Audit 60%* treatment.<sup>17</sup>

## 4. EXPERIMENTAL RESULTS

### 4.1 Estimation Strategy

Following the practice in many RCTs on tax compliance (such as Holz et al., 2023 and Bjerneby et al., 2021), we start off with a ‘static’  $2 \times 2$  difference-in-difference regression

<sup>17</sup>*Deterrence* letters obviously include the *Ambiguity* condition. We will take a closer look at the *Ambiguity* condition as we study mechanisms in Section 5.



model of the following form to estimate the effects of our treatment letters:<sup>18</sup>

$$Y_{i,t} = \beta_0 + \beta_1 POST_t + \beta_2 TREAT_i^j + \beta_3 (POST_t \times TREAT_i^j) + \mu X_i + \varepsilon_{i,t}. \quad (1)$$

$Y_{i,t}$  denotes our main outcome of interest, SSC tax base ( $F$  in our model), for firm  $i$  in month  $t$ . The unit of observation thus is the firm-month. Having the level of the SSC tax base as the outcome variable, we study intensive margin responses in the reporting decision. Because firms usually report some SSC, we do not consider the extensive margin decision of whether to report SSC at all.  $TREAT_i^j$  is a dummy variable equal to one if firm  $i$  received treatment  $j$  and zero if it is in the baseline condition.  $POST_t$  is a dummy variable indicating the months after the treatment, and  $X_i$  is a vector of two pre-defined control variables (pre-experimental 2016 values of number of employees – measured in categories – and a firm’s industry) which we include to gain precision. Results are generally robust to excluding controls (see Appendix B.2).  $\varepsilon_{i,t}$  is the error term.

Our coefficient of interest is  $\beta_3$ , the coefficient on the interaction term  $POST_t \times TREAT_i^j$ . It corresponds to the difference in reported SSC between treated and baseline firms between pre-treatment and post-treatment months. Hence, it represents the causal effect of our respective treatment mailings on the firms’ tax base. We start with *pooled* regressions in which we benchmark firms in the *Baseline* condition against all firms who received a *Moral* treatment or a *Deterrence* treatment, respectively. Subsequently, we compare each experimental group separately relative to the *Baseline* condition. Obviously, the  $TREAT_i^j$  dummy will be differently defined across these comparisons. We use standard OLS regressions and cluster standard errors at the firm level. Our results are robust to using standard errors that are adjusted for multiple hypothesis testing (see Appendix B, where we use the MHT approach of Jones et al., 2019.)

We include four pre-treatment months (to account for monthly fluctuations and seasonality) in all specifications (results are robust to including different number of pre-treatment months, see Appendix B.4). We further differentiate between effects that occur in the months after the intervention and overall effects (spanning all post months in our data). We include four post-treatment months in the above regression to study the effects occurring directly in the months after the intervention and ten post-treatment months for the overall effects. To ensure that our results are not dependent on an arbitrarily chosen post-treatment horizon, we report results for two, four, six, eight and ten post-treatment months in Appendix B.5. The results are robust to including different numbers of post-treatment months. We do not consider very-immediate effects (say one post month) as firms need some time to respond to the treatment and adjust tax filing behavior.

To understand dynamic treatment effects over time, we run generalized DiD-models where we interact the treatment dummy with month dummies, thereby omitting the interaction with the month before the treatment (that is, we basically replace  $POST_t \times TREAT_i^j$  in the above equation with interactions of the treatment dummy with month

<sup>18</sup>Note that all treated firms were treated at the same point of time. This simple  $2 \times 2$  model is therefore not subject to the concerns that were recently raised in the context of DiD models where different units are treated at different points in time (Goodman-Bacon, 2021, Baker et al., 2022).

dummies). We include all months available in our data in these regressions and, in the figures, display the results for four pre- and ten post-experimental months (consistent with the overall DiD specifications). Appendix B.6 shows the figures that we include in the main part of the paper, but displaying more pre-treatment periods.

We conduct an exploratory analysis to investigate heterogeneous treatment effects, as outlined in our pre-registration. Our analysis uses the static DiD model with sample splits based on pre-determined variables to compare treatment effects across all sources of heterogeneity that we can investigate in our data. Our sources of heterogeneity are: size (employees, 2016 tax base), industry, 2016 SSC tax base variance, and tax authority risk score. We use *log*-values for comparability across firms and industries. The comparison groups in these sample split analyses always consist of control group firms with similar characteristics to the treatment group.

We report all analyses using the extended sample that includes firms which do not directly communicate with the authority in Appendix D. The results using this sample are generally robust, though sometimes smaller in size (which is consistent with the explanation that some accountants were confused and/or ignored the treatment message). None of the conclusions that we draw in the paper differ from the conclusions that could be drawn from including firms that do not directly communicate with the authorities in the analysis.

#### 4.2 Moral treatments

*Static DiD.* Table 1 presents the main results for the effect of the moral appeal treatments on SSC. Panel A depicts the immediate effects of our intervention (including four post-experimental months) and Panel B shows the results for the overall effects (including ten post-treatment months). Column (1) reports the regressions where we pool all *Moral* treatments. Columns (2-5) present the regression results in the *Cooperation*, *Example*, *Necessity*, *Picture* treatments, respectively. All reported effects are relative to the *Baseline* condition.

All  $POST \times TREAT$  interaction terms in Panel A are positive and statistically significant, showing that firms in the *Moral* treatments raised payroll tax compliance relative to the control group in the months after the intervention. This is consistent with our predictions. In the specification where we pool all moral treatments, we find an average DiD coefficient of BGN 278 (USD 140), which is equivalent to a 3.5% increase in SSC tax base (relative to control mean) in each of the four months following the treatment intervention (Column 1).<sup>19</sup>

We find that the estimates for each type of moral appeal message (i.e., *Cooperation*, *Example*, *Necessity* and *Picture*) are positive and statistically significant (relative to base-

<sup>19</sup>We find positive coefficients for the post-treatment indicator (POST), indicating that firms in the baseline condition increased their payroll tax base after the intervention. This can be due to a summer effect (since treatment were sent in early summer), improved economic conditions in the second half of the year, or a combination of both. The Bulgarian economy improved in the latter half of 2017, as shown by the pre-experimental data and quarterly GDP data (GDP in million Euro: 2017Q1 10,724.7; 2017Q2 12,741.9; 2017Q3 14,302.0; 2017Q4 14,762.6; Source: Eurostat). Eventually, these results emphasize the need to have a randomized design with treatment and control group.

TABLE 1. Treatment effects of moral treatments on SSC

| <b>Panel A:</b>                 |                         |                           |                         |                         |                        |
|---------------------------------|-------------------------|---------------------------|-------------------------|-------------------------|------------------------|
| <b>4 post-treatment months</b>  |                         |                           |                         |                         |                        |
|                                 | <i>Moral all</i><br>(1) | <i>Cooperation</i><br>(2) | <i>Example</i><br>(3)   | <i>Necessity</i><br>(4) | <i>Picture</i><br>(5)  |
| POST                            | 251.254***<br>(61.911)  | 257.023***<br>(61.195)    | 262.808***<br>(61.169)  | 246.786***<br>(61.437)  | 252.624***<br>(61.510) |
| TREAT                           | 453.152<br>(479.180)    | 279.908<br>(632.364)      | -190.730<br>(632.525)   | 1202.532*<br>(679.752)  | 322.274<br>(575.844)   |
| POST x TREAT                    | 278.195***<br>(76.559)  | 304.621**<br>(118.416)    | 267.742***<br>(102.450) | 291.545***<br>(103.315) | 242.031**<br>(109.151) |
| <i>Observations</i>             | 186377                  | 74366                     | 74505                   | 74850                   | 74409                  |
| <i>No of firms</i>              | 27808                   | 11069                     | 11088                   | 11157                   | 11114                  |
| <i>Adjusted R<sup>2</sup></i>   | 0.365                   | 0.370                     | 0.346                   | 0.389                   | 0.407                  |
| <b>Panel B:</b>                 |                         |                           |                         |                         |                        |
| <b>10 post-treatment months</b> |                         |                           |                         |                         |                        |
|                                 | <i>Moral all</i><br>(1) | <i>Cooperation</i><br>(2) | <i>Example</i><br>(3)   | <i>Necessity</i><br>(4) | <i>Picture</i><br>(5)  |
| POST                            | 393.967***<br>(96.747)  | 406.160***<br>(94.624)    | 413.521***<br>(94.452)  | 385.653***<br>(95.101)  | 397.150***<br>(95.093) |
| TREAT                           | 457.751<br>(479.270)    | 286.619<br>(632.485)      | -173.612<br>(633.140)   | 1204.180*<br>(678.039)  | 325.659<br>(575.483)   |
| POST x TREAT                    | 232.393**<br>(111.396)  | 329.416**<br>(144.980)    | 175.107<br>(127.062)    | 204.189<br>(148.571)    | 208.070<br>(154.560)   |
| <i>Observations</i>             | 321202                  | 128123                    | 128327                  | 129002                  | 128113                 |
| <i>No of firms</i>              | 27808                   | 11069                     | 11088                   | 11157                   | 11114                  |
| <i>Adjusted R<sup>2</sup></i>   | 0.362                   | 0.366                     | 0.338                   | 0.387                   | 0.401                  |

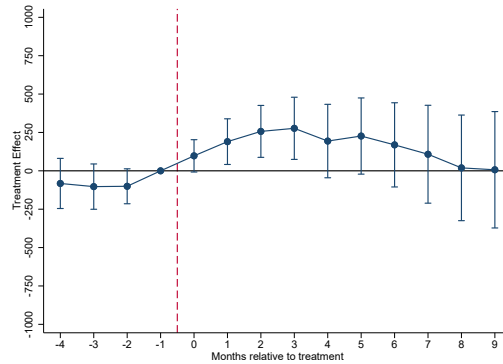
Notes: Treatment effects of moral messages on SSC. Displayed are DiD regression estimates of treatment messages on tax base SSC. The estimated treatment effects are relative to the baseline condition. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. The pre-treatment time period includes four months before and the post-treatment time period four (Panel A) or ten (Panel B) months after the treatment. The pre-experiment control mean of tax base SSC in the baseline condition is BGN 8,004. A firm's number of employees and its industry affiliation are included as controls. Standard errors clustered on firm level are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

line). However, all these coefficients are similar in magnitude and they are not significantly different from each other. Inconsistent with our predictions, this suggests that the type of message does not make a considerable difference; simple cooperation messages and messages that directly refer to the taxpayer and include a picture of a government financed children playground have similar effects on compliance.

As shown in Panel B, the pooled effect of all moral appeal messages sustains as we consider ten post-experimental months. For these overall effects, we detect differences across the different types of appeals. The *Cooperation* message generates more sustainable compliance, whereas the moral appeals with higher fiscal exchange character and direct appeals to the taxpayer (*Example*, *Necessity*, and *Picture*) do not (although the effects are directionally still positive; see below for more on dynamics). We summarize our main findings for the effects of moral appeals as follows:

**RESULT 1** (The effect of moral appeals on SSC compliance). *Moral appeals highlighting the individual benefit of paying taxes and social security contributions increase social security payments in the four (ten) months after our treatment intervention. Moral appeals providing concrete examples of public goods and appealing to the taxpayer directly do not have larger effects than simple cooperation messages.*

*Dynamics.* Figure 1 presents the monthly dynamics of the treatment effects for the specification where we pool all *Moral* treatments. The impact of our *Moral* treatments is immediate but diminishes over time. Treatment effects build up in the four months after the intervention and vanish subsequently. Panels (a)-(d) of Figure 2 present the dynamic effects for each of the *Moral* treatments separately. The effects of the different moral appeals align with the pooled treatment results. Treatment effects increase in the first months after the intervention but fade out in all but one of the *Moral* treatments. Consistent with the static results, the *Cooperation* treatment is an exemption where the treatment effect appears to be more stable over time (see Panel (a) of the Figure). The dynamic results resemble patterns from (conditional) contributions to public goods in laboratory experiments (see, e.g., Chaudhuri, 2011, Ledyard, 1995, for reviews). Cooperation decreases as firms learn that there are other firms who do not comply.

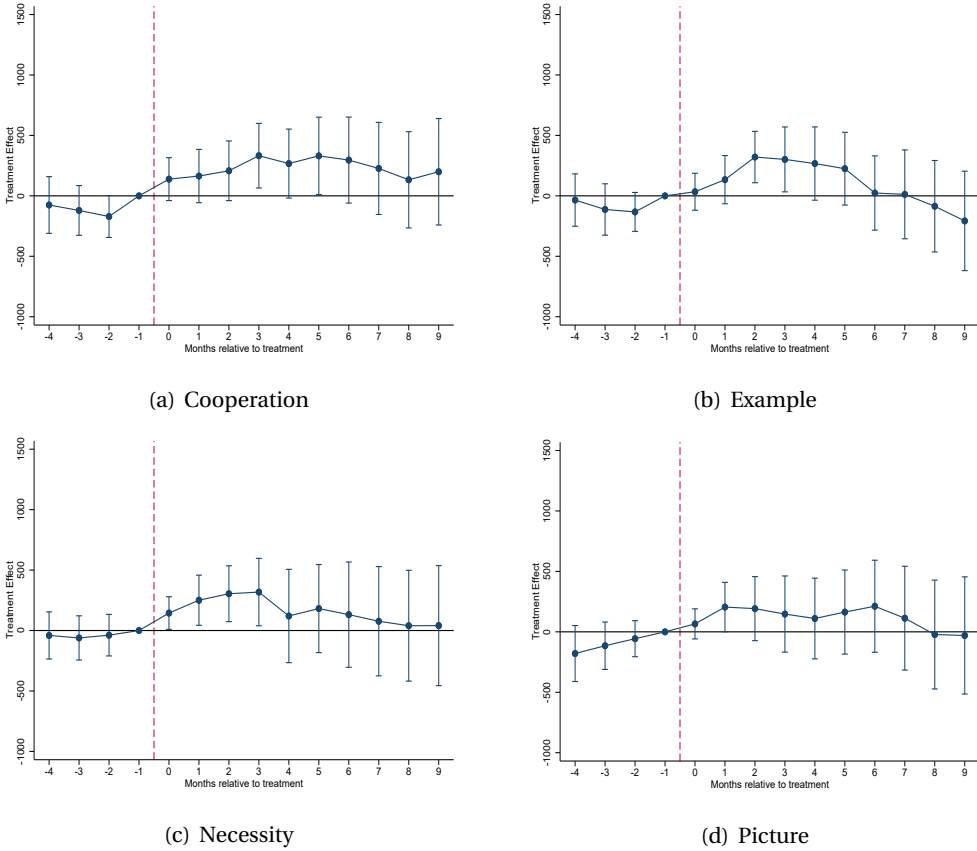


Notes: Pooled monthly treatment effects of the moral appeal messages (Cooperation - Picture). The points plotted are the estimated DiD regression coefficients of treatment messages on tax base SSC by months relative to the treatment. Treatment effects are relative to the control message. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. 95% confidence intervals are represented by the blue lines and based on standard errors clustered on firm level.

FIGURE 1. Dynamic effects of moral treatments on SSC

*Heterogeneity.* To understand heterogeneous effects of our treatment messages, we perform exploratory analyses in which we estimate the pooled ‘static’ DiD model separately for different groups. Our sources of heterogeneity are shaped by the variables that we have in our data. The corresponding results are presented in Figure 3 which plots the  $POST \times TREAT$  interaction coefficient for the different sample splits. Specifically, we test if treatment effects depend on firm size in Panels (a) and (b) (based on the number of employees in 2016 in (a) and on pre-experimental tax base SSC quintiles in (b)), industry affiliation based on NACE codes in Panel (c), volatility of past tax payment behavior in Panel (d) and riskiness (from 1 - low-risk to 3 - high-risk as assessed by the tax authorities) in Panel (e). To make firms of different sizes and across different industries comparable and to account for differences in initial tax bases across sub-samples, we present the results as percentage changes (i.e., log of outcome variable).

Our heterogeneity analysis shows that larger firms, riskier firms and firms with fluctuating SSC payments are more likely to change payroll tax reporting behavior in re-



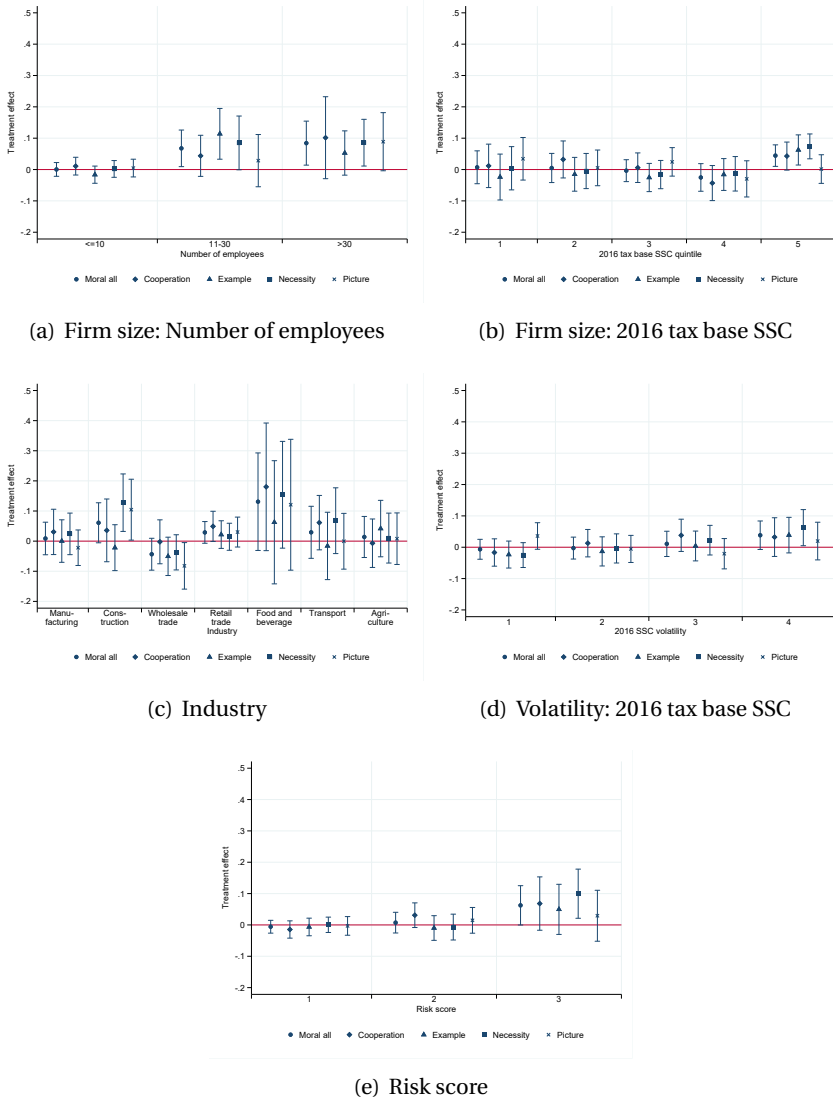
Notes: Monthly treatment effects of the moral appeal messages (Cooperation, Example, Necessity, Picture) on SSC. The points plotted are the estimated DiD regression coefficients of treatment messages on tax base SSC by months relative to the treatment. Treatment effects are relative to the control message. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. 95% confidence intervals are represented by the blue lines and based on standard errors clustered on firm level.

FIGURE 2. Dynamic effects of moral treatments on SSC by sub-treatment

sponse to moral treatment interventions. In addition, we observe a slightly higher compliance effect in the construction industry, but do not observe any other industry specific treatment effects. There are two potential explanations for this. First, larger firms have more scope for changing filing behavior. The correlation between firm size and tax base volatility (in the pre-experiment periods) is consistent with this explanation. Second, larger firms benefit more from public goods and have closer connections to local communities, making them more responsive to the increased salience of the 'fiscal exchange' character of our treatment mailings.

#### 4.3 Deterrence treatments

*Static DiD.* Table 2 presents the DiD estimates for our *Deterrence* treatments. The analysis is organized in the same way as in the *Moral* treatments. Panel A of the Table reports the immediate treatment effects (including four months after the intervention) and Panel B reports overall effects from our RCT (including ten post-treatment months).



Notes: Panel (a): Heterogeneous effects of moral messages on SSC by the number of employees. Panel (b): Heterogeneous effects of moral messages on SSC by firm size in 2016 tax base SSC quintiles. Panel (c): Heterogeneous effects of moral messages on SSC by industry affiliation. Panel (d): Heterogeneous effects of moral messages on SSC by 2016 tax base SSC volatility quartiles. Panel (e): Heterogeneous effects of moral messages on SSC by the tax authorities' internal risk score (between 1-low risk to 3-high risk). The points plotted are the estimated DiD regression coefficients of treatment messages on  $\log(\text{tax base SSC})$ . Displayed treatment effects are in percent relative to the control message. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. The pre-treatment time period includes four months before and the post-treatment time period four months after the treatment. 95% confidence intervals are represented by the blue lines and based on standard errors clustered on firm level.

FIGURE 3. Heterogeneous effects of moral treatments on SSC (in percent)

Benchmarking all *Deterrence* treatments against the *Baseline* group, we find that the experimental interventions have a positive and statistically significant effect on SSC payments in the months after the intervention (Panel A, Column 1). This is consistent with our predictions. The treated firms increase their SSC tax base by BGN 277 (USD 138) or 3.5% (relative to control mean) per month relative to the baseline firms. The regressions further show that higher announced audit probabilities are generally associated with

TABLE 2. Treatment effects of deterrence treatments on SSC

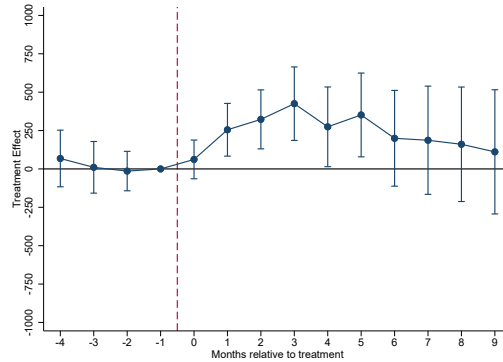
| <b>Panel A:</b>               |                         | <b>4 post-treatment months</b>  |                         |                         |                         |                         |  |
|-------------------------------|-------------------------|---------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|--|
|                               | <i>Audit All</i><br>(1) | <i>Audit 1%</i><br>(2)          | <i>Audit 10%</i><br>(3) | <i>Audit 40%</i><br>(4) | <i>Audit 60%</i><br>(5) | <i>Ambiguous</i><br>(6) |  |
| POST                          | 262.798***<br>(61.408)  | 263.278***<br>(61.272)          | 261.602***<br>(60.718)  | 260.219***<br>(60.669)  | 256.963***<br>(60.493)  | 261.147***<br>(60.765)  |  |
| TREAT                         | 365.205<br>(732.532)    | 926.281<br>(1410.560)           | -433.133<br>(496.358)   | -296.488<br>(1034.382)  | 1700.435<br>(1492.180)  | -251.134<br>(530.352)   |  |
| POST x TREAT                  | 277.037***<br>(91.270)  | 297.985**<br>(134.778)          | 112.389<br>(127.836)    | 437.186***<br>(166.276) | 664.887***<br>(248.315) | 215.630**<br>(108.930)  |  |
| <i>Observations</i>           | 87553                   | 56652                           | 56147                   | 44735                   | 41772                   | 55817                   |  |
| <i>No of Firms</i>            | 15789                   | 8448                            | 8350                    | 6664                    | 6190                    | 8297                    |  |
| <i>Adjusted R<sup>2</sup></i> | 0.255                   | 0.207                           | 0.445                   | 0.403                   | 0.403                   | 0.422                   |  |
| <b>Panel B:</b>               |                         | <b>10 post-treatment months</b> |                         |                         |                         |                         |  |
|                               | <i>Audit All</i><br>(1) | <i>Audit 1%</i><br>(2)          | <i>Audit 10%</i><br>(3) | <i>Audit 40%</i><br>(4) | <i>Audit 60%</i><br>(5) | <i>Ambiguous</i><br>(6) |  |
| POST                          | 410.524***<br>(95.274)  | 412.378***<br>(94.326)          | 412.914***<br>(93.209)  | 409.157***<br>(92.717)  | 403.895***<br>(92.357)  | 415.904***<br>(93.133)  |  |
| TREAT                         | 374.376<br>(731.812)    | 932.811<br>(1409.755)           | -420.435<br>(495.623)   | -276.345<br>(1035.002)  | 1712.675<br>(1488.077)  | -233.207<br>(530.306)   |  |
| POST x TREAT                  | 235.915*<br>(123.973)   | 230.592<br>(145.757)            | 76.163<br>(177.653)     | 381.102**<br>(189.863)  | 706.298**<br>(329.200)  | 132.387<br>(132.282)    |  |
| <i>Observations</i>           | 150976                  | 97605                           | 96741                   | 77045                   | 71948                   | 96166                   |  |
| <i>No of Firms</i>            | 15789                   | 8448                            | 8350                    | 6664                    | 6190                    | 8297                    |  |
| <i>Adjusted R<sup>2</sup></i> | 0.258                   | 0.211                           | 0.432                   | 0.394                   | 0.393                   | 0.412                   |  |

Notes: Treatment effects of deterrence messages on SSC. Displayed are DID regression estimates of treatment messages on tax base SSC. Displayed are DID regression estimates of treatment messages on tax base SSC. The estimated treatment effects are relative to the baseline condition. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. The pre-treatment time period includes four months before and the post-treatment time period four (Panel A) or ten (Panel B) months after the treatment. The pre-experiment control mean of tax base SSC in the baseline condition is BGN 8,004. A firm's number of employees and its industry affiliation are included as controls. Standard errors clustered on firm level are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

larger treatment effects (an exception is the *Audit 10%* treatment). Firms in the *Audit 1%* treatment increase monthly SSC tax base by BGN 298 (USD 149) per month (Column 2), firms in the *Audit 40%* treatment raise their SSC tax base by BGN 437 (USD 219) per month (Column 4). In the *Audit 60%* treatment payroll tax payments increase by BGN 665 (USD 333) in the four months following our treatment mailings (Column 5). This indicates that higher audit probabilities trigger higher payroll tax compliance. Yet, although large in magnitude, the differences between the audit treatments are statistically insignificant. We also estimate positive treatment effects for those deterrence messages announcing an *Ambiguous* audit probability – we discuss these results in more detail in Section 5 below.

Including ten post-experimental months in the analysis (Panel B), we find less powerful effects of low audit probabilities (i.e., in the *Audit 1%*), suggesting that the effects are less sustainable (see more on the dynamic effects below). However, we still find statistically significant and economically meaningful treatment effects for the *Audit 40%* and *Audit 60%* treatment. This indicates that more severe deterrence measures have longer lasting effects. Thus, consistent with our predictions, the higher the announced audit probability, the more positive the effect on reported tax base SSC. We summarize our main findings for the deterrence treatments in the following:

RESULT 2 (The effect of deterrence messages on SSC compliance). *Deterrence messages increase SSC payments. High deterrence messages (with larger announced audit probabilities) lead to economically larger and more sustainable effects than low deterrence messages.*



Notes: Pooled monthly treatment effects of the audit probability messages (Audit 1% - Audit 60%). The points plotted are the estimated DiD regression coefficients of treatment messages on tax base SSC by months relative to the treatment. Treatment effects are relative to the control message. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. 95% confidence intervals are represented by the blue lines and based on standard errors clustered on firm level.

FIGURE 4. Dynamic effects of deterrence treatments on SSC

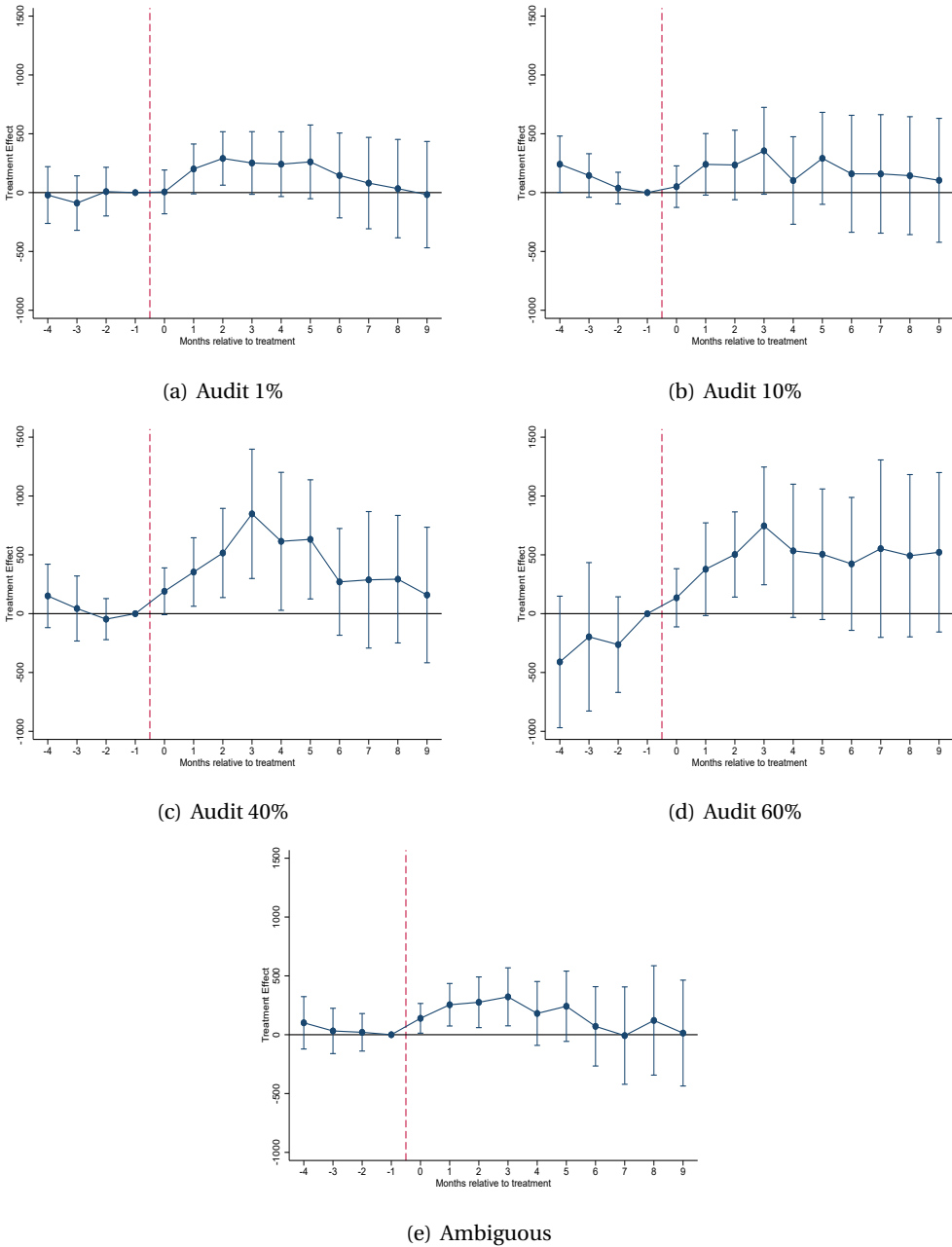
*Dynamics.* Figure 4 displays effects of the pooled *Deterrence* treatments on SSC reporting by month. The effects build up for five post-treatment months and then phase out in the following months. Panel (a)-(e) of Figure 5 present the dynamic treatment effects separately for each sub-treatment.<sup>20</sup> The Figure shows that treatment effects are short-lived when a low audit probability is announced. However, we see larger and more persistent effects in the *Audit 40%* and *Audit 60%* treatments (Panel (c)-(d) of the Figure). The dynamic treatment effects thus confirm the static DiD results and are consistent with our predictions: high audit probabilities lead to sizable and stable effects over time, while the effect of low audit probabilities on tax base SSC is smaller and not sustainable in our sample.

*Heterogeneity.* To study heterogeneous effects of the *Deterrence* treatments across different types of firms, we perform similar exploratory analyses as in the *Moral* treatments. The results are summarized in Figure 6. As before, we run our ‘static’ DiD model separately for different groups of firms (where the assignment is based on pre-experiment data) and consider relative changes to account for size differences across firms.

The treatment effects are particularly pronounced for large firms (with many employees and which are in higher 2016 tax base quintiles), firms that are classified as high-risk by tax authorities, and firms with volatile pre-experimental filing behavior. These

<sup>20</sup>Note that we report dynamic effects including ten pre-treatment months in Appendix B.6. The figures show that there are no significant pre-trends in the treatments.





Notes: Monthly treatment effects of the audit messages (Audit 1%, Audit 10%, Audit 40%, Audit 60%, Ambiguous) on SSC. The points plotted are the estimated DiD regression coefficients of treatment messages on tax base SSC by months relative to the treatment. Treatment effects are relative to the control message. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. 95% confidence intervals are represented by the blue lines and based on standard errors clustered on firm level.

FIGURE 5. Dynamic effects of deterrence treatments on SSC by sub-treatment

findings align with [Holz et al. \(2023\)](#), who also report that large firms are more responsive to their treatment interventions. One possible interpretation for our finding is sim-



Notes: Panel (a): Heterogeneous effects of deterrence messages on SSC by the number of employees. Panel (b): Heterogeneous effects of deterrence messages by firm size in 2016 tax base SSC quintiles. Panel (c): Heterogeneous effects of deterrence messages on SSC by industry affiliation. Panel (d): Heterogeneous effects of deterrence messages on SSC by 2016 tax base SSC volatility quartiles. Panel (e): Heterogeneous effects of deterrence messages on SSC by the tax authorities' internal risk score (between 1-low risk to 3-high risk). The points plotted are the estimated DiD regression coefficients of treatment messages on log(tax base SSC). Displayed treatment effects are in percent relative to the control message. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. The pre-treatment time period includes four months before and the post-treatment time period four months after the treatment. 95% confidence intervals are represented by the blue lines and based on standard errors clustered on firm level.

FIGURE 6. Heterogeneous effects of deterrence treatments on SSC (in percent)

ilar to that brought forward in the moral treatments: large firms have more employees, more resources, higher abilities and therefore more competence to engage in payroll tax evasion. Their scope to adjust their SSC is therefore higher compared with that of smaller firms. Holz et al. (2023) put forward the possible interpretation that threats are more credible for larger firms, which is also likely for firms who are classified as high-risk and with inconsistent filing behavior.

## 5. MECHANISMS AND REVENUE EFFECTS

### 5.1 *Understanding the Effects of Moral Treatments*

The results reaffirm our conjecture on moral behavior of firms: the *Moral* treatments, which make firms aware that tax and social security payments are a civic duty and that they receive something in return for paying taxes, trigger compliance. In the words of our model presented in Section 3, the effect occurs because the treatment mailings increase salience  $s$  of the moral costs among firms who give some fundamental weight to moral costs (i.e., among firms whose  $\beta$  is larger than zero). The latter assumption is supported by our survey which indicates that responding firms deem it generally moral to pay taxes and social security contributions (see Table E.1 in Appendix E). Generally, this finding is in line with work such as List et al. (2021) who show that pro-social behavior (in the form of charitable giving by individuals) increases if people are reminded of the potential increase in (warm-glow) utility for themselves. The finding is likewise in line with results on fiscal exchange from laboratory experiments (see, e.g., Alm and Jackson, 1993) or field experiments with delinquent individual taxpayers as subjects (Eguino and Schächtele, 2020). Our findings on the dynamic effects are in line with research studying contributions to public goods and conditional cooperation (Fischbacher et al., 2001). Over time, firms potentially learn that other firms do not cooperate. This induces firms who responded to our treatment interventions to reduce compliance which explains why effects fade out over time.

Contrary to our predictions, we do not observe significant differences between the four arms of the *Moral* treatments. Generally, this finding is in line with, for example, Dwenger et al. (2016) who do not find differences between two types of moral appeals in their study of individuals' compliance with local church taxes. The similarity in effectiveness of our four *Moral* treatments in the four months after the intervention may be the result of a ceiling effect indicating that firms are either susceptible to moral appeals in general or not, and that the differences in the moral messages are not strong enough to change taxpayers' behavior. Alternatively, our treatments may not trigger different compliance effects because the appeals are not perceived to be different (in other words, the salience  $s$  does not differ between treatments). While we do not observe differences from a statistical significance point of view, the point coefficient decreases as we move from the *Cooperation* treatment to the other *Moral* treatments. In addition, the dynamic results suggest that the *Cooperation* effects are more sustainable. In this context, a third possibility may be that the *Necessity*, *Example*, and *Picture* treatments caused some reluctance compared with *Cooperation*. Since all *Moral* treatments build on each other, the reluctance created in the stronger moral appeals may have reduced the effectiveness of the *Cooperation* message. This could explain why we observe longer lasting effects in this treatment compared with the other *Moral* treatments.

### 5.2 *Understanding the Effects of Deterrence Treatments*

Our deterrence effects confirm our prediction that the threat of an audit increases compliance relative to our baseline control condition. The finding is consistent with a simple deterrence model and its interpretation is rather intuitive.

We further predicted that the compliance effect increases with the announced audit probability. While this prediction is based on standard deterrence models such as Allingham and Sandmo (1972), it conflicts with literature showing that people have problems to correctly assess probabilities (e.g., Tversky and Kahneman, 1974). Consistent with difficult probability assessment, some studies provide evidence that tax compliance effects do not increase with the announced audit probability, implying that taxpayers fall victim to probability neglect (Dwenger et al., 2016, Bérigolo et al., 2023).

Bérigolo et al. (2023) propose that their finding of probability neglect is consistent with a model of *risk-as-feelings* (Loewenstein et al., 2001), according to which responses to risks neglect underlying probabilities when fear is involved. Translated to our context, this implies that any message involving audit announcements has an effect on tax compliance, as it induces fear, and that the actual level of audit probability does not make a difference for the effect size. Our main results are not indicative of probability neglect and such a model of risk-as-feelings. For example, the point coefficient of announcing a 60% audit probability is more than twice as large as the point coefficient in the 1% treatment. Our results further suggest that high audit probabilities trigger a more persistent compliance effect than smaller probabilities.

*Experimental Test of Probability Neglect and Risk-as-Feelings.* To test probability neglect and a risk-as-feelings notion, our field experiment includes the *Ambiguous* treatment (see Section 2.2.3). In contrast to the other *Deterrence* messages, this treatment did not explicitly mention an audit probability. Considering that the treatment does mention the audit threat, thus inducing a fear to be audited, the risk-as-feelings model with probability neglect would predict that the *Ambiguous* treatment has a similar effect as a treatment that explicitly announces an audit probability.

Our theoretical intuition that we presented in Section 3 distinguishes between the mere threat/fear effect and the probability itself. Recall that in the illustrative model, the perceived probability of being detected,  $p$  (where  $p = a \times l$  and  $p \in [0, 1]$ ), depends on two parameters: i) parameter  $a$  (with  $a \in \{0, 1\}$ ) describes if the firm is aware of the possibility of an audit, and ii) parameter  $l$  (with  $l \in [0, 1]$ ) describes the perceived likelihood that such an audit might happen (conditional on audit awareness). Probability neglect and the notion of risk-as-feelings would predict that an increase in the audit probability  $l$  does not affect compliance for taxpayers who are aware of an audit i.e., for whom  $a = 1$ , because the awareness already induces the feeling of fear and the probability itself is neglected.

So far, we compared treatments that mention audits (i.e.,  $a = 1$ ) along with a specific audit probability (i.e.,  $l$  specified) to the baseline condition where taxpayers' awareness of audits is lower (we assume for simplicity  $a = 0$ ). To disentangle the effect of  $a$  and  $l$ , we now consider the *Ambiguous* treatment. This treatment shifts  $a$  from 0 to 1, but it does not specify  $l$ . We can isolate the effect of  $l$  by comparing the treatments with specific audit probabilities to the *Ambiguous* treatment. With a risk-as-feelings notion, we would predict no differences across these groups.

However, considering the evidence that we have collected so far, we make a prediction that is consistent with standard deterrence models where the audit probability

matters. The comparison between the *Ambiguous* treatment and the treatments with specific probabilities then depends on the subjective belief about the audit risk in *Ambiguous*. In treatments where the announced probability is higher than the belief about the audit probability in *Ambiguous*, the standard deterrence model predicts that compliance increases. By contrast with probability neglect and risk-as-feelings, there will not be a difference between the groups – even as we compare the *Ambiguous* with a group with very high audit probability – , because the probabilities are neglected in a state of fear.

Beliefs about audit probabilities in the *Ambiguous* group are unobservable to us.<sup>21</sup> Assuming that the *Ambiguous* letter somehow increases the awareness of, and belief about, audit probabilities (compared to firms in our baseline) and considering that the NRA performs audits on a regular basis, it is conceivable that specified audit probabilities need to be sufficiently high to induce a difference between the *Ambiguous* treatment and treatment arms with specified probability. We acknowledge that this prediction rests on assumptions about the unobservable belief about audit probabilities in the *Ambiguous* group. However, it appears plausible to us that the probability has to be sufficiently high to trigger an effect beyond the mere threat effect and we therefore postulate the following prediction:

*Expected Result for Ambiguous Treatment:* Relative to the *Ambiguous* treatment, the compliance effect is positive for treatments announcing a high probability.

Table 3 features regression specifications (analogous to our previous analyses) in which we benchmark all treatments with a specified audit probability against the *Ambiguous* treatment. In specification (1), where we pool all audit treatments, the interaction coefficient of interest is positive, but small and insignificant. Considering the audit treatments separately, the point coefficient becomes larger as we increase the audit probability throughout specifications (2) to (5) (with the exception of the 10% treatment which had been insignificant before). However, while positive in magnitude, the effects of the 1% and 40% treatments are not precisely measured. The effect for the 60% treatment group is considerably higher than for the other groups (more than three times as large as for the 1% group and almost twice as large as the 40% group) and statistically significant at the 10% level, both in the specification with 4 (Panel A) and 10 (Panel B) post-treatment months. Thus, in our experiment, the announcement of a very high audit probability (60%) seems to have a positive compliance effect compared to a treatment with an ambiguous audit probability. The behavior of firms is thus inconsistent with probability neglect and a risk-as-feelings notion.

RESULT 3 (General audit threat versus specified audit probability). *Consistent with standard models of deterrence, announcing a specific high audit probability increases SSC compliance relative to a treatment (Ambiguous) that communicates an audit threat without specifying an audit probability.*

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<sup>21</sup>To maintain a clean comparison across all treatments (including those without audit probability) and for logistical reasons, we did not survey the participants in the respective treatment groups about their perceived audit probability.

TABLE 3. Treatment effects of audit probability messages relative to ambiguous treatment on SSC

| <b>Panel A:</b>               |                        | <b>4 post-treatment months</b>  |                        |                        |                        |  |
|-------------------------------|------------------------|---------------------------------|------------------------|------------------------|------------------------|--|
|                               | <i>Audit all</i>       | <i>Audit 1%</i>                 | <i>Audit 10%</i>       | <i>Audit 40%</i>       | <i>Audit 60%</i>       |  |
|                               | (1)                    | (2)                             | (3)                    | (4)                    | (5)                    |  |
| POST                          | 453.483***<br>(90.108) | 440.044***<br>(94.580)          | 473.857***<br>(86.938) | 471.683***<br>(86.454) | 470.013***<br>(86.213) |  |
| TREAT                         | 548.950<br>(639.074)   | 1094.355<br>(1198.656)          | -11.430<br>(519.966)   | -273.692<br>(878.869)  | 1938.789<br>(1469.233) |  |
| POST x TREAT                  | 88.147<br>(115.897)    | 123.758<br>(173.439)            | -91.363<br>(140.083)   | 235.713<br>(176.692)   | 442.883*<br>(253.200)  |  |
| <i>Observations</i>           | 68868                  | 37967                           | 37462                  | 26050                  | 23087                  |  |
| <i>No of firms</i>            | 10249                  | 5665                            | 5567                   | 3881                   | 3407                   |  |
| <i>Adjusted R<sup>2</sup></i> | 0.230                  | 0.163                           | 0.544                  | 0.460                  | 0.463                  |  |
| <b>Panel B:</b>               |                        | <b>10 post-treatment months</b> |                        |                        |                        |  |
|                               | <i>Audit all</i>       | <i>Audit 1%</i>                 | <i>Audit 10%</i>       | <i>Audit 40%</i>       | <i>Audit 60%</i>       |  |
|                               | (1)                    | (2)                             | (3)                    | (4)                    | (5)                    |  |
| POST                          | 525.205***<br>(89.733) | 519.977***<br>(96.049)          | 549.128***<br>(87.239) | 559.127***<br>(88.293) | 540.977***<br>(87.096) |  |
| TREAT                         | 534.326<br>(641.169)   | 1085.179<br>(1201.428)          | -22.946<br>(521.334)   | -299.621<br>(882.041)  | 1899.851<br>(1468.800) |  |
| POST x TREAT                  | 127.296<br>(119.104)   | 134.233<br>(153.703)            | -41.441<br>(172.723)   | 253.383<br>(183.467)   | 562.706*<br>(322.939)  |  |
| <i>Observations</i>           | 118900                 | 65529                           | 64665                  | 44969                  | 39872                  |  |
| <i>No of firms</i>            | 10249                  | 5665                            | 5567                   | 3881                   | 3407                   |  |
| <i>Adjusted R<sup>2</sup></i> | 0.236                  | 0.168                           | 0.527                  | 0.455                  | 0.453                  |  |

Notes: Treatment effects of audit probability messages relative to the ambiguous message on SSC. Displayed are DiD regression estimates of treatment messages on tax base SSC. The estimated treatment effects are relative to the audit ambiguous treatment. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. The pre-treatment time period includes four months before and the post-treatment time period four (Panel A) or ten (Panel B) months after the treatment. The pre-experiment control mean of tax base SSC in the ambiguous condition is BGN 7,136. A firm's number of employees and its industry affiliation are included as controls. Standard errors clustered on firm level are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

*The Role of Performed Audits.* We observe the highest compliance levels in the *Audit 40%* and *Audit 60%* treatments. Because our experiment is non-deceptive, by design the share of firms that received an audit is higher in these treatments than in treatments with lower announced audit probabilities. One potential explanation for our results could therefore be that the higher compliance levels are due to the performed audits rather than the announced audit probability. To disentangle the difference between the effects of announcing an audit probability and the effects of having received an audit, the NRA provided us with data on the dates on which audits were implemented. We run our main DiD specifications for the deterrence treatments, but exclude all firm-months after the performance of an audit. The resulting estimates can therefore not be driven by the performed audit, but are necessarily due to the announcement of the audit.

The corresponding results presented in Table B.5 in Appendix B are very similar to our main results. Firms in the audit treatments which did not (yet) receive an audit increase their reported tax base by more than the firms in the benchmark group. The effects are again larger for the higher audit probabilities and also the effects' sizes are very comparable. This suggests that firms report higher tax bases in expectation of potential upcoming audits.

*The Role of Bankruptcies.* Firms that comply due to the treatment may face a disadvantage compared to non-compliant competitors. To study if treated firms are more likely to go out of business, we compare the share of firms who cease reporting SSC in the ten months after the treatment mailing across experimental groups. No evidence of treatment-induced bankruptcies was found, with a roughly 5% share of zero reporting firms in all conditions and no statistically significant differences.

### 5.3 Implications for Tax Revenue

We assess the experiment's impact on payroll tax revenue collected by the tax authority through a simple back-of-the-envelope calculation. We determine the benefits in terms of increased tax revenue for the two main treatment groups, considering both the four months after the intervention and the overall effect ten months after the intervention, and compare them to the costs of the interventions for these time periods.

To calculate the increase in payroll tax revenue from the RCT, we multiply the estimated treatment effects from Tables 1 and 2 by the number of treated firms, the number of post-treatment months, and the average payroll tax rate. The costs of the treatment interventions are then subtracted. For the moral appeals, costs are assumed to be minimal since the messages were prepared by researchers and sending requires minimal effort on the side of the tax authority. Based on information about standard audit costs provided by the tax authority (based on the average duration and cost of an audit), we assume  $20 \text{ (hours)} \times 50 \text{ (BGN/h)} = \text{BGN } 1,000$  (about USD 500) as costs for an audit in the deterrence treatments.

Using the explained calculation  $[(DiDEstimate) \times (NoTreatedFirms) \times (Months) \times (TaxRate)]$  for the (pooled) *Moral* treatments, we arrive at RCT-induced revenue effects of BGN 7,433,816 (USD 3,739,165) in the four months after the intervention, and BGN 15,524,782 (USD 7,808,872) for the overall (10 months) treatment revenue. For the *Deterrence* treatments, we base our cost-benefit calculation on the following equation:  $[(DiDEstimate) \times (NoTreatedFirms) \times (Months) \times (TaxRate)] - (AuditCosts)$ . This results in BGN 2,229,973 (USD 1,121,663) revenue benefit occurring four months after the intervention and BGN 6,076,429 (USD 3,056,407) as the overall revenue from the RCT (10 months after).

The RCT thus triggered a substantial increase in collective social security payments of BGN 21,601,210 (approximately USD 10,856,280). Considering that the average pension in Bulgaria was BGN 345.46 (USD 147) during the time of the experiment (LINK), the additional revenue is equivalent to yearly pensions for 5,210 individuals. These estimates may be lower bounds as they do not account for higher personal income tax reporting of employees which increases with higher payroll tax compliance.

For tax authorities, understanding the benefit per letter/ mailing sent in each treatment is relevant. This information helps assessing the cost-benefit of different policies and informs future interventions (e.g., how to scale efficiently; see List, 2022 on the importance of scaling). Table 4 displays the per letter revenue in the different treatment arms. Panel A shows the results for *Moral* treatments and Panel B for the *Deterrence* treatments. The additional SSC are calculated in the same way as described above for

TABLE 4. SSC revenue per letter

| Panel A:          |                 | Moral Treatments |                    |                |                  |                |
|-------------------|-----------------|------------------|--------------------|----------------|------------------|----------------|
|                   |                 | <i>Moral all</i> | <i>Cooperation</i> | <i>Example</i> | <i>Necessity</i> | <i>Picture</i> |
|                   |                 | (1)              | (2)                | (3)            | (4)              | (5)            |
| Immediate revenue | <i>(in BGN)</i> | 333.83           | 365.55             | 321.29         | 349.85           | 290.44         |
|                   | <i>(in USD)</i> | 167.92           | 183.87             | 161.61         | 175.97           | 146.09         |
| Overall revenue   | <i>(in BGN)</i> | 697.18           | 988.25             | 525.32         | 612.57           | 624.21         |
|                   | <i>(in USD)</i> | 350.68           | 497.08             | 264.23         | 308.12           | 313.97         |

| Panel B:          |                 | Deterrence Treatments |                 |                  |                  |                  |                  |
|-------------------|-----------------|-----------------------|-----------------|------------------|------------------|------------------|------------------|
|                   |                 | <i>Audit all</i>      | <i>Audit 1%</i> | <i>Audit 10%</i> | <i>Audit 40%</i> | <i>Audit 60%</i> | <i>Ambiguous</i> |
|                   |                 | (1)                   | (2)             | (3)              | (4)              | (5)              | (6)              |
| Immediate revenue | <i>(in BGN)</i> | 217.58                | 347.58          | 34.87            | 124.62           | 197.86           | 248.76           |
|                   | <i>(in USD)</i> | 109.44                | 174.83          | 17.54            | 62.68            | 99.52            | 125.12           |
| Overall revenue   | <i>(in BGN)</i> | 592.88                | 681.78          | 128.49           | 743.31           | 1,518.89         | 387.16           |
|                   | <i>(in USD)</i> | 298.22                | 342.93          | 64.63            | 373.88           | 763.99           | 194.74           |

Notes: Per mailing/letter revenue (in BGN) in the moral (Panel A) and deterrence (Panel B) treatments. The first two rows of each panel show the revenue up to four months after the intervention in BGN and USD respectively. The last two rows of each panel show the revenue up to ten months after the intervention in BGN and USD respectively. Revenue is calculated as  $DiD\ Estimate \times No\ of\ Treated\ Firms \times Month\ after\ Intervention \times Tax\ Rate - Intervention\ Cost$ . The cost of the intervention is assumed to be zero in moral treatments and is equal BGN 1,000 per audit (20 hours  $\times$   $i\ m\ e\ s$  BGN 50/hour) in the deterrence treatments.

the overall tax revenue. The table shows that, because of the high cost of audits, the *Moral* treatments are overall more cost effective. They generate a per letter revenue of BGN 697 (USD 350) for ten post months whereas the *Deterrence* treatments generate an additional overall SSC income of BGN 593 (USD 298). Confirming the results from the previous analysis, the *Cooperation* treatment and the (*Audit 60%*) treatment are effective and efficient. The *Cooperation* treatment generates an overall benefit of BGN 988 (USD 497) per letter. The *Audit 60%* treatment generates additional SSC of BGN 1,519 (USD 764) per letter. The most effective *Deterrence* treatment thus generates almost 50% more payroll tax revenue than the ‘best’ performing *Moral* treatment when considering the entire time span for which we have data. To be implemented in practice, it is sometimes required that the benefits of the intervention exceed the costs by a certain ratio. The revenue effects in our study exceed a conservative 3:1 ratio between benefits and costs in all treatment conditions.

## 6. CONCLUSION

We present findings from a field experiment on payroll tax compliance among firms in Bulgaria. Payroll tax evasion is a critical issue that poses a challenge for governments and tax authorities due to difficulties in detection and its impact on the social security system. Despite its importance, payroll tax evasion is not sufficiently studied in existing work. We narrow this research gap using a ‘field experiment *across* firms’ (Bandiera et al., 2011) which are infrequently used in existing compliance work.

In our experiment, we investigate the effect of deterrence measures and moral appeals. Compared with the control group, all types of moral appeals and deterrence threats significantly and substantially increase monthly payroll tax compliance in the months following our intervention. While the different moral messages used in our experiment largely have comparable effects on tax compliance, firms are more sensitive to



deterrence messages with higher audit probabilities (compared to lower probabilities). Considering (dynamic) effects up to ten months after the intervention, we find that simple moral messages as well as high audit probabilities (40% and 60%) induce more sustainable changes in tax reporting behavior. High audit probabilities are thereby approximately 50% more effective compared with the best performing moral appeal treatment. Both forms of interventions are more effective with larger firms and with firms which the tax authority considers more risky. We further find that specifying high audit probabilities triggers a larger effect than announcing unspecified audit probabilities, suggesting that firms respond to higher audit threats.

Our deterrence treatments contribute to the literature and to policy making by showing that long existing theories on tax compliance (Allingham and Sandmo, 1972) are applicable to the firm context and that it pays off for tax authorities to invest in audit and investigation capacities as effects are sustainable if threats are substantially high.

Taking a closer look at our moral appeal treatments, our results substantiate, and add to, previous findings which mostly cover individual taxpayers. We show that moral messages appealing to the fiscal exchange character of taxes and social security contributions increase compliance of firms. Firms (or decision-makers within firms) thus seem to have social preferences and react to messages highlighting the benefits from cooperation. This is, to some degree, remarkable as firms who comply with their taxes in a mostly non-compliant environment reduce their competitiveness as higher compliance comes with higher cost. However, it's important to note that the effects of most moral messages are short-lived and only the simplest form of moral messages comes with a somewhat more persistent compliance effect. Many studies using moral messages and yearly data may therefore not have identified effects. Policymakers can use this simple and cheap intervention of sending emails to boost compliance in the immediate wake of treatment reception.

Our experiment was conducted in Bulgaria, which is classified as a middle-income country by the World Bank. While most countries around the world are classified as middle-income and are thus somewhat comparable to Bulgaria, the literature mostly focuses on either the (OECD) high-income countries or very low-income countries, thereby somewhat neglecting the "middle class" of countries. One reason is that studying tax compliance in these parts of the world is usually difficult, e.g., because of access to data. We think, however, that research on this category of 'normal' countries is important and our experiment can help inform policies in similar countries. A well functioning tax collection may boost development and enable middle-income countries to close the gap to high-income countries.

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APPENDIX A: RANDOMIZATION AND SUMMARY STATISTICS

TABLE A.1. Summary statistics and balance across all treatments

|  | <i>Main sample</i>      | <i>No letter</i>         | <i>Baseline</i>         | <i>Deterrence</i>       | <i>Moral</i>            | <i>Survey</i>           | <i>p-value test</i> |
|--|-------------------------|--------------------------|-------------------------|-------------------------|-------------------------|-------------------------|---------------------|
| <b>Panel A:</b>                            |                         |                          |                         |                         |                         |                         |                     |
| <b>Outcome Variables</b>                   |                         |                          |                         |                         |                         |                         |                     |
| SSC 2016<br>(Pre experiment averages 2016) | 8017.53<br>(40393.83)   | 8089.55<br>(42514.66)    | 8004.00<br>(33976.24)   | 7788.17<br>(43732.58)   | 8001.22<br>(37003.14)   | 7848.12<br>(31669.35)   | 0.9710              |
| VAT 2016<br>(Pre experiment averages 2016) | 16276.30<br>(983559.57) | 15673.17<br>(1300714.86) | 14344.14<br>(167882.66) | 16001.82<br>(223994.03) | 17131.56<br>(364186.21) | 20914.20<br>(417082.61) | 0.7132              |
| <b>Panel B:</b>                            |                         |                          |                         |                         |                         |                         |                     |
| <b>No of Employees</b>                     |                         |                          |                         |                         |                         |                         |                     |
| Share of firms with less than 11 employees | 0.8561<br>(0.3510)      | 0.8556<br>(0.3514)       | 0.8572<br>(0.3499)      | 0.8551<br>(0.3520)      | 0.8567<br>(0.3504)      | 0.8593<br>(0.3478)      | 0.9459              |
| Share of firms with 11 to 30 employees     | 0.0916<br>(0.2885)      | 0.0913<br>(0.2881)       | 0.0908<br>(0.2873)      | 0.0938<br>(0.2915)      | 0.0930<br>(0.2904)      | 0.0860<br>(0.2804)      | 0.4963              |
| Share of firms with more than 30 employees | 0.0520<br>(0.2220)      | 0.0528<br>(0.2237)       | 0.0516<br>(0.2213)      | 0.0509<br>(0.2199)      | 0.0500<br>(0.2179)      | 0.0547<br>(0.2274)      | 0.4558              |
| <b>Panel C:</b>                            |                         |                          |                         |                         |                         |                         |                     |
| <b>Industry Affiliation</b>                |                         |                          |                         |                         |                         |                         |                     |
| Share of firms in manufacturing            | 0.1227<br>(0.3281)      | 0.1224<br>(0.3278)       | 0.1150<br>(0.3190)      | 0.1212<br>(0.3264)      | 0.1254<br>(0.3312)      | 0.1245<br>(0.3302)      | 0.2696              |
| Share of firms in construction             | 0.0781<br>(0.2683)      | 0.0793<br>(0.2701)       | 0.0691<br>(0.2537)      | 0.0776<br>(0.2675)      | 0.0784<br>(0.2687)      | 0.0754<br>(0.2641)      | 0.0750              |
| Share of firms in wholesale trade          | 0.1202<br>(0.3252)      | 0.1208<br>(0.3259)       | 0.1213<br>(0.3265)      | 0.1208<br>(0.3259)      | 0.1168<br>(0.3211)      | 0.1254<br>(0.3312)      | 0.3751              |
| Share of firms in retail trade             | 0.2002<br>(0.4001)      | 0.1990<br>(0.3992)       | 0.2112<br>(0.4082)      | 0.2053<br>(0.4039)      | 0.2004<br>(0.4003)      | 0.1895<br>(0.3919)      | 0.0360              |
| Share of firms in food and beverage        | 0.0393<br>(0.1943)      | 0.0391<br>(0.1937)       | 0.0440<br>(0.2052)      | 0.0387<br>(0.1930)      | 0.0385<br>(0.1925)      | 0.0407<br>(0.1975)      | 0.4418              |
| Share of firms in transport                | 0.0617<br>(0.2407)      | 0.0638<br>(0.2445)       | 0.0606<br>(0.2387)      | 0.0580<br>(0.2337)      | 0.0594<br>(0.2363)      | 0.0597<br>(0.2370)      | 0.0548              |
| Share of firms in agriculture              | 0.0592<br>(0.2360)      | 0.0589<br>(0.2354)       | 0.0596<br>(0.2367)      | 0.0594<br>(0.2364)      | 0.0603<br>(0.2381)      | 0.0570<br>(0.2319)      | 0.8979              |
| <b>No of firms</b>                         | 95508                   | 51894                    | 5540                    | 10249                   | 22268                   | 5557                    |                     |

Notes: Pre-experimental average for outcome variables and different firm characteristics across treatments with standard deviation in parentheses. The last column of each row presents the p-value testing the null hypothesis that the mean is equal for all treatment groups. Data on SSC and VAT tax bases and firm characteristics come from administrative tax records. SSC and VAT are expressed in BGN.



TABLE A.2. Summary statistics and balance across moral treatments

|   | Baseline                    | Cooperation               | Example                   | Necessity                 | Picture                   | p-value test |
|---|-----------------------------|---------------------------|---------------------------|---------------------------|---------------------------|--------------|
| <b>Panel A:</b>                               |                             |                           |                           |                           |                           |              |
|   | <b>Outcome Variables</b>    |                           |                           |                           |                           |              |
| SSC<br>(Pre-experiment average tax base 2016) | 8003.999<br>(33976.243)     | 7725.060<br>(35036.859)   | 7112.225<br>(36546.137)   | 8946.541<br>(42460.071)   | 8204.141<br>(33236.669)   | 0.2103       |
| VAT<br>(Pre-experiment average tax base 2016) | 14344.145<br>(167882.659)   | 14871.930<br>(195274.907) | 18964.633<br>(575308.122) | 15979.228<br>(275328.999) | 18709.149<br>(293556.660) | 0.8008       |
| <b>Panel B:</b>                               |                             |                           |                           |                           |                           |              |
|   | <b>No of Employees</b>      |                           |                           |                           |                           |              |
| Share of firms with less than 11 employees    | 0.857<br>(0.350)            | 0.859<br>(0.348)          | 0.865<br>(0.341)          | 0.852<br>(0.355)          | 0.850<br>(0.357)          | 0.1522       |
| Share of firms with 11 to 30 employees        | 0.091<br>(0.287)            | 0.090<br>(0.287)          | 0.090<br>(0.287)          | 0.095<br>(0.294)          | 0.096<br>(0.295)          | 0.7211       |
| Share of firms with more than 30 employees    | 0.052<br>(0.221)            | 0.050<br>(0.219)          | 0.044<br>(0.205)          | 0.052<br>(0.222)          | 0.054<br>(0.225)          | 0.1201       |
| <b>Panel C:</b>                               |                             |                           |                           |                           |                           |              |
|   | <b>Industry Affiliation</b> |                           |                           |                           |                           |              |
| Share of firms in manufacturing               | 0.115<br>(0.319)            | 0.123<br>(0.328)          | 0.126<br>(0.332)          | 0.131<br>(0.338)          | 0.121<br>(0.326)          | 0.1039       |
| Share of firms in construction                | 0.069<br>(0.254)            | 0.081<br>(0.272)          | 0.077<br>(0.266)          | 0.077<br>(0.266)          | 0.079<br>(0.270)          | 0.1609       |
| Share of firms in wholesale trade             | 0.121<br>(0.327)            | 0.114<br>(0.318)          | 0.123<br>(0.328)          | 0.114<br>(0.317)          | 0.117<br>(0.321)          | 0.4333       |
| Share of firms in retail trade                | 0.211<br>(0.408)            | 0.206<br>(0.404)          | 0.194<br>(0.395)          | 0.205<br>(0.404)          | 0.197<br>(0.398)          | 0.1278       |
| Share of firms in food and beverage           | 0.044<br>(0.205)            | 0.035<br>(0.185)          | 0.036<br>(0.187)          | 0.043<br>(0.204)          | 0.039<br>(0.193)          | 0.0602       |
| Share of firms in transport                   | 0.061<br>(0.239)            | 0.062<br>(0.241)          | 0.058<br>(0.234)          | 0.060<br>(0.238)          | 0.057<br>(0.233)          | 0.8393       |
| Share of firms in agriculture                 | 0.060<br>(0.237)            | 0.057<br>(0.231)          | 0.065<br>(0.247)          | 0.055<br>(0.227)          | 0.065<br>(0.246)          | 0.0637       |
| <b>No of firms</b>                            | 5540                        | 5529                      | 5548                      | 5617                      | 5574                      |              |

Notes: Pre-experimental average for outcome variables and different firm characteristics across moral treatments with standard deviation in parentheses. The last column of each row presents the p-value testing the null hypothesis that the mean is equal for all treatment groups. Data on SSC and VAT tax bases and firm characteristics come from administrative tax records. SSC and VAT are expressed in BGN.

TABLE A.3. Summary statistics and balance across deterrence treatments

|  | <i>Baseline</i>           | <i>Audit 1%</i>           | <i>Audit 10%</i>          | <i>Audit 40%</i>          | <i>Audit 60%</i>          | <i>Ambiguous</i>          | <i>p-value test</i> |
|--|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------|
| <b>Panel A:</b>                            |                           |                           |                           |                           |                           |                           |                     |
| <b>Outcome Variables</b>                   |                           |                           |                           |                           |                           |                           |                     |
| SSC  | 8003.999<br>(3976.243)    | 8453.453<br>(65820.641)   | 7311.148<br>(26178.217)   | 7527.440<br>(35865.834)   | 10046.234<br>(41969.878)  | 7136.360<br>(30137.210)   | 0.5518              |
| (Pre-experiment average tax base 2016)     |                           |                           |                           |                           |                           |                           |                     |
| VAT  | 14344.145<br>(167882.659) | 16417.453<br>(160523.255) | 15362.765<br>(302770.938) | 14175.889<br>(190603.144) | 11240.609<br>(151902.590) | 18084.251<br>(213604.991) | 0.8710              |
| (Pre-experiment average tax base 2016)     |                           |                           |                           |                           |                           |                           |                     |
| <b>Panel B:</b>                            |                           |                           |                           |                           |                           |                           |                     |
| <b>No of Employees</b>                     |                           |                           |                           |                           |                           |                           |                     |
| Share of firms with less than 11 employees | 0.857<br>(0.350)          | 0.852<br>(0.355)          | 0.857<br>(0.350)          | 0.879<br>(0.326)          | 0.832<br>(0.374)          | 0.852<br>(0.356)          | 0.1098              |
| Share of firms with 11 to 30 employees     | 0.091<br>(0.287)          | 0.093<br>(0.291)          | 0.094<br>(0.292)          | 0.069<br>(0.253)          | 0.102<br>(0.302)          | 0.103<br>(0.304)          | 0.0154              |
| Share of firms with more than 30 employees | 0.052<br>(0.221)          | 0.054<br>(0.226)          | 0.049<br>(0.215)          | 0.052<br>(0.223)          | 0.066<br>(0.249)          | 0.046<br>(0.209)          | 0.4047              |
| <b>Panel C:</b>                            |                           |                           |                           |                           |                           |                           |                     |
| <b>Industry Affiliation</b>                |                           |                           |                           |                           |                           |                           |                     |
| Share of firms in manufacturing            | 0.115<br>(0.319)          | 0.127<br>(0.333)          | 0.126<br>(0.332)          | 0.124<br>(0.329)          | 0.123<br>(0.329)          | 0.108<br>(0.311)          | 0.1952              |
| Share of firms in construction             | 0.069<br>(0.254)          | 0.075<br>(0.263)          | 0.079<br>(0.270)          | 0.070<br>(0.256)          | 0.085<br>(0.279)          | 0.080<br>(0.271)          | 0.3468              |
| Share of firms in wholesale trade          | 0.121<br>(0.327)          | 0.126<br>(0.332)          | 0.117<br>(0.321)          | 0.117<br>(0.321)          | 0.097<br>(0.296)          | 0.127<br>(0.333)          | 0.2599              |
| Share of firms in retail trade             | 0.211<br>(0.408)          | 0.205<br>(0.404)          | 0.205<br>(0.404)          | 0.188<br>(0.391)          | 0.198<br>(0.399)          | 0.215<br>(0.411)          | 0.4488              |
| Share of firms in food and beverage        | 0.044<br>(0.205)          | 0.038<br>(0.192)          | 0.032<br>(0.177)          | 0.056<br>(0.230)          | 0.063<br>(0.243)          | 0.033<br>(0.179)          | 0.0003              |
| Share of firms in transport                | 0.061<br>(0.239)          | 0.050<br>(0.217)          | 0.059<br>(0.235)          | 0.053<br>(0.225)          | 0.055<br>(0.229)          | 0.069<br>(0.253)          | 0.0626              |
| Share of firms in agriculture              | 0.060<br>(0.237)          | 0.060<br>(0.237)          | 0.057<br>(0.232)          | 0.061<br>(0.240)          | 0.069<br>(0.254)          | 0.058<br>(0.234)          | 0.9256              |
| <b>No of firms</b>                         | 5540                      | 2908                      | 2810                      | 1124                      | 650                       | 2757                      |                     |

Notes: Pre-experimental average for outcome variables and different firm characteristics across deterrence treatments, with standard deviation in parentheses. The last column of each row presents the p-value testing the null hypothesis that the mean is equal for all treatment groups. Data on SSC and VAT tax bases and firm characteristics come from administrative tax records. SSC and VAT are expressed in BGN.

## APPENDIX B: ROBUSTNESS CHECKS AND ADDITIONAL ANALYSES

B.1 *Multiple Hypothesis Testing*

TABLE B.1. Multiple hypothesis testing moral treatments

| <b>Panel A:</b>  |                   | <b>4 post-treatment months</b>  |                           |                       |                         |                       |
|------------------|-------------------|---------------------------------|---------------------------|-----------------------|-------------------------|-----------------------|
|                  |                   | <i>Moral All</i><br>(1)         | <i>Cooperation</i><br>(2) | <i>Example</i><br>(3) | <i>Necessity</i><br>(4) | <i>Picture</i><br>(5) |
| TREATMENT EFFECT |                   | 278.195                         | 304.621                   | 267.742               | 291.545                 | 242.031               |
| <i>P-values</i>  | <i>Unadjusted</i> | 0.000***                        | 0.010**                   | 0.009***              | 0.005***                | 0.027**               |
|                  | <i>Adjusted</i>   | 0.001***                        | 0.020*                    | 0.018**               | 0.009***                | 0.053*                |
| <b>Panel B:</b>  |                   | <b>10 post-treatment months</b> |                           |                       |                         |                       |
|                  |                   | <i>Moral All</i><br>(1)         | <i>Cooperation</i><br>(2) | <i>Example</i><br>(3) | <i>Necessity</i><br>(4) | <i>Picture</i><br>(5) |
| TREATMENT EFFECT |                   | 232.393                         | 329.416                   | 175.107               | 204.189                 | 208.070               |
| <i>P-values</i>  | <i>Unadjusted</i> | 0.037**                         | 0.023**                   | 0.168                 | 0.169                   | 0.178                 |
|                  | <i>Adjusted</i>   | 0.074*                          | 0.046**                   | 0.336                 | 0.169                   | 0.357                 |

Notes: Treatment effects and corresponding p-values for the moral treatments. Treatment effect represents the DiD coefficient regressing the treatment message on tax base SSC in BGN. Panel A reports Immediate effects for four months and Panel B Overall effects for ten months after the treatment intervention. A firm's number of employees and its industry affiliation are included as control variables. Unadjusted p-values are not corrected for testing multiple hypotheses. Adjusted p-values are corrected for testing multiple hypothesis. The command used is `wyong` by Jones et al. (2019). \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

TABLE B.2. Multiple hypothesis testing deterrence treatments

| <b>Panel A:</b>  |                   | <b>4 post-treatment months</b>  |                        |                         |                         |                         |                         |
|------------------|-------------------|---------------------------------|------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
|                  |                   | <i>Audit All</i><br>(1)         | <i>Audit 1%</i><br>(2) | <i>Audit 10%</i><br>(3) | <i>Audit 40%</i><br>(4) | <i>Audit 60%</i><br>(5) | <i>Ambiguous</i><br>(6) |
| TREATMENT EFFECT |                   | 277.037                         | 297.985                | 112.389                 | 437.186                 | 664.887                 | 215.630                 |
| <i>P-values</i>  | <i>Unadjusted</i> | 0.002***                        | 0.027**                | 0.379                   | 0.009***                | 0.007***                | 0.048**                 |
|                  | <i>Adjusted</i>   | 0.004***                        | 0.054*                 | 0.759                   | 0.017**                 | 0.015**                 | 0.096*                  |
| <b>Panel B:</b>  |                   | <b>10 post-treatment months</b> |                        |                         |                         |                         |                         |
|                  |                   | <i>Audit All</i><br>(1)         | <i>Audit 1%</i><br>(2) | <i>Audit 10%</i><br>(3) | <i>Audit 40%</i><br>(4) | <i>Audit 60%</i><br>(5) | <i>Ambiguous</i><br>(6) |
| TREATMENT EFFECT |                   | 235.915                         | 230.592                | 76.163                  | 381.102                 | 706.298                 | 132.662                 |
| <i>P-values</i>  | <i>Unadjusted</i> | 0.059*                          | 0.114                  | 0.668                   | 0.045**                 | 0.032**                 | 0.317                   |
|                  | <i>Adjusted</i>   | 0.117                           | 0.227                  | 0.793                   | 0.089*                  | 0.064*                  | 0.634                   |

Notes: Treatment effects and corresponding p-values for the deterrence treatments. Treatment effect represents the DiD coefficient regressing the treatment message on tax base SSC in BGN. Panel A reports Immediate effects for four months and Panel B Overall effects for ten months after the treatment intervention. A firm's number of employees and its industry affiliation are included as control variables. Unadjusted p-values are not corrected for testing multiple hypotheses. Adjusted p-values are corrected for testing multiple hypothesis. The command used is `wyong` by Jones et al. (2019). \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

## B.2 Treatment Effects without Control Variables

TABLE B.3. Treatment effects of moral treatments on SSC

| <b>Panel A:</b>                 |                         |                           |                         |                         |                         |
|---------------------------------|-------------------------|---------------------------|-------------------------|-------------------------|-------------------------|
| <b>4 post-treatment months</b>  |                         |                           |                         |                         |                         |
|                                 | <i>Moral All</i><br>(1) | <i>Cooperation</i><br>(2) | <i>Example</i><br>(3)   | <i>Necessity</i><br>(4) | <i>Picture</i><br>(5)   |
| POST                            | 322.293***<br>(76.072)  | 322.293***<br>(76.075)    | 322.293***<br>(76.075)  | 322.293***<br>(76.075)  | 322.293***<br>(76.075)  |
| TREAT                           | -82.359<br>(608.581)    | -313.681<br>(778.880)     | -1165.587<br>(764.100)  | 944.437<br>(858.877)    | 195.178<br>(755.012)    |
| POST x TREAT                    | 266.140***<br>(87.973)  | 240.981**<br>(120.067)    | 282.055**<br>(113.613)  | 297.134***<br>(114.640) | 244.806**<br>(117.876)  |
| <i>Observations</i>             | 186457                  | 74390                     | 74537                   | 74882                   | 74449                   |
| <i>No of Firms</i>              | 27808                   | 11069                     | 11088                   | 11157                   | 11114                   |
| <i>Adjusted R<sup>2</sup></i>   | 0.000                   | 0.000                     | 0.000                   | 0.000                   | 0.000                   |
| <b>Panel B:</b>                 |                         |                           |                         |                         |                         |
| <b>10 post-treatment months</b> |                         |                           |                         |                         |                         |
|                                 | <i>Moral All</i><br>(1) | <i>Cooperation</i><br>(2) | <i>Example</i><br>(3)   | <i>Necessity</i><br>(4) | <i>Picture</i><br>(5)   |
| POST                            | 594.709***<br>(104.387) | 594.709***<br>(104.390)   | 594.709***<br>(104.390) | 594.709***<br>(104.390) | 594.709***<br>(104.390) |
| TREAT                           | -82.359<br>(608.579)    | -313.681<br>(778.873)     | -1165.587<br>(764.094)  | 944.437<br>(858.869)    | 195.178<br>(755.005)    |
| POST x TREAT                    | 175.584<br>(117.816)    | 210.514<br>(145.012)      | 167.069<br>(136.155)    | 134.917<br>(161.637)    | 189.770<br>(159.775)    |
| <i>Observations</i>             | 321342                  | 128165                    | 128383                  | 129058                  | 128183                  |
| <i>No of Firms</i>              | 27808                   | 11069                     | 11088                   | 11157                   | 11114                   |
| <i>Adjusted R<sup>2</sup></i>   | 0.000                   | 0.000                     | 0.000                   | 0.000                   | 0.000                   |

Notes: Treatment effects of moral messages on SSC without control variables. Displayed are DiD regression estimates of treatment messages on tax base SSC. The estimated treatment effects are relative to the baseline condition. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. The pre-treatment time period includes four months before and the post-treatment time period four (Panel A) or ten (Panel B) months after the treatment. The pre-experiment control mean of tax base SSC in the baseline condition is BGN 8,004. Standard errors clustered on firm level are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

TABLE B.4. Treatment effects of deterrence treatments on SSC

| <b>Panel A:</b>               |                         | <b>4 post-treatment months</b>  |                         |                         |                         |                         |  |
|-------------------------------|-------------------------|---------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|--|
|                               | <i>Audit All</i>        | <i>Audit 1%</i>                 | <i>Audit 10%</i>        | <i>Audit 40%</i>        | <i>Audit 60%</i>        | <i>Ambiguous</i>        |  |
|                               | (1)                     | (2)                             | (3)                     | (4)                     | (5)                     | (6)                     |  |
| POST                          | 322.293***<br>(76.074)  | 322.293***<br>(76.077)          | 322.293***<br>(76.077)  | 322.293***<br>(76.079)  | 322.293***<br>(76.080)  | 322.293***<br>(76.077)  |  |
| TREAT                         | -79.102<br>(850.893)    | 655.465<br>(1594.565)           | -1085.961<br>(759.325)  | -705.277<br>(1334.460)  | 2018.227<br>(1945.043)  | -1373.977*<br>(771.004) |  |
| POST x TREAT                  | 284.528***<br>(102.769) | 274.304**<br>(132.153)          | 128.264<br>(140.289)    | 484.344***<br>(179.331) | 645.506**<br>(260.201)  | 167.373<br>(118.150)    |  |
| <i>Observations</i>           | 87577                   | 56668                           | 56171                   | 44751                   | 41788                   | 55833                   |  |
| <i>No of Firms</i>            | 15789                   | 8448                            | 8350                    | 6664                    | 6190                    | 8297                    |  |
| <i>Adjusted R<sup>2</sup></i> | 0.000                   | 0.000                           | 0.000                   | 0.000                   | 0.000                   | 0.000                   |  |
| <b>Panel B:</b>               |                         | <b>10 post-treatment months</b> |                         |                         |                         |                         |  |
|                               | <i>Audit All</i>        | <i>Audit 1%</i>                 | <i>Audit 10%</i>        | <i>Audit 40%</i>        | <i>Audit 60%</i>        | <i>Ambiguous</i>        |  |
|                               | (1)                     | (2)                             | (3)                     | (4)                     | (5)                     | (6)                     |  |
| POST                          | 594.709***<br>(104.389) | 594.709***<br>(104.393)         | 594.709***<br>(104.393) | 594.709***<br>(104.395) | 594.709***<br>(104.396) | 594.709***<br>(104.393) |  |
| TREAT                         | -79.102<br>(850.887)    | 655.465<br>(1594.547)           | -1085.961<br>(759.316)  | -705.277<br>(1334.440)  | 2018.227<br>(1945.013)  | -1373.977*<br>(770.995) |  |
| POST x TREAT                  | 202.359<br>(132.662)    | 146.583<br>(145.885)            | 82.940<br>(190.202)     | 377.377*<br>(204.159)   | 638.145*<br>(344.545)   | 38.130<br>(138.751)     |  |
| <i>Observations</i>           | 151018                  | 97633                           | 96783                   | 77073                   | 71976                   | 96194                   |  |
| <i>No of Firms</i>            | 15789                   | 8448                            | 8350                    | 6664                    | 6190                    | 8297                    |  |
| <i>Adjusted R<sup>2</sup></i> | 0.000                   | 0.000                           | 0.000                   | 0.000                   | 0.000                   | 0.000                   |  |

Notes: Treatment effects of deterrence messages on SSC without control variables. Displayed are DiD regression estimates of treatment messages on tax base SSC. Displayed are DiD regression estimates of treatment messages on tax base SSC. The estimated treatment effects are relative to the baseline condition. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. The pre-treatment time period includes four months before and the post-treatment time period four (Panel A) or ten (Panel B) months after the treatment. The pre-experiment control mean of tax base SSC in the baseline condition is BGN 8,004. Standard errors clustered on firm level are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

## B.3 Treatment Effects Excluding Audited Firms

TABLE B.5. Treatment effects of deterrence treatments on SSC excluding audited firms

| <b>Panel A:</b>               |                        | <b>4 post-treatment months</b>  |                        |                         |                         |                        |  |
|-------------------------------|------------------------|---------------------------------|------------------------|-------------------------|-------------------------|------------------------|--|
|                               | <i>Audit all</i>       | <i>Audit 1%</i>                 | <i>Audit 10%</i>       | <i>Audit 40%</i>        | <i>Audit 60%</i>        | <i>Ambiguous</i>       |  |
|                               | (1)                    | (2)                             | (3)                    | (4)                     | (5)                     | (6)                    |  |
| POST                          | 262.798***<br>(61.408) | 263.278***<br>(61.272)          | 261.602***<br>(60.718) | 260.219***<br>(60.669)  | 256.963***<br>(60.493)  | 261.147***<br>(60.765) |  |
| TREAT                         | 365.205<br>(732.532)   | 926.281<br>(1410.560)           | -433.133<br>(496.358)  | -296.488<br>(1034.382)  | 1700.435<br>(1492.180)  | -251.134<br>(530.352)  |  |
| POST x TREAT                  | 277.037***<br>(91.270) | 297.985**<br>(134.778)          | 112.389<br>(127.836)   | 437.186***<br>(166.276) | 664.887***<br>(248.315) | 215.630**<br>(108.930) |  |
| <i>Observations</i>           | 87553                  | 56652                           | 56147                  | 44735                   | 41772                   | 55817                  |  |
| <i>No of firms</i>            | 15789                  | 8448                            | 8350                   | 6664                    | 6190                    | 8297                   |  |
| <i>Adjusted R<sup>2</sup></i> | 0.260                  | 0.221                           | 0.352                  | 0.351                   | 0.353                   | 0.240                  |  |
| <b>Panel B:</b>               |                        | <b>10 post-treatment months</b> |                        |                         |                         |                        |  |
|                               | <i>Audit all</i>       | <i>Audit 1%</i>                 | <i>Audit 10%</i>       | <i>Audit 40%</i>        | <i>Audit 60%</i>        | <i>Ambiguous</i>       |  |
|                               | (1)                    | (2)                             | (3)                    | (4)                     | (5)                     | (6)                    |  |
| POST                          | 373.052***<br>(89.769) | 373.798***<br>(89.104)          | 368.768***<br>(88.309) | 364.235***<br>(87.861)  | 363.877***<br>(87.727)  | 369.784***<br>(88.104) |  |
| TREAT                         | 371.120<br>(731.556)   | 934.764<br>(1409.878)           | -422.058<br>(495.652)  | -278.588<br>(1035.141)  | 1695.102<br>(1491.296)  | -233.664<br>(530.506)  |  |
| POST x TREAT                  | 267.183**<br>(130.996) | 271.928*<br>(146.080)           | 113.970<br>(180.933)   | 464.023*<br>(268.042)   | 740.744**<br>(333.989)  | 192.879<br>(131.455)   |  |
| <i>Observations</i>           | 147811                 | 97348                           | 95864                  | 75764                   | 70793                   | 95880                  |  |
| <i>No of firms</i>            | 15789                  | 8448                            | 8350                   | 6664                    | 6190                    | 8297                   |  |
| <i>Adjusted R<sup>2</sup></i> | 0.257                  | 0.219                           | 0.342                  | 0.338                   | 0.340                   | 0.230                  |  |

Notes: Treatment effects of deterrence treatments on SSC excluding audited firms' observations after the audit has ended. Displayed are DiD regression estimates of treatment messages on tax base SSC. The estimated treatment effects are relative to the baseline condition. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. The pre-treatment time period includes four months before and the post-treatment time period four (Panel A) or ten (Panel B) months after the treatment. The pre-experiment control mean of tax base SSC in the baseline condition is BGN 8,004. A firm's number of employees and its industry affiliation are included as controls. Standard errors clustered on firm level are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

## B.4 Treatment Effects Varying the Pre-treatment Period

TABLE B.6. Treatment effects of moral treatments on SSC varying the pre-treatment period

| <b>Panel A:</b>               |                      | <b>4 post-treatment months</b>  |                           |                         |                         |                        |
|-------------------------------|----------------------|---------------------------------|---------------------------|-------------------------|-------------------------|------------------------|
|                               | Pre-treatment months | <i>Moral All</i><br>(1)         | <i>Cooperation</i><br>(2) | <i>Example</i><br>(3)   | <i>Necessity</i><br>(4) | <i>Picture</i><br>(5)  |
| POST x TREAT                  | 4                    | 278.195***<br>(76.559)          | 304.621**<br>(118.416)    | 267.742***<br>(102.450) | 291.545***<br>(103.315) | 242.031**<br>(109.151) |
| <i>Observations</i>           |                      | 186377                          | 74366                     | 74505                   | 74850                   | 74409                  |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.365                           | 0.370                     | 0.346                   | 0.389                   | 0.407                  |
| POST x TREAT                  | 6                    | 302.064***<br>(81.651)          | 330.848**<br>(129.831)    | 291.127***<br>(107.433) | 320.968***<br>(110.306) | 255.381**<br>(114.281) |
| <i>Observations</i>           |                      | 233877                          | 93320                     | 93421                   | 93938                   | 93382                  |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.366                           | 0.374                     | 0.347                   | 0.390                   | 0.410                  |
| POST x TREAT                  | 8                    | 281.825***<br>(86.373)          | 315.919**<br>(140.618)    | 251.104**<br>(106.131)  | 321.102***<br>(116.192) | 232.006**<br>(118.163) |
| <i>Observations</i>           |                      | 282031                          | 112532                    | 112600                  | 113286                  | 112645                 |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.367                           | 0.378                     | 0.346                   | 0.391                   | 0.412                  |
| POST x TREAT                  | 10                   | 254.834***<br>(91.334)          | 305.432**<br>(153.188)    | 204.724*<br>(107.145)   | 296.658**<br>(119.584)  | 205.259*<br>(120.907)  |
| <i>Observations</i>           |                      | 330618                          | 131910                    | 131953                  | 132809                  | 132084                 |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.370                           | 0.380                     | 0.347                   | 0.393                   | 0.415                  |
| <i>No of Firms</i>            |                      | 27808                           | 11069                     | 11088                   | 11157                   | 11114                  |
| <b>Panel B:</b>               |                      | <b>10 post-treatment months</b> |                           |                         |                         |                        |
|                               | Pre-treatment months | <i>Moral All</i><br>(1)         | <i>Cooperation</i><br>(2) | <i>Example</i><br>(3)   | <i>Necessity</i><br>(4) | <i>Picture</i><br>(5)  |
| POST x TREAT                  | 4                    | 232.393**<br>(111.396)          | 329.416**<br>(144.980)    | 175.107<br>(127.062)    | 204.189<br>(148.571)    | 208.070<br>(154.560)   |
| <i>Observations</i>           |                      | 321202                          | 128123                    | 128327                  | 129002                  | 128113                 |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.362                           | 0.366                     | 0.338                   | 0.387                   | 0.401                  |
| POST x TREAT                  | 6                    | 302.064***<br>(81.651)          | 330.848**<br>(129.831)    | 291.127***<br>(107.433) | 320.968***<br>(110.306) | 255.381**<br>(114.281) |
| <i>Observations</i>           |                      | 233877                          | 93320                     | 93421                   | 93938                   | 93382                  |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.363                           | 0.369                     | 0.340                   | 0.387                   | 0.403                  |
| POST x TREAT                  | 8                    | 235.656**<br>(117.385)          | 340.078**<br>(163.730)    | 159.839<br>(129.815)    | 232.659<br>(155.718)    | 197.570<br>(160.842)   |
| <i>Observations</i>           |                      | 416856                          | 166289                    | 166422                  | 167438                  | 166349                 |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.364                           | 0.371                     | 0.340                   | 0.388                   | 0.405                  |
| POST x TREAT                  | 10                   | 208.627*<br>(122.858)           | 329.552*<br>(176.177)     | 113.804<br>(135.331)    | 208.073<br>(161.998)    | 170.939<br>(164.553)   |
| <i>Observations</i>           |                      | 465443                          | 185667                    | 185775                  | 186961                  | 185788                 |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.366                           | 0.374                     | 0.341                   | 0.390                   | 0.407                  |
| <i>No of Firms</i>            |                      | 27808                           | 11069                     | 11088                   | 11157                   | 11114                  |

Notes: Treatment effects of moral messages on SSC extending the pre-treatment period. Displayed are DiD regression estimates of treatment messages on tax base SSC. The estimated treatment effects are relative to the baseline condition. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. The pre-treatment time period includes four, six, eight or ten months before and the post-treatment time period four (Panel A) or ten (Panel B) months after the treatment. The pre-experiment control mean of tax base SSC in the baseline condition is BGN 8,004. A firm's number of employees and its industry affiliation are included as control variables. Standard errors clustered on firm level are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

TABLE B.7. Treatment effects of deterrence treatments on SSC varying pre-treatment period

| <b>Panel A:</b>               |                      | <b>4 post-treatment months</b>  |                        |                         |                         |                         |                         |
|-------------------------------|----------------------|---------------------------------|------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
|                               | Pre-treatment months | <i>Audit All</i><br>(1)         | <i>Audit 1%</i><br>(2) | <i>Audit 10%</i><br>(3) | <i>Audit 40%</i><br>(4) | <i>Audit 60%</i><br>(5) | <i>Ambiguous</i><br>(6) |
| POST x TREAT                  | 4                    | 277.037***<br>(91.270)          | 297.985**<br>(134.778) | 112.389<br>(127.836)    | 437.186***<br>(166.276) | 664.887***<br>(248.315) | 215.630**<br>(108.930)  |
| <i>Observations</i>           |                      | 87553                           | 56652                  | 56147                   | 44735                   | 41772                   | 55817                   |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.255                           | 0.207                  | 0.445                   | 0.403                   | 0.403                   | 0.422                   |
| POST x TREAT                  | 6                    | 290.132***<br>(97.549)          | 361.213**<br>(155.765) | 69.386<br>(130.839)     | 437.087**<br>(173.830)  | 730.305***<br>(252.150) | 164.477<br>(165.002)    |
| <i>Observations</i>           |                      | 109852                          | 71086                  | 70427                   | 56136                   | 52387                   | 69998                   |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.256                           | 0.209                  | 0.447                   | 0.405                   | 0.405                   | 0.420                   |
| POST x TREAT                  | 8                    | 274.282**<br>(107.480)          | 405.570**<br>(182.735) | 18.434<br>(142.031)     | 368.826**<br>(175.473)  | 705.472***<br>(259.653) | 87.776<br>(215.013)     |
| <i>Observations</i>           |                      | 132461                          | 85727                  | 84913                   | 67693                   | 63160                   | 84385                   |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.258                           | 0.210                  | 0.450                   | 0.407                   | 0.407                   | 0.419                   |
| POST x TREAT                  | 10                   | 252.257**<br>(118.381)          | 425.042**<br>(207.932) | -17.767<br>(158.685)    | 304.088*<br>(177.283)   | 647.605**<br>(264.031)  | 7.342<br>(246.182)      |
| <i>Observations</i>           |                      | 155275                          | 100509                 | 99522                   | 79358                   | 74024                   | 98894                   |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.260                           | 0.211                  | 0.453                   | 0.409                   | 0.409                   | 0.419                   |
| <i>No of Firms</i>            |                      | 15789                           | 8448                   | 8350                    | 6664                    | 6190                    | 8297                    |
| <b>Panel B:</b>               |                      | <b>10 post-treatment months</b> |                        |                         |                         |                         |                         |
|                               | Pre-treatment months | <i>Audit All</i><br>(1)         | <i>Audit 1%</i><br>(2) | <i>Audit 10%</i><br>(3) | <i>Audit 40%</i><br>(4) | <i>Audit 60%</i><br>(5) | <i>Ambiguous</i><br>(6) |
| POST x TREAT                  | 4                    | 235.915*<br>(124.699)           | 230.592<br>(145.757)   | 76.163<br>(177.653)     | 381.102**<br>(189.863)  | 706.298**<br>(329.200)  | 132.387<br>(132.282)    |
| <i>Observations</i>           |                      | 150976                          | 97605                  | 96741                   | 77045                   | 71948                   | 96166                   |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.258                           | 0.211                  | 0.432                   | 0.394                   | 0.393                   | 0.412                   |
| POST x TREAT                  | 6                    | 249.376**<br>(127.177)          | 294.043*<br>(162.529)  | 34.016<br>(176.308)     | 380.885*<br>(195.669)   | 773.112**<br>(331.847)  | 82.336<br>(180.312)     |
| <i>Observations</i>           |                      | 173275                          | 112039                 | 111021                  | 88446                   | 82563                   | 110347                  |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.258                           | 0.211                  | 0.435                   | 0.396                   | 0.395                   | 0.413                   |
| POST x TREAT                  | 8                    | 233.773*<br>(135.566)           | 338.430*<br>(186.564)  | -16.619<br>(186.237)    | 313.080<br>(198.867)    | 748.405**<br>(341.085)  | 6.319<br>(229.506)      |
| <i>Observations</i>           |                      | 195884                          | 126680                 | 125507                  | 100003                  | 93336                   | 124734                  |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.259                           | 0.212                  | 0.438                   | 0.398                   | 0.397                   | 0.413                   |
| POST x TREAT                  | 10                   | 211.796<br>(146.048)            | 357.832*<br>(209.746)  | -52.576<br>(203.269)    | 248.544<br>(210.360)    | 690.228*<br>(353.748)   | -73.629<br>(261.665)    |
| <i>Observations</i>           |                      | 218698                          | 141462                 | 140116                  | 111668                  | 104200                  | 139243                  |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.261                           | 0.213                  | 0.441                   | 0.400                   | 0.400                   | 0.413                   |
| <i>No of Firms</i>            |                      | 15789                           | 8448                   | 8350                    | 6664                    | 6190                    | 8297                    |

Notes: Treatment effects of deterrence messages on SSC extending the pre-treatment period. Displayed are DiD regression estimates of treatment messages on tax base SSC. The estimated treatment effects are relative to the baseline condition. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. The pre-treatment time period includes four, six, eight or ten months before and the post-treatment time period four (Panel A) or ten (Panel B) months after the treatment. The pre-experiment control mean of tax base SSC in the baseline condition is BGN 8,004. A firm's number of employees and its industry affiliation are included as control variables. Standard errors clustered on firm level are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .



### B.5 Treatment Effects Varying the Post-treatment Period

TABLE B.8. Treatment effects of moral treatments on SSC varying the post-treatment period

|                               | Post-treatment<br>months | <i>Moral All</i><br>(1) | <i>Cooperation</i><br>(2) | <i>Example</i><br>(3)   | <i>Necessity</i><br>(4) | <i>Picture</i><br>(5)  |
|-------------------------------|--------------------------|-------------------------|---------------------------|-------------------------|-------------------------|------------------------|
| POST x TREAT                  | 2                        | 216.775***<br>(64.928)  | 244.663**<br>(109.554)    | 153.530*<br>(85.023)    | 235.009***<br>(87.037)  | 225.348**<br>(89.742)  |
| <i>Observations</i>           |                          | 140373                  | 56019                     | 56091                   | 56359                   | 56063                  |
| <i>Adjusted R<sup>2</sup></i> |                          | 0.364                   | 0.370                     | 0.348                   | 0.388                   | 0.406                  |
| POST x TREAT                  | 4                        | 278.195***<br>(76.559)  | 304.621**<br>(118.416)    | 267.742***<br>(102.450) | 291.545***<br>(103.315) | 242.031**<br>(109.151) |
| <i>Observations</i>           |                          | 186377                  | 74366                     | 74505                   | 74850                   | 74409                  |
| <i>Adjusted R<sup>2</sup></i> |                          | 0.365                   | 0.370                     | 0.346                   | 0.389                   | 0.407                  |
| POST x TREAT                  | 6                        | 280.934***<br>(88.329)  | 335.305***<br>(127.697)   | 284.036**<br>(112.855)  | 258.842**<br>(118.838)  | 237.640*<br>(125.567)  |
| <i>Observations</i>           |                          | 231952                  | 92526                     | 92727                   | 93153                   | 92578                  |
| <i>Adjusted R<sup>2</sup></i> |                          | 0.364                   | 0.368                     | 0.341                   | 0.389                   | 0.406                  |
| POST x TREAT                  | 8                        | 265.795***<br>(99.969)  | 343.128**<br>(137.542)    | 236.430**<br>(119.137)  | 232.348*<br>(134.984)   | 242.357*<br>(141.264)  |
| <i>Observations</i>           |                          | 277005                  | 110489                    | 110725                  | 111234                  | 110532                 |
| <i>Adjusted R<sup>2</sup></i> |                          | 0.362                   | 0.366                     | 0.339                   | 0.387                   | 0.403                  |
| POST x TREAT                  | 10                       | 232.393**<br>(111.396)  | 329.416**<br>(144.980)    | 175.107<br>(127.062)    | 204.189<br>(148.571)    | 208.070<br>(154.560)   |
| <i>Observations</i>           |                          | 321202                  | 128123                    | 128327                  | 129002                  | 128113                 |
| <i>Adjusted R<sup>2</sup></i> |                          | 0.362                   | 0.366                     | 0.338                   | 0.387                   | 0.401                  |
| <i>No of Firms</i>            |                          | 27808                   | 11069                     | 11088                   | 11157                   | 11114                  |

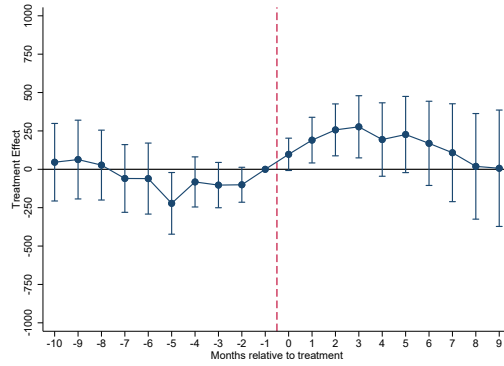
Notes: Treatment effects of moral messages on SSC varying the post-treatment period. Displayed are DiD regression estimates of treatment messages on tax base SSC. The estimated treatment effects are relative to the baseline condition. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. The pre-treatment time period includes four months before and the post-treatment time period two, four, six, eight and ten months after the treatment. The pre-experiment control mean of tax base SSC in the baseline condition is BGN 8,004. A firm's number of employees and its industry affiliation are included as control variables. Standard errors clustered on firm level are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

TABLE B.9. Treatment effects of deterrence treatments on SSC varying the post-treatment period

|                               | Pre-treatment<br>months | <i>Audit All</i><br>(1) | <i>Audit 1%</i><br>(2) | <i>Audit 10%</i><br>(3) | <i>Audit 40%</i><br>(4) | <i>Audit 60%</i><br>(5) | <i>Ambiguous</i><br>(6) |
|-------------------------------|-------------------------|-------------------------|------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| POST x TREAT                  | 2                       | 162.377**<br>(75.674)   | 188.123*<br>(111.105)  | 37.877<br>(102.785)     | 233.309*<br>(131.891)   | 477.739**<br>(206.510)  | 163.350*<br>(96.729)    |
| <i>Observations</i>           |                         | 65930                   | 42672                  | 42273                   | 33694                   | 31450                   | 42008                   |
| <i>Adjusted R<sup>2</sup></i> |                         | 0.255                   | 0.208                  | 0.447                   | 0.403                   | 0.406                   | 0.424                   |
| POST x TREAT                  | 4                       | 277.037***<br>(91.270)  | 297.985**<br>(134.778) | 112.389<br>(127.836)    | 437.186***<br>(166.276) | 664.887***<br>(248.315) | 215.630**<br>(108.930)  |
| <i>Observations</i>           |                         | 87553                   | 56652                  | 56147                   | 44735                   | 41772                   | 55817                   |
| <i>Adjusted R<sup>2</sup></i> |                         | 0.255                   | 0.207                  | 0.445                   | 0.403                   | 0.403                   | 0.422                   |
| POST x TREAT                  | 6                       | 303.700***<br>(106.315) | 347.719**<br>(160.507) | 104.312<br>(144.150)    | 485.718***<br>(182.075) | 692.831**<br>(277.185)  | 204.253*<br>(113.500)   |
| <i>Observations</i>           |                         | 108982                  | 70507                  | 69874                   | 55652                   | 51981                   | 69470                   |
| <i>Adjusted R<sup>2</sup></i> |                         | 0.253                   | 0.205                  | 0.441                   | 0.400                   | 0.399                   | 0.419                   |
| POST x TREAT                  | 8                       | 293.199**<br>(122.057)  | 352.784*<br>(187.490)  | 91.449<br>(164.513)     | 427.065**<br>(182.657)  | 700.090**<br>(307.464)  | 155.031<br>(120.777)    |
| <i>Observations</i>           |                         | 130193                  | 84203                  | 83447                   | 66449                   | 62069                   | 82945                   |
| <i>Adjusted R<sup>2</sup></i> |                         | 0.251                   | 0.204                  | 0.436                   | 0.397                   | 0.396                   | 0.415                   |
| POST x TREAT                  | 10                      | 252.257**<br>(118.381)  | 425.042**<br>(207.932) | -17.767<br>(158.685)    | 304.088*<br>(177.283)   | 647.605**<br>(264.031)  | 7.342<br>(246.182)      |
| <i>Observations</i>           |                         | 155275                  | 100509                 | 99522                   | 79358                   | 74024                   | 98894                   |
| <i>Adjusted R<sup>2</sup></i> |                         | 0.260                   | 0.211                  | 0.453                   | 0.409                   | 0.409                   | 0.419                   |
| <i>No of Firms</i>            |                         | 15789                   | 8448                   | 8350                    | 6664                    | 6190                    | 8297                    |

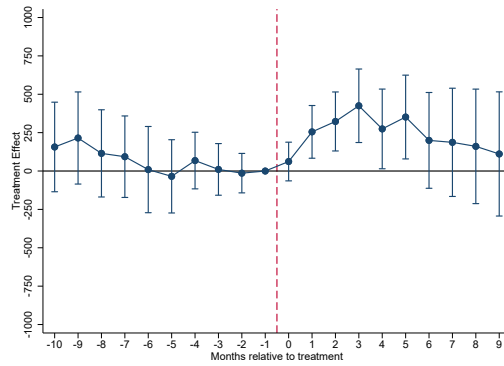
Notes: Treatment effects of deterrence messages on SSC, varying the post-treatment period. Displayed are DiD regression estimates of treatment messages on tax base SSC. The estimated treatment effects are relative to the baseline condition. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. The pre-treatment time period includes four months before and the post-treatment time period two, four, six, eight and ten months after the treatment. The pre-experiment control mean of tax base SSC in the baseline condition is BGN 8,004. A firm's number of employees and its industry affiliation are included as control variables. Standard errors clustered on firm level are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

## B.6 Dynamic Treatment Effects Displaying ten Pre-Treatment Periods



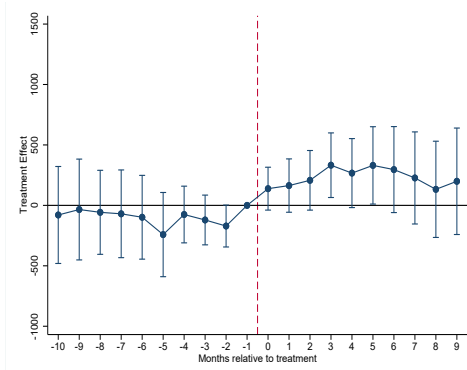
Notes: Pooled monthly treatment effects of the moral appeal messages (Cooperation - Picture). The points plotted are the estimated DiD regression coefficients of treatment messages on tax base SSC by months relative to the treatment. Treatment effects are relative to the control message. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. 95% confidence intervals are represented by the blue lines and based on standard errors clustered on firm level.

FIGURE B.1. Dynamic effects of moral treatments on SSC

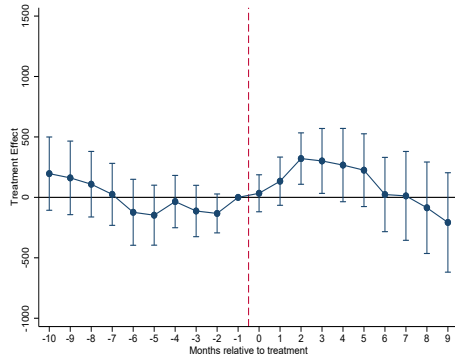


Notes: Pooled monthly treatment effects of the audit probability messages (Audit 1% - Audit 60%). The points plotted are the estimated DiD regression coefficients of treatment messages on tax base SSC by months relative to the treatment. Treatment effects are relative to the control message. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. 95% confidence intervals are represented by the blue lines and based on standard errors clustered on firm level.

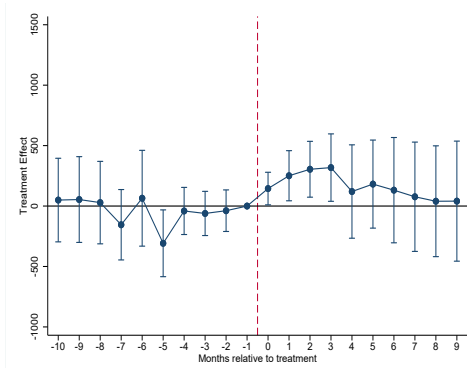
FIGURE B.2. Dynamic effects of deterrence treatments on SSC



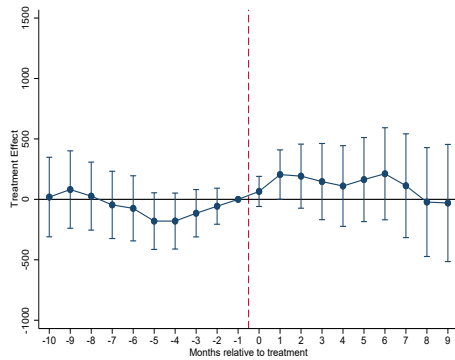
(a) Cooperation



(b) Example



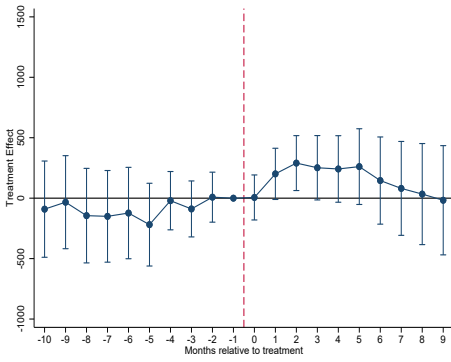
(c) Necessity



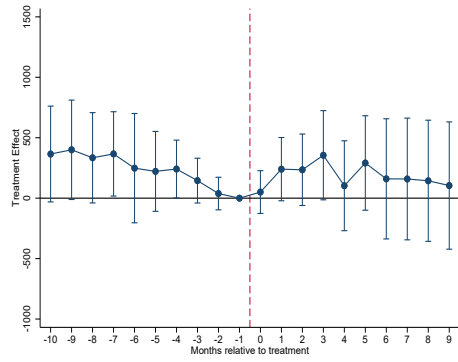
(d) Picture

Notes: Monthly treatment effects of the moral appeal messages (Cooperation, Example, Necessity, Picture) on SSC. The points plotted are the estimated DiD regression coefficients of treatment messages on tax base SSC by months relative to the treatment. Treatment effects are relative to the control message. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. 95% confidence intervals are represented by the blue lines and based on standard errors clustered on firm level.

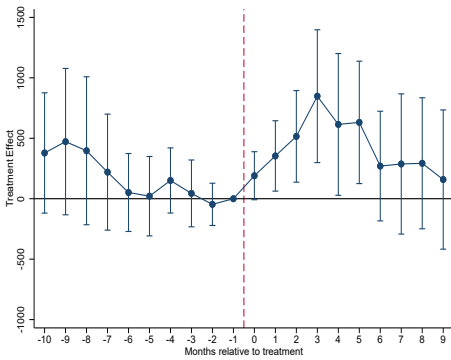
FIGURE B.3. Dynamic effects of moral treatments on SSC by sub-treatment



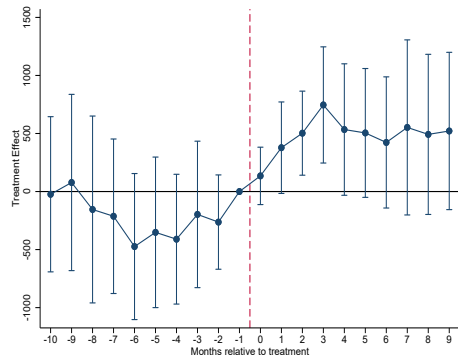
(a) Audit 1%



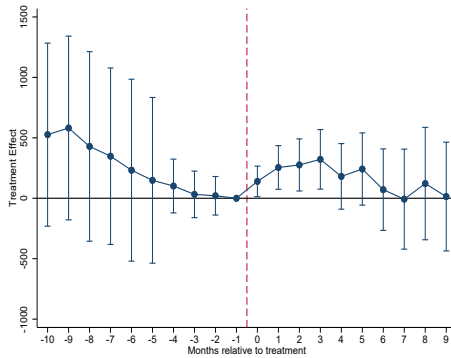
(b) Audit 10%



(c) Audit 40%



(d) Audit 60%



(e) Ambiguous

Notes: Monthly treatment effects of the audit messages (Audit 1%, Audit 10%, Audit 40%, Audit 60%, Ambiguous) on SSC. The points plotted are the estimated DiD regression coefficients of treatment messages on tax base SSC by months relative to the treatment. Treatment effects are relative to the control message. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. 95% confidence intervals are represented by the blue lines and based on standard errors clustered on firm level.

FIGURE B.4. Dynamic effects of deterrence treatments on SSC by sub-treatment

## APPENDIX C: VAT

We focus on the SSC tax base (payroll taxes) throughout the main body of our paper. However, our treatment letters mention VAT payments alongside SSC and underreporting SSC contributions potentially allows firms to credibly lower reported revenue to save on VAT. Our conjecture is therefore that firms potentially change behavior in both domains and we thus also report results for the VAT tax base. Below, we first briefly explain the Bulgarian VAT system (C.1). We then present the main effects of our experimental interventions on the reported VAT base (C.2). Finally, we investigate potential spillover effects of treatment-induced SSC adjustments on VAT reporting behavior (C.3).

### C.1 *Institutional Background*

VAT payments account for 50% of total tax revenues in Bulgaria. VAT is levied on the sale of goods and the provision of services. The tax rate applied in Bulgaria is 20%.<sup>22</sup> Firms collect VAT paid by customers for their goods and services and pay VAT on purchasing goods and services. VAT paid on input costs (VAT credit) is credited against the VAT collected from customers (VAT debit). The difference comprises a firm's VAT tax base. Bulgarian firms have to file a monthly VAT return that contains all this information. A key distinction between VAT and payroll taxes is the degree to which third-party reporting is enforced. Firms additionally have to submit the ledgers of account with their VAT return including a purchase day and a sales day book and a list that details all the customers and the values of sales made to them. This creates an information trail that the Bulgarian tax authority can use to cross-check revenues. Thus, the NRA observes every sale or purchase along the value chain making the case for VAT evasion more difficult.

### C.2 *Treatment Effects*

Table C.1 (for the *Moral* treatments) and Table C.2 (for the *Deterrence* treatments) below depict how the treatment mailings affect VAT payments. The empirical specifications are analogous to the DiD specifications we presented before, but replace the SSC base with the monthly VAT base as outcome variable. Overall, we find insignificant effects (with very large standard errors relative to coefficients) of our treatments on VAT payments for all treatment groups and both time spans that we consider in our analysis.

One possible interpretation for the overall insignificant effect on VAT is rooted in the strong enforcement possibilities associated with VAT (mentioned above). In addition, there is a paper trail for VAT payments (see the well established results by [Pomeranz, 2015](#) in this context). These features allow the tax authority to cross-check revenues quite properly. For SSC, by contrast, both employers and employees have an incentive to evade payroll taxes. By teaming up, employers and employees can easily circumvent the third-party enforcement mechanism and evade part of the social security payments. As a result, initial evasion levels are possibly different across the two tax bases and SSC payments have more scope for being improved in response to treatment mailings.

<sup>22</sup>A reduced tax rate of 9% applies only to hotel accommodations and similar establishments.

TABLE C.1. Treatment effects of moral treatments on VAT

| <b>Panel A:</b>                 |                           |                           |                           |                           |                           |
|---------------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| <b>4 post-treatment months</b>  |                           |                           |                           |                           |                           |
|                                 | <i>Moral all</i><br>(1)   | <i>Cooperation</i><br>(2) | <i>Example</i><br>(3)     | <i>Necessity</i><br>(4)   | <i>Picture</i><br>(5)     |
| POST                            | 4573.455***<br>(1292.997) | 4600.902***<br>(1293.741) | 4572.615***<br>(1294.025) | 4581.113***<br>(1294.311) | 4570.988***<br>(1294.567) |
| TREAT                           | 1135.555<br>(3816.330)    | -2970.387<br>(3483.487)   | 5733.959<br>(8259.795)    | -1100.040<br>(4113.921)   | 1361.819<br>(5304.250)    |
| POST x TREAT                    | 244.637<br>(1609.127)     | -1632.795<br>(1930.412)   | 4088.705<br>(3174.903)    | 86.007<br>(1794.257)      | -1582.751<br>(2097.713)   |
| <i>Observations</i>             | 218112                    | 86838                     | 86971                     | 87647                     | 87201                     |
| <i>No of firms</i>              | 27808                     | 11069                     | 11088                     | 11157                     | 11114                     |
| <i>Adjusted R<sup>2</sup></i>   | 0.020                     | 0.022                     | 0.018                     | 0.026                     | 0.020                     |
| <b>Panel B:</b>                 |                           |                           |                           |                           |                           |
| <b>10 post-treatment months</b> |                           |                           |                           |                           |                           |
|                                 | <i>Moral all</i><br>(1)   | <i>Cooperation</i><br>(2) | <i>Example</i><br>(3)     | <i>Necessity</i><br>(4)   | <i>Picture</i><br>(5)     |
| POST                            | 2833.804**<br>(1247.044)  | 2894.723**<br>(1248.399)  | 2813.628**<br>(1249.759)  | 2867.691**<br>(1248.977)  | 2845.344**<br>(1249.437)  |
| TREAT                           | 1048.130<br>(3818.163)    | -2946.527<br>(3485.931)   | 5676.822<br>(8247.914)    | -1086.003<br>(4121.657)   | 1027.277<br>(5320.064)    |
| POST x TREAT                    | -2809.223<br>(3758.232)   | -155.144<br>(1740.725)    | 3494.675<br>(2845.856)    | 963.021<br>(1717.734)     | -15590.462<br>(13880.197) |
| <i>Observations</i>             | 378391                    | 150718                    | 150894                    | 152087                    | 151348                    |
| <i>No of firms</i>              | 27808                     | 11069                     | 11088                     | 11157                     | 11114                     |
| <i>Adjusted R<sup>2</sup></i>   | 0.002                     | 0.022                     | 0.017                     | 0.025                     | 0.000                     |

Notes: Treatment effects of moral messages on VAT. Displayed are DiD regression estimates of treatment messages on tax base VAT. The estimated treatment effects are relative to the baseline condition. VAT tax base is the monthly reported tax base for VAT payments expressed in BGN. The pre-treatment time period includes four months before and the post-treatment time period four (Panel A) or ten (Panel B) months after the treatment. The pre-experiment control mean of tax base VAT in the baseline condition is BGN 14,344. A firm's number of employees and its industry affiliation are included as controls. Standard errors clustered on firm level are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

### C.3 VAT Spillover

To shed more light on firm behavior and to complement our analysis, we also consider potential spillovers between SSC and VAT. To this end, we check whether firms which increase their SSC payments in response to our treatments also change their behavior with regard to VAT payments. To the best of our knowledge, our data on SSC and VAT are unique in that we can identify such spillovers, which may – depending on their direction – be worrisome or encouraging for policymakers. On the one hand, if firms, for instance, increase tax base SSC in response of our treatments, but reduce tax base VAT, our interventions will be overall less effective from a tax revenue perspective. On the other hand, firms could also behave consistently and increase honesty in both categories which might render our interventions more effective than when looking at SSC alone.<sup>23</sup>

To test spillovers between SSC and VAT, we run VAT regressions in which the treatment group is restricted to firms which increase SSC in response to our treatment mes-

<sup>23</sup>Economic arguments on substitution effects between SSC compliance and VAT evasion could result in negative treatment effects on tax base VAT. Firms might want to offset the higher cost from SSC compliance with lower reported tax base VAT (similar to the offsetting effects identified in Carrillo et al., 2017). Literature from behavioral economics and social psychology on moral licensing likewise provides arguments for negative spillovers (see, e.g., Blanken et al., 2015, Tiefenbeck et al., 2013).

TABLE C.2. Treatment effects of deterrence treatments on VAT

| <b>Panel A:</b>               |                           | <b>4 post-treatment months</b>  |                           |                           |                           |                           |  |
|-------------------------------|---------------------------|---------------------------------|---------------------------|---------------------------|---------------------------|---------------------------|--|
|                               | <i>Audit All</i><br>(1)   | <i>Audit 1%</i><br>(2)          | <i>Audit 10%</i><br>(3)   | <i>Audit 40%</i><br>(4)   | <i>Audit 60%</i><br>(5)   | <i>Ambiguous</i><br>(6)   |  |
| POST                          | 4589.835***<br>(1292.579) | 4590.148***<br>(1292.864)       | 4589.010***<br>(1294.489) | 4592.399***<br>(1295.154) | 4597.398***<br>(1295.279) | 4579.133***<br>(1294.483) |  |
| Treat                         | -54.030<br>(4143.510)     | 4861.945<br>(7624.958)          | -2055.837<br>(4091.851)   | -5111.872<br>(3844.176)   | -6298.307<br>(6154.175)   | 2727.004<br>(4775.444)    |  |
| Post x Treat                  | -1616.486<br>(3104.482)   | -6138.736<br>(6720.442)         | -132.946<br>(2902.376)    | 6230.884<br>(4786.333)    | -1425.218<br>(2491.336)   | -1031.338<br>(1830.890)   |  |
| <i>Observations</i>           | 102205                    | 66215                           | 65619                     | 52290                     | 48626                     | 65219                     |  |
| <i>No of Firms</i>            | 15789                     | 8448                            | 8350                      | 6664                      | 6190                      | 8297                      |  |
| <i>Adjusted R<sup>2</sup></i> | 0.015                     | 0.013                           | 0.022                     | 0.022                     | 0.021                     | 0.026                     |  |
| <b>Panel B:</b>               |                           | <b>10 post-treatment months</b> |                           |                           |                           |                           |  |
|                               | <i>Audit All</i><br>(1)   | <i>Audit 1%</i><br>(2)          | <i>Audit 10%</i><br>(3)   | <i>Audit 40%</i><br>(4)   | <i>Audit 60%</i><br>(5)   | <i>Ambiguous</i><br>(6)   |  |
| POST                          | 2879.611**<br>(1247.835)  | 2876.003**<br>(1249.321)        | 2881.799**<br>(1249.543)  | 2888.935**<br>(1250.602)  | 2891.723**<br>(1250.977)  | 2867.297**<br>(1249.693)  |  |
| Treat                         | -108.445<br>(4127.353)    | 4796.740<br>(7577.951)          | -2112.855<br>(4071.881)   | -5266.909<br>(3842.161)   | -6166.926<br>(6148.060)   | 2797.885<br>(4810.193)    |  |
| Post x Treat                  | -1050.593<br>(3021.118)   | -5526.369<br>(6708.561)         | 1922.547<br>(2782.274)    | 4150.965<br>(2837.191)    | -2875.171<br>(2901.436)   | -895.856<br>(2139.042)    |  |
| <i>Observations</i>           | 177382                    | 114911                          | 113936                    | 90777                     | 84414                     | 113196                    |  |
| <i>No of Firms</i>            | 15789                     | 8448                            | 8350                      | 6664                      | 6190                      | 8297                      |  |
| <i>Adjusted R<sup>2</sup></i> | 0.016                     | 0.015                           | 0.018                     | 0.021                     | 0.021                     | 0.026                     |  |

Notes: Treatment effects of deterrence treatments on VAT. Displayed are DiD regression estimates of treatment messages on tax base VAT. The estimated treatment effects are relative to the baseline condition. VAT tax base is the monthly reported tax base for VAT payments expressed in BGN. The pre-treatment time period includes four months before and the post-treatment time period four (Panel A) or ten (Panel B) months after the treatment. The pre-experiment control mean of tax base VAT in the baseline condition is BGN 14,344. A firm's number of employees and its industry affiliation are included as controls. Standard errors clustered on firm level are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

sages. For this, we calculate the average before-after difference (comparing average tax base SSC in the four months before and after the experiment) for the firms in our control condition. We then only keep treatment firms that have a SSC change that is larger than the average SSC change in the control group. We then run our static DiD regression with VAT as the dependent variable only including these treatment firms and the usual control firms. Based on this approach, we find support for consistent treatment effects on both SSC and VAT. Firms which increase tax base SSC also report significantly higher tax base VAT for both the *Moral* and the *Deterrence* treatments. Table C.3 (for *Moral* treatments) and C.4 (for *Deterrence treatments*) below show our DiD results for this analysis.

Although the effects are not strong enough to affect VAT payments directly (see Tables C.1 and C.2), this finding is encouraging news for tax authorities and adds an important and missing piece to the literature as it suggests that, in our sample, there is no offsetting of compliant behavior in one domain of tax payments with higher evasion in another. This indicates that reported tax revenue in other studies may report lower bounds with respect to the actual tax revenue. Because of positive spillover effects through compliance on other, not directly studied taxes revenue effects may be larger.



TABLE C.3. VAT spillover: Treatment effects of moral treatments on VAT

| <b>Panel A:</b>               |                                 |                           |                            |                            |                            |
|-------------------------------|---------------------------------|---------------------------|----------------------------|----------------------------|----------------------------|
|                               | <b>4 post-treatment months</b>  |                           |                            |                            |                            |
|                               | <i>Moral all</i><br>(1)         | <i>Cooperation</i><br>(2) | <i>Example</i><br>(3)      | <i>Necessity</i><br>(4)    | <i>Picture</i><br>(5)      |
| POST                          | 4569.568***<br>(1296.792)       | 4588.413***<br>(1295.731) | 4576.054***<br>(1296.420)  | 4568.555***<br>(1296.552)  | 4590.899***<br>(1296.742)  |
| TREAT                         | 10072.276<br>(7171.827)         | 4416.991<br>(6394.764)    | 40101.883<br>(28511.525)   | 7234.503<br>(10675.511)    | -3114.352<br>(10425.848)   |
| POST x TREAT                  | 15491.372***<br>(3416.805)      | 6505.355*<br>(3849.253)   | 26825.518**<br>(11061.161) | 15884.618***<br>(3779.072) | 12977.819***<br>(4596.098) |
| <i>Observations</i>           | 78446                           | 52116                     | 51973                      | 52415                      | 52487                      |
| <i>No of firms</i>            | 9938                            | 6623                      | 6605                       | 6663                       | 6667                       |
| <i>Adjusted R<sup>2</sup></i> | 0.022                           | 0.027                     | 0.020                      | 0.028                      | 0.024                      |
| <b>Panel B:</b>               |                                 |                           |                            |                            |                            |
|                               | <b>10 post-treatment months</b> |                           |                            |                            |                            |
|                               | <i>Moral all</i><br>(1)         | <i>Cooperation</i><br>(2) | <i>Example</i><br>(3)      | <i>Necessity</i><br>(4)    | <i>Picture</i><br>(5)      |
| POST                          | 2810.411**<br>(1252.225)        | 2878.158**<br>(1251.558)  | 2797.206**<br>(1253.606)   | 2842.780**<br>(1252.267)   | 2894.013**<br>(1251.876)   |
| TREAT                         | 10271.123<br>(7151.820)         | 4192.530<br>(6380.155)    | 39969.949<br>(28510.717)   | 7440.138<br>(10663.494)    | -2738.063<br>(10334.434)   |
| POST x TREAT                  | 12195.037***<br>(3029.321)      | 5870.988*<br>(3396.449)   | 23447.110***<br>(8102.087) | 15038.429***<br>(4424.540) | 4621.560<br>(5631.713)     |
| <i>Observations</i>           | 136461                          | 90560                     | 90305                      | 91053                      | 91199                      |
| <i>No of firms</i>            | 9938                            | 6623                      | 6605                       | 6663                       | 6667                       |
| <i>Adjusted R<sup>2</sup></i> | 0.022                           | 0.026                     | 0.021                      | 0.026                      | 0.021                      |

Notes: Treatment effects of moral messages on VAT for firms that improved SSC compliance in response to the experiment. The underlying sample includes only firms that have an larger than average before-after difference in tax base SSC compared to firms in the baseline condition. Displayed are DiD regression estimates of treatment messages on tax base VAT. The estimated treatment effects are relative to the baseline condition. VAT tax base is the monthly reported tax base for VAT payments expressed in BGN. The pre-treatment time period includes four months before and the post-treatment time period four (Panel A) or ten (Panel B) months after the treatment. The pre-experiment control mean of tax base VAT in the baseline condition is BGN 14,344. A firm's number of employees and its industry affiliation are included as controls. Standard errors clustered on firm level are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

TABLE C.4. VAT spillover: Treatment effects of deterrence treatments on VAT

| <b>Panel A:</b>               |                           | <b>4 post-treatment months</b>  |                           |                            |                           |                            |  |
|-------------------------------|---------------------------|---------------------------------|---------------------------|----------------------------|---------------------------|----------------------------|--|
|                               | <i>Audit All</i>          | <i>Audit 1%</i>                 | <i>Audit 10%</i>          | <i>Audit 40%</i>           | <i>Audit 60%</i>          | <i>Ambiguous</i>           |  |
|                               | (1)                       | (2)                             | (3)                       | (4)                        | (5)                       | (6)                        |  |
| POST                          | 4598.932***<br>(1295.923) | 4599.934***<br>(1295.872)       | 4589.053***<br>(1295.953) | 4593.083***<br>(1295.710)  | 4596.037***<br>(1295.682) | 4575.548***<br>(1295.832)  |  |
| TREAT                         | 3278.637<br>(6522.782)    | 10468.279<br>(11323.815)        | 4215.027<br>(12299.754)   | -1455.338<br>(11100.731)   | -10313.979<br>(22996.478) | 31817.509**<br>(15090.918) |  |
| POST x TREAT                  | 15456.998**<br>(6179.663) | 10467.670*<br>(5446.722)        | 13854.814<br>(12961.416)  | 37898.718*<br>(21263.330)  | 6290.882<br>(8866.546)    | 5306.107<br>(5370.669)     |  |
| <i>Observations</i>           | 55530                     | 48359                           | 47748                     | 45349                      | 44619                     | 48039                      |  |
| <i>No of Firms</i>            | 7050                      | 6148                            | 6073                      | 5770                       | 5679                      | 6107                       |  |
| <i>Adjusted R<sup>2</sup></i> | 0.026                     | 0.030                           | 0.020                     | 0.023                      | 0.023                     | 0.033                      |  |
| <b>Panel B:</b>               |                           | <b>10 post-treatment months</b> |                           |                            |                           |                            |  |
|                               | <i>Audit All</i>          | <i>Audit 1%</i>                 | <i>Audit 10%</i>          | <i>Audit 40%</i>           | <i>Audit 60%</i>          | <i>Ambiguous</i>           |  |
|                               | (1)                       | (2)                             | (3)                       | (4)                        | (5)                       | (6)                        |  |
| POST                          | 2890.474**<br>(1251.650)  | 2892.941**<br>(1251.839)        | 2881.651**<br>(1251.931)  | 2885.950**<br>(1251.517)   | 2888.867**<br>(1251.612)  | 2858.879**<br>(1251.813)   |  |
| TREAT                         | 3151.210<br>(6484.433)    | 10322.589<br>(11420.581)        | 3979.495<br>(12044.216)   | -1377.820<br>(11141.600)   | -9672.770<br>(22952.872)  | 31937.588**<br>(14971.141) |  |
| POST x TREAT                  | 10568.014**<br>(5219.102) | 4847.844<br>(5307.213)          | 16079.482<br>(11756.860)  | 23467.184**<br>(11603.665) | -6915.401<br>(11595.159)  | 2583.828<br>(7896.123)     |  |
| <i>Observations</i>           | 96520                     | 84010                           | 82944                     | 78748                      | 77474                     | 83440                      |  |
| <i>No of Firms</i>            | 7050                      | 6148                            | 6073                      | 5770                       | 5679                      | 6107                       |  |
| <i>Adjusted R<sup>2</sup></i> | 0.025                     | 0.028                           | 0.020                     | 0.022                      | 0.021                     | 0.029                      |  |

Notes: Treatment effects of deterrence treatments on VAT for firms with improved SSC compliance. Displayed are DID regression estimates of treatment messages on tax base VAT. The estimated treatment effects are relative to the baseline condition. VAT tax base is the monthly reported tax base for VAT payments expressed in BGN. The pre-treatment time period includes four months before and the post-treatment time period four (Panel A) or ten (Panel B) months after the treatment. The pre-experiment control mean of tax base VAT in the baseline condition in BGN 14,344. A firm's number of employees and its industry affiliation are included as controls. Standard errors clustered on firm level are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

## APPENDIX D: EXTENDED SAMPLE (INCLUDING FIRMS THAT DO NOT DIRECTLY COMMUNICATE WITH THE TAX AUTHORITY)

## D.1 Randomization and Summary Statistics

TABLE D.1. Extended sample: Summary statistics and balance across all treatments

|  | <i>Extended sample</i>  | <i>No letter</i>        | <i>Baseline</i>         | <i>Deterrence</i>       | <i>Moral</i>            | <i>Survey</i>           | <i>p-value test</i> |
|--|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|---------------------|
| <b>Panel A:</b>                            |                         |                         |                         |                         |                         |                         |                     |
| <b>Outcome Variables</b>                   |                         |                         |                         |                         |                         |                         |                     |
| SSC 2016<br>(Pre experiment averages 2016) | 7133.60<br>(34988.56)   | 7179.88<br>(35445.20)   | 7124.08<br>(32199.65)   | 7039.36<br>(41958.72)   | 7091.88<br>(32734.68)   | 7051.96<br>(26893.92)   | 0.9858              |
| VAT 2016<br>(Pre experiment averages 2016) | 14423.42<br>(748001.59) | 13992.75<br>(982843.64) | 13542.00<br>(153140.11) | 13292.23<br>(211855.91) | 15675.03<br>(305902.26) | 16430.15<br>(333256.46) | 0.5668              |
| <b>Panel B:</b>                            |                         |                         |                         |                         |                         |                         |                     |
| <b>No of Employees</b>                     |                         |                         |                         |                         |                         |                         |                     |
| Share of firms with less than 11 employees | 0.8660<br>(0.3406)      | 0.8655<br>(0.3411)      | 0.8693<br>(0.3371)      | 0.8658<br>(0.3409)      | 0.8663<br>(0.3403)      | 0.8668<br>(0.3398)      | 0.8751              |
| Share of firms with 11 to 30 employees     | 0.0882<br>(0.2835)      | 0.0879<br>(0.2832)      | 0.0862<br>(0.2807)      | 0.0900<br>(0.2862)      | 0.0892<br>(0.2851)      | 0.0845<br>(0.2782)      | 0.4604              |
| Share of firms with more than 30 employees | 0.0456<br>(0.2086)      | 0.0463<br>(0.2102)      | 0.0442<br>(0.2055)      | 0.0441<br>(0.2053)      | 0.0442<br>(0.2055)      | 0.0486<br>(0.2150)      | 0.1710              |
| <b>Panel C:</b>                            |                         |                         |                         |                         |                         |                         |                     |
| <b>Industry Affiliation</b>                |                         |                         |                         |                         |                         |                         |                     |
| Share of firms in manufacturing            | 0.1104<br>(0.3134)      | 0.1105<br>(0.3135)      | 0.1046<br>(0.3061)      | 0.1097<br>(0.3125)      | 0.1111<br>(0.3143)      | 0.1134<br>(0.3171)      | 0.3064              |
| Share of firms in construction             | 0.0748<br>(0.2631)      | 0.0756<br>(0.2643)      | 0.0688<br>(0.2531)      | 0.0748<br>(0.2630)      | 0.0743<br>(0.2623)      | 0.0754<br>(0.2640)      | 0.1595              |
| Share of firms in wholesale trade          | 0.1203<br>(0.3253)      | 0.1198<br>(0.3248)      | 0.1239<br>(0.3295)      | 0.1202<br>(0.3252)      | 0.1195<br>(0.3244)      | 0.1242<br>(0.3298)      | 0.5509              |
| Share of firms in retail trade             | 0.1941<br>(0.3955)      | 0.1935<br>(0.3951)      | 0.2051<br>(0.4038)      | 0.1966<br>(0.3974)      | 0.1929<br>(0.3946)      | 0.1880<br>(0.3907)      | 0.0250              |
| Share of firms in food and beverage        | 0.0444<br>(0.2060)      | 0.0447<br>(0.2067)      | 0.0467<br>(0.2110)      | 0.0441<br>(0.2053)      | 0.0434<br>(0.2038)      | 0.0605<br>(0.2049)      | 0.2448              |
| Share of firms in transport                | 0.0669<br>(0.2499)      | 0.0685<br>(0.2527)      | 0.0650<br>(0.2465)      | 0.0649<br>(0.2463)      | 0.0649<br>(0.2464)      | 0.0654<br>(0.2472)      | 0.0687              |
| Share of firms in agriculture              | 0.0607<br>(0.2388)      | 0.0605<br>(0.2384)      | 0.0606<br>(0.2386)      | 0.0611<br>(0.2395)      | 0.0613<br>(0.2399)      | 0.0597<br>(0.2369)      | 0.9658              |
| <b>No of firms</b>                         | 172172                  | 93592                   | 10000                   | 18580                   | 40000                   | 10000                   |                     |

Notes: Pre-experimental average for outcome variables and different firm characteristics across treatments with standard deviation in parentheses. The last column of each row presents the p-value testing the null hypothesis that the mean is equal for all treatment groups. Data on SSC and VAT tax bases and firm characteristics come from administrative tax records. SSC and VAT are expressed in BGN. The underlying sample includes firms that do not directly communicate with the tax authority.

TABLE D.2. Extended Sample: Summary statistics and balance across moral appeals

|  | <i>Baseline</i>  | <i>Cooperation</i> | <i>Example</i>              | <i>Necessity</i> | <i>Picture</i>   | <i>p-value test</i> |
|--|------------------|--------------------|-----------------------------|------------------|------------------|---------------------|
| <b>Panel A:</b>                            |                  |                    |                             |                  |                  |                     |
|  |                  |                    | <b>Outcome Variables</b>    |                  |                  |                     |
| SSC  | 7124.079         | 6795.104           | 6612.200                    | 7756.223         | 7198.823         | 0.255               |
| (Pre-experiment average tax base 2016)     | (32199.652)      | (29531.641)        | (32223.483)                 | (39490.918)      | (28483.175)      |                     |
| VAT  | 13541.999        | 14624.856          | 16815.067                   | 15669.303        | 15590.647        | 0.810               |
| (Pre-experiment average tax base 2016)     | (153140.108)     | (189886.149)       | (446229.406)                | (245860.217)     | (280462.937)     |                     |
| <b>Panel B:</b>                            |                  |                    |                             |                  |                  |                     |
|  |                  |                    | <b>No of Employees</b>      |                  |                  |                     |
| Share of firms with less than 11 employees | 0.869<br>(0.337) | 0.869<br>(0.337)   | 0.871<br>(0.335)            | 0.864<br>(0.342) | 0.861<br>(0.346) | 0.174               |
| Share of firms with 11 to 30 employees     | 0.086<br>(0.281) | 0.088<br>(0.283)   | 0.088<br>(0.283)            | 0.090<br>(0.286) | 0.091<br>(0.288) | 0.760               |
| Share of firms with more than 30 employees | 0.044<br>(0.206) | 0.043<br>(0.202)   | 0.041<br>(0.198)            | 0.045<br>(0.208) | 0.048<br>(0.214) | 0.131               |
| <b>Panel C:</b>                            |                  |                    |                             |                  |                  |                     |
|  |                  |                    | <b>Industry Affiliation</b> |                  |                  |                     |
| Share of firms in manufacturing            | 0.105<br>(0.306) | 0.108<br>(0.311)   | 0.112<br>(0.315)            | 0.111<br>(0.315) | 0.113<br>(0.317) | 0.316               |
| Share of firms in construction             | 0.069<br>(0.253) | 0.079<br>(0.270)   | 0.074<br>(0.261)            | 0.071<br>(0.258) | 0.073<br>(0.260) | 0.087               |
| Share of firms in wholesale trade          | 0.124<br>(0.329) | 0.119<br>(0.324)   | 0.121<br>(0.326)            | 0.120<br>(0.325) | 0.117<br>(0.322) | 0.696               |
| Share of firms in retail trade             | 0.205<br>(0.404) | 0.195<br>(0.396)   | 0.186<br>(0.389)            | 0.200<br>(0.400) | 0.191<br>(0.393) | 0.007               |
| Share of firms in food and beverage        | 0.047<br>(0.211) | 0.043<br>(0.202)   | 0.042<br>(0.199)            | 0.045<br>(0.208) | 0.044<br>(0.206) | 0.409               |
| Share of firms in transport                | 0.065<br>(0.247) | 0.067<br>(0.250)   | 0.064<br>(0.244)            | 0.066<br>(0.247) | 0.064<br>(0.244) | 0.906               |
| Share of firms in agriculture              | 0.061<br>(0.239) | 0.058<br>(0.234)   | 0.064<br>(0.245)            | 0.059<br>(0.236) | 0.064<br>(0.245) | 0.220               |
| <b>No of Firms</b>                         | 10000            | 10000              | 10000                       | 10000            | 10000            |                     |

Notes: Pre-experimental average for outcome variables and different firm characteristics across moral treatments with standard deviation in parentheses. The last column of each row presents the p-value testing the null hypothesis that the means are equal for all treatment groups. Data on SSC and VAT tax bases and firm characteristics come from administrative tax records. SSC and VAT are expressed in BGN. The underlying sample includes firms that do not directly communicate with the tax authority

TABLE D.3. Extended Sample: Summary statistics and balance across deterrence treatments

|  | Baseline                  | Audit 1%                  | Audit 10%                 | Audit 40%                 | Audit 60%                | Ambiguous                 | p-value test |
|--|---------------------------|---------------------------|---------------------------|---------------------------|--------------------------|---------------------------|--------------|
| <b>Panel A:</b>                            |                           |                           |                           |                           |                          |                           |              |
| <b>Outcome Variables</b>                   |                           |                           |                           |                           |                          |                           |              |
| SSC  | 7124.079<br>(32199.652)   | 7241.176<br>(51260.970)   | 6530.959<br>(28338.409)   | 6652.373<br>(29415.911)   | 9049.614<br>(38889.374)  | 7096.467<br>(47961.841)   | 0.471        |
| VAT  | 13541.999<br>(153140.108) | 15303.190<br>(225394.888) | 12096.689<br>(240932.829) | 12496.899<br>(178280.742) | 8111.472<br>(215361.926) | 13456.484<br>(173708.093) | 0.750        |
| <b>Panel B:</b>                            |                           |                           |                           |                           |                          |                           |              |
| <b>No of Employees</b>                     |                           |                           |                           |                           |                          |                           |              |
| Share of firms with less than 11 employees | 0.869<br>(0.337)          | 0.864<br>(0.343)          | 0.870<br>(0.336)          | 0.875<br>(0.330)          | 0.854<br>(0.353)         | 0.860<br>(0.347)          | 0.302        |
| Share of firms with 11 to 30 employees     | 0.086<br>(0.281)          | 0.089<br>(0.285)          | 0.087<br>(0.282)          | 0.084<br>(0.277)          | 0.091<br>(0.287)         | 0.097<br>(0.297)          | 0.310        |
| Share of firms with more than 30 employees | 0.044<br>(0.206)          | 0.047<br>(0.211)          | 0.042<br>(0.201)          | 0.041<br>(0.198)          | 0.055<br>(0.228)         | 0.042<br>(0.201)          | 0.399        |
| <b>Panel C:</b>                            |                           |                           |                           |                           |                          |                           |              |
| <b>Industry Affiliation</b>                |                           |                           |                           |                           |                          |                           |              |
| Share of firms in manufacturing            | 0.105<br>(0.306)          | 0.116<br>(0.320)          | 0.110<br>(0.313)          | 0.111<br>(0.314)          | 0.103<br>(0.303)         | 0.104<br>(0.306)          | 0.310        |
| Share of firms in construction             | 0.069<br>(0.253)          | 0.073<br>(0.260)          | 0.074<br>(0.262)          | 0.072<br>(0.259)          | 0.081<br>(0.272)         | 0.078<br>(0.268)          | 0.381        |
| Share of firms in wholesale trade          | 0.124<br>(0.329)          | 0.121<br>(0.326)          | 0.119<br>(0.324)          | 0.126<br>(0.332)          | 0.114<br>(0.317)         | 0.119<br>(0.324)          | 0.835        |
| Share of firms in retail trade             | 0.205<br>(0.404)          | 0.201<br>(0.401)          | 0.197<br>(0.398)          | 0.185<br>(0.388)          | 0.189<br>(0.392)         | 0.200<br>(0.400)          | 0.327        |
| Share of firms in food and beverage        | 0.047<br>(0.211)          | 0.043<br>(0.203)          | 0.039<br>(0.193)          | 0.057<br>(0.232)          | 0.053<br>(0.223)         | 0.042<br>(0.201)          | 0.326        |
| Share of firms in transport                | 0.065<br>(0.247)          | 0.062<br>(0.240)          | 0.063<br>(0.244)          | 0.059<br>(0.237)          | 0.069<br>(0.254)         | 0.071<br>(0.257)          | 0.364        |
| Share of firms in agriculture              | 0.061<br>(0.239)          | 0.058<br>(0.233)          | 0.061<br>(0.239)          | 0.069<br>(0.254)          | 0.065<br>(0.247)         | 0.059<br>(0.236)          | 0.606        |
| <b>No of firms</b>                         | 10000                     | 5200                      | 5000                      | 2000                      | 1180                     | 5000                      |              |

Notes: Pre-experimental average for outcome variables and different firm characteristics across deterrence treatments with standard deviation in parentheses. The last column of each row presents the p-value testing the null hypothesis that the mean is equal for all treatment groups. Data on SSC and VAT tax bases and firm characteristics come from administrative tax records. SSC and VAT are expressed in BGN. The underlying sample includes firms that do not directly communicate with the tax authority.

D.2 *Static DiD*

TABLE D.4. Extended sample: Treatment effects of moral appeals on SSC

| <b>Panel A:</b>                 |                         |                           |                        |                         |                        |
|---------------------------------|-------------------------|---------------------------|------------------------|-------------------------|------------------------|
| <b>4 post-treatment months</b>  |                         |                           |                        |                         |                        |
|                                 | <i>Moral all</i><br>(1) | <i>Cooperation</i><br>(2) | <i>Example</i><br>(3)  | <i>Necessity</i><br>(4) | <i>Picture</i><br>(5)  |
| POST                            | 319.765***<br>(71.832)  | 320.950***<br>(71.098)    | 325.559***<br>(71.255) | 312.641***<br>(71.130)  | 318.631***<br>(71.273) |
| TREAT                           | 117.644<br>(353.500)    | 9.260<br>(428.275)        | -301.862<br>(423.465)  | 708.660<br>(507.384)    | 19.424<br>(409.869)    |
| POST x TREAT                    | 155.161**<br>(78.519)   | 164.369*<br>(95.715)      | 160.947*<br>(96.108)   | 158.100*<br>(95.192)    | 150.170<br>(93.985)    |
| <i>Observations</i>             | 326681                  | 130802                    | 130913                 | 131216                  | 130220                 |
| <i>No of firms</i>              | 50000                   | 20000                     | 20000                  | 20000                   | 20000                  |
| <i>Adjusted R<sup>2</sup></i>   | 0.340                   | 0.349                     | 0.322                  | 0.331                   | 0.371                  |
| <b>Panel B:</b>                 |                         |                           |                        |                         |                        |
| <b>10 post-treatment months</b> |                         |                           |                        |                         |                        |
|                                 | <i>Moral all</i><br>(1) | <i>Cooperation</i><br>(2) | <i>Example</i><br>(3)  | <i>Necessity</i><br>(4) | <i>Picture</i><br>(5)  |
| POST                            | 411.386***<br>(87.959)  | 415.123***<br>(85.709)    | 422.970***<br>(85.959) | 398.942***<br>(85.788)  | 409.722***<br>(85.964) |
| TREAT                           | 120.135<br>(353.306)    | 11.269<br>(427.950)       | -294.273<br>(423.248)  | 708.857<br>(507.037)    | 22.544<br>(409.313)    |
| POST x TREAT                    | 149.626<br>(95.866)     | 190.241*<br>(112.034)     | 107.894<br>(107.608)   | 183.461<br>(120.525)    | 134.820<br>(115.219)   |
| <i>Observations</i>             | 562293                  | 224963                    | 225239                 | 225753                  | 223994                 |
| <i>No of firms</i>              | 50000                   | 20000                     | 20000                  | 20000                   | 20000                  |
| <i>Adjusted R<sup>2</sup></i>   | 0.335                   | 0.341                     | 0.313                  | 0.324                   | 0.362                  |

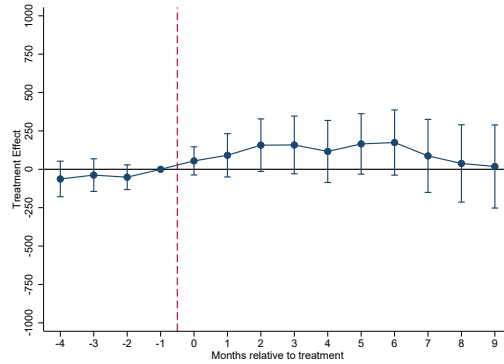
Notes: Treatment effects of moral messages on SSC. Displayed are DiD regression estimates of treatment messages on tax base SSC. Displayed are DiD regression estimates of treatment messages on tax base SSC. The estimated treatment effects are relative to the baseline condition. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. The pre-treatment time period includes four months before and the post-treatment time period four (Panel A) or ten (Panel B) months after the treatment. The pre-experiment control mean of tax base SSC in the baseline condition is BGN 7,124. A firm's number of employees and its industry affiliation are included as controls. The underlying sample includes firms that do not directly communicate with the tax authority. Standard errors clustered on firm level are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

TABLE D.5. Extended sample: Treatment effects of deterrence treatments on SSC

| <b>Panel A:</b>               |                        | <b>4 post-treatment months</b>  |                        |                        |                        |                        |  |
|-------------------------------|------------------------|---------------------------------|------------------------|------------------------|------------------------|------------------------|--|
|                               | <i>Audit all</i>       | <i>Audit 1%</i>                 | <i>Audit 10%</i>       | <i>Audit 40%</i>       | <i>Audit 60%</i>       | <i>Ambiguous</i>       |  |
|                               | (1)                    | (2)                             | (3)                    | (4)                    | (5)                    | (6)                    |  |
| POST                          | 319.415***<br>(71.242) | 320.503***<br>(70.845)          | 318.006***<br>(70.800) | 320.638***<br>(70.530) | 317.204***<br>(70.265) | 316.682***<br>(71.092) |  |
| TREAT                         | 217.320<br>(490.642)   | 348.846<br>(850.774)            | -126.234<br>(495.690)  | -149.545<br>(681.022)  | 1484.226<br>(1074.364) | 157.713<br>(869.791)   |  |
| POST x TREAT                  | 130.429<br>(85.245)    | 78.836<br>(108.854)             | 56.523<br>(99.986)     | 256.982**<br>(131.026) | 467.609**<br>(187.046) | 107.283<br>(96.450)    |  |
| <i>Observations</i>           | 153231                 | 99431                           | 98333                  | 78603                  | 73334                  | 98383                  |  |
| <i>No of firms</i>            | 28380                  | 15200                           | 15000                  | 12000                  | 11180                  | 15000                  |  |
| <i>Adjusted R<sup>2</sup></i> | 0.260                  | 0.221                           | 0.352                  | 0.351                  | 0.353                  | 0.240                  |  |
| <b>Panel B:</b>               |                        | <b>10 post-treatment months</b> |                        |                        |                        |                        |  |
|                               | <i>Audit all</i>       | <i>Audit 1%</i>                 | <i>Audit 10%</i>       | <i>Audit 40%</i>       | <i>Audit 60%</i>       | <i>Ambiguous</i>       |  |
|                               | (1)                    | (2)                             | (3)                    | (4)                    | (5)                    | (6)                    |  |
| POST                          | 411.055***<br>(86.267) | 414.755***<br>(84.920)          | 410.535***<br>(84.536) | 413.421***<br>(83.667) | 407.112***<br>(83.090) | 408.353***<br>(85.520) |  |
| TREAT                         | 223.352<br>(490.050)   | 347.415<br>(850.206)            | -115.573<br>(495.070)  | -139.585<br>(681.003)  | 1494.344<br>(1071.398) | 170.311<br>(870.807)   |  |
| POST x TREAT                  | 140.179<br>(103.929)   | 61.333<br>(121.064)             | 91.811<br>(130.939)    | 225.109<br>(145.474)   | 546.349**<br>(242.774) | 136.650<br>(131.389)   |  |
| <i>Observations</i>           | 263664                 | 171057                          | 169087                 | 135060                 | 126116                 | 169278                 |  |
| <i>No of firms</i>            | 28380                  | 15200                           | 15000                  | 12000                  | 11180                  | 15000                  |  |
| <i>Adjusted R<sup>2</sup></i> | 0.260                  | 0.221                           | 0.343                  | 0.339                  | 0.341                  | 0.231                  |  |

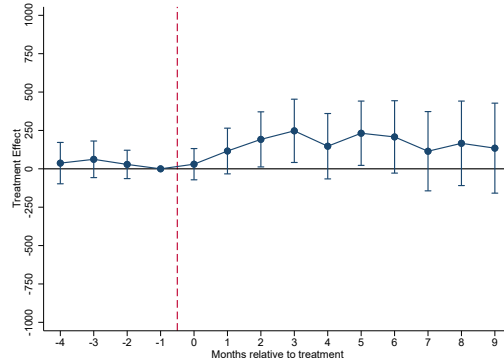
Notes: Treatment effects of moral messages on SSC. Displayed are DiD regression estimates of treatment messages on tax base SSC. Displayed are DiD regression estimates of treatment messages on tax base SSC. The estimated treatment effects are relative to the baseline condition. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. The pre-treatment time period includes four months before and the post-treatment time period four (Panel A) or ten (Panel B) months after the treatment. The pre-experiment control mean of tax base SSC in the baseline condition is BGN 7,124. A firm's number of employees and its industry affiliation are included as controls. The underlying sample includes firms that do not directly communicate with the tax authority. Standard errors clustered on firm level are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

### D.3 Dynamics



Notes: Pooled monthly treatment effects of the moral appeal messages (Cooperation - Picture) on SSC. The points plotted are the estimated DiD regression coefficients of treatment messages on tax base SSC by months relative to the treatment. Treatment effects are relative to the control message. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. The underlying sample includes firms that do not directly communicate with the tax authority. 95% confidence intervals are represented by the blue lines and based on standard errors clustered on firm level.

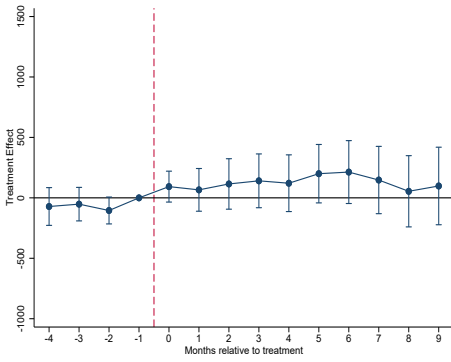
FIGURE D.1. Extended sample: Dynamic effects of moral treatments on SSC



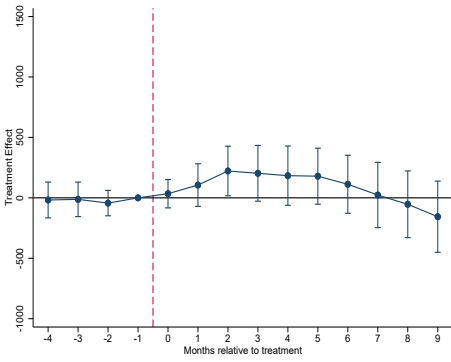
Notes: Pooled monthly treatment effects of the audit probability messages (Audit 1% - Audit 60%) on SSC. The points plotted are the estimated DiD regression coefficients of treatment messages on tax base SSC by months relative to the treatment. Treatment effects are relative to the control message. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. The underlying sample includes firms that do not directly communicate with the tax authority. 95% confidence intervals are represented by the blue lines and based on standard errors clustered on firm level.

FIGURE D.2. Extended sample: Dynamic effects of deterrence treatments on SSC

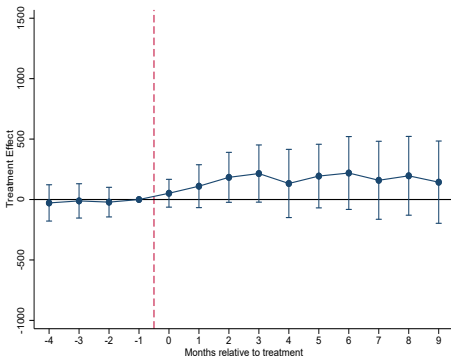




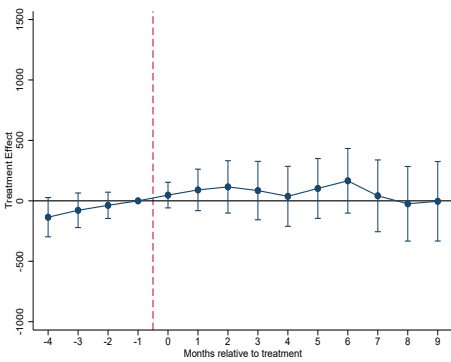
(a) Cooperation



(b) Example



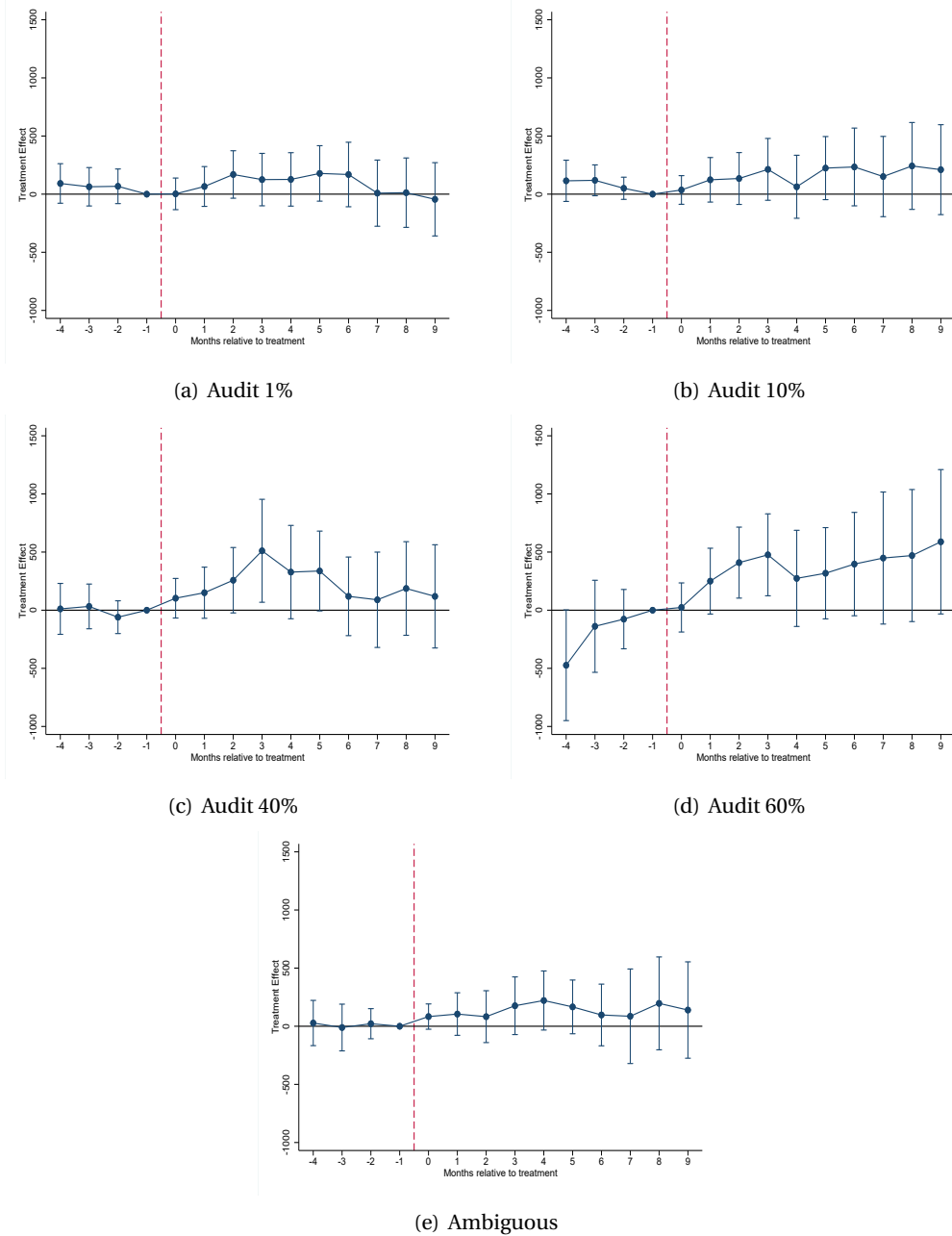
(c) Necessity



(d) Picture

Notes: Monthly treatment effects of moral appeal messages (Cooperation, Example, Necessity, Picture) on SSC. The points plotted are the estimated DiD regression coefficients of treatment messages on tax base SSC by months relative to the treatment. Treatment effects are relative to the control message. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. The underlying sample includes firms that do not directly communicate with the tax authority. 95% confidence intervals are represented by the blue lines and based on standard errors clustered on firm level.

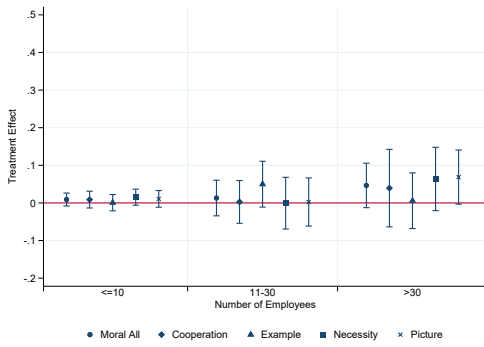
FIGURE D.3. Extended sample: Dynamic effects of moral treatments on SSC by sub-treatment



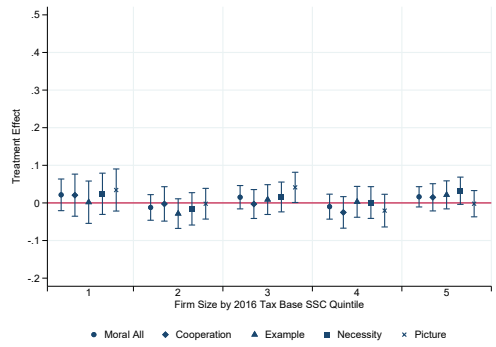
Notes: Monthly treatment effects of audit messages (Audit 1%, Audit 10%, Audit 40%, Audit 60%, Ambiguous) on SSC. The points plotted are the estimated DiD regression coefficients of treatment messages on tax base SSC by months relative to the treatment. Treatment effects are relative to the control message. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. The underlying sample includes firms that do not directly communicate with the tax authority. 95% confidence intervals are represented by the blue lines and based on standard errors clustered on firm level.

FIGURE D.4. Extended sample: Dynamic effects of deterrence treatments on SSC by sub-treatment

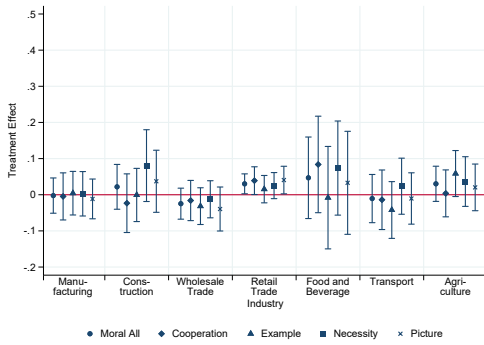
### D.4 Heterogeneity



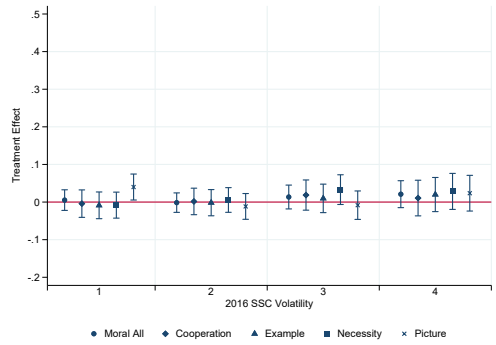
(a) Firm size: Number of employees



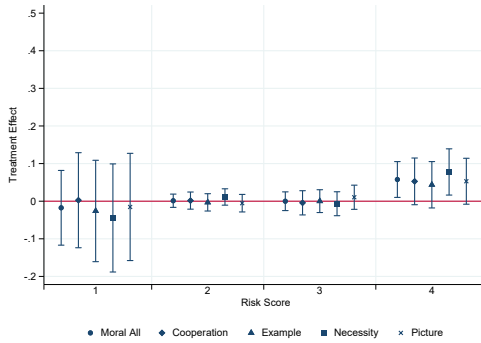
(b) Firm size: 2016 tax base SSC



(c) Industry



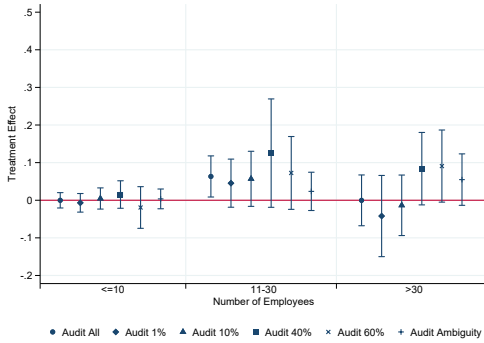
(d) Volatility: 2016 tax base SSC



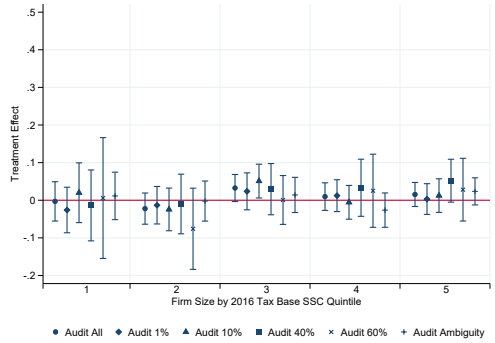
(e) Risk score

Notes: Panel (a): Heterogeneous effects of moral messages on SSC by the number of employees. Panel (b): Heterogeneous effects of moral messages by firm size in 2016 tax base SSC quintiles. Panel (c): Heterogeneous effects of moral messages on SSC by industry affiliation. Panel (d): Heterogeneous effects of moral messages on SSC by 2016 tax base SSC volatility quartiles. Panel (e): Heterogeneous effects of moral messages on SSC by the tax authorities' internal risk score (between 1-low risk to 3-high risk). The points plotted are the estimated DID regression coefficients of treatment messages on log(tax base SSC). Displayed treatment effects are in percent relative to the control message.

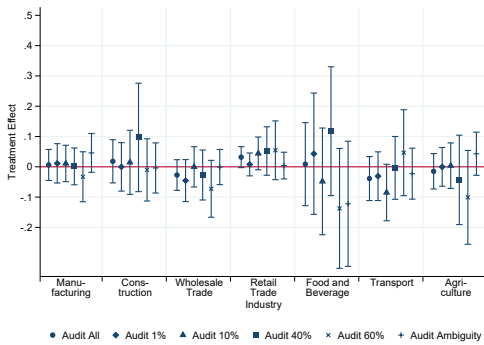
FIGURE D.5. Extended sample: Heterogeneous effects of moral treatments on SSC (in percent)



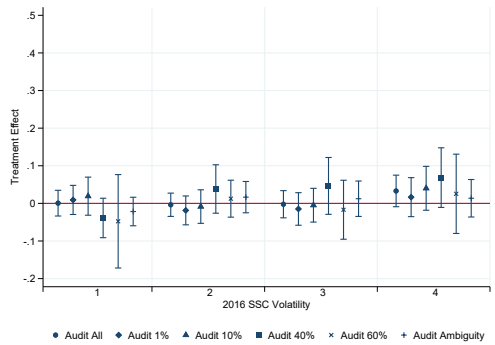
(a) Firm size: Number of employees



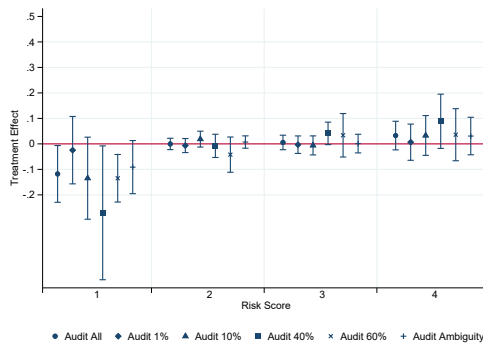
(b) Firm size: 2016 tax base SSC



(c) Industry



(d) Volatility: 2016 tax base SSC



(e) Risk score

Notes: Panel (a): Heterogeneous effects of deterrence messages on SSC by the number of employees. Panel (b): Heterogeneous effects of deterrence messages by firm size in 2016 tax base SSC quintiles. Panel (c): Heterogeneous effects of deterrence messages on SSC by industry affiliation. Panel (d): Heterogeneous effects of deterrence messages on SSC by 2016 tax base SSC volatility quartiles. Panel (e): Heterogeneous effects of deterrence messages on SSC by the tax authorities' internal risk score (between 1-low risk to 3-high risk). The points plotted are the estimated DID regression coefficients of treatment messages on log(tax base SSC). Displayed treatment effects are in percent relative to the control message. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. The pre-treatment time period includes four months before and the post-treatment time period four months after the treatment. The underlying sample includes firms that do not directly communicate with the tax authority. 95% confidence intervals are represented by the blue lines and based on standard errors clustered on firm level.

FIGURE D.6. Extended sample: Heterogeneous effects of deterrence treatments on SSC (in percent)

## D.5 Robustness Checks and Additional Analyses

TABLE D.6. Extended sample: Multiple hypothesis testing moral treatments

| <b>Panel A:</b>  |                   | <b>4 post-treatment months</b>  |                    |                |                  |                |
|------------------|-------------------|---------------------------------|--------------------|----------------|------------------|----------------|
|                  |                   | <i>Moral All</i>                | <i>Cooperation</i> | <i>Example</i> | <i>Necessity</i> | <i>Picture</i> |
|                  |                   | (1)                             | (2)                | (3)            | (4)              | (5)            |
| TREATMENT EFFECT |                   | 155.161                         | 164.369            | 160.947        | 158.100          | 150.170        |
| <i>P-values</i>  | <i>Unadjusted</i> | 0.048**                         | 0.086*             | 0.094*         | 0.097*           | 0.110          |
|                  | <i>Adjusted</i>   | 0.096*                          | 0.172              | 0.188          | 0.194            | 0.220          |
| <b>Panel B:</b>  |                   | <b>10 post-treatment months</b> |                    |                |                  |                |
|                  |                   | <i>Moral All</i>                | <i>Cooperation</i> | <i>Example</i> | <i>Necessity</i> | <i>Picture</i> |
|                  |                   | (1)                             | (2)                | (3)            | (4)              | (5)            |
| TREATMENT EFFECT |                   | 149.626                         | 190.241            | 107.894        | 183.461          | 134.820        |
| <i>P-values</i>  | <i>Unadjusted</i> | 0.119                           | 0.090*             | 0.316          | 0.128            | 0.242          |
|                  | <i>Adjusted</i>   | 0.237                           | 0.179              | 0.632          | 0.256            | 0.484          |

Notes: Treatment effects and corresponding p-values for the moral treatments. Treatment effect represents the DiD coefficient regressing the treatment message on tax base SSC in BGN. Panel A reports Immediate effects for four months and Panel B Overall effects for ten months after the treatment intervention. A firm's number of employees and its industry affiliation are included as control variables. Unadjusted p-values are not corrected for testing multiple hypotheses. Adjusted p-values are corrected for testing multiple hypothesis. The command used is `wyong` by Jones et al. (2019). The underlying sample includes firms that do not directly communicate with the tax authority. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

TABLE D.7. Extended sample: Multiple hypothesis testing deterrence treatments

| <b>Panel A:</b>  |                   | <b>4 post-treatment months</b>  |                 |                  |                  |                  |                  |
|------------------|-------------------|---------------------------------|-----------------|------------------|------------------|------------------|------------------|
|                  |                   | <i>Audit All</i>                | <i>Audit 1%</i> | <i>Audit 10%</i> | <i>Audit 40%</i> | <i>Audit 60%</i> | <i>Ambiguous</i> |
|                  |                   | (1)                             | (2)             | (3)              | (4)              | (5)              | (6)              |
| TREATMENT EFFECT |                   | 130.429                         | 78.836          | 56.523           | 256.982          | 467.609          | 107.283          |
| <i>P-values</i>  | <i>Unadjusted</i> | 0.126                           | 0.469           | 0.572            | 0.049**          | 0.012**          | 0.226            |
|                  | <i>Adjusted</i>   | 0.252                           | 0.938           | 0.817            | 0.099*           | 0.025**          | 0.532            |
| <b>Panel B:</b>  |                   | <b>10 post-treatment months</b> |                 |                  |                  |                  |                  |
|                  |                   | <i>Audit All</i>                | <i>Audit 1%</i> | <i>Audit 10%</i> | <i>Audit 40%</i> | <i>Audit 60%</i> | <i>Ambiguous</i> |
|                  |                   | (1)                             | (2)             | (3)              | (4)              | (5)              | (6)              |
| TREATMENT EFFECT |                   | 140.179                         | 61.333          | 91.811           | 225.109          | 546.349          | 136.650          |
| <i>P-values</i>  | <i>Unadjusted</i> | 0.177                           | 0.612           | 0.483            | 0.122            | 0.024**          | 0.298            |
|                  | <i>Adjusted</i>   | 0.355                           | 0.850           | 0.966            | 0.244            | 0.049**          | 0.597            |

Notes: Treatment effects and corresponding p-values for the moral treatments. Treatment effect represents the DiD coefficient regressing the treatment message on tax base SSC in BGN. Panel A reports Immediate effects for four months and Panel B Overall effects for ten months after the treatment intervention. A firm's number of employees and its industry affiliation are included as control variables. Unadjusted p-values are not corrected for testing multiple hypotheses. Adjusted p-values are corrected for testing multiple hypothesis. The command used is `wyong` by Jones et al. (2019). The underlying sample includes firms that do not directly communicate with the tax authority. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

TABLE D.8. Extended sample: Treatment effects of moral treatments on SSC

| <b>Panel A:</b>                 |                         |                           |                        |                         |                        |
|---------------------------------|-------------------------|---------------------------|------------------------|-------------------------|------------------------|
| <b>4 post-treatment months</b>  |                         |                           |                        |                         |                        |
|                                 | <i>Moral All</i><br>(1) | <i>Cooperation</i><br>(2) | <i>Example</i><br>(3)  | <i>Necessity</i><br>(4) | <i>Picture</i><br>(5)  |
| POST                            | 370.653***<br>(79.244)  | 370.653***<br>(79.246)    | 370.653***<br>(79.246) | 370.653***<br>(79.246)  | 370.653***<br>(79.246) |
| TREAT                           | -106.956<br>(437.767)   | -332.641<br>(531.834)     | -794.343<br>(523.480)  | 647.083<br>(615.203)    | 49.075<br>(522.808)    |
| POST x TREAT                    | 134.870<br>(85.010)     | 115.117<br>(98.328)       | 155.669<br>(101.385)   | 138.009<br>(101.556)    | 132.300<br>(100.017)   |
| <i>Observations</i>             | 326787                  | 130842                    | 130961                 | 131256                  | 130270                 |
| <i>No of Firms</i>              | 50000                   | 20000                     | 20000                  | 20000                   | 20000                  |
| <i>Adjusted R<sup>2</sup></i>   | 0.000                   | 0.000                     | 0.000                  | 0.000                   | 0.000                  |
| <b>Panel B:</b>                 |                         |                           |                        |                         |                        |
| <b>10 post-treatment months</b> |                         |                           |                        |                         |                        |
|                                 | <i>Moral All</i><br>(1) | <i>Cooperation</i><br>(2) | <i>Example</i><br>(3)  | <i>Necessity</i><br>(4) | <i>Picture</i><br>(5)  |
| POST                            | 569.684***<br>(97.147)  | 569.684***<br>(97.150)    | 569.684***<br>(97.150) | 569.684***<br>(97.150)  | 569.684***<br>(97.150) |
| TREAT                           | -106.956<br>(437.766)   | -332.641<br>(531.832)     | -794.343<br>(523.478)  | 647.083<br>(615.200)    | 49.075<br>(522.805)    |
| POST x TREAT                    | 91.441<br>(103.741)     | 95.574<br>(116.978)       | 80.212<br>(114.915)    | 105.277<br>(129.959)    | 85.720<br>(123.039)    |
| <i>Observations</i>             | 562477                  | 225033                    | 225323                 | 225823                  | 224080                 |
| <i>No of Firms</i>              | 50000                   | 20000                     | 20000                  | 20000                   | 20000                  |
| <i>Adjusted R<sup>2</sup></i>   | 0.000                   | 0.000                     | 0.000                  | 0.000                   | 0.000                  |

Notes: Treatment effects of moral messages on SSC without control variables. Displayed are DID regression estimates of treatment messages on tax base SSC. Displayed are DID regression estimates of treatment messages on tax base SSC. The estimated treatment effects are relative to the baseline condition. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. The pre-treatment time period includes four months before and the post-treatment time period four (Panel A) or ten (Panel B) months after the treatment. The pre-experiment control mean of tax base SSC in the baseline condition is BGN 8,004. The underlying sample includes firms that do not directly communicate with the tax authority. Standard errors clustered on firm level are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

TABLE D.9. Extended sample: Treatment effects of deterrence treatments on SSC

| <b>Panel A:</b>               |                                 |                        |                        |                        |                        |                        |
|-------------------------------|---------------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
|                               | <b>4 post-treatment months</b>  |                        |                        |                        |                        |                        |
|                               | <i>Audit All</i>                | <i>Audit 1%</i>        | <i>Audit 10%</i>       | <i>Audit 40%</i>       | <i>Audit 60%</i>       | <i>Ambiguous</i>       |
|                               | (1)                             | (2)                    | (3)                    | (4)                    | (5)                    | (6)                    |
| POST                          | 370.653***<br>(79.245)          | 370.653***<br>(79.247) | 370.653***<br>(79.247) | 370.653***<br>(79.248) | 370.653***<br>(79.248) | 370.653***<br>(79.247) |
| TREAT                         | -134.234<br>(575.513)           | 177.008<br>(964.827)   | -829.388<br>(623.923)  | -557.588<br>(859.743)  | 2147.701<br>(1406.528) | -250.907<br>(935.359)  |
| POST x TREAT                  | 136.768<br>(92.545)             | 68.985<br>(112.794)    | 54.903<br>(107.770)    | 326.018**<br>(139.760) | 438.179**<br>(194.671) | 69.484<br>(102.932)    |
| <i>Observations</i>           | 153263                          | 99455                  | 98365                  | 78627                  | 73358                  | 98407                  |
| <i>No of Firms</i>            | 28380                           | 15200                  | 15000                  | 12000                  | 11180                  | 15000                  |
| <i>Adjusted R<sup>2</sup></i> | 0.000                           | 0.000                  | 0.000                  | 0.000                  | 0.000                  | 0.000                  |
| <b>Panel B:</b>               |                                 |                        |                        |                        |                        |                        |
|                               | <b>10 post-treatment months</b> |                        |                        |                        |                        |                        |
|                               | <i>Audit All</i>                | <i>Audit 1%</i>        | <i>Audit 10%</i>       | <i>Audit 40%</i>       | <i>Audit 60%</i>       | <i>Ambiguous</i>       |
|                               | (1)                             | (2)                    | (3)                    | (4)                    | (5)                    | (6)                    |
| POST                          | 569.684***<br>(97.149)          | 569.684***<br>(97.151) | 569.684***<br>(97.151) | 569.684***<br>(97.152) | 569.684***<br>(97.152) | 569.684***<br>(97.151) |
| TREAT                         | -134.234<br>(575.511)           | 177.008<br>(964.820)   | -829.388<br>(623.919)  | -557.588<br>(859.736)  | 2147.701<br>(1406.515) | -250.907<br>(935.353)  |
| POST x TREAT                  | 118.958<br>(112.672)            | 4.518<br>(126.753)     | 81.108<br>(140.095)    | 271.423*<br>(159.291)  | 483.892*<br>(255.113)  | 37.900<br>(127.676)    |
| <i>Observations</i>           | 263720                          | 171099                 | 169143                 | 135102                 | 126158                 | 169320                 |
| <i>No of Firms</i>            | 28380                           | 15200                  | 15000                  | 12000                  | 11180                  | 15000                  |
| <i>Adjusted R<sup>2</sup></i> | 0.000                           | 0.000                  | 0.000                  | 0.000                  | 0.000                  | 0.000                  |

Notes: Treatment effects of deterrence messages on SSC without control variables. Displayed are DiD regression estimates of treatment messages on tax base SSC. Displayed are DiD regression estimates of treatment messages on tax base SSC. The estimated treatment effects are relative to the baseline condition. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. The pre-treatment time period includes four months before and the post-treatment time period four (Panel A) or ten (Panel B) months after the treatment. The pre-experiment control mean of tax base SSC in the baseline condition is BGN 8,004. The underlying sample includes firms that do not directly communicate with the tax authority. Standard errors clustered on firm level are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

TABLE D.10. Extended sample: Treatment effects of deterrence treatments on SSC excluding audited firms

| <b>Panel A:</b>               |                        | <b>4 post-treatment months</b>  |                        |                        |                        |                        |  |
|-------------------------------|------------------------|---------------------------------|------------------------|------------------------|------------------------|------------------------|--|
|                               | <i>Audit all</i>       | <i>Audit 1%</i>                 | <i>Audit 10%</i>       | <i>Audit 40%</i>       | <i>Audit 60%</i>       | <i>Ambiguous</i>       |  |
|                               | (1)                    | (2)                             | (3)                    | (4)                    | (5)                    | (6)                    |  |
| POST                          | 319.415***<br>(71.242) | 320.503***<br>(70.845)          | 318.006***<br>(70.800) | 320.638***<br>(70.530) | 317.204***<br>(70.265) | 316.682***<br>(71.092) |  |
| TREAT                         | 217.320<br>(490.642)   | 348.846<br>(850.774)            | -126.234<br>(495.690)  | -149.545<br>(681.022)  | 1484.226<br>(1074.364) | 157.713<br>(869.791)   |  |
| POST x TREAT                  | 130.429<br>(85.245)    | 78.836<br>(108.854)             | 56.523<br>(99.986)     | 256.982**<br>(131.026) | 467.609**<br>(187.046) | 107.283<br>(96.450)    |  |
| <i>Observations</i>           | 153231                 | 99431                           | 98333                  | 78603                  | 73334                  | 98383                  |  |
| <i>No of Firms</i>            | 28380                  | 15200                           | 15000                  | 12000                  | 11180                  | 15000                  |  |
| <i>Adjusted R<sup>2</sup></i> | 0.260                  | 0.221                           | 0.352                  | 0.351                  | 0.353                  | 0.240                  |  |
| <b>Panel B:</b>               |                        | <b>10 post-treatment months</b> |                        |                        |                        |                        |  |
|                               | <i>Audit all</i>       | <i>Audit 1%</i>                 | <i>Audit 10%</i>       | <i>Audit 40%</i>       | <i>Audit 60%</i>       | <i>Ambiguous</i>       |  |
|                               | (1)                    | (2)                             | (3)                    | (4)                    | (5)                    | (6)                    |  |
| POST                          | 375.310***<br>(84.486) | 377.598***<br>(83.439)          | 372.739***<br>(83.333) | 374.338***<br>(82.657) | 372.060***<br>(82.197) | 370.456***<br>(83.888) |  |
| TREAT                         | 221.348<br>(489.738)   | 348.106<br>(850.156)            | -116.867<br>(495.365)  | -144.101<br>(680.586)  | 1488.880<br>(1076.417) | 170.644<br>(871.169)   |  |
| POST x TREAT                  | 178.162<br>(108.971)   | 130.565<br>(122.742)            | 153.683<br>(136.570)   | 298.069<br>(189.320)   | 471.844*<br>(253.919)  | 184.255<br>(133.894)   |  |
| <i>Observations</i>           | 258056                 | 170564                          | 167472                 | 132839                 | 124132                 | 168780                 |  |
| <i>No of firms</i>            | 28380                  | 15200                           | 15000                  | 12000                  | 11180                  | 15000                  |  |
| <i>Adjusted R<sup>2</sup></i> | 0.257                  | 0.219                           | 0.342                  | 0.338                  | 0.340                  | 0.230                  |  |

Notes: Treatment effects of deterrence treatments on SSC excluding audited firms' observations after the audit has ended. Displayed are DiD regression estimates of treatment messages on tax base SSC. The estimated treatment effects are relative to the baseline condition. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. The pre-treatment time period includes four months before and the post-treatment time period four (Panel A) or ten (Panel B) months after the treatment. The pre-experiment control mean of tax base SSC in the baseline condition is BGN 8,004. A firm's number of employees and its industry affiliation are included as controls. The underlying sample includes firms that do not directly communicate with the tax authority. Standard errors clustered on firm level are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .



TABLE D.11. Extended sample: Treatment effects of moral treatments on SSC extending the pre-treatment period

| <b>Panel A:</b>               |                      | <b>4 post-treatment months</b>  |                           |                       |                         |                       |
|-------------------------------|----------------------|---------------------------------|---------------------------|-----------------------|-------------------------|-----------------------|
|                               | Pre-treatment months | <i>Moral All</i><br>(1)         | <i>Cooperation</i><br>(2) | <i>Example</i><br>(3) | <i>Necessity</i><br>(4) | <i>Picture</i><br>(5) |
| POST x TREAT                  | 4                    | 155.161**<br>(78.519)           | 164.369*<br>(95.715)      | 160.947*<br>(96.108)  | 158.100*<br>(95.192)    | 150.170<br>(93.985)   |
| <i>Observations</i>           |                      | 326681                          | 130802                    | 130913                | 131216                  | 130220                |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.340                           | 0.349                     | 0.322                 | 0.331                   | 0.371                 |
| POST x TREAT                  | 6                    | 171.798**<br>(83.368)           | 186.528*<br>(102.880)     | 145.686<br>(102.583)  | 200.566**<br>(101.406)  | 167.373*<br>(99.265)  |
| <i>Observations</i>           |                      | 410068                          | 164190                    | 164258                | 164773                  | 163507                |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.341                           | 0.352                     | 0.323                 | 0.333                   | 0.374                 |
| POST x TREAT                  | 8                    | 157.336*<br>(85.540)            | 181.470*<br>(107.598)     | 101.947<br>(104.377)  | 204.761**<br>(103.924)  | 154.597<br>(100.965)  |
| <i>Observations</i>           |                      | 494665                          | 198060                    | 198100                | 198786                  | 197313                |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.343                           | 0.356                     | 0.323                 | 0.335                   | 0.377                 |
| POST x TREAT                  | 10                   | 138.947<br>(88.109)             | 183.907<br>(113.413)      | 56.464<br>(105.490)   | 192.479*<br>(106.329)   | 136.822<br>(102.131)  |
| <i>Observations</i>           |                      | 580039                          | 232245                    | 232256                | 233095                  | 231445                |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.345                           | 0.360                     | 0.326                 | 0.338                   | 0.381                 |
| <i>No of Firms</i>            |                      | 50000                           | 20000                     | 20000                 | 20000                   | 20000                 |
| <b>Panel B:</b>               |                      | <b>10 post-treatment months</b> |                           |                       |                         |                       |
|                               | Pre-treatment months | <i>Moral All</i><br>(1)         | <i>Cooperation</i><br>(2) | <i>Example</i><br>(3) | <i>Necessity</i><br>(4) | <i>Picture</i><br>(5) |
| POST x TREAT                  | 4                    | 149.626<br>(95.866)             | 190.241*<br>(112.034)     | 107.894<br>(107.608)  | 183.461<br>(120.525)    | 134.820<br>(115.219)  |
| <i>Observations</i>           |                      | 562293                          | 224963                    | 225239                | 225753                  | 223994                |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.335                           | 0.341                     | 0.313                 | 0.324                   | 0.362                 |
| POST x TREAT                  | 6                    | 166.207*<br>(99.799)            | 211.977*<br>(118.101)     | 93.423<br>(111.657)   | 225.265*<br>(125.523)   | 152.121<br>(119.772)  |
| <i>Observations</i>           |                      | 645680                          | 258351                    | 258584                | 259310                  | 257281                |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.336                           | 0.344                     | 0.314                 | 0.326                   | 0.364                 |
| POST x TREAT                  | 8                    | 151.613<br>(103.780)            | 206.673*<br>(124.427)     | 49.898<br>(115.379)   | 229.201*<br>(130.152)   | 139.290<br>(123.543)  |
| <i>Observations</i>           |                      | 730277                          | 292221                    | 292426                | 293323                  | 291087                |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.337                           | 0.347                     | 0.315                 | 0.328                   | 0.367                 |
| POST x TREAT                  | 10                   | 133.075<br>(108.587)            | 208.887<br>(131.830)      | 4.391<br>(120.657)    | 216.780<br>(135.722)    | 121.441<br>(127.408)  |
| <i>Observations</i>           |                      | 815651                          | 326406                    | 326582                | 327632                  | 325219                |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.340                           | 0.350                     | 0.317                 | 0.330                   | 0.371                 |
| <i>No of Firms</i>            |                      | 50000                           | 20000                     | 20000                 | 20000                   | 20000                 |

Notes: Treatment effects of moral messages on SSC extending the pre-treatment period. Displayed are DiD regression estimates of treatment messages on tax base SSC. The estimated treatment effects are relative to the baseline condition. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. The pre-treatment time period includes four, six, eight or ten months before and the post-treatment time period four (Panel A) or ten (Panel B) months after the treatment. The pre-experiment control mean of tax base SSC in the baseline condition is BGN 8,004. A firm's number of employees and its industry affiliation are included as control variables. The underlying sample includes firms that do not directly communicate with the tax authority. Standard errors clustered on firm level are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

TABLE D.12. Extended sample: Treatment effects of deterrence treatments on SSC varying the pre-treatment period

| <b>Panel A:</b>               |                      | <b>4 post-treatment months</b>  |                        |                         |                         |                         |                         |
|-------------------------------|----------------------|---------------------------------|------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
|                               | Pre-treatment months | <i>Audit All</i><br>(1)         | <i>Audit 1%</i><br>(2) | <i>Audit 10%</i><br>(3) | <i>Audit 40%</i><br>(4) | <i>Audit 60%</i><br>(5) | <i>Ambiguous</i><br>(6) |
| POST x TREAT                  | 4                    | 130.429<br>(85.245)             | 78.836<br>(108.854)    | 56.523<br>(99.986)      | 256.982**<br>(131.026)  | 467.609**<br>(187.046)  | 107.283<br>(96.450)     |
| <i>Observations</i>           |                      | 153231                          | 99431                  | 98333                   | 78603                   | 73334                   | 98383                   |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.260                           | 0.221                  | 0.352                   | 0.351                   | 0.353                   | 0.240                   |
| POST x TREAT                  | 6                    | 152.238*<br>(90.974)            | 100.693<br>(120.314)   | 53.641<br>(106.055)     | 282.887**<br>(137.084)  | 586.699***<br>(207.946) | 86.660<br>(121.064)     |
| <i>Observations</i>           |                      | 192402                          | 124850                 | 123446                  | 98717                   | 92049                   | 123456                  |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.262                           | 0.223                  | 0.357                   | 0.353                   | 0.355                   | 0.240                   |
| POST x TREAT                  | 8                    | 150.858<br>(95.854)             | 114.617<br>(132.400)   | 39.133<br>(114.353)     | 246.215*<br>(138.712)   | 639.123***<br>(224.901) | 52.115<br>(146.803)     |
| <i>Observations</i>           |                      | 232144                          | 150636                 | 148940                  | 119110                  | 111052                  | 148899                  |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.264                           | 0.225                  | 0.361                   | 0.357                   | 0.359                   | 0.243                   |
| POST x TREAT                  | 10                   | 144.143<br>(101.715)            | 114.172<br>(144.705)   | 36.433<br>(125.620)     | 217.180<br>(141.389)    | 635.331***<br>(237.182) | 28.327<br>(170.437)     |
| <i>Observations</i>           |                      | 272261                          | 176677                 | 174665                  | 139692                  | 130229                  | 174597                  |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.267                           | 0.228                  | 0.365                   | 0.361                   | 0.363                   | 0.248                   |
| <i>No of Firms</i>            |                      | 28380                           | 15200                  | 15000                   | 12000                   | 11180                   | 15000                   |
| <b>Panel B:</b>               |                      | <b>10 post-treatment months</b> |                        |                         |                         |                         |                         |
|                               | Pre-treatment months | <i>Audit All</i><br>(1)         | <i>Audit 1%</i><br>(2) | <i>Audit 10%</i><br>(3) | <i>Audit 40%</i><br>(4) | <i>Audit 60%</i><br>(5) | <i>Ambiguous</i><br>(6) |
| POST x TREAT                  | 4                    | 140.179<br>(103.929)            | 61.333<br>(121.064)    | 91.811<br>(130.939)     | 225.109<br>(145.474)    | 546.349**<br>(242.774)  | 136.650<br>(131.389)    |
| <i>Observations</i>           |                      | 263664                          | 171057                 | 169087                  | 135060                  | 126116                  | 169278                  |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.260                           | 0.221                  | 0.343                   | 0.339                   | 0.341                   | 0.231                   |
| POST x TREAT                  | 6                    | 162.315<br>(108.538)            | 83.178<br>(130.927)    | 89.974<br>(134.926)     | 250.861*<br>(152.203)   | 666.413**<br>(259.677)  | 116.231<br>(154.790)    |
| <i>Observations</i>           |                      | 302835                          | 196476                 | 194200                  | 155174                  | 144831                  | 194351                  |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.261                           | 0.222                  | 0.346                   | 0.342                   | 0.344                   | 0.233                   |
| POST x TREAT                  | 8                    | 161.054<br>(114.766)            | 96.798<br>(143.484)    | 76.019<br>(143.996)     | 214.200<br>(157.119)    | 719.172***<br>(278.376) | 81.729<br>(186.679)     |
| <i>Observations</i>           |                      | 342577                          | 222262                 | 219694                  | 175567                  | 163834                  | 219794                  |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.262                           | 0.223                  | 0.350                   | 0.345                   | 0.347                   | 0.235                   |
| POST x TREAT                  | 10                   | 154.303<br>(122.376)            | 95.854<br>(156.438)    | 73.697<br>(156.672)     | 184.913<br>(167.075)    | 715.437**<br>(295.233)  | 57.920<br>(218.150)     |
| <i>Observations</i>           |                      | 382694                          | 248303                 | 245419                  | 196149                  | 183011                  | 245492                  |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.264                           | 0.225                  | 0.353                   | 0.349                   | 0.351                   | 0.239                   |
| <i>No of Firms</i>            |                      | 28380                           | 15200                  | 15000                   | 12000                   | 11180                   | 15000                   |

Notes: Treatment effects of deterrence messages on SSC extending the pre-treatment period. Displayed are DID regression estimates of treatment messages on tax base SSC. The estimated treatment effects are relative to the baseline condition. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. The pre-treatment time period includes four, six, eight or ten months before and the post-treatment time period four (Panel A) or ten (Panel B) months after the treatment. The pre-experiment control mean of tax base SSC in the baseline condition is BGN 8,004. A firm's number of employees and its industry affiliation are included as control variables. The underlying sample includes firms that do not directly communicate with the tax authority. Standard errors clustered on firm level are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

TABLE D.13. Extended sample: Treatment effects of moral treatments on SSC varying the post-treatment period

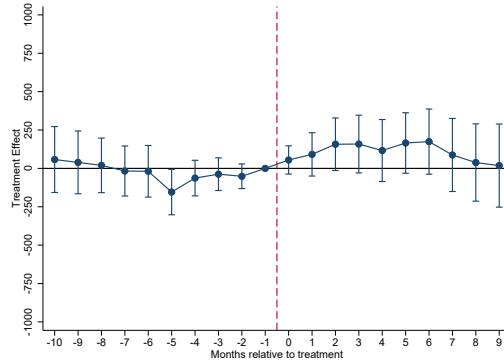
|                               | Post-treatment months | <i>Moral All</i><br>(1)           | <i>Cooperation</i><br>(2)         | <i>Example</i><br>(3)             | <i>Necessity</i><br>(4)           | <i>Picture</i><br>(5)            |
|-------------------------------|-----------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|----------------------------------|
| POST x TREAT                  | 2                     | 112.740*<br>(65.163)              | 140.009*<br>(84.113)              | 89.463<br>(79.461)                | 99.204<br>(79.668)                | 134.803*<br>(78.119)             |
| <i>Observations</i>           |                       | 246119                            | 98543                             | 98617                             | 98849                             | 98118                            |
| <i>Adjusted R<sup>2</sup></i> |                       | 0.340                             | 0.350                             | 0.326                             | 0.331                             | 0.372                            |
| POST x TREAT                  | 4                     | 155.161**<br>(78.519)<br>(76.559) | 164.369*<br>(95.715)<br>(118.416) | 160.947*<br>(96.108)<br>(102.450) | 158.100*<br>(95.192)<br>(103.315) | 150.170<br>(93.985)<br>(109.151) |
| <i>Observations</i>           |                       | 326681                            | 130802                            | 130913                            | 131216                            | 130220                           |
| <i>Adjusted R<sup>2</sup></i> |                       | 0.340                             | 0.349                             | 0.322                             | 0.331                             | 0.371                            |
| POST x TREAT                  | 6                     | 164.339*<br>(85.189)              | 184.232*<br>(102.333)             | 174.469*<br>(101.817)             | 167.017<br>(104.885)              | 146.072<br>(102.036)             |
| <i>Observations</i>           |                       | 406365                            | 162658                            | 162839                            | 163193                            | 161959                           |
| <i>Adjusted R<sup>2</sup></i> |                       | 0.338                             | 0.346                             | 0.318                             | 0.329                             | 0.369                            |
| POST x TREAT                  | 8                     | 167.515*<br>(90.133)<br>485054    | 200.423*<br>(107.382)<br>194111   | 153.931<br>(104.005)<br>194358    | 179.459<br>(113.129)<br>194757    | 153.387<br>(108.612)<br>193296   |
| <i>Observations</i>           |                       | 485054                            | 194111                            | 194358                            | 194757                            | 193296                           |
| <i>Adjusted R<sup>2</sup></i> |                       | 0.336                             | 0.343                             | 0.315                             | 0.329                             | 0.365                            |
| POST x TREAT                  | 10<br>(95.866)        | 149.626<br>(112.034)<br>562293    | 190.241*<br>(107.608)<br>224963   | 107.894<br>(120.525)<br>225239    | 183.461<br>(115.219)<br>225753    | 134.820<br>(102.036)<br>223994   |
| <i>Observations</i>           |                       | 562293                            | 224963                            | 225239                            | 225753                            | 223994                           |
| <i>Adjusted R<sup>2</sup></i> |                       | 0.335                             | 0.341                             | 0.313                             | 0.324                             | 0.362                            |
| <i>No of Firms</i>            |                       | 50000                             | 20000                             | 20000                             | 20000                             | 20000                            |

Notes: Treatment effects of moral messages on SSC varying the post-treatment period. Displayed are DiD regression estimates of treatment messages on tax base SSC. The estimated treatment effects are relative to the baseline condition. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. The pre-treatment time period includes four months before and the post-treatment time period two, four, six, eight and ten months after the treatment. The pre-experiment control mean of tax base SSC in the baseline condition is BGN 8,004. A firm's number of employees and its industry affiliation are included as control variables. The underlying sample includes firms that do not directly communicate with the tax authority. Standard errors clustered on firm level are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

TABLE D.14. Extended sample: Treatment effects of deterrence treatments on SSC varying the post-treatment period

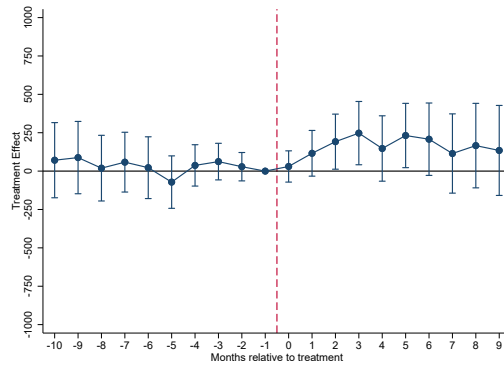
|                               | Pre-treatment months | <i>Audit All</i><br>(1) | <i>Audit 1%</i><br>(2) | <i>Audit 10%</i><br>(3) | <i>Audit 40%</i><br>(4) | <i>Audit 60%</i><br>(5) | <i>Ambiguous</i><br>(6) |
|-------------------------------|----------------------|-------------------------|------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| POST x TREAT                  | 2                    | 53.994<br>(70.759)      | 10.157<br>(93.681)     | 10.130<br>(81.727)      | 129.139<br>(101.059)    | 313.127**<br>(158.622)  | 88.499<br>(85.530)      |
| <i>Observations</i>           |                      | 115425                  | 74898                  | 74071                   | 59232                   | 55232                   | 74080                   |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.260                   | 0.222                  | 0.355                   | 0.353                   | 0.356                   | 0.238                   |
| POST x TREAT                  | 4                    | 130.429<br>(85.245)     | 78.836<br>(108.854)    | 56.523<br>(99.986)      | 256.982**<br>(131.026)  | 467.609**<br>(187.046)  | 107.283<br>(96.450)     |
| <i>Observations</i>           |                      | 153231                  | 99431                  | 98333                   | 78603                   | 73334                   | 98383                   |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.260                   | 0.221                  | 0.352                   | 0.351                   | 0.353                   | 0.240                   |
| POST x TREAT                  | 6                    | 151.987<br>(93.624)     | 117.711<br>(122.118)   | 61.774<br>(110.727)     | 282.405**<br>(138.780)  | 471.257**<br>(200.575)  | 137.004<br>(102.769)    |
| <i>Observations</i>           |                      | 190610                  | 123688                 | 122288                  | 97709                   | 91209                   | 122391                  |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.257                   | 0.218                  | 0.348                   | 0.347                   | 0.349                   | 0.238                   |
| POST x TREAT                  | 8                    | 159.582<br>(101.196)    | 130.802<br>(135.680)   | 76.728<br>(122.223)     | 240.476*<br>(139.148)   | 506.232**<br>(222.908)  | 127.057<br>(114.034)    |
| <i>Observations</i>           |                      | 227530                  | 147634                 | 145934                  | 116573                  | 108857                  | 146074                  |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.255                   | 0.216                  | 0.345                   | 0.343                   | 0.344                   | 0.234                   |
| POST x TREAT                  | 10                   | 140.179<br>(103.929)    | 61.333<br>(121.064)    | 91.811<br>(130.939)     | 225.109<br>(145.474)    | 546.349**<br>(242.774)  | 136.650<br>(131.389)    |
| <i>Observations</i>           |                      | 263664                  | 171057                 | 169087                  | 135060                  | 126116                  | 169278                  |
| <i>Adjusted R<sup>2</sup></i> |                      | 0.260                   | 0.221                  | 0.343                   | 0.339                   | 0.341                   | 0.231                   |
| <i>No of Firms</i>            |                      | 28380                   | 15200                  | 15000                   | 12000                   | 11180                   | 15000                   |

Notes: Treatment effects of deterrence messages on SSC varying the post-treatment period. Displayed are DiD regression estimates of treatment messages on tax base SSC. The estimated treatment effects are relative to the baseline condition. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. The pre-treatment time period includes four months before and the post-treatment time period two, four, six, eight and ten months after the treatment. The pre-experiment control mean of tax base SSC in the baseline condition is BGN 8,004. A firm's number of employees and its industry affiliation are included as control variables. The underlying sample includes firms that do not directly communicate with the tax authority. Standard errors clustered on firm level are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .



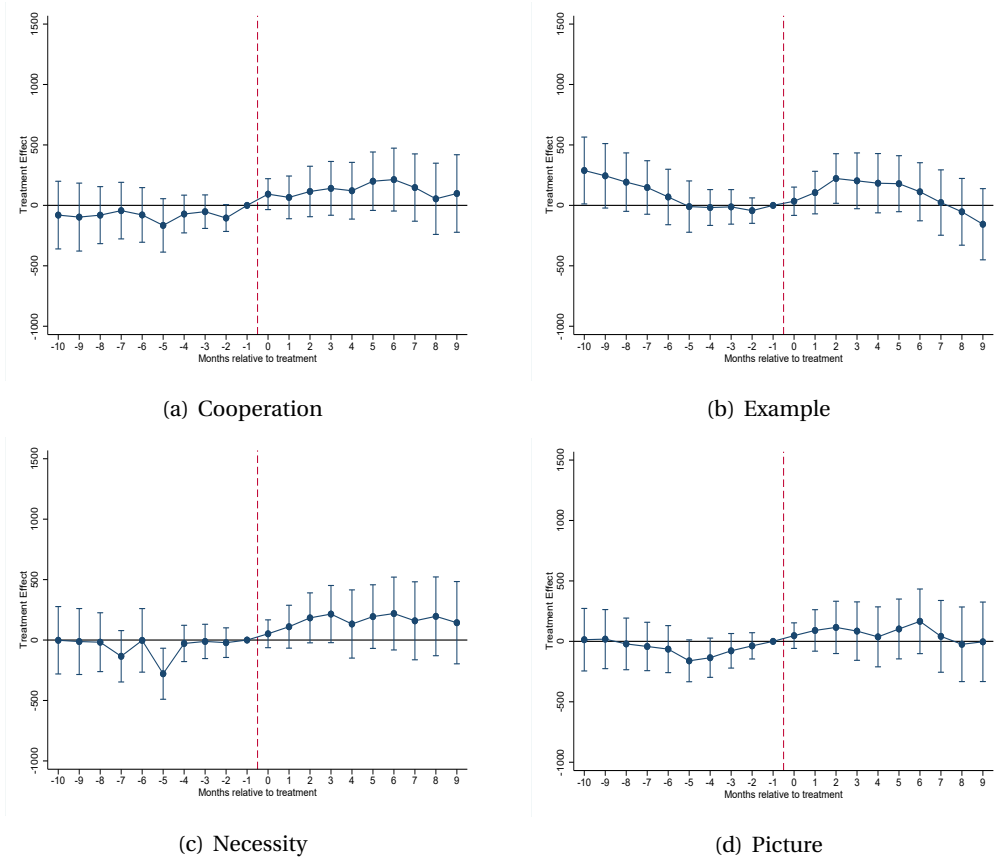
Notes: Pooled monthly treatment effects of the moral appeal messages (Cooperation - Picture). The points plotted are the estimated DiD regression coefficients of treatment messages on tax base SSC by months relative to the treatment. Treatment effects are relative to the control message. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. 95% confidence intervals are represented by the blue lines and based on standard errors clustered on firm level.

FIGURE D.7. Dynamic effects of moral treatments on SSC



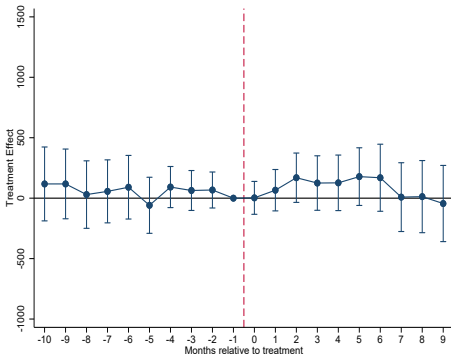
Notes: Pooled monthly treatment effects of the audit probability messages (Audit 1% - Audit 60%). The points plotted are the estimated DiD regression coefficients of treatment messages on tax base SSC by months relative to the treatment. Treatment effects are relative to the control message. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. 95% confidence intervals are represented by the blue lines and based on standard errors clustered on firm level.

FIGURE D.8. Dynamic effects of deterrence treatments on SSC

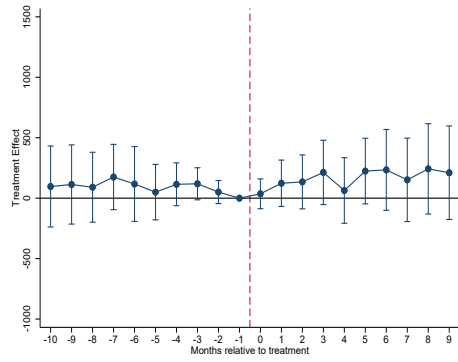


Notes: Monthly treatment effects of the moral appeal messages (Cooperation, Example, Necessity, Picture) on SSC. The points plotted are the estimated DiD regression coefficients of treatment messages on tax base SSC by months relative to the treatment. Treatment effects are relative to the control message. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. 95% confidence intervals are represented by the blue lines and based on standard errors clustered on firm level.

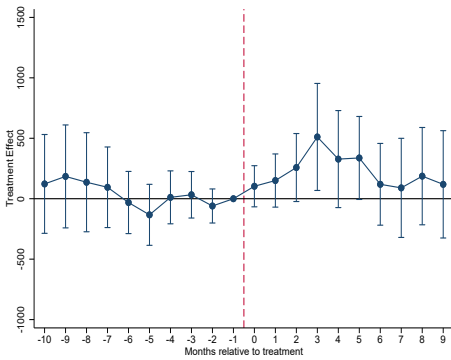
FIGURE D.9. Dynamic effects of moral treatments on SSC by sub-treatment



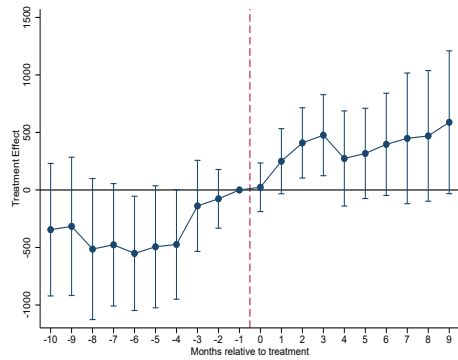
(a) Audit 1%



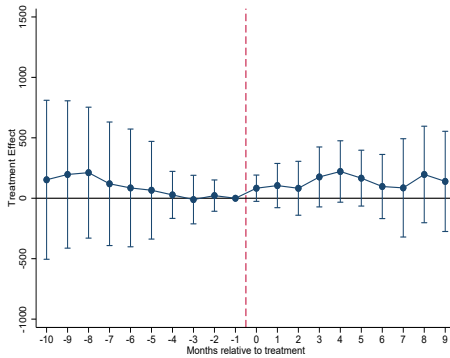
(b) Audit 10%



(c) Audit 40%



(d) Audit 60%



(e) Ambiguous

Notes: Monthly treatment effects of the audit messages (Audit 1%, Audit 10%, Audit 40%, Audit 60%, Ambiguous) on SSC. The points plotted are the estimated DiD regression coefficients of treatment messages on tax base SSC by months relative to the treatment. Treatment effects are relative to the control message. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. 95% confidence intervals are represented by the blue lines and based on standard errors clustered on firm level.

FIGURE D.10. Dynamic effects of deterrence treatments on SSC by sub-treatment

## D.6 VAT

TABLE D.15. Extended sample: Treatment effects of moral treatments on VAT

| <b>Panel A:</b>                 |                          |                           |                          |                          |                          |
|---------------------------------|--------------------------|---------------------------|--------------------------|--------------------------|--------------------------|
| <b>4 post-treatment months</b>  |                          |                           |                          |                          |                          |
|                                 | <i>Moral all</i><br>(1)  | <i>Cooperation</i><br>(2) | <i>Example</i><br>(3)    | <i>Necessity</i><br>(4)  | <i>Picture</i><br>(5)    |
| POST                            | 4156.370***<br>(997.283) | 4162.677***<br>(999.839)  | 4152.900***<br>(996.187) | 4161.191***<br>(998.837) | 4151.265***<br>(999.166) |
| TREAT                           | -167.359<br>(2303.751)   | -1936.967<br>(2384.514)   | 3216.642<br>(4737.539)   | -1304.688<br>(2564.147)  | -1254.444<br>(3197.015)  |
| POST x TREAT                    | 1990.294<br>(1247.771)   | 195.725<br>(1448.355)     | 3713.783*<br>(2043.386)  | 3000.049<br>(2030.845)   | 1038.731<br>(1598.431)   |
| <i>Observations</i>             | 391472                   | 156741                    | 156602                   | 156766                   | 156614                   |
| <i>No of Firms</i>              | 50000                    | 20000                     | 20000                    | 20000                    | 20000                    |
| <i>Adjusted R<sup>2</sup></i>   | 0.020                    | 0.027                     | 0.021                    | 0.028                    | 0.022                    |
| <b>Panel B:</b>                 |                          |                           |                          |                          |                          |
| <b>10 post-treatment months</b> |                          |                           |                          |                          |                          |
|                                 | <i>Moral all</i><br>(1)  | <i>Cooperation</i><br>(2) | <i>Example</i><br>(3)    | <i>Necessity</i><br>(4)  | <i>Picture</i><br>(5)    |
| POST                            | 2668.355***<br>(874.773) | 2687.011***<br>(878.096)  | 2656.217***<br>(874.424) | 2682.316***<br>(877.328) | 2671.424***<br>(877.207) |
| TREAT                           | -240.134<br>(2304.233)   | -1934.779<br>(2384.062)   | 3172.040<br>(4729.239)   | -1325.075<br>(2565.733)  | -1429.911<br>(3205.327)  |
| POST x TREAT                    | -97.812<br>(2195.052)    | 1421.228<br>(1236.866)    | 2597.006<br>(1771.625)   | 2608.250*<br>(1535.294)  | -7055.039<br>(7810.568)  |
| <i>Observations</i>             | 678931                   | 271887                    | 271597                   | 271972                   | 271625                   |
| <i>No of firms</i>              | 50000                    | 20000                     | 20000                    | 20000                    | 20000                    |
| <i>Adjusted R<sup>2</sup></i>   | 0.002                    | 0.026                     | 0.018                    | 0.027                    | 0.000                    |

Notes: Treatment effects of moral messages on VAT. Displayed are DiD regression estimates of treatment messages on tax base SSC. The estimated treatment effects are relative to the baseline condition. VAT tax base is the monthly reported tax base for VAT payments expressed in BGN. The pre-treatment time period includes four months before and the post-treatment time period four (Panel A) or ten (Panel B) months after the treatment. The pre-experiment control mean of tax base VAT in the baseline condition is BGN 14,344. A firm's number of employees and its industry affiliation are included as controls. The underlying sample includes firms that do not directly communicate with the tax authority. Standard errors clustered on firm level are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .



TABLE D.16. Extended sample: Treatment effects of deterrence treatments on VAT

| <b>Panel A:</b>               |                          | <b>4 post-treatment months</b>  |                          |                           |                            |                          |  |
|-------------------------------|--------------------------|---------------------------------|--------------------------|---------------------------|----------------------------|--------------------------|--|
|                               | <i>Audit all</i>         | <i>Audit 1%</i>                 | <i>Audit 10%</i>         | <i>Audit 40%</i>          | <i>Audit 60%</i>           | <i>Ambiguous</i>         |  |
|                               | (1)                      | (2)                             | (3)                      | (4)                       | (5)                        | (6)                      |  |
| POST                          | 4161.517***<br>(998.536) | 4158.480***<br>(998.602)        | 4161.856***<br>(999.465) | 4157.192***<br>(1000.372) | 4156.501***<br>(1000.385)  | 4159.815***<br>(999.027) |  |
| TREAT                         | -2403.622<br>(2580.261)  | 1602.015<br>(4469.732)          | -4145.930<br>(2568.558)  | -5155.761*<br>(2915.604)  | -10138.278**<br>(4542.118) | -1448.009<br>(2852.236)  |  |
| POST x TREAT                  | 583.392<br>(2065.454)    | -1721.508<br>(4230.012)         | 1292.293<br>(2096.536)   | 5607.974*<br>(3408.441)   | -829.078<br>(1801.319)     | 457.178<br>(1345.792)    |  |
| <i>Observations</i>           | 183152                   | 118986                          | 117719                   | 94020                     | 87678                      | 117613                   |  |
| <i>No of firms</i>            | 28380                    | 15200                           | 15000                    | 12000                     | 11180                      | 15000                    |  |
| <i>Adjusted R<sup>2</sup></i> | 0.016                    | 0.017                           | 0.025                    | 0.030                     | 0.031                      | 0.034                    |  |
| <b>Panel B:</b>               |                          | <b>10 post-treatment months</b> |                          |                           |                            |                          |  |
|                               | <i>Audit all</i>         | <i>Audit 1%</i>                 | <i>Audit 10%</i>         | <i>Audit 40%</i>          | <i>Audit 60%</i>           | <i>Ambiguous</i>         |  |
|                               | (1)                      | (2)                             | (3)                      | (4)                       | (5)                        | (6)                      |  |
| POST                          | 2684.175***<br>(876.847) | 2679.505***<br>(877.659)        | 2687.260***<br>(877.897) | 2682.785***<br>(879.446)  | 2681.211***<br>(879.606)   | 2682.114***<br>(877.401) |  |
| TREAT                         | -2462.551<br>(2554.268)  | 1560.152<br>(4440.505)          | -4173.869<br>(2561.733)  | -5196.895*<br>(2916.050)  | -9917.669**<br>(4535.566)  | -1417.505<br>(2859.544)  |  |
| POST x TREAT                  | 726.099<br>(1847.429)    | -1743.092<br>(3919.810)         | 1883.239<br>(1744.532)   | 5423.745**<br>(2435.266)  | -1326.660<br>(1863.200)    | 98.810<br>(1376.008)     |  |
| <i>Observations</i>           | 317670                   | 206426                          | 204258                   | 163065                    | 152071                     | 203984                   |  |
| <i>No of firms</i>            | 28380                    | 15200                           | 15000                    | 12000                     | 11180                      | 15000                    |  |
| <i>Adjusted R<sup>2</sup></i> | 0.018                    | 0.019                           | 0.022                    | 0.028                     | 0.028                      | 0.030                    |  |

Notes: Treatment effects of deterrence messages on VAT. Displayed are DID regression estimates of treatment messages on tax base SSC. The estimated treatment effects are relative to the baseline condition. VAT tax base is the monthly reported tax base for VAT payments expressed in BGN. The pre-treatment time period includes four months before and the post-treatment time period four (Panel A) or ten (Panel B) months after the treatment. The pre-experiment control mean of tax base VAT in the baseline condition is BGN 14,344. A firm's number of employees and its industry affiliation are included as controls. The underlying sample includes firms that do not directly communicate with the tax authority. Standard errors clustered on firm level are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

TABLE D.17. Extended sample: VAT spillover: Treatment effects of moral treatments on VAT

| <b>Panel A:</b>                 |                            |                            |                            |                            |                            |
|---------------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| <b>4 post-treatment months</b>  |                            |                            |                            |                            |                            |
|                                 | <i>Moral all</i><br>(1)    | <i>Cooperation</i><br>(2)  | <i>Example</i><br>(3)      | <i>Necessity</i><br>(4)    | <i>Picture</i><br>(5)      |
| POST                            | 4138.260***<br>(999.149)   | 4150.195***<br>(1000.741)  | 4151.956***<br>(997.043)   | 4148.432***<br>(999.854)   | 4146.576***<br>(1001.239)  |
| TREAT                           | 5270.415<br>(4616.702)     | 3457.110<br>(6104.360)     | 21648.942<br>(16637.096)   | 5803.424<br>(6991.172)     | -7959.640<br>(7373.800)    |
| POST x TREAT                    | 18523.791***<br>(3159.063) | 10501.807***<br>(3302.960) | 24020.778***<br>(6732.639) | 23395.549***<br>(8332.522) | 16046.850***<br>(4616.825) |
| <i>Observations</i>             | 138599                     | 93393                      | 93514                      | 93540                      | 93403                      |
| <i>No of firms</i>              | 17580                      | 11887                      | 11900                      | 11906                      | 11887                      |
| <i>Adjusted R<sup>2</sup></i>   | 0.024                      | 0.033                      | 0.026                      | 0.032                      | 0.026                      |
| <b>Panel B:</b>                 |                            |                            |                            |                            |                            |
| <b>10 post-treatment months</b> |                            |                            |                            |                            |                            |
|                                 | <i>Moral all</i><br>(1)    | <i>Cooperation</i><br>(2)  | <i>Example</i><br>(3)      | <i>Necessity</i><br>(4)    | <i>Picture</i><br>(5)      |
| POST                            | 2644.265***<br>(877.801)   | 2673.333***<br>(879.900)   | 2650.822***<br>(875.897)   | 2664.354***<br>(879.246)   | 2682.575***<br>(880.163)   |
| TREAT                           | 5102.701<br>(4600.414)     | 3210.033<br>(6027.404)     | 21812.033<br>(16638.390)   | 6146.883<br>(6960.757)     | -7909.004<br>(7350.588)    |
| POST x TREAT                    | 14389.691***<br>(2362.350) | 10898.498***<br>(2717.819) | 19145.349***<br>(4829.440) | 17558.215***<br>(5693.160) | 9826.246**<br>(4051.885)   |
| <i>Observations</i>             | 240979                     | 162156                     | 162375                     | 162413                     | 162185                     |
| <i>No of firms</i>              | 17580                      | 11887                      | 11900                      | 11906                      | 11887                      |
| <i>Adjusted R<sup>2</sup></i>   | 0.023                      | 0.030                      | 0.022                      | 0.030                      | 0.024                      |

Notes: Treatment effects of moral messages on VAT for firms that improved SSC compliance in response to the experiment. The underlying sample includes only firms that have an larger than average before-after difference in tax base SSC compared to firms in the baseline condition. Displayed are DID regression estimates of treatment messages on tax base VAT. The estimated treatment effects are relative to the baseline condition. VAT tax base is the monthly reported tax base for VAT payments expressed in BGN. The pre-treatment time period includes four months before and the post-treatment time period four (Panel A) or ten (Panel B) months after the treatment. The pre-experiment control mean of tax base VAT in the baseline condition is BGN 14,344. A firm's number of employees and its industry affiliation are included as controls. The underlying sample includes firms that do not directly communicate with the tax authority. Standard errors clustered on firm level are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

TABLE D.18. Extended sample: VAT spillover: Treatment effects of deterrence treatments on VAT

| <b>Panel A:</b>               |                            | <b>4 post-treatment months</b>  |                           |                            |                           |                          |  |
|-------------------------------|----------------------------|---------------------------------|---------------------------|----------------------------|---------------------------|--------------------------|--|
|                               | <i>Audit all</i>           | <i>Audit 1%</i>                 | <i>Audit 10%</i>          | <i>Audit 40%</i>           | <i>Audit 60%</i>          | <i>Ambiguous</i>         |  |
|                               | (1)                        | (2)                             | (3)                       | (4)                        | (5)                       | (6)                      |  |
| POST                          | 4151.048***<br>(1000.502)  | 4152.586***<br>(1000.296)       | 4155.106***<br>(1000.335) | 4154.083***<br>(1000.675)  | 4155.982***<br>(1000.566) | 4152.955***<br>(999.238) |  |
| TREAT                         | -2585.172<br>(4523.404)    | 2785.862<br>(8195.121)          | -3534.920<br>(7829.594)   | -2498.171<br>(7722.997)    | -18301.098<br>(16435.898) | 11204.810<br>(9213.131)  |  |
| POST x TREAT                  | 17679.286***<br>(5222.601) | 16254.251*<br>(8347.274)        | 17407.880*<br>(9350.934)  | 28850.086**<br>(12877.308) | 5788.243<br>(6441.780)    | 8930.415**<br>(3975.135) |  |
| <i>Observations</i>           | 98774                      | 86416                           | 85824                     | 81541                      | 80244                     | 86247                    |  |
| <i>No of firms</i>            | 13545                      | 11004                           | 10933                     | 10392                      | 10230                     | 10986                    |  |
| <i>Adjusted R<sup>2</sup></i> | 0.027                      | 0.033                           | 0.026                     | 0.033                      | 0.032                     | 0.038                    |  |
| <b>Panel B:</b>               |                            | <b>10 post-treatment months</b> |                           |                            |                           |                          |  |
|                               | <i>Audit all</i>           | <i>Audit 1%</i>                 | <i>Audit 10%</i>          | <i>Audit 40%</i>           | <i>Audit 60%</i>          | <i>Ambiguous</i>         |  |
|                               | (1)                        | (2)                             | (3)                       | (4)                        | (5)                       | (6)                      |  |
| POST                          | 2684.534***<br>(879.473)   | 2683.034***<br>(879.541)        | 2683.960***<br>(879.467)  | 2680.435***<br>(880.009)   | 2682.213***<br>(880.042)  | 2675.405***<br>(878.083) |  |
| TREAT                         | -2342.680<br>(4510.862)    | 3277.857<br>(8274.917)          | -3549.035<br>(7687.778)   | -1986.093<br>(7703.875)    | -17474.760<br>(16403.491) | 11570.055<br>(9124.751)  |  |
| POST x TREAT                  | 11678.533***<br>(3571.895) | 8621.237*<br>(4736.911)         | 14803.069**<br>(7318.754) | 20739.543***<br>(7282.721) | -3075.322<br>(7350.106)   | 5354.490<br>(4952.397)   |  |
| <i>Observations</i>           | 171532                     | 150013                          | 148950                    | 141490                     | 139229                    | 149680                   |  |
| <i>No of firms</i>            | 13545                      | 11004                           | 10933                     | 10392                      | 10230                     | 10986                    |  |
| <i>Adjusted R<sup>2</sup></i> | 0.026                      | 0.032                           | 0.025                     | 0.031                      | 0.030                     | 0.033                    |  |

Notes: Treatment effects of deterrence messages on VAT for firms that improved SSC compliance in response to the experiment. The underlying sample includes only firms that have an larger than average before-after difference in tax base SSC compared to firms in the baseline condition. Displayed are DiD regression estimates of treatment messages on tax base VAT. The estimated treatment effects are relative to the baseline condition. VAT tax base is the monthly reported tax base for VAT payments expressed in BGN. The pre-treatment time period includes four months before and the post-treatment time period four (Panel A) or ten (Panel B) months after the treatment. The pre-experiment control mean of tax base VAT in the baseline condition is BGN 14,344. A firm's number of employees and its industry affiliation are included as controls. The underlying sample includes firms that do not directly communicate with the tax authority. Standard errors clustered on firm level are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

## D.7 Mechanisms and Revenue Effects

TABLE D.19. Treatment effects of audit probability messages relative to ambiguous message on SSC

| <b>Panel A:</b>                 |                        |                        |                        |                        |                        |
|---------------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| <b>4 post-treatment months</b>  |                        |                        |                        |                        |                        |
|                                 | <i>Audit all</i>       | <i>Audit 1%</i>        | <i>Audit 10%</i>       | <i>Audit 40%</i>       | <i>Audit 60%</i>       |
|                                 | (1)                    | (2)                    | (3)                    | (4)                    | (5)                    |
| POST                            | 417.282***<br>(64.546) | 414.794***<br>(64.859) | 424.567***<br>(64.367) | 423.908***<br>(64.397) | 425.514***<br>(64.722) |
| TREAT                           | 20.900<br>(856.296)    | 65.663<br>(1095.731)   | -156.969<br>(792.315)  | -312.614<br>(990.419)  | 1273.538<br>(1368.837) |
| POST x TREAT                    | 28.002<br>(79.784)     | -22.767<br>(107.911)   | -58.333<br>(95.673)    | 148.260<br>(128.574)   | 344.472*<br>(184.851)  |
| <i>Observations</i>             | 68868                  | 37967                  | 37462                  | 26050                  | 23087                  |
| <i>No of firms</i>              | 18380                  | 10200                  | 10000                  | 7000                   | 6180                   |
| <i>Adjusted R<sup>2</sup></i>   | 0.196                  | 0.141                  | 0.210                  | 0.184                  | 0.194                  |
| <b>Panel B:</b>                 |                        |                        |                        |                        |                        |
| <b>10 post-treatment months</b> |                        |                        |                        |                        |                        |
|                                 | <i>Audit all</i>       | <i>Audit 1%</i>        | <i>Audit 10%</i>       | <i>Audit 40%</i>       | <i>Audit 60%</i>       |
|                                 | (1)                    | (2)                    | (3)                    | (4)                    | (5)                    |
| POST                            | 537.636***<br>(86.815) | 542.853***<br>(90.747) | 550.980***<br>(90.966) | 562.133***<br>(94.802) | 561.002***<br>(97.617) |
| TREAT                           | 21.295<br>(856.414)    | 57.933<br>(1098.197)   | -142.166<br>(788.611)  | -315.984<br>(993.576)  | 1250.042<br>(1373.346) |
| POST x TREAT                    | 8.155<br>(109.269)     | -73.844<br>(135.427)   | -52.896<br>(143.052)   | 59.143<br>(170.296)    | 357.054<br>(254.422)   |
| <i>Observations</i>             | 207838                 | 115231                 | 113261                 | 79234                  | 70290                  |
| <i>No of firms</i>              | 18380                  | 10200                  | 10000                  | 7000                   | 6180                   |
| <i>Adjusted R<sup>2</sup></i>   | 0.196                  | 0.141                  | 0.206                  | 0.179                  | 0.190                  |

Notes: Treatment effects of audit probability messages relative to the ambiguous message on SSC. Displayed are DiD regression estimates of treatment messages on tax base SSC. The estimated treatment effects are relative to the audit ambiguous treatment. SSC tax base is the monthly reported tax base for social security payments expressed in BGN. The pre-treatment time period includes four months before and the post-treatment time period four (Panel A) or ten (Panel B) months after the treatment. The pre-experiment control mean of tax base SSC in the ambiguous condition is BGN 7,096. A firm's number of employees and its industry affiliation are included as controls. The underlying sample includes firms that do not directly communicate with the tax authority. Standard errors clustered on firm level are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

TABLE D.20. Extended sample: SSC revenue per letter

| <b>Panel A:</b>   |                 | <b>Moral Treatments</b> |                           |                       |                         |                       |
|-------------------|-----------------|-------------------------|---------------------------|-----------------------|-------------------------|-----------------------|
|                   |                 | <i>Moral all</i><br>(1) | <i>Cooperation</i><br>(2) | <i>Example</i><br>(3) | <i>Necessity</i><br>(4) | <i>Picture</i><br>(5) |
| Immediate revenue | <i>(in BGN)</i> | 186.19                  | 197.24                    | 193.14                | 189.72                  | 180.20                |
|                   | <i>(in USD)</i> | 93.65                   | 99.21                     | 97.15                 | 95.43                   | 90.64                 |
| Overall revenue   | <i>(in BGN)</i> | 448.88                  | 570.72                    | 323.68                | 550.38                  | 404.46                |
|                   | <i>(in USD)</i> | 225.78                  | 287.07                    | 162.81                | 276.84                  | 203.44                |

| <b>Panel B:</b>   |                 | <b>Deterrence Treatments</b> |                        |                         |                         |                         |                         |
|-------------------|-----------------|------------------------------|------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
|                   |                 | <i>Audit all</i><br>(1)      | <i>Audit 1%</i><br>(2) | <i>Audit 10%</i><br>(3) | <i>Audit 40%</i><br>(4) | <i>Audit 60%</i><br>(5) | <i>Ambiguous</i><br>(6) |
| Immediate revenue | <i>(in BGN)</i> | 41.42                        | 84.60                  | -32.17                  | -91.62                  | -38.87                  | 118.74                  |
|                   | <i>(in USD)</i> | 20.83                        | 42.55                  | -16.18                  | -46.09                  | -19.55                  | 59.73                   |
| Overall revenue   | <i>(in BGN)</i> | 305.74                       | 174.00                 | 175.43                  | 275.33                  | 1,039.05                | 399.95                  |
|                   | <i>(in USD)</i> | 153.78                       | 87.52                  | 88.24                   | 138.49                  | 522.63                  | 201.17                  |

Notes: Per mailing/letter revenue (in BGN) in the moral (Panel A) and deterrence (Panel B) treatments. The first two rows of each panel show the revenue up to four months after the intervention in BGN and USD respectively. The last two rows of each panel show the revenue up to ten months after the intervention in BGN and USD respectively. Revenue is calculated as  $DiD\ Estimate \times No\ of\ Treated\ Firms \times Month\ after\ Intervention \times Tax\ Rate - Intervention\ Cost$ . The cost of the intervention is assumed to be zero in moral treatments and is equal BGN 1,000 per audit (20 *hours times* BGN 50/*hour*) in the deterrence treatments. The underlying sample includes firms that do not directly communicate with the tax authority.

## APPENDIX E: TAX SURVEY

E.1 *Survey Design and Implementation*

To get a more detailed understanding about the beliefs and tax moral of firms in Bulgaria, we conducted a brief survey with SMEs which were comparable to those in the experimental conditions but were not subject to the interventions.

Table A.1 randomization provides an overview of the firms invited to participate in the survey compared to the general population of similar firms (in terms of size and revenue) in Bulgaria and firms in our experimental conditions. Firms which have been invited to participate in the survey are comparable (and statistically not different) to the population of SMEs in Bulgaria in terms of tax base VAT, social security payments, number of employees. Consequentially, the invited firms are comparable to the firms in our RCT population.

In the survey we asked participants to indicate their moral attitudes towards paying taxes, whether they think that tax evasion is a problem in Bulgaria, their beliefs about receiving a tax inspection and their beliefs about evasion channels and behaviors in their industry. Questions on tax morale were (in part) adapted from the World Values Survey ([LINK](#)). Additionally, the firms were asked whether they use a tax accountant (in-house or externally) or file their taxes without expert help (see Table E.1 for survey questions and results).

The tax authorities invited 10.000 firms to participate in the survey but it was explained to firms that the survey was organized and conducted by the research team. The survey invitation (in Bulgarian and an English translation) is available in Appendix F. Only aggregated data was shared with the tax authorities and no individual firm-level information was asked from participants. Specifically, firms were invited to follow a link redirecting them to the survey software Qualtrics ([LINK](#)) with which we administered the survey.<sup>24</sup>

The survey invitation was sent out at the same day as the treatment mailings to gather meaningful data at the time of the main study, i.e., representing beliefs, opinions and attitudes at the time of our experiment.<sup>25</sup>

Note that the survey also entailed an experimental component: At the beginning of the survey, some firms (randomly determined) were presented with the current distribution of tax spending at the time of the survey (with and without the possibility to indicate preferred changes in that distribution). Other firms (again randomly determined) did not see the distribution and proceeded to the questionnaire directly. Since differences in reporting behavior were minimal between conditions, we report pooled results over all conditions in this paper. Table E.2 limits results to the control group of the survey experiment only. Results are consistent with those reported for the full survey population.

<sup>24</sup>The original survey is available upon request.

<sup>25</sup>Responses may be different if the survey was conducted at a different point in time because, e.g., attitudes with respect to tax morale etc. may change because of exogenous events (like tax scandals) or may seasonably vary (more optimistic in the summer and pessimistic in the winter or vice versa).

## *E.2 Survey Results*

Of the 10,000 invited firms, 1,725 (17.25%) SMEs initiated their participation in the survey. 54.6% (942) of the firms that started the survey answered all questions. As noted above, the survey (and the experiment) were a collaboration between the tax authorities and us researchers. Not all survey questions are therefore relevant and informative for the paper. The main purpose of the survey was to shed light on different aspects of firm tax evasion, in particular i) attitudes towards tax evasion along different dimensions (tax morale), ii) the extent of tax evasion in Bulgaria, and iii) firms' belief about the likelihood of being audited. Table E.1 provides an overview of our survey variables.

Because of the different dimensions, we disseminate the results of the survey in several blocks. First, we present the results of our questions concerning the attitudes towards tax evasion (Panel A of Table E.1). Here, we elicited four different dimensions of intrinsic tax morale. In particular, we asked survey participants to rate (on a scale from 1 - strongly disagree to 5 - strongly agree) their opinion to the following six statements: i.) 'One should honestly declare all income on the tax return.' ii.) 'It is acceptable to overstate deductions on the tax return.' iii.) 'Legally avoiding to pay taxes if possible is acceptable.' iv.) 'It can always be justified to cheat on taxes if there is a chance'. The purpose of eliciting different dimensions of tax morale is to gain a more nuanced impression of tax-evasion attitudes. Second, we focus on the extent of evasion, evasion channels and beliefs about audit probabilities in (Panel B, Panel C and, Panel D of Table E.1). Two widely discussed devices for tax evasion are side payments in cash (for example as hidden wages to employees) and e-commerce business activities. The survey asks participants about the prevalence of these two evasion channels in Bulgaria. In particular, respondents had to indicate their degree of agreement with the following two statements: i) 'Making payments in cash to evade tax and insurance contributions is a common offense.' ii) 'In e-commerce (internet commerce), tax evasion is easier.' In addition, firms were asked to indicate their opinion whether they think that i.) 'avoiding tax payments is a problem in Bulgaria?' (Panel B). They also needed to answer: ii.) 'In your opinion, what part of the profits (in percent) is officially declared in your industry?', iii.) 'In your opinion, what part of the revenues of the companies (in percent) in your industry is related to cash payments, in which the due taxes and social security contributions are evaded.', iv.) 'In your opinion, what part of the profits from e-commerce (in percent) is officially declared in your industry?' and, v.) 'In your opinion, what proportion of wages (in percent) in your industry are paid "in an envelope" without being declared?' (Panel C). We asked firms about their belief about receiving a tax audit (Panel D): i.) 'In your opinion, how high is the probability (in percent) that a company in your industry is subject to a tax audit/inspection?', ii.) 'In your opinion, how high is the probability (in percent) of your company or you personally being subject to tax audit / inspection?'. Finally, we also asked firms to indicate their number of employees and whether they use a tax accountant (Panel E).

Finally, we also asked firms how many employees they have and whether they use a tax accountant. Firms report to have on average between 1-20 employees. About 42% of the firms that completed the survey reported to use the service of an external tax

accountant. 25% of the firms have an internal accountant and 7% of the firms do not have a tax accountant. These percentages match reasonably well with our observation from the field experiment where a large fraction of the firms in the sample redirect their communication and use an external accounting service.

Of particular interest are answers reported in Panel C and D of the Table. The Panel C results indicate that the vast majority of firms in our sample (85%) think that tax evasion is a problem in Bulgaria. A large fraction further states that about 22% of earnings are evaded and, most importantly, about 22% of the wages are paid without reporting social security contributions. The Panel D results are informative for our deterrence treatments. About 60% of respondents indicate that they believe an inspection (any form of including audits) is likely. These are remarkably high beliefs which can be explained by interpreting any type of check as inspection (e.g., that the reported tax return is at least looked at and checked for consistency). The tax authorities report that in this regard, 60% may not be unrealistic. We need to be cautious with the interpretation of these numbers as it is possible that firms underreport in Panel C and over-report in Panel D for strategic reasons. That is, they downplay (knowing that they need to report somewhat realistic numbers) the percentage of social security payments evaded and overly signal that inspections are performed. Nevertheless, these high reported beliefs, however, also provide an indication for why low audit probability treatments have not been as effective.

Figure E.1 and Figure E.2 provide detailed information on the Panel A and Panel B questions concerned with firms' reported tax moral and beliefs about cash payments as a potential evasion channel. The Figures report the frequency of answers on the 5-point Likert Scale (which ranged from 1-strongly disagree to 5-strongly agree). The upper-left panel of Figure E.1 shows survey respondents with respect to the very general question regarding tax morale. Expressed tax morale among small Bulgarian firms and self-employed is fairly high: 97% of all respondents strongly agree or agree that 'everyone should honestly declare their income in the tax return'. The picture becomes more dispersed as we turn to more nuanced questions about tax-evasion attitudes. The upper-right panel of the same Figure depicts the results for the survey question on acceptance of over-reporting deductions in the tax return. Since over-reporting of costs is effectively an action of tax evasion, we would expect similar results as for the previous statement on the general desirability of tax honesty. The share of respondents who strongly disagree or disagree that cost over-reporting is acceptable is 62%. The bottom-right panel of the Figure shows results for the justifiability of tax cheating. The pattern here is similar to the pattern that is observed for over-reporting of costs: 59% disagree or strongly disagree that cheating is justified. The bottom-left panel of Figure E.1 deals with a survey question regarding the acceptability of legal tax avoidance. As one would expect, we see a higher acceptability than for illegal cheating behavior. However, roughly 20% of respondents express that they do not even find legal avoidance acceptable. Jointly the results suggest that individual tax morale is high and prevalent in the survey population. This may explain why our moral appeal treatments have been effective means to increase tax compliance.



TABLE E.1. Summary of survey variables - All participants

|  | Completed responses                      | Partial responses | All responses     |
|--|--|-------------------|-------------------|
| <b>Panel A:</b>  | <b>Tax Morale</b>                        |                   |                   |
| Everyone should honestly declare their income in the tax return:<br>(Strongly disagree 1 – Strongly agree 5) | 4.656<br>(0.762)                         | 4.574<br>(0.904)  | 4.643<br>(0.787)  |
| It is acceptable to overstate costs in the tax return:<br>(Strongly disagree 1 – Strongly agree 5)           | 1.828<br>(0.930)                         | 1.770<br>(0.884)  | 1.819<br>(0.923)  |
| Legal avoidance of tax payments, if possible, is acceptable:<br>(Strongly disagree 1 – Strongly agree 5)     | 2.978<br>(1.366)                         | 2.749<br>(1.347)  | 2.940<br>(1.365)  |
| Cheating on taxes, if they exist, can always be justified:<br>(Strongly disagree 1 – Strongly agree 5)       | 1.825<br>(0.995)                         | 1.880<br>(1.067)  | 1.834<br>(1.007)  |
| <b>Panel B:</b>  | <b>Evasion channels</b>                  |                   |                   |
| Making payments in cash to evade taxes is a common offense:<br>(Strongly disagree 1 – Strongly agree 5)      | 2.868<br>(1.278)                         | 2.765<br>(1.315)  | 2.852<br>(1.284)  |
| In e-commerce (internet commerce), tax evasion is easier:<br>(Strongly disagree 1 – Strongly agree 5)        | 3.062<br>(1.157)                         | 3.005<br>(1.198)  | 3.052<br>(1.164)  |
| <b>Panel C:</b>  | <b>Beliefs about tax evasion</b>         |                   |                   |
| % of firms who think tax evasion is a problem<br>(0% – 100%)   | 85.46<br>(35.27)                         | 90.06<br>(30.01)  | 86.16<br>(34.54)  |
| % Evasion of earnings in the own industry:<br>(0% – 100%)  | 22.39<br>(24.56)                         | 14.75<br>(17.79)  | 22.26<br>(24.48)  |
| % Revenue related to cash payments that hide taxes and SSC:<br>(0% – 100%)                                   | 19.39<br>(21.90)                         | 28.94<br>(30.76)  | 19.55<br>(22.09)  |
| % Evasion in e-commerce<br>(0% – 100%)   | 42.86<br>(36.11)                         | 34.44<br>(31.13)  | 42.72<br>(36.03)  |
| % Evasion of wages<br>(0% – 100%)  | 21.45<br>(22.93)                         | 27.88<br>(30.92)  | 21.56<br>(23.08)  |
| <b>Panel D:</b>  | <b>Beliefs about audit probabilities</b> |                   |                   |
| % Belief audit/inspection industry<br>(0% – 100%)  | 62.94<br>(26.00)                         | 59.91<br>(28.30)  | 62.69<br>(26.20)  |
| % Belief audit/inspection own firm<br>(0% – 100%)  | 59.08<br>(27.50)                         | 56.66<br>(30.15)  | 58.90<br>(27.70)  |
| <b>Panel E:</b>  | <b>No of Employees/use of accountant</b> |                   |                   |
| Number of employees<br>(1=0,2 = 1-10, 3 = 11-20,4 = 21-30,5 = 31-50,6 = 50+)                                 | 2.487<br>(1.245)                         | 2.786<br>(1.578)  | 2.493<br>(1.252)  |
| Use tax accounting firm<br>(0=No or 1=Yes)   | 0.424<br>(0.494)                         | -<br>-            | 0.231<br>(0.422)  |
| In-house tax accountant<br>(0=No or 1=Yes)   | 0.248<br>(0.432)                         | -<br>-            | 0.136<br>(0.343)  |
| No accountant<br>(0=No or 1=Yes)   | 0.0722<br>(0.259)                        | -<br>-            | 0.0394<br>(0.195) |
| <b>Observations</b>  | 942                                      | 783               | 1725              |

Notes: Averages with standard deviation in parentheses. Column 1: All questions answered. Column 2: Not all questions answered. Column 3: Average over all respondents. **Panel A:** Mean of variables reflecting tax morale. **Panel B:** Questions reflect statements concerning the evasion channel. In Panel A and B: High values (max 5) indicate that respondents strongly agree with the statement. Low values (min 1) indicate strong disagreement. **Panel C:** Mean beliefs about tax evasion. **Panel D:** Mean of % belief about the likelihood of receiving a tax inspection in the own industry and in the own firm. **Panel E:** General survey information about number of employees and the use of an (external or internal) tax accounting service.

Finally, Figure E.2 presents detailed information about firms opinion about cash payments as a means for tax evasion. 55% of the respondents indeed believe that cash payments are used to evade taxes.

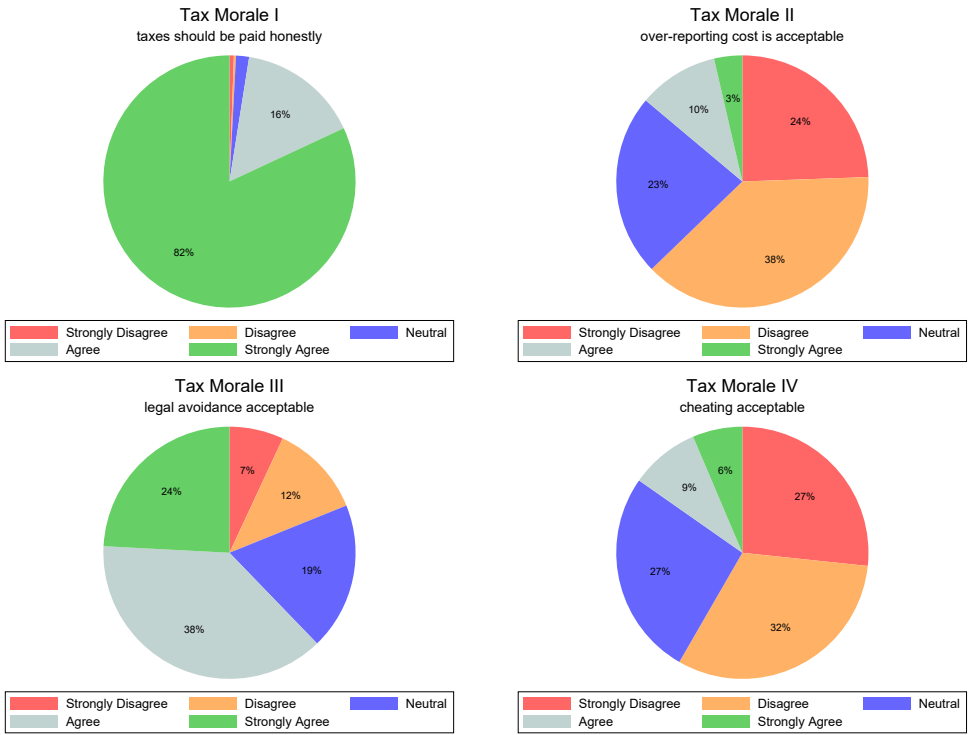


FIGURE E.1. Tax Morale I–Tax Morale IV

Notes: Answers to statements about tax morale by question and category. Answers limited to respondents who completed the survey. **Tax Morale I:** Taxes should be paid honestly. **Tax Morale II:** Over-reporting cost is acceptable. **Tax Morale III:** Legal avoidance is acceptable. **Tax Morale IV:** Cheating on taxes is acceptable. Categories are: Strongly disagree (red), Disagree (orange), Neutral (blue), Agree (lime) and, Strongly agree (green). Size and percentage number in pie-slices indicates mean frequency of responses.

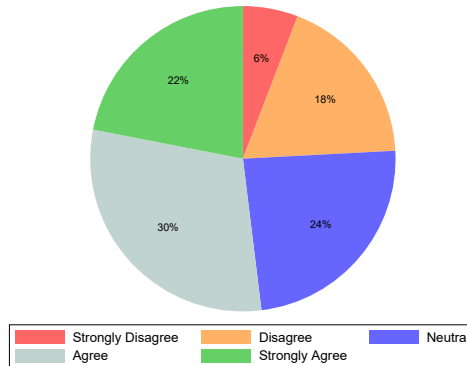


FIGURE E.2. Cash payments as a means for tax evasion

Notes: Answers to statements about cash payments as an evasion channel. Categories are: Strongly disagree (red), Disagree (orange), Neutral (blue), Agree (lime) and, Strongly agree (green). Size and percentage number in pie-slices indicates mean frequency of responses.

TABLE E.2. Summary of survey variables: Control Group

|  | Completed responses                      | Partial responses | All responses    |
|--|--|-------------------|------------------|
| <b>Panel A:</b>  | <b>Tax Morale</b>                        |                   |                  |
| Everyone should honestly declare their income in the tax return:<br>(Strongly disagree 1 – Strongly agree 5) | 4.776<br>(0.645)                         | 4.566<br>(0.957)  | 4.726<br>(0.736) |
| It is acceptable to overstate costs in the tax return:<br>(Strongly disagree 1 – Strongly agree 5)           | 1.739<br>(0.905)                         | 1.645<br>(0.860)  | 1.716<br>(0.894) |
| Legal avoidance of tax payments, if possible, is acceptable:<br>(Strongly disagree 1 – Strongly agree 5)     | 3.133<br>(1.384)                         | 2.711<br>(1.374)  | 3.032<br>(1.391) |
| Cheating on taxes, if they exist, can always be justified:<br>(Strongly disagree 1 – Strongly agree 5)       | 1.718<br>(0.924)                         | 1.908<br>(1.061)  | 1.763<br>(0.960) |
| <b>Panel B:</b>  | <b>Evasion channels</b>                  |                   |                  |
| Making payments in cash to evade taxes is a common offense:<br>(Strongly disagree 1 – Strongly agree 5)      | 2.863<br>(1.285)                         | 2.592<br>(1.308)  | 2.798<br>(1.294) |
| In e-commerce (internet commerce), tax evasion is easier:<br>(Strongly disagree 1 – Strongly agree 5)        | 3.029<br>(1.123)                         | 2.895<br>(1.228)  | 2.997<br>(1.149) |
| <b>Panel C:</b>  | <b>Beliefs about tax evasion</b>         |                   |                  |
| % of firms who think tax evasion is a problem<br>(0% – 100%)   | 86.31<br>(34.45)                         | 91.30<br>(28.38)  | 87.42<br>(33.22) |
| % Evasion of earnings in the own industry:<br>(0% – 100%)  | 22.15<br>(24.55)                         | 12.58<br>(18.59)  | 21.70<br>(24.36) |
| % Revenue related to cash payments that hide taxes and SSC:<br>(0% – 100%)                                   | 20.82<br>(24.00)                         | 31.92<br>(33.58)  | 21.35<br>(24.57) |
| % Evasion in e-commerce<br>(0% – 100%)   | 44<br>(36.30)                            | 29.25<br>(29.04)  | 43.30<br>(36.08) |
| % Evasion of wages<br>(0% – 100%)  | 22.89<br>(25.10)                         | 26.25<br>(31.86)  | 23.05<br>(25.40) |
| <b>Panel D:</b>  | <b>Beliefs about audit probabilities</b> |                   |                  |
| % Belief audit/inspection industry<br>(0% – 100%)  | 63.51<br>(26.13)                         | 62.68<br>(25.61)  | 63.41<br>(26.02) |
| % Belief audit/inspection own firm<br>(0% – 100%)  | 58.15<br>(26.43)                         | 59.67<br>(31.02)  | 58.32<br>(26.91) |
| <b>Panel E:</b>  | <b>No of Employees</b>                   |                   |                  |
| Number of employees<br>(1=0,2 = 1-10, 3 = 11-20,4 = 21-30,5 = 31-50,6 = 50+)                                 | 2.461<br>(1.218)                         | 2.583<br>(1.379)  | 2.466<br>(1.223) |
| <b>Observations</b>  | 241                                      | 198               | 439              |

Notes: Averages with standard deviation in parentheses. Control group from survey experiment only. Column 1: All questions answered. Column 2: Not all questions answered. Column 3: Average over all respondents. **Panel A:** Mean of variables reflecting tax morale. **Panel B:** Questions reflect statements concerning the evasion channel. In Panel A and B: High values (max 5) indicate that respondents strongly agree with the statement. Low values (min 1) indicate strong disagreement. **Panel C:** Mean beliefs about tax evasion. **Panel D:** Mean of % belief about the likelihood of receiving a tax inspection in the own industry and in the own firm. **Panel E:** General survey information about number of employees. Note: due to a mistake in the survey software the answers about the use of an (external or internal) tax accounting service was not elicited in this condition.

## APPENDIX F: TREATMENT LETTERS

F.1 *Baseline Condition*

ДО  
ПРЕДСТАВИТЕЛ НА  
АТ- МЕД- Д-Р СНЕЖАНА АТАНАСОВА- АМБУЛАТОРИЯ ЗА  
ИНДИВИДУАЛНА ПРАКТИКА ЗА СПЕЦИАЛИЗИРАНА  
МЕДИЦИНСКА ПОМОЩ ПО ДЕРМАТОЛОГИЯ И ВЕНЕРОЛОГИЯ

Уважаеми данькоплатци,

Желаем да направим плащането на данъци и осигурителни вноски възможно най-удобно за Вас. В тази връзка, бихме искали да Ви информираме за нашия сайт ([www.nra.bg](http://www.nra.bg)), където може да откриете повече информация относно данъците и задължителните осигурителни вноски.

Надяваме се да намерите сайта ни за полезен!

С уважение,

Александър Георгиев – заместник изпълнителен директор на НАП

(a) Original email in Bulgarian

*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 (include link) 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*

(b) Email text in English

FIGURE F.1. Baseline condition

## F.2 Moral Appeals

**ДО  
ПРЕДСТАВИТЕЛ НА  
АТ- МЕД- Д-Р СНЕЖАНА АТАНАСОВА- АМБУЛАТОРИЯ ЗА  
ИНДИВИДУАЛНА ПРАКТИКА ЗА СПЕЦИАЛИЗИРАНА  
МЕДИЦИНСКА ПОМОЩ ПО ДЕРМАТОЛОГИЯ И ВЕНЕРОЛОГИЯ**

Уважаеми данъкоплатци,

Желаем да направим плащането на данъци и осигурителни вноски възможно най-удобно за Вас. В тази връзка, бихме искали да Ви информираме за нашия сайт ([www.nra.bg](http://www.nra.bg)), където може да откриете повече информация относно данъците и задължителните осигурителни вноски.

Надяваме се да намерите сайта ни за полезен!

Бихме искали да Ви напомним също, че плащането на данъци и задължителни осигурителни вноски е граждански дълг. Данъците и осигурителните вноски са необходими за поддържането и финансирането на публично предоставени стоки и услуги за Вас и за всички други в Република България.

С уважение,

Александър Георгиев – заместник изпълнителен директор на НАП

(a) Original email in Bulgarian

*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 (include link) 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*

(b) Email text in English

FIGURE F.2. Cooperation treatment

**ДО  
ПРЕДСТАВИТЕЛ НА  
АТ- МЕД- Д-Р СНЕЖАНА АТАНАСОВА- АМБУЛАТОРИЯ ЗА  
ИНДИВИДУАЛНА ПРАКТИКА ЗА СПЕЦИАЛИЗИРАНА  
МЕДИЦИНСКА ПОМОЩ ПО ДЕРМАТОЛОГИЯ И ВЕНЕРОЛОГИЯ**

Уважаеми данъкоплатци,

Използвате ли публичен транспорт? Използвате ли пътищата и публични услуги като здравеопазването? Възползвате ли се от общественото образование? Тогава разбирате, че тези стоки и услуги изискват финансиране!

Желаем да направим плащането на данъци и осигурителни вноски възможно най-удобно за Вас. В тази връзка, бихме искали да Ви информираме за нашия сайт ([www.nra.bg](http://www.nra.bg)), където може да откриете повече информация относно данъците и задължителните осигурителни вноски.

Надяваме се да намерите сайта ни за полезен!

Бихме искали да Ви напомним също, че плащането на данъци и задължителни осигурителни вноски е граждански дълг. Данъците и осигурителните вноски са необходими за поддържането и финансирането на публично предоставени стоки и услуги за Вас и за всички други в Република България.

С уважение,

Александър Георгиев – заместник изпълнителен директор на НАП

(a) Original email in Bulgarian

*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 (include link) 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*

(b) Email text in English

FIGURE F.3. Example treatment

**ДО  
ПРЕДСТАВИТЕЛ НА  
АТ- МЕД- Д-Р СНЕЖАНА АТАНАСОВА- АМБУЛАТОРИЯ ЗА  
ИНДИВИДУАЛНА ПРАКТИКА ЗА СПЕЦИАЛИЗИРАНА  
МЕДИЦИНСКА ПОМОЩ ПО ДЕРМАТОЛОГИЯ И ВЕНЕРОЛОГИЯ**

Уважаеми данъкоплатци,

Използвате ли публичен транспорт? Използвате ли пътищата и публични услуги като здравеопазването? Възползвате ли се от общественото образование? Тогава разбирате, че тези стоки и услуги изискват финансиране!

Желаем да направим плащането на данъци и осигурителни вноски възможно най-удобно за Вас. В тази връзка, бихме искали да Ви информираме за нашия сайт ([www.nra.bg](http://www.nra.bg)), където може да откриете повече информация относно данъците и задължителните осигурителни вноски.

Надяваме се да намерите сайта ни за полезен!

Бихме искали да Ви напомним също, че плащането на данъци и задължителни осигурителни вноски е граждански дълг. Данъците и осигурителните вноски са необходими за поддържането и финансирането на публично предоставени стоки и услуги за Вас и за всички други в Република България.

Без Вашите данъчни плащания и задължителни осигурителни вноски, ние не сме в състояние да поддържаме, например обществените училища, детските градини, болниците и социалноосигурителната система.

С уважение,

Александър Георгиев – заместник изпълнителен директор на НАП

(a) Original email in Bulgarian

*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 (include link) 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**

(b) Email text in English

FIGURE F.4. Necessity treatment

ДО  
ПРЕДСТАВИТЕЛ НА  
АТ- МЕД- Д-Р СНЕЖАНА АТАНАСОВА- АМБУЛАТОРИЯ ЗА  
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МЕДИЦИНСКА ПОМОЩ ПО ДЕРМАТОЛОГИЯ И ВЕНЕРОЛОГИЯ

Уважаеми данъкоплатци,

Използвате ли публичен транспорт? Използвате ли пътищата и публични услуги като здравеопазването? Възползвате ли се от общественото образование? Тогава разбирате, че тези стоки и услуги изискват финансиране!

Желаем да направим плащането на данъци и осигурителни вноски възможно най-удобно за Вас. В тази връзка, бихме искали да Ви информираме за нашия сайт ([www.nra.bg](http://www.nra.bg)), където може да откриете повече информация относно данъците и задължителните осигурителни вноски.

Надяваме се да намерите сайта ни за полезен!

Бихме искали да Ви напомним също, че плащането на данъци и задължителни осигурителни вноски е граждански дълг. Данъците и осигурителните вноски са необходими за поддържането и финансирането на публично предоставени стоки и услуги за Вас и за всички други в Република България.

Без Вашите данъчни плащания и задължителни осигурителни вноски, ние не сме в състояние да поддържаме, например обществените училища, детските градини, болниците и социалноосигурителната система.

Моля, разгледайте тази снимка! Тя показва един пример за публично финансирани услуги.



С уважение,

Александър Георгиев – заместник изпълнителен директор на НАП

(a) Original email in Bulgarian

*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 (include link) 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*

(b) Email text in English

FIGURE F.5. Picture treatment



### F.3 Deterrence Treatments

ДО  
 ПРЕДСТАВИТЕЛ НА  
 АТ- МЕД- Д-Р СНЕЖАНА АТАНАСОВА- АМБУЛАТОРИЯ ЗА  
 ИНДИВИДУАЛНА ПРАКТИКА ЗА СПЕЦИАЛИЗИРАНА  
 МЕДИЦИНСКА ПОМОЩ ПО ДЕРМАТОЛОГИЯ И ВЕНЕРОЛОГИЯ

Уважаеми данъкоплатци,

Желаем да направим плащането на данъци и осигурителни вноски възможно най-удобно за Вас. В тази връзка, бихме искали да Ви информираме за нашия сайт ([www.nra.bg](http://www.nra.bg)), където може да откриете повече информация относно данъците и задължителните осигурителни вноски.

Бихме искали да Ви напомним също, че НАП предприема редица контролни мерки, за да гарантира ефективното събиране на данъците и задължителните осигурителни вноски.

В този контекст, НАП е подбрала произволно група от данъкоплатци, включително Вас, за специално проучване. **Четиридесетима от всеки 100 данъкоплатци в тази група ще бъдат избрани на случаен принцип и ще бъдат обект на контрол в следващите месеци.**

С други думи, налична е **40% вероятност** да бъдете проверен.

С уважение,

Александър Георгиев – заместник изпълнителен директор на НАП

(a) Original email in Bulgarian

*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 (include link) 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. **40 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 **40% probability** that you will be audited.*

*Yours sincerely, SIGNATURE*

(b) Email text in English

FIGURE F.6. Audit 40% treatment

**ДО  
ПРЕДСТАВИТЕЛ НА  
АТ- МЕД- Д-Р СНЕЖАНА АТАНАСОВА- АМБУЛАТОРИЯ ЗА  
ИНДИВИДУАЛНА ПРАКТИКА ЗА СПЕЦИАЛИЗИРАНА  
МЕДИЦИНСКА ПОМОЩ ПО ДЕРМАТОЛОГИЯ И ВЕНЕРОЛОГИЯ**

Уважаеми данъкоплатци,

Желаем да направим плащането на данъци и осигурителни вноски възможно най-удобно за Вас. В тази връзка, бихме искали да Ви информираме за нашия сайт ([www.nra.bg](http://www.nra.bg)), където може да откриете повече информация относно данъците и задължителните осигурителни вноски.

Надяваме се да намерите сайта ни за полезен!

Бихме искали да Ви напомним също, че НАП предприема редица контролни мерки, за да гарантира ефективното събиране на данъците и задължителните осигурителни вноски.

В този контекст, НАП е подбрала произволно група от данъкоплатци, включително Вас, за специално проучване. Има вероятност данъкоплатците в тази група да бъдат обект на контрол в рамките на следващите месеци.

С уважение,

Александър Георгиев – заместник изпълнителен директор на НАП

(a) Original email in Bulgarian

*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 (include link) 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*

(b) Email text in English

FIGURE F.7. Ambiguous treatment

## F.4 Survey

**ПРЕДСТАВИТЕЛ НА  
АТ- МЕД- Д-Р СНЕЖАНА АТАНАСОВА- АМБУЛАТОРИЯ ЗА  
ИНДИВИДУАЛНА ПРАКТИКА ЗА СПЕЦИАЛИЗИРАНА  
МЕДИЦИНСКА ПОМОЩ ПО ДЕРМАТОЛОГИЯ И ВЕНЕРОЛОГИЯ**

Уважаеми данькоплатци,

Каним Ви да участвате в кратък въпросник, администриран от НАП в сътрудничество с изследователи от Швейцарския федерален технологичен институт (ETH Zurich) и Центъра за европейски икономически изследвания.

Проучването ще Ви отнеме не повече от 10 минути. Ще Ви бъдат зададени няколко въпроса относно Вашето мнение за данъчното облагане в Република България.

Националната агенция за приходите си сътрудничи с научни изследователи с оглед подобряване на данъчната система в България. Целта на въпросника е придобиване на информация относно нагласите, свързани с данъчното облагане в България, сред българските дружества.

**Отговорите, които ще предоставите при попълване на въпросника ще бъдат напълно анонимни. Никой никога няма да разкрие самоличността Ви, нито идентичността на Вашето дружество, както и никой няма да може да свърже Вашите отговори в проучването с данните на Вашето дружество.**

С цел да гарантира Вашата анонимност, НАП, с настоящата покана, Ви изпраща линк към онлайн въпросника. Съдействащите изследователи не познават нито електронните адреси, нито идентичността на което и да било дружество, поканено да участва в проучването. От друга страна, изследователите извършват администрирането на самия въпросник, като отговорите, дадени от дружествата във въпросника са видими само по анонимен начин за изследователите.

Линкът, поместен по-долу, ще Ви пренасочи към онлайн проучване, до което НАП няма достъп. В проучването няма въпроси относно самоличността Ви. **Това означава, че НАП не разполага с достъп до самото проучване и предоставените в него отговори, както и че изследователите нямат достъп до личните данни и електронните адреси на дружествата.** Това гарантира спазване на абсолютна поверителност, както и че никой не би могъл никога да проследи Вашите отговори.

Данните, получени от Вашите отговори ще бъдат използвани единствено за изследователски цели.

**Предварително благодарим за попълването на следния въпросник:**

[Линк към анкетата!](#)

Или копирайте и поставете посочения по-долу адрес във Вашия интернет браузър:

[https://descil.eu.qualtrics.com/jfe/form/SV\\_732FIMfh571Dty](https://descil.eu.qualtrics.com/jfe/form/SV_732FIMfh571Dty)

С уважение,

Александър Георгиев – заместник изпълнителен директор на НАП

### (a) Original email in Bulgarian

*Dear taxpayer,*

*We invite you to participate in a short questionnaire administered by the NRA in cooperation with researchers from the ETH Zurich and the Center for European Economic Research.*

*The survey will not take more than 10 minutes and you will be asked a couple of questions regarding your opinion about taxation in Bulgaria. The NRA cooperates with researchers to improve the tax system in Bulgaria. The purpose of the questionnaire is to gain knowledge about the perceptions about taxation in Bulgaria among Bulgarian firms.*

***In the questionnaire, your answers are completely anonymous. No one will ever know your identity or the identity of your firm, and no one will be able to link your answers in the survey to the identity of your firm.***

*To ensure your anonymity, the NRA herewith sends out the link to the online questionnaire. The cooperating researchers do not know the email addresses or identities of any firms, which are asked to participate in the survey. On the other hand, the researchers administer the questionnaire itself, and the answers given by the firms in the questionnaire are only visible in an anonymous way to the researchers.*

*The link below will redirect you to an online survey to which the NRA has no access. In the survey you are not asked for your identity. **This means, the NRA does not have access to the actual survey and the responses given and the researchers have no access to the identities and email addresses of the firms.** This ensures total anonymity and no one can ever track your responses.*

*The data generated from your answers is used for research purposes only.*

***Thank you very much in advance for filling in the following questionnaire.***

*Link*

*Yours sincerely,*

*SIGNATURE*

### (b) Email text in English

FIGURE F.8. Survey treatment