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Behavioral interventions, tax compliance and consequences on inequality

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Behavioral Interventions, Tax Compliance and Consequences on Inequality

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School of Business & Economics
Discussion Paper

Economics

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Behavioral Interventions, Tax Compliance and Consequences on Inequality

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WORKING PAPER

Abstract

Tax evasion is associated with high social and fiscal costs. To address these, many governments employ behavioral interventions given their low implementation costs and high potential efficiency. Although many studies report positive effects of behavioral interventions to combat tax evasion, the effect sizes are often quite small. This may result from the partial cancellation of heterogeneous effects and prompts calls in the literature for individualized or group-tailored interventions. While classification approaches for taxpayer types exist, their practical implementation is limited by data availability. We systematically review 144 studies conducted between 1996 and 2024 and show that group-tailored interventions along key inequality dimensions—gender, income, age, and regionality—may not only enhance tax compliance but also help address inequality. Furthermore, our heterogeneity analysis shows that intervention effectiveness can be enhanced by the incorporation of specific characteristics related to framing, intervention frequency, and communication channels. Finally, we present a theoretical model to support group-tailored interventions and thus provide policymakers with an efficient strategy to combat tax evasion.

Keywords: Tax Compliance, Behavioral Intervention, Heterogeneity, Inequality

JEL-Classification: H26, D31, D90

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1 Introduction

Tax compliance is fundamental to the functioning of modern economies. A government's ability to collect taxes efficiently is essential for the maintenance of institutions and the financing of public goods and services (Slemrod, 2007; Besley and Persson, 2009). For instance, in the European Union, the tax gap due to tax evasion is estimated at €824 billion annually (Murphy, 2019). These losses, combined with the administrative and financial burden of effectively enforcing tax compliance and pursuing delinquent taxpayers, can undermine the fiscal health of states (Slemrod, 2019). In recent years, economic research has identified additional determinants of tax compliance behavior and prompted debates about new policy measures that go beyond traditional tax enforcement to improve compliance (Hallsworth et al., 2017; Alm, 2019). Among these measures, behavioral interventions, as nonfinancial policy instruments, have gained widespread attention in economic research and have frequently been tested and adopted by governments in quasiexperimental settings or as measures to increase tax compliance. Policymakers often find behavioral interventions particularly attractive due to their cost-effectiveness, as even incremental increases in tax compliance can generate significant additional revenues while reducing government spending (Benartzi et al., 2017). To illustrate the potential scale, De Neve et al. (2021), conducted a field experiment in collaboration with the Belgian tax administration, which showed that compared with enforcement strategies, a simplification intervention could significantly increase tax revenues from late taxpayers. Moreover, if fully implemented, it would cost approximately 67 times less than traditional enforcement strategies would; this highlights the cost-effectiveness of behavioral interventions as a policy measure to improve tax compliance while reducing enforcement costs. However, evidence on the overall effectiveness of behavioral interventions in enhancing tax compliance remains mixed, as some studies report unintended negative effects (Holzmeister et al., 2022).

A potential issue contributing to these mixed effects is unobserved heterogeneity. Many interventions fail to account for heterogeneity in taxpayer responses to behavioral interventions, which leads to average treatment effects that may mask significant differences in individual tax compliance behavior. This concern is increasingly emphasized in the scientific debate, and studies note the importance of accounting for heterogeneity in the design and implementation of behavioral interventions to maximize their effectiveness (Costa and Kahn, 2013; Bitler et al., 2017; Mills, 2022). However, differences in how subgroups of taxpayers interact with interventions are

important to consider not only for assessments of their effectiveness. Another important consideration is that existing inequalities may be exacerbated if certain socioeconomic subgroups are disproportionately disadvantaged by such interventions. For example, Brockmann et al. (2016, p.394) showed that the behavioral intervention implemented reduced overall tax compliance, but noted that this was *'entirely driven by the strong negative reactions of male participants, which completely overshadowed the weakly positive response of female participants'.* This example illustrates two critical points: First, such heterogeneity reduces the effectiveness of behavioral interventions by neutralizing their overall impact. Second, and more concerningly, it shows that in this scenario, the intervention could exacerbate economic inequality between men and women—in this case, the gender pay gap. This is a critical issue, as prior evidence suggests that men are more likely to evade taxes even in the absence of interventions. Existing economic inequalities have far-reaching societal consequences, including negative externalities on economic growth and social cohesion. Moreover, tax systems can unintentionally reinforce these inequalities (Støstad and Cowell, 2024; Spicer and Becker, 1980; Fortin et al., 2007). Consequently, the design and implementation of behavioral interventions represent an opportunity to not only address existing inequalities but also reduce them by aligning tax compliance policies with broader social welfare goals.

In this paper, we systematically review the literature on the heterogeneous treatment effects of behavioral interventions on tax compliance, drawing on two key meta-analyses. First, we base our review on the work of Alm and Malezieux (2021), who conducted a meta-analysis on the effects of public policies on tax compliance in experimental settings. Second, we extend our investigation using the meta-analysis by Antinyan and Asatryan (2024), which offers greater external validity because of its focus on field studies. Our approach to identifying heterogeneity involves examining the interaction effects between behavioral interventions and exogenous variables, such as age, income, and gender. In addition to adopting this methodological criterion, we include studies that report significant heterogeneous effects between subgroups, even if these effects are not explicitly captured as interactions. This two-stage approach applies not only to the main analyses in the reviewed papers but also to the corresponding robustness tests and appendices.

On the basis of our analysis, we identify three taxpayer dimensions in interaction with behavioral interventions: *Sociodemographics & Regionality*, *Experiences, Attitudes & Norms*, and *Behavioral Intervention Techniques*. Our results provide strong

evidence of subgroup heterogeneity in interactions with behavioral interventions. We present our findings in results matrices that summarize significant interaction effects for each taxpayer dimension. This approach provides valuable insights for further research and enables policymakers to incorporate heterogeneity as a key element in intervention design. Moreover, we advocate for a more nuanced approach to behavioral interventions that incorporates distributional effects as a second key dimension for welfare optimization. To further the scientific debate, we introduce a theoretical bidirectional model of heterogeneous taxpayers, which assesses tax compliance decisions on the basis of economic, individual, and social determinants in interaction with policy and behavioral interventions. Ultimately, our classification framework advances the literature by supporting the development of tailored, group-based interventions that effectively increase tax compliance while minimizing unintended inequalities. The remainder of the paper is structured as follows: Section 2 explores the relationship between taxes and inequality. Section 3 provides an overview of the determinants of tax compliance behavior, identifying (i) audits and fines, (ii) tax morale, and (iii) tax complexity. Section 4 categorizes behavioral interventions into (i) deterrence, (ii) public goods and social norms, and (iii) simplification. Section 5 explores heterogeneous treatment effects of behavioral interventions on the basis of evidence from tax evasion games and field experiments, and it concludes with the introduction of a novel model of heterogeneous taxpayers that incorporates tax compliance behavior and its interaction with behavioral interventions. Section 6 explores the consequences of heterogeneous effects on inequality and their implications for group-tailored behavioral interventions and introduces a new taxpayer classification approach along key inequality dimensions. Finally, Section 7 summarizes the findings and concludes the paper.

2 Interaction between Taxation & Inequality

While traditional economic theory often overlooks the societal implications of inequality (Støstad and Cowell, 2024), empirical evidence shows that inequality is closely linked to significant negative externalities in economic and sociopolitical contexts. From an economic perspective, inequality is negatively correlated with macroeconomic stability and productivity growth, and several mechanisms are at play. A key factor driving this dynamic is reduced social mobility that results from unequal access to opportunities, such as professional networks and education (Corak (2013);

Durlauf et al. (2022)). When skilled individuals encounter socioeconomic barriers, innovation and economic growth suffer. This effect can be further exacerbated by weak demand and limited purchasing power among low- and middle-income households, which slows overall economic growth.[1] With respect to economic stability, Rajan (2011) and Kumhof et al. (2015) argue that rising inequality fueled a credit boom, which contributed to the 2008 U.S. financial crisis through the increase in loan issuance to individuals with poor credit ratings. Overall, it appears that the implications of inequality have been substantially underestimated in economic theory, largely because its effects are primarily social and sociopolitical. In societies characterized by high inequality, crime rates are elevated (Van Wilsem, 2004), life expectancy is reduced (Currie and Schwandt (2016); Haslam et al. (2018)), and overall life satisfaction decreases (Van de Werfhorst and Salverda (2012) for income inequality; Clark (1997) for gender inequality). Støstad and Cowell (2024)[2] propose treating inequality itself as an externality and incorporating it into the framework of optimal taxation. The standard theory of optimal taxation[3] posits that tax systems should be designed to maximize a social welfare function while adhering to various constraints. Central to this framework is the trade-off between the social benefits of wealth and well-being redistribution and the associated costs of tax and transfer systems. These costs include not only administrative burdens, such as bureaucratic collection expenses, but also behavioral responses, such as labor supply distortions, which highlights the inherent tension between economic efficiency and equity (Mankiw et al., 2009).

Given these considerations, income taxation is generally regarded as the most efficient instrument for combating inequality and managing the equity–efficiency trade-off, whereas other forms of taxation, such as excise taxes, are typically less progressive and, in some cases, even regressive (Atkinson and Stiglitz, 1976). To achieve distributive objectives while minimizing economic distortions, the tax literature also highlights the importance of differentiated taxation. While the degree of progressivity is intended primarily to reduce income inequality between poor and wealthy individuals, regional tax disparities and gender-based tax differentiation are two additional

[1] The relationship between economic growth and inequality is inherently complex. While some studies identify a significant negative impact of inequality on economic growth and its duration (Cingano (2014); Berg and Ostry (2017)), other empirical research finds no such adverse effects (Forbes (2000); Panizza (2002)) or suggests the presence of a non-linear relationship (Banerjee and Duflo (2003); Brueckner et al. (2015)).

[2] This approach aligns with Pigou (2017) perspective on addressing externalities.

[3] The field of optimal taxation is supported by an extensive body of literature (e.g. Diamond and Mirrlees (1971); Stiglitz (1987); Mankiw et al. (2009); Piketty et al. (2014); Saez and Stantcheva (2016)) rooted in the seminal work of Ramsey (1927) and Mirrlees (1971).

dimensions addressed in tax policy and inequality research. Regional tax disparities seek to address regional inequalities, such as differences in income, labor mobility, or productivity (Kessing et al., 2020). In contrast, gender-based tax approaches address structural differences between men and women in terms of labor market participation, income, and unpaid care work. Considering both individual and cross-labor supply elasticities, optimal tax rates for secondary earners—often wives—should be significantly lower than those for primary earners, typically husbands (Boskin and Sheshinski, 1983). However, despite the internalization of individual inequality dimensions into the optimization calculation, several factors undermine the politically intended redistributive effects of income taxation. These factors should therefore be considered in the design of optimal tax policies and, consequently, behavioral interventions.

One primary concern in tax policy is that the progressive redistributive effect of income taxation is undermined by the increasing complexity of tax laws. For instance, Akcigit et al. (2022, p.2) stated that *'complexity tends to make the tax system become more regressive'*, meaning that tax compliance costs are particularly high for low-income households. Since 1980, tax codes in many industrialized countries—including Germany, France, Switzerland, Canada, and the United States—have doubled in length, significantly increasing complexity (Benzarti and Wallossek, 2024). This growing complexity has three major consequences. First, it increases the likelihood that lower-income households refrain from filing tax returns. In Germany, which has one of the most complex tax systems in the world (Blömer et al., 2024), this complexity generates an additional 1 billion euros in annual government revenue, as many citizens fail to file their tax returns and consequently do not claim the tax refunds they are entitled to (Hauck and Wallossek, 2021). Second, many tax policies designed to assist low-income households are undermined by tax complexity, which prevents these taxpayers from fully benefiting from the measures intended to support them (Akcigit et al., 2022). Third, complexity further exacerbates socioeconomic inequality, as wealthier individuals are better positioned to benefit from professional tax advice and banking services (Hauck and Wallossek, 2021).

Trust is another crucial factor that challenges optimal taxation theory, as general trust declines sharply in highly unequal societies—both among citizens and between citizens and the government (Bobzien, 2023; Fehr et al., 2020; Rothstein and Uslaner, 2005). This erosion of trust presents a critical challenge, as mutual trust between citizens and the government is essential for enforcing tax laws and ensuring compli-

ance (Kastlunger et al., 2013). Trust arises when taxpayers perceive tax authorities as fair, cooperative, and benevolent, which fosters voluntary compliance. In this context, it is essential to consider the heterogeneous effects of behavioral interventions across key dimensions of inequality. If such interventions exacerbate existing disparities—for instance, as demonstrated by Brockmann et al. (2016) in the case of gender differences—they risk undermining trust. Behavioral interventions can be effective in both the short and long terms only if heterogeneous effects are adequately considered. In the short term, these effects may lead to opposing outcomes that offset each other or reduce the overall impact. In the long term, tax policies that reinforce existing inequalities risk eroding public trust in the state and ultimately leading to lower voluntary compliance. In summary, inequality represents a multidimensional economic and sociopolitical challenge that should be recognized as a negative externality, and it should therefore be efficiently internalized within the welfare function. From an economic perspective, income taxation is considered an effective instrument for this purpose. However, challenges arise through the compliance channel due to the complexity of tax laws and the trust relationship between citizens and the government—factors that must be carefully considered.

These different tax compliance costs can partially justify and/or reinforce the finding that wealthy individuals demonstrate lower tax honesty than poor individuals do in income tax filing (Alstadsæter et al., 2019). Preventing the erosion of trust is particularly important in the context of behavioral interventions. However, this risk arises when interventions produce heterogeneous effects along existing dimensions of inequality, potentially exacerbating them further. Building on this foundation, we argue that research on inequality should move beyond a sole focus on net wages and additionally examine net wages after income tax filing and behavioral interventions. This requires a better understanding of the mechanisms of behavioral interventions, as there is a theoretical possibility that these interventions could either exacerbate existing inequalities or reduce them. The heterogeneous effects of behavioral interventions could also be strategically leveraged by policymakers to combat inequality. We suggest that the analysis of heterogeneity in behavioral interventions not only deepens the understanding of inequality but also contributes to the literature on optimal taxation by showing that the consideration of theoretical tax rates alone cannot fully address the complexities of real-world tax systems.

3 Determinants of Tax Compliance Behavior

The successful implementation of behavioral interventions to improve tax compliance requires a thorough understanding of the determinants that drive taxpayer behavior. Economic research has examined these determinants extensively, both theoretically and empirically. Earlier research (Allingham and Sandmo, 1972; Scotchmer, 1987; Slemrod et al., 2001) focused primarily on monetary considerations, particularly in relation to deterrence and enforcement policies. However, more recent studies (Alm and Torgler, 2011; Luttmer and Singhal, 2014; Alm, 2019), have explored additional nonpecuniary, individual, and social determinants, that help explain high compliance rates even in the absence of strong deterrence mechanisms.

Audits & Fines

The standard economic model of the rational taxpayer is based on the expected utility framework developed by Von Neumann and Morgenstern (1947) as well as the economic model of criminal activity proposed by Becker (1968) which was later applied to decision-making in tax compliance behavior by Allingham and Sandmo (1972). According to this, a risk-averse individual tries to maximize his net income by weighing the benefits of successful cheating against the prospect of detection and punishment. However, audit rates tend to be low. For example, in 2010, only about 1.1% of individual income tax returns in the United States were audited, potentially weakening deterrence effects based on economic determinants Brockmann et al. (2016). According to the expected utility framework, such low audit rates would suggest significantly higher levels of tax evasion if taxpayers behaved purely rationally (e.g., Andreoni et al. (1998)). And while monetary considerations remain a central determinant, recent research has identified additional behavioral and nonpecuniary determinants, such as psychological, social, and institutional determinants, that influence individual tax compliance (Alm, 2012; Brizi et al., 2015).

Tax Morale

Among nonpecuniary determinants, tax morale has emerged as a central explanation for high tax compliance despite low enforcement levels (Torgler, 2007). Tax morale refers to the voluntary willingness to comply in the absence of deterrence measures, and is often used as an umbrella concept for the intrinsic motivation to pay taxes (Luttmer and Singhal, 2014). As a key determinant, previous studies found strong evidence that strong tax morale can promote honest behavior (Christian and Alm,

2014; Dwenger et al., 2016). Moreover, taxpayers are in constant interaction with their social environment. Social peer effects and influences can have different effects on conformity behavior. For example, information on peer compliance and therefore the impact of social norms can directly impact taxpayer's own compliance. Empirical evidence on social norms, including moral suasion, have shown mixed results. The reason is, that it is usually difficult to infer causal relations. Nonetheless, information about tax morale determinants can be leveraged to better inform policy-makers and improve overall compliance rates (Besley and Persson, 2014; Alm et al., 2017; Gaber and Gruevski, 2018; López-Luzuriaga and Scartascini, 2019). Another aspect of tax morale is the reciprocity between taxpayers and institutions. This includes not only the quality of administrative institutions, but also the overall level of trust and satisfaction with government (Kirchler et al., 2008). A central aspect of institutional reciprocity highlights the perceived fairness associated with the efficient use of tax revenues, which relates to distributional fairness and the tax system itself, with the levying of taxes implying procedural fairness (e.g. the scheme of progressive taxes) (Van Dijke and Verboon, 2010). Importantly, fairness has further implications for subjective perceptions of social inequality in, for instance, influencing the acceptance of redistributional tax policies (Hvidberg et al. (2023)).

Tax Complexity

Lastly, tax compliance is affected by information imperfections. Imperfections such as information asymmetries between tax authorities and taxpayers can lead to an underestimation of audit probabilities and enforcement consequences. This aspect also includes decision biases, such as loss aversion, which can reduce tax compliance by overweighting tax losses against long-term benefits of contributing to the public good (Lewis et al., 2009; Engström et al., 2015). Another component of information imperfections is attributed to the complexity of tax systems, which can lead to unintentional deviations from the correct tax declaration. If individuals are unwilling or unable to invest the time, cognitive effort, and financial resources needed to accurately determine the true value, they may over-report out of fear of making errors or facing scrutiny. Conversely, some taxpayers may perceive tax complexity as an opportunity for evasion, anticipating that any discrepancies will be attributed to error rather than deliberate misconduct in the event of an audit (Forest and Sheffrin, 2002; De Neve et al., 2021).

In summary, it has been shown that tax compliance is not only affected by mone-

tary determinants stemming from enforcement policies (audits & fines). Tax morale, which refers to the voluntary willingness to comply in the absence of deterrence policies, drives taxpayers to comply on the basis of intrinsic motivation, social peer effects and institutional reciprocity. In addition, information imperfections due to tax complexity and cognitive biases can lead to undesirable compliance outcomes. In line with the literature, (Andreoni et al., 1998; Alm, 2019) this strongly suggests, that tax compliance need to be considered from a multidimensional perspective for which, behavioral interventions have substantial prospects as a policy tool to improve tax compliance by addressing its various determinants in a comprehensive manner.

4 Behavioral Interventions

Over the past three decades, a growing body of literature has advocated for the use of behavioral interventions to enhance tax compliance (Del Carpio, 2013; Chetty and Saez, 2013; Castro and Scartascini, 2015; Dwenger et al., 2016; Hallsworth et al., 2017; Mascagni, 2018; Bergolo et al., 2023). We define behavioral interventions as non-financial policy measures, with the aim to increase the likelihood that individuals accurately declare their income, remit the correct amount of tax deductions and pay taxes on time - all without altering the outcome structure. This distinguishes behavioral interventions from traditional policy tools, which typically rely on financial incentives, such as increasing penalties in case of tax evasion (Slemrod et al., 2001). Behavioral interventions, as non-financial policy measures, aim to enhance tax compliance through various strategies. These include emphasizing fines or audit rates, referred to as *deterrence*; enhancing tax morale by emphasizing the role of *public goods* and the use of *social norms*; and simplifying the tax process itself, known as *simplification*.

(i) *Deterrence* interventions influence the individual monetary cost-benefit analysis by highlighting one or more economic determinants. Specifically, this type of behavioral intervention focuses on the expected cost of noncompliance rather than the objective audit probability Kirchler et al. (2008) as well as Danz et al. (2022) have shown that subjective expectations are fundamental for economic decision-making. In behavioral interventions, expected costs are often conveyed through messages that highlight fines for tax evasion or signal increased scrutiny by tax authorities. For example, the Norwegian tax authorities communicated to taxpayers who falsely reported foreign income: *"The tax administration has received information that you*

have had income and/or assets abroad in previous years" (Bott et al., 2020, p.2807). Similarly, Castro and Scartascini (2015, p,72) send deterrence messages explaining the cost of noncompliance: *"Did you know that if you do not pay the CVP (Public Space Conservation tax) on time for a debt of AR$ 1000 you will have to disburse AR$ 268 in arrears at the end of the year and the Municipality can take administrative and legal action?".* Summarized, deterrence interventions target extrinsic determinants of tax compliance and are consistent with the predictions of the standard economic model of tax compliance.

To sustainably improve tax honesty, it is essential to raise citizens' awareness of the importance and value of voluntary tax compliance (e.g., Kirchler (2007)), as tax morale plays a significant role in tax compliance (Fehr and Gächter, 2000). Moral-related interventions aim to appeal to taxpayers' sense of civic duty and justice. While Antinyan and Asatryan (2024) referred to tax morale interventions in general, we introduce a further distinction by subdividing them into public good and social norm interventions, as these target different determinants of tax compliance behavior within tax morality. (ii) *Public good* interventions represent moral appeals that highlight the societal importance of taxes (e.g., Blumenthal et al. (2001)).

An illustrative example of this can be found in Torgler (2004, p.240), which examined the impact of moral suasion messages on timely tax payments: *"if the taxpayers did not contribute their share, our commune with its, 6226 inhabitants would suffer greatly. With your taxes, you help keep Trimbach attractive for its inhabitants".* (iii) *Social norm* interventions represent another approach to targeting tax morale. They typically involve disclosing the tax compliance behavior of others, thereby addressing social peer effects (e.g., John and Blume (2018); Andersson et al. (2023)). Such interventions can induce feelings of guilt in those who evade or delay payment, reminding them that their actions undermine the well-being of their peers, community, or society as a whole. Psychological research has already shown that people have a fundamental need to conform to the behavior of their social environment (Moscovici and Faucheux, 1972; Cialdini and Goldstein, 2004). A moral suasion message can be formulated as follows: *"96% of Medway Council Tax is paid promptly. You are currently in the very small minority of people who have not paid on time"* (Larkin et al., 2019, p.6). In summary, tax morale interventions seek to address intrinsic determinants of tax compliance, emphasizing social norms and public good appeals.

The fourth type of behavioral intervention aims to reduce tax complexity by making the compliance process simpler and more accessible. (iv) *Simplification* interventions

can lower cognitive load and, consequently, reduce the compliance costs associated with completing an income tax return (Benzarti and Wallossek, 2024). These interventions provide taxpayers with clear and concise guidance on accurately declaring income, which is crucial, as tax evasion can result not only from deliberate actions but also from cognitive errors (Eerola et al., 2020). Additional strategies to enhance simplification include minimizing information overload, optimizing communication from tax authorities, and emphasizing relevant information for taxpayers (De Neve et al., 2021).

One thoroughly studied example of behavioral interventions aimed at addressing the determinants of tax compliance behavior is the use of honesty oaths. Zickfeld et al. (2024) adapted this concept from psychological research on tax honesty in their recently published meta-study. This approach prompts taxpayers to actively confirm the accuracy of the information provided in their income tax returns:

(i) *"I understand that dishonest reporting is a fraudulent way of getting money I do not deserve. I hereby declare that I will provide honest information." (+ Deterrence).*

(ii) *"In general, tax avoidance results in less funding for schools, hospitals and welfare. It hurts me and the society. I hereby declare that I will provide honest information." (+ Public good).*

(iii) *"89% of participants reported honesty. I hereby declare that I will provide honest information." (+ Social norm).*

Rather than treating honesty oaths as a standalone intervention, we view them as a customizable technique addressing the three determinants of tax compliance: (i) Audits & Fines (extrinsic motivation), (ii) Tax morale (intrinsic motivation), and (iii) Complexity (cognitive costs).

In summary, we identified four types of interventions that target different tax compliance determinants. Deterrence seeks to enforce compliance through extrinsic factors, while moral interventions—including public good and social norm suasion—seek to strengthen intrinsic motivation. However, tax evasion is not solely driven by intrinsic or extrinsic motivation; it can also result from high complexity. Simplification reduces the cognitive burden associated with income tax declarations, thereby lowering tax compliance costs. Honesty oaths serve as an illustrative example of a behavioral intervention that integrates these approaches, addressing multiple tax compliance determinants simultaneously.

5 Analysis of the Heterogeneous Effects of Behavioral Interventions on Tax Compliance

Most existing research on behavioral interventions has examined their effectiveness primarily through a focus on average treatment effects. Meta-analyses synthesizing this body of literature conclude that behavioral interventions can indeed increase the likelihood of tax compliance (Hummel and Maedche, 2019; Antinyan and Asatryan, 2024). For example, Antinyan and Asatryan (2024) report that, compared with a baseline scenario, moral-based interventions lead to a 1.4 percentage point (pp.) increase in compliance probabilities, deterrence interventions to a 3.2 pp. increase, and simple reminders (i.e., simplification measures) to a 2.7 pp. increase. Although these findings confirm the positive impact of behavioral interventions, the observed effect sizes are relatively small. We propose that this modest impact on average effects may be attributed to heterogeneous treatment effects.

In what follows, we analyze heterogeneous treatment effects with respect to taxpayer characteristics using evidence from two significant meta-analyses. To include literature from both field and laboratory experimental settings, we first draw on Alm and Malezieux (2021), who collected individual data from 70 tax evasion games in laboratory settings. We then examine the synthesized literature of Antinyan and Asatryan (2024) to identify heterogeneity in behavioral tax compliance interventions across 73 field studies, which provides a more general approach with higher external validity. In addition, we examine a recently published large-scale study by Zickfeld et al. (2024) for heterogeneous treatment effects in ex ante honesty oaths. As a behavioral intervention, honesty oaths are increasingly being used in tax filings and have proven to be an effective method for improving tax compliance. Our strategy for identifying heterogeneity focuses on interaction effects between behavioral interventions and exogenous variables, such as age, income or gender. In addition to adopting this methodological criterion, we include studies that report significant heterogeneous effects between subgroups, even if these effects are not explicitly captured as interactions. This two-stage approach applies not only to the main analyses in the reviewed papers but also to the corresponding robustness tests and appendices.

In total, we screened 144 studies for evidence of significant heterogeneous treatment and interaction effects and identified 41 studies reporting such effects. We grouped these heterogeneities into three taxpayer dimensions, with at least two studies required to report significant heterogeneity within a dimension: *sociodemographics & regional-*

ity; *experiences, attitudes & norms*; and *behavioral intervention techniques*. Finally, after presenting evidence for each taxpayer dimension, we summarized our findings in a matrix to illustrate heterogeneous interactions between taxpayer characteristics and behavioral interventions on tax compliance, which provides a comprehensive identification of existing and missing evidence.

5.1 Sociodemographics & Regionality

The first taxpayer dimension in which we identified heterogeneous treatment effects of behavioral interventions on tax compliance is composed of sociodemographic factors and regional disparities. In the literature, sociodemographic characteristics not only have an influence on general tax compliance behavior (e.g. Kastlunger et al. (2010), Hofmann et al. (2017)) but also have important implications for behavioral interventions. We found evidence for six significant sociodemographic domains in interaction with behavioral interventions. Regional disparities, such as differences between urban and rural taxpayers, can significantly influence various economic outcomes. Our analysis indicates that heterogeneity also arises in behavioral interventions aimed at improving tax compliance. Spillover effects across neighborhoods should be carefully considered to enhance the effectiveness of these interventions. Furthermore, the identification of geographical clusters and consideration of factors such as population density can have important implications for policy design

Evidence from Tax Evasion Games

Brockmann et al. (2016, p.392-394) conducted a laboratory experiment implementing a three-group between-subject design, focusing on rewarding honest participants with material and immaterial rewards, in comparison to a standard deterrence treatment used as the control group. Although the results suggested that positive rewards reduced tax compliance compared with standard deterrence, on average, the direction and size of the effect changed when conditioned on gender. The introduction of interaction terms between a female dummy variable and the two reward treatments revealed heterogeneous gender-specific effects. The immaterial reward had a weakly significant effect on women, increasing tax compliance by 31.88 pp. (SE = 18.95, $p<0.1$) relative to men. The material reward had an even stronger effect, increasing tax compliance by 60.96 pp. (SE = 16.17, $p<0.01$). However, men reacted to the reward treatment with a strong increase in tax evasion, reflected in the fact that the compliance rate for men decreased by 26.25 pp. for the immaterial reward (SE =

12.67 p.p. , $p < 0.05$) and 47.16 pp. for the material reward (SE = 11.74 p.p., $p < 0.01$). The deterrence treatment resulted in the strongest increase in tax compliance for men, with an effect of 73.85 pp. (SE = 8.368, $p<0.01$). In contrast, the reaction of women was weaker and in the opposite direction, with a change of 58.46 pp., which was not statistically significant. While not all findings were significant due to the small sample size, the gender differences were consistent across multiple iterations of the experiment.

Bruner et al. (2017, p.48-52) specifically examined the role of gender differences in tax compliance in a cross-national experimental setting, presenting taxation as a public contribution. In addition to informing participants about standard parameters, such as the tax rate, fine rate, and audit probability, the experiment introduced a public good multiplier $m \in \{0, 1, 2\}$, which simulated the amplification of tax contributions to the public good. In relation to behavioral interventions, m can be associated with public good treatments, which are commonly used in quasiexperimental studies. With respect to gender differences and public good provision, an interesting behavioral pattern was observed. The female compliance rates were much higher in the absence of the multiplier. Specifically, the cross-national compliance rate of men was approximately 41% lower than that of women. In contrast, an increase in the multiplier reduced this difference, on average, so that the compliance rate of men was only 18% lower. However, the introduction of the public goods multiplier led to an increase in tax compliance for both genders. The relative increase in compliance was greater for men; this suggests that a public goods intervention has the potential to reduce the gender gap in tax compliance, since there is strong evidence that women tend to be more compliant than men. Fortin et al. (2007, p.2106) also identified gender-specific heterogeneity in a tax evasion game incorporating social interactions, which can be linked to a social norm intervention. The estimated parameter for gender showed that women reported, on average, 14.7 more experimental income units than men did ($p<0.05$ in the specification without group dummies; not significant with group dummies) in response to the social interaction treatment, in which individuals' tax payment rates were compared to the average of their peers.

Evidence from Field Experiments

Sociodemographics: Heterogeneous treatment effects are important to consider when accounting for sociodemographic variables, such as age, gender, or socioeconomic status. Randomized controlled trials (RCTs) of behavioral interventions on

tax compliance have focused primarily on average treatment effects, with heterogeneity analyses often treated as robustness checks and statistically significant results being overlooked. The following section highlights these heterogeneities with respect to socioeconomic and sociodemographic variables.

Bott et al. (2020, p.2815) examined the effects of different types of informative treatment letters on Norwegian taxpayers, focusing on the causal impact of moral suasion interventions and distinguishing between the effects of fairness and prosocial arguments on the truthful declaration of foreign income. The heterogeneity analysis displayed overall robust results for the behavioral interventions, although some statistically significant interaction effects emerged. With respect to the interaction between moral treatment and socioeconomic status (SES), individuals in the top 25% of the income and wealth distributions at baseline (high SES) reported a greater amount of foreign income than did those with lower SES. Specifically, the high SES group reported an additional 14,849 Norwegian krone (NOK), with a standard error (SE) of 6,135.6 NOK ($p<0.05$). An additional statistically significant interaction was found between the moral treatment and taxpayers who had declared foreign income in the baseline year prior to the RCT. The moral suasion letter increased the reported level of foreign income by 14,382 NOK (SE = 7,458, $p<0.1$). The detection treatment, aimed at increasing taxpayers' perceptions of detection probabilities, resulted in significant interaction effects for several subgroups. The results suggest that receiving an intervention letter explicitly highlighting detection probabilities, combined with being a Norwegian citizen, increased the probability of reporting a positive amount of foreign income by 5.99 pp (SE = 0.0233 $p<0.05$). Similarly, for the subgroup of taxpayers aged above 60, the detection treatment had a statistically significant effect, and the probability of reporting a positive amount of foreign income increased by 12.6 pp. (SE = 0.0229, $p<0.01$). As only a subgroup of taxpayers aged 60 and older was created for the age analysis, no inferences can be made regarding the interaction of younger taxpayers with the moral or detection treatments in this study. Finally, for the positive base group, the detection treatment resulted in a statistically significant decrease in the probability of reporting foreign income by 9.18 pp. (SE = 0.0239, $p<0.01$).

De Neve et al. (2021, p.1449-1450) demonstrated that behavioral intervention letters generally show wide variance in treatment effects on the basis of taxpayer characteristics, such as age and gender. Although specific interaction effects were not analyzed, treatment effect disparities were compared across the same set of taxpayer

characteristics for each intervention. The simplification treatment resulted in a wide variance, whereas the deterrence and tax morale treatments resulted in more concentrated effects. Notably, the simplification intervention did not result in negative effects on tax payment rates, whereas the deterrence treatment produced negative outcomes for certain groups of taxpayers. Moreover, the tax morale treatment appeared to backfire for the majority of taxpayers, with small effect sizes. Regarding specific interactions between interventions and subgroup variables, payment reminders were most effective for taxpayers aged 41–50, as they increased the probability of payment before enforcement by 2.5 pp. (SE = 0.014). While positive effects were still observed for the 31–40 and 51–60 age groups, with increases of 1.2 (SE = 0.013) and 1.1 (SE = 0.013) pp. respectively, the reminders had an unexpected negative effect on taxpayers aged 60 and older, reducing the probability of payment by 1.7 pp. (SE = 0.013). Moreover, the probability of payment increased with the number of children. Having one child increased the likelihood of payment by 1.9 pp. (SE = 0.013), whereas having two children further increased this probability to 2.7 pp. (SE = 0.014), which was nearly 1.5 times the effect of having one child. This could be related to the fact that it is difficult for large families to submit tax documents on time.

In another RCT, Hernandez et al. (2017, pp.20-22) reported that in a standard behavioral intervention involving the use of clear descriptions and easy-to-understand legal language, late taxpayers aged 50–64 years were more responsive than those aged 20–29 years, with a payment rate of 48.7%, compared with 46% for those aged 20-29. Although this difference was not statistically significant, positive public good letters were more effective for the younger group, with a 48.9% payment rate, than for the older group, with a 46.1% payment rate. In terms of heterogeneity across genders, women consistently had higher payment rates across all interventions, which indicated that women were more responsive to the interventions than men were. This was also true for the control group, which received a standard dunning letter. These gender-related differences are consistent with the findings of Mogollon et al. (2021, p.1313), who reported that phone call interventions were more effective in reducing delinquency among women than men, although this effect was not statistically significant. In addition to addressing age, the analysis explored the effect of behavioral interventions on the basis of whether individuals had children. A clear pattern emerged for non-parents, or individuals without children, such that this sociodemographic subgroup was significantly more responsive to the abovementioned standard behavioral intervention than parents with at least one child. In the heterogeneity analysis, dif-

ferences between urban and rural populations were also explored, and individuals in rural areas were found to be more responsive to behavioral interventions

Meiselman (2018, p.187) demonstrated that high compliance rates were associated with taxpayers who had high incomes, were older, and had a recent history of filing returns. A fractional polynomial regression plot of response rates against income further confirmed that wealthy taxpayers were more likely to comply than poor taxpayers. Age, income, and filing history all independently contributed to predicting compliance, even when considered together. The highest compliance rate, 39%, was observed in the group that received the penalty salience treatment; this group comprised taxpayers over the age of 50, with incomes exceeding $50,000, and having been identified as suspected resident nonfilers fewer than three times. In terms of income, Slemrod et al. (2001, p.482) examined the effects of deterrence letters on income tax compliance, controlling for different income levels. Their findings indicated that increasing the threat of audits led to higher declared income and tax liability among low- and middle-income taxpayers, especially those with more opportunities for tax evasion. However, the additional tax collected from this group is small, amounting to less than 2% of total tax liability. In contrast, high-income taxpayers tended to declare less income, probably because they believed that an audit would not fully detect and penalize all forms of tax evasion. This may suggest that behavioral deterrence interventions, such as an increase in the degree of audit threat, should be tailored to different income levels and considered alongside other types of behavioral interventions. Cahlíková et al. (2021, p.19-21) found heterogeneity in the interaction effects between age groups and registration rates for TV license fees in the Czech Republic. Deterrence messages in letters were more effective among older individuals (aged 39 to 47), yielding an increase of 4.9 pp. in registration rates, than among younger individuals (aged 31 to 38), with an increase of 3.3 pp. Both results were significant at the 1% level.

Further variations in subgroup effects of sociodemographic variables were identified by Torgler (2004, p.248), who conducted a controlled field experiment in Switzerland to investigate the effect of moral suasion on tax compliance, specifically focusing on timely payments and the submission of tax forms. The analysis suggested that being in the moral suasion group increased the likelihood of being in the most compliant group by approximately 3 pp., although this effect was not statistically significant. There was a strong link between timely tax form submission and increased payment compliance. Additionally, individuals aged 65 and older were 9 to 14 pp. more

likely to be fully compliant than those aged 20–29. When age was treated as a continuous variable, it also presented a statistically significant positive relationship with compliance. Swiss citizens tended to be slightly less compliant than foreigners, but this difference was only marginally significant. Compared with being single, being married lowered the likelihood of being in the highest compliance group by 5.9 to 7.9 pp. Last, owning a home had a clear positive effect on compliance, which was consistent with theoretical expectations.

Eerola et al. (2020, p.20) investigated heterogeneous treatment effects on rental income tax compliance in the context of a randomized field experiment in Finland, which involved the sending of various informational letters containing third-party data about property ownership and occupancy. Three out of the four information treatments had significant heterogeneous effects on the compliance rates of taxpayers who had not previously reported rental income, with an increase ranging from 4.5 to 7.9 pp. ($p<0.05$). Additionally, heterogeneity was found among taxpayers younger than 40 years. Depending on the content of the information, an increase in tax compliance of 3.9 to 4.7 pp. was observed among young rental income taxpayers. Interestingly, some information interventions also increased compliance rates for individuals who already owned at least one property before the interventions. When heterogeneity in treatment effects by age and property characteristics were controlled, the analysis revealed that different information letters produced varying or no effects. In contrast, the overall treatment effect for the entire sample masked these heterogeneities, as it suggested that all information letters had a significant effect on tax compliance rates.

Regionality: Collin (2022, pp.11-12) found heterogeneity in relation to geographic distribution effects when examining differences in treatment effects across a city in Tanzania, with the aim to specifically investigate property tax compliance in a representative low- or middle-income country. For this purpose, the sample was divided into 1211 strata based on the property location. A wide distribution in effect sizes was found across all strata; this implied that if the field experiment had been conducted in a randomly chosen neighborhood, there would have been only a 58% chance that the observed effect size would have fallen within 1 pp. of the average effect. Additionally, only 65% of neighborhoods had estimated effect sizes greater than zero. Finally, the results suggested that areas with high levels of tax compliance were least responsive to behavioral treatments, which further highlights the importance of tailoring interventions, as ineffective treatment effects for certain areas can lead to increased costs for authorities.

In line with these findings, Fellner et al. (2013, pp.655-656) reported significant interaction effects when comparing social information treatments across different municipalities in Austria, where the treatments entailed the disclosure of information about others' compliance behavior. The probability of taxpayer registration in municipalities within the top quartile of local evasion rates was 1.4 pp. higher (SE = 0.007) than that in municipalities outside this quartile, with statistical significance at the 10% level. This suggested that the information treatment had a stronger impact in areas with higher rates of tax evasion. These findings are particularly interesting because they point to heterogeneity in responses and link the results to the concept of conditional cooperation (Frey and Torgler (2007)) and the broader influence of social environments on individuals' tax compliance decisions. The conducted analysis of heterogeneous treatment effects additionally revealed that for municipalities where right-leaning voters represented more than the median share of voters, the threat intervention increased the probability of registration by 0.6 pp. (SE = 0.003 p <0.1). A threat also had a stronger effect on individuals with household incomes above the median, increasing the probability of registration by 2 pp. (SE = 0.005, p <0.01). Additionally, positive effects of the deterrence message were associated with highly populated urban municipalities.

In Argentina, Cruces et al. (2023, pp.22,35) developed a partial population framework to study spillover effects in clusters with similar characteristics (e.g., geographical areas), which allowed them to investigate possible interaction effects between these clusters and focus on heterogeneous treatment effects in relation to property tax compliance. They sought to explain the decline in compliance among neighbors who had been compliant in 2019 but became less compliant during the COVID-19 pandemic in 2020. It was argued that this core group of previously compliant taxpayers was more likely to respond to the intervention, which increased the likelihood of spillover effects in these areas. In this context, spillover effects referred to the indirect impact of treatments on individuals who did not directly receive reminders but were influenced by their neighbors. In the empirical analysis, different saturation levels were introduced, with reference to the percentage of individuals in a certain area exposed to the intervention, which consisted of reminders about due taxes and information on current and past debt amounts. For areas with 20% saturation, only one relatively small spillover effect was found, as a 0.68 pp. increase in tax compliance (SE = 0.33, $p < 0.05$) was observed for the below-median compliance cluster that received no treatment. No statistically significant spillover effect was observed

in the 50% saturation areas. However, for areas with 80% saturation, in blocks with above-median compliance, spillover effects were significant for both early and late payers. Untreated individuals increased their tax payments by 1.58 pp. (SE = 0.67, $p < 0.05$); this increase exceeded the direct effect of 1.06 pp. (SE = 0.42, $p < 0.05$) for treated individuals. Untreated late payers also showed a significant increase in payments of 2.56 pp. (SE = 1.27, $p < 0.05$), compared with a direct effect of 5.09 pp. (SE = 0.81, $p < 0.01$) for the treated group. Similar evidence of heterogeneity was found by Brockmeyer et al. (2021, p.99), who observed differential effects of enforcement letters on property tax compliance in Mexico, depending on the population density of the areas. The indirect treatment effects led to a statistically significant increase in tax compliance of 1.24 pp. for properties in high-density neighborhoods. By comparison, the public good treatment had no significant effect, increasing tax compliance by only 0.431 pp. After controlling for property-related variables, such as year of construction and area, a second OLS regression yielded the same findings. Santoro (2024, Appendix F.2) showed for taxpayers in Eswatini that for those who had never filed tax returns, behavioral interventions had different impacts on rural and urban areas. In rural areas, deterrence messages increased the probability of filing a tax return by 3.2 pp. (SE = 0.011, $p<0.01$), compared with a smaller increase of 2 pp. (SE = 0.008, $p<0.05$) in urban areas. These differences may be due to the lower interaction with tax authorities in urban areas, as the probability of taxpayers interacting with authorities was 43% in urban areas compared with 35% in rural areas. Moreover, urban taxpayers were more responsive to social norm messages, with a 2.3 pp. increase in the likelihood of filing a tax return (SE = 0.010, $p < 0.05$), whereas there was no effect in rural areas. In this context, we discuss the differential impacts of behavioral interventions and the role of institutional reciprocity in the next section.

Finally, Okunogbe (2021, p.21) conducted a heterogeneity analysis of property owners in Congo Town, Liberia, by dividing the sample into three geographical areas within the city. Although there was no detailed breakdown of socioeconomic variables, such as property value and economic activity, across areas, the analysis revealed that property owners in only two of the three areas who had previously experienced enforcement were significantly responsive to deterrence messages. This further highlights the importance of accounting for geographical differences when implementing behavioral interventions to effectively increase tax compliance.

Overall, the evidence shows significant heterogeneity in the results of behavioral

interventions in tax compliance according to sociodemographic variables, particularly across the age, gender and income levels. Gender patterns suggest that women generally have higher compliance rates and respond more positively to rewards and moral suasion, whereas men respond more strongly to deterrence treatments. In terms of income, high-income individuals are less influenced by deterrence, whereas low- and middle-income taxpayers are more sensitive to audit threats. Age plays a decisive role, with older taxpayers often exhibiting greater compliance with social norm interventions and younger individuals tending to respond more favorably to simplified or deterrence-based messages. Behavioral interventions also present significant heterogeneity across regions, areas with different population densities, and neighborhoods with different compliance levels. Urban areas and high-density neighborhoods tend to respond more strongly to deterrence-based approaches, whereas rural areas benefit more from direct engagement with tax authorities and moral-focused interventions. Notably, in high-compliance neighborhoods, spillover effects are observed among untreated individuals under the indirect influence of their peers.

Table 1. Sociodemographics & Regionality

	Deterrence	***Public Good***	***Social Norm***	***Simplification***
Age	31-47 ↑ >60 y/o ↑		≥ 65 y/o ↑	**20 to 60 y/o ↑↑** >60 y/o ↓
Gender	Women ↓ Men ↑	**Women ↑↑** Men ↑	**Women ↑↑**	Women ↑
Citizenship	Native ↑		Native ↑	
Income	Low-Middle income ↑ High income ↓		High income ↑	
Children	No ↑			**Yes ↑ ↑**
Martial Status			Married ↓	
Geographic region	Urban Area ↑	Rural Area ↑	Rural Area ↑	
Population density	**High ↑ ↑**	High Ø		
Neighborhood compliance	High level↑	High level ↓	Low level ↑	

↑ = Positive; ↑↑ = Strong positive; ↓ = Negative; ↓↓ = Strong negative; Ø= No effect;
□ = No evidence

5.2 Experiences, Attitudes and Norms

The second taxpayer dimension we identified is related to individual taxpayer history, personal attitudes and individual norms. Some explanatory factors are associated with independent, heterogeneous treatment effects of behavioral interventions in aspects such as compliance history or balance due. We also found evidence of characteristics that occur in interaction with sociodemographic variables, as discussed in the above section. With respect to the type of intervention, evidence was found mainly for deterrence and social norm interventions. Another dimension where the heterogeneity of behavioral interventions needs to be accounted for is that of tax morale. While it is difficult for policymakers to account for individual types of tax morale, recent research has identified its significant effect on tax compliance decisions (see e.g. Fochmann et al. (2025), Bruns et al. (2023)). We identified two field experiments that investigated the influence of motivational and normative interactions with behavioral interventions. Moreover, taxpayers have an ongoing relationship with tax authorities, who face a trade-off between encouraging voluntary tax compliance and enforcing behavioral interventions; such interactions provide an opportunity to communicate with taxpayers and potentially build trust by addressing concerns, such as fairness (Kirchler et al. (2008)). Our analysis revealed evidence of heterogeneity in the effectiveness of reciprocal messages with taxpayers.

Evidence from Field Experiments

Taxpayer history: In a large-scale field experiment, Dong and Sinning (2022, pp.7-8) investigated the tax compliance behavior of individuals entering the tax system for the first time in Australia. The targeted population consisted of 18,000 individuals aged between 18 and 65 years. The heterogeneity analysis revealed that both deterrence and nondeterrence interventions had a significantly stronger effect for first-time taxpayers aged 18-21 years who held Australian citizenship, increasing the use of lodgment tools by approximately 2-3 pp. compared with the overall sample. Furthermore, the effect of the welcome letter on lodgment rates was approximately 3 pp greater than the corresponding overall treatment effect. In contrast, for Australian citizens aged above 21 years, the treatment effects on lodgment via the use of lodgment registration tools were approximately 3–5 pp. lower than the overall treatment effects. These findings suggest that within the Australian citizen group, both treatments were more effective for younger taxpayers than for older taxpayers. When differentiated by citizenship status, younger noncitizens were less responsive to the behavioral letters

than the older group, which highlights the potential role of tax morale influenced by cultural background in tax compliance. Additionally, both the deterrence and welcome letters had stronger effects on taxpayers who had been registered with a tax file number for a longer period, with the welcome letter having a slightly greater impact. This finding suggests the need for further investigation, as the welcome letter was originally designed to enhance engagement with newly registered taxpayers.

Santoro (2024) focused on heterogeneous treatment effects and identified mixed behavioral responses among taxpayers in Eswatini. The first important dimension of heterogeneity was identified according to taxpayers' filing history on the basis of the assumption that past filing behavior influences current tax compliance. A persistent filing history was defined as consistent behavior over six years, with no deviations, such as shifts from positive to negative tax filings. It was found that nonfilers—those who had never filed tax returns—were the least responsive to behavioral deterrence, simplification, or public good interventions. For example, public good messages highlighting that tax revenues are invested in national development increased the probability of tax filing by 1.3 pp. (SE = 0.008, $p < 0.1$) overall. When accounting for heterogeneous treatment effects in relation to filing history, no treatment effects were observed for nonfilers. However, for partly compliant filers, the probability of filing increased by 2.6 pp. (SE = 0.013, $p < 0.01$), which was twice the treatment effect observed in the overall population sample. The importance of heterogeneous treatment effects became even more evident in the context of the treatment effects of the social norm message. In contrast to previous findings, the social norm message increased the probability of tax filing among nonfilers by 2.1 pp. (SE = 0.009, $p < 0.05$), which was 1.5 times greater than the overall treatment effect of only 1.4 pp. (SE = 0.008, $p < 0.1$). No effect was observed for partly compliant filers. The second dimension of heterogeneity was identified in relation to newly registered taxpayers. As observed by Dong and Sinning (2022), simplification treatments designed as instructional interventions had no effect on younger first-time taxpayers. Determining the cause of this finding requires further investigation, as instructional interventions are particularly important for young first-time taxpayers. Moreover, the public good message had an unforeseen negative effect on young first-time taxpayers, decreasing the probability of tax filing by 6.4 pp. (SE = 0.032, $p < 0.05$). Finally, social norm messages had the greatest impact, increasing tax filings by 11.5 pp. (SE = 0.053, $p < 0.05$) (Santoro, 2024, Appendix F.2).

Regarding taxpayer registration, Schächtele et al. (2022, pp.5-6) examined the im-

pact of low-cost interventions in Brazil in which individuals were simply invited to register. Their findings on heterogeneous treatment effects revealed that, in terms of interaction effects with gender, men were consistently more likely to register across all treatment groups, namely, the control group, a group that received an information letter about the online registry, and a group that received an information letter with the addition of a lottery reward. Even for simple email requests, the response rate among men was statistically higher than that among women at the 5% significance level. For example, women were 1.101 pp. less likely to attempt registration (SE = 0.0959) in response to the information letter. In terms of age, the likelihood of registering in response to email communication was highest among individuals around the age of 50. Older individuals may be little inclined to engage with an online tax registry or respond to emails, whereas younger taxpayers might no longer rely on email as a primary communication method, which makes them less responsive. These differences indicate that email may not be equally effective across different age groups. Further results indicated that compliant taxpayers were more likely to respond to emails, which supports the notion that registration is less appealing to noncompliant individuals. Interestingly, in the status quo group, both compliant and noncompliant taxpayers were similarly likely to join the registry, which suggests the existence of 'noncompliant but willing' taxpayers who see value in the registry tool. Finally, an interesting interaction effect was observed between property size and registration likelihood. The likelihood was low for individuals with small properties, peaked for those with medium property values, and, surprisingly, decreased for those with high property values in the informative treatment. This may suggest reluctance among noncompliant owners of highly valuable properties. In terms of taxpayer history, Cranor et al. (2020, p.347) demonstrated that treatment heterogeneity can also occur in interaction with taxpayers' balance due. To explore this issue, their sample was divided into three balance-due categories. For individuals with outstanding tax liabilities less than $95 (USD), a detailed penalty intervention that highlighted an interest rate increase, framed as loss aversion in the event of nonpayment, significantly increased the probability of full payment by 1.82 pp. (SE = 0.852, p <0.05), which represented a 3.1 pp. increase compared to the probability for the control group. Additionally, a generally framed penalty message increased payments by 1.24 pp. (SE = 0.763), representing a 2.1 pp. increase relative to the control group, although the results were not statistically significant in this case. For the second tertile with a balance between $95 (USD) and $433(US), the detailed penalty intervention led to a

similar significant increase of 1.9 pp. (SE = 0.758, p <0.05), which was, interestingly, 6.1 pp. greater than that of the control group. For individuals in this range of outstanding tax liabilities, the general penalty message had no statistically significant effect. Finally, for those with outstanding balances above $433 (USD), no significant increase in payments was found. However, the detailed penalty message increased the likelihood of initiating a payment plan for outstanding liabilities by 1.2 pp. (SE = 0.479, p <0.05). Moreover, the social norm intervention, which emphasized that other taxpayers had already paid their taxes, had no economically significant effect on payments at all.

Perez-Truglia and Troiano (2018, p.130) measured the effects of shaming penalty interventions on delinquent tax payments in the USA. This was achieved by imposing social costs within the behavioral intervention, in which delinquent taxpayers were informed about the visibility of an online list of tax delinquents. A comparison of the treatment effects for different income quartiles revealed a statistically significant effect only for the lowest quartile of tax debt between $250 and $2273. The shaming penalty increased the payment rates by 2.1 pp. ($p < 0.01$). Relative to a baseline payment rate of 10%, the increase represented an economically significant increase of 21%. For all other quartiles ranging between $2273 and $149,738 the effect was nearly zero. The salience of shaming as a form of social deterrence seemed effective only for small tax debt amounts.

Del Carpio (2013, p.23) reported in a field experiment that social norm and payment reminders had a greater impact on previously compliant taxpayers than on noncompliant taxpayers. This is consistent with the authors' 'pure reminder hypothesis', which suggested that behavioral interventions are less effective for noncompliant taxpayers because of the ineffectiveness of their previous interactions with the authorities. First, the comparison of interaction effects between the social norm intervention and compliance history revealed that for taxpayers who were always compliant, a social norm message increased tax compliance significantly by 15.6 pp. compared with the control group (SE = 0.068; $p < 0.05$). On the other hand, for taxpayers who had never complied, no statistically significant interaction effect was found. The same pattern emerged for the reminder treatments in interaction with compliance history. For always compliant taxpayers, reminder interventions significantly increased tax compliance by 12.9 pp. (SE=0.064; $p < 0.05$), but no effect was found for never compliant individuals. In the second stage of the field experiment, following the implementation of a deterrence policy through warnings sent to both always compliant

and never compliant taxpayers, the social norm intervention was ex post most effective for individuals who had never complied. It increased compliance by 6 pp., although the result was not statistically significant. These results highlight that the effectiveness of behavioral interventions depends not only on compliance history but also on the broader tax policy context, including interactions with enforcement strategies. Finally, Hasseldine et al. (2007) compared treatment effects between self-preparers and taxpayers who hired tax preparers. Across all intervention letters, except for an enabling letter, the effects of simplification and deterrence treatments were significantly stronger for self-preparers than for those who employed tax preparers. The enabling letter, which informed taxpayers that the tax agency provided assistance, may explain why there was no difference in this case, as those individuals were not paying for preparers.

Attitudes & Norms*:* Boyer et al. (2016, p.141)) investigated how external incentives affect extrinsic motivation in tax compliance, particularly in relation to potential crowding-out effects on overall motivation and its interaction with intrinsic motivation. Three treatment groups were used to compare the effects of different treatment strategies. The compulsory treatment letter emphasized the legal obligation to contribute to the public good; the voluntary treatment letter referenced a legal norm but framed it as nonbinding; and the donation treatment letter presented the church levy as a charitable contribution. Letters were randomly addressed to a total sample of approximately 40,000 individuals obligated to pay local church levies. The findings revealed heterogeneous responses to the treatment. Taxpayers with regular contributions to the church levies, who are presumably highly intrinsically motivated, showed no responsiveness to the framing of the church levy as a tax. In contrast, individuals who made payments only sporadically, who may have low intrinsic motivation, reduced their contributions in response to the letter framing the church levy as voluntary. Additionally, this subgroup did not exhibit any behavioral changes in response to the compulsory tax letter intervention. These results align with the possibility of backfiring effects when norms are imposed on prosocial behavior. As the authors demonstrated, this can lead to a crowding out of intrinsic motivation, which may be counterbalanced by binding and enforced tax laws. In the field experiment, the crowding-out effect was found to be economically significant. Under the voluntary tax treatment, individuals with the lowest levels of baseline motivation were approximately 19% less likely to contribute positively than those receiving the donation letter. Moreover, those who initially did not contribute significantly increased their

payments when they were sent the compulsory tax letter but remained unresponsive to the voluntary letter, which outlined a nonbinding legal obligation. Surprisingly, the average treatment effects were statistically insignificant, even though several sub groups of taxpayers exhibited strong behavioral responses. The authors concluded that it is crucial to account for possible heterogeneities in motivational types when implementing behavioral interventions with external incentives.

Dwenger et al. (2016, p.227) also examined types of motivation in taxpayers, focusing on the interaction between extrinsic and intrinsic motivation in relation to tax compliance behavior regarding a church tax in Germany. This element of the tax system, characterized by its legally binding nature and the absence of deterrence, relies primarily on intrinsic motivation for compliance. This structure enabled the researchers to distinguish between intrinsically motivated compliers and donors and extrinsically motivated evaders, which supported a heterogeneity analysis of treatment effects and interactions between motivational types. The exploration of possible heterogeneities in tax compliance behavior revealed that the pooling of taxpayers can lead to misleading results across different motivational types. Extrinsically motivated evaders showed a statistically significant 1.27% increase in the probability of evasion, along with a 16% reduction in the likelihood of increasing tax payments in response to a reward or recognition intervention letter. These results suggest a negative interaction between extrinsically motivated taxpayers and external incentives or reflect a backfiring effect that reinforces existing behavior—namely, evasion. Among intrinsically motivated donors, the offer of a reward had no statistically significant effect on the probability of donating. However, it did significantly increase the amount donated by 4.8%, which is notable given that these individuals were already contributing. The heterogeneous behavioral responses to the treatment across different taxpayer types present a trade-off for policymakers. The overall benefit of offering rewards depends not only on how extrinsically and intrinsically motivated taxpayers react but also on the distribution of each group within the population.

Institutional reciprocity: Castro and Scartascini (2015, p.76) reported that reciprocity messages highlighting infrastructure achievements did not lead to changes in tax compliance behavior, and neither did peer-effect letters mentioning the proportion of noncompliers in the population. In contrast, deterrence messages had a significant effect. In addition, while average effects may conceal potential heterogeneities, low levels of trust in the government among noncompliant individuals may further reduce the effectiveness of reciprocity interventions. To test this hypothesis further, a

heterogeneity analysis was performed. The analysis revealed varying effects when a composite variable representing the overall provision of public services, derived from the first principal component of several public good measures, was used. The findings suggested that the reciprocity message had a different impact depending on the level of public services received. Those who received low-quality services responded positively to the reciprocity message, likely revising their beliefs upward. Conversely, individuals who received high-quality services reacted negatively, possibly adjusting their beliefs downward. Additionally, the data suggested that trust did not play a significant role, as taxpayers with less access to public services were more responsive to deterrence messages than those who received high-quality services. To further investigate heterogeneous effects and belief formation, regressions were run separately for taxpayers who owned property in the city but lived outside the city. This group likely held different prior beliefs than city residents did because of fewer interactions with the municipal government and city residents. Interestingly, the initial findings showed that compliance among this group was 25% lower than the average of residents within the city. The results indicated that both the deterrence and reciprocity messages had a more positive impact on this group than on the overall population. This suggested that taxpayers living outside the city were more responsive to information about deterrence and public services, likely because they were less familiar with the municipality's efforts than individuals living in the city.

While it is essential to account for heterogeneities in the interactions between taxpayers and authorities, it is equally important to recognize that these interactions can be influenced by policymakers through targeted interventions. For instance, Wenzel (2006) demonstrated that the type of letter used in communication significantly affected perceived informational justice. Both informational and interpersonal letters were perceived as more fair compared to a standard tax letter, suggesting that the clarity and tone of communication can shape taxpayer perceptions and influence compliance behaviour. Therefore, it may be important to explore the distribution of beliefs within the population, as this could help tailor interventions more effectively, particularly in terms of reciprocity and how taxpayers perceive the actions of authorities.

To summarize our findings, younger, first-time taxpayers and individuals with consistent compliance histories typically exhibit stronger positive responses to interventions. In contrast, older or non-compliant taxpayers often show weaker or negligible effects, highlighting the influence of past behavior and reinforcing the need for tailored

strategies to optimize compliance outcomes. Our results also show that individuals do not necessarily base their tax decisions on the rational assumptions of the standard economic model. Individual motives and social norms significantly influence both the willingness to pay taxes and the response to behavioral interventions, leading to heterogeneity. External monetary incentives can undermine the intrinsic motivation of those with strong intrinsic drives (crowding out), while extrinsically motivated individuals often show inconsistent responses to voluntary measures. These findings underscore the risk of unintended behavioral effects in policy design and highlight the importance of considering motivational diversity to improve the effectiveness of interventions. Finally, the consumption of public goods and services - including the perceived quality of services and their frequency of use - plays an important role in shaping the effectiveness of tax compliance interventions. High levels of public good consumption can reduce the impact of public good interventions and the effectiveness of deterrence measures. Conversely, when public good consumption is low, both deterrent messages and public good interventions can increase compliance by positively influencing taxpayers' perceptions of service provision.

Table 2. Experiences, Attitudes and Norms

	Deterrence	***Public Good***	***Social Norm***	***Simplification***
Public Good Consumption	Low consumption ↑	Low consumption ↑ High consumption ↓		
Balance due	Low to Middle ↑ High Ø		Ø	
. **Compliance history**			Always comply ↑	
Self-preparer	Yes ↑		Yes ↑	
1st time taxpayer*Age*Native	18-21 y/o ↑			
Taxpayer registration*Gender				Men ↑
Taxpayer registration*Age				≤ 50 ↑

↑ = Positive; ↑↑ = Strong positive; ↓ = Negative; ↓↓ = Strong negative; Ø= No effect; □ = No evidence

5.3 Behavioral Intervention Techniques

Behavioral interventions vary in design, as specified by policies. Depending on these designs, heterogeneity can arise within interventions. Our results suggest that design choices, such as the timing and frequency of an intervention, are crucial for their effectiveness.

Evidence from tax evasion games

Muehlbacher et al. (2017, p.130-132) found that mental tax accounting, which refers to the process of integrating taxes and revenue, was associated with interaction effects in income framing. To provide a broader perspective, Thaler (1999, p.183) defined mental accounting as "the set of cognitive operations used by individuals and households to organize, evaluate, and keep track of financial activities." Based on this concept, compliance was found to be significantly higher when income was framed as net income, especially when mental tax accounting involved mentally segregating the tax liability. In this context, tax compliance increased by 23.57 pp. (SE = 5.44; $p \leq 0.01$) compared to when income was framed as gross income. Additionally, older individuals and women exhibited higher tax compliance, likely due to their use of different mental accounting strategies and a stronger association of tax liability segregation with a more positive attitude toward tax payment. Specifically, tax compliance increased by 1.76 pp. (SE = 0.58; $p \leq 0.01$) with each additional year of age. On average, women exhibited 6.87 pp. higher tax compliance than men (SE = 7.79), though this effect was not statistically significant. Both older individuals and women showed higher levels of tax compliance, which may be due to their tendency to use mental accounting strategies to separate tax liabilities, thus fostering a more positive attitude towards paying taxes. The stronger correlation between increased tax compliance and mentally segregated accounts can be explained through prospect theory Tversky and Kahneman (1992). Mental accounting can influence the reference point used in tax compliance decisions. When taxes are mentally separated from income, net income serves as the reference point. In this case, tax evasion—if detected during an audit—is perceived as a painful loss relative to the expected net income. Conversely, when gross income acts as the reference point, paying taxes is perceived as an immediate loss, reducing the incentive for compliance.

Another consideration regarding heterogeneity within behavioral intervention techniques is the use of honesty oaths. These are often included in tax declaration letters or filings to enhance tax compliance. The effect of honesty oaths has previously been

studied in psychological research on honesty behavior but has not been systematically examined in the tax compliance literature until the recent meta-analysis by Zickfeld et al. (2024, pp.6-9). In their systematic analysis, 21 variations of honesty oaths were tested not only to explore overall effectiveness but also to examine different behavioral intervention mechanisms, such as social norm or moral reminders combined with various commitment techniques. For example, the study evaluated the effectiveness of retyping an oath versus simply checking a box. A total of 21,506 participants from the UK and the US took part in this meta-analysis. Across all oath variations, tax compliance increased by 3.9 pp. (mean=86.2%, SD=29.9%) compared to the control condition without an oath (mean=82.3%, SD=33.5%). The most effective oath variation, which referred to a specific behavior in the task, increased tax compliance by 8.5 pp., significant at $\alpha = 0.05$. Heterogeneity in the effectiveness of honesty oaths as a behavioral intervention can partially be attributed to observed heterogeneity. First, for honesty, oaths that participants had to retype were more effective (mean=86.7%; SD=29.4%) than just checking an oath with a box (mean=85.8%; SD = 30.5%). Though these differences were found not to be statistically significant. On the other hand, the placement of honesty oaths in terms of timing have been found to be statistically significant. Tax compliance was higher when the honesty oath was after completing income declaration tasks (mean = 87.4%; SD = 28.8%), compared to placing oaths prior to the declaration (mean = 85.0%; SD = 31.0%). The third source of heterogeneity emerged in relation to gender differences. Specifically, women exhibited higher baseline levels of tax compliance than men. However, across five variations of the oath, the behavioral intervention increased tax compliance among men but decreased it among women, with all findings reaching statistical significance ($p < 0.05$).

Previously, Jacquemet et al. (2020, p.3-4) demonstrated that integrating honesty oaths as a behavioral intervention technique can significantly improve compliance. In their experimental setting, the average compliance rate increased from 49.0% to 63.2% ($p < 0.05$). Additionally, under oath, 50% of respondents reported all their income, compared to only 25.4% without an oath ($p < 0.01$). Interestingly, the increase in compliance was primarily driven by a positive reaction from partial liars, as the proportion of partially compliant individuals (compliance rate between 10% and 90%) decreased significantly from 49.2% to 31.8% ($p < 0.1$). In contrast, the proportion of low compliers (<10%) remained relatively stable, declining slightly from 20.6% to 16.7% ($p < 0.1$) indicating a possible limited effect of honesty oaths on individuals

with lower levels of compliance.

Evidence from Field Experiments

Furthermore, heterogeneity needs to be taken into account when considering different design options for behavioural interventions. Not only that, disparities can occur within different types of interventions. Factors such as the type of delivery or frequency of interventions can lead to deviations from the desired effectiveness.

A further source of heterogeneity in the context of behavioral interventions on tax compliance is the frequency of reminders. Antinyan et al. (2021, p.753) examined the effect of reminder frequency as a behavioral intervention for overdue property taxes in China. They conducted a randomized controlled trial (RCT) where taxpayers received reminders either once (low-frequency), once a week (medium-frequency), or twice a week (high-frequency) over a four-week period, prompting them to pay their overdue taxes. The results suggest heterogeneity in treatment effects based on the frequency of reminders for each respective group. Compared to the control group, those receiving medium- and high-frequency reminders were 12-14 pp. less likely to exhibit overdue tax payments, representing an increase in compliance of over 300%. In contrast, low-frequency reminders resulted in a 5-7 pp. increase in compliance, reflecting a 40-60% improvement. However, it was also observed that increasing the frequency of reminders beyond a certain threshold yields diminishing returns on tax compliance behaviour. When comparing the effectiveness of medium-frequency and high-frequency reminders, the increase in compliance was only around 2 pp.. In a subsequent step, Antinyan et al. (2021, p.760-761) conducted a heterogeneity analysis to examine how various subgroups responded to different reminder frequencies. Statistically significant differences were identified across subgroups based on gender and previous payment history. Medium-frequency reminders led to a statistically significant improvement in tax compliance for women compared to low-frequency reminders ($F = 3.9$, $p = 0.049$), while high-frequency reminders had similar effects across genders. For men, there was no statistically significant difference between the treatment effects of low- and medium-frequency reminders ($F = 0.58$, $p = 0.446$), indicating that variations in reminder frequency did not significantly affect tax compliance for this group. A second source of heterogeneity was observed with long overdue tax debt, where no robust treatment effects were identified. This lack of responsiveness can likely be attributed to the fact that highly non-compliant taxpayers tend to be insensitive to tax payment reminders, regardless of reminder frequency. In

this specific case, some of these highly non-compliant taxpayers had relatively small tax debts, suggesting that the financial burden may have been too low to elicit a stronger response. Conversely, highly non-compliant taxpayers with larger debts may face liquidity constraints, which could hinder their ability to settle the outstanding amounts, regardless of receiving reminders.

But also the delivery can play a crucial rule when taking into account the effectiveness of behavioral interventions. Schächtele et al. (2023, p.805) observed that, for taxpayers in arrears, a treatment letter highlighting renovated public spaces had a significant effect on the probability of payment, increasing the likelihood by 9.02 pp. (SE = 4.03). When delivered in person, the effect was even more pronounced, raising the probability of payment by 14.6 pp. (SE = 7.28), representing an additional increase of 5.58 pp. compared to the effect when not controlling for the delivery mode. Both treatment effects were statistically significant at the 5% level. These results suggest that in-person delivery of the public service ad was particularly effective in encouraging payment among those with outstanding tax liabilities, which is in line with the current literature (Antinyan and Asatryan, 2024).

In terms of delivery methods, Gallego and Ortega (2022, p.1556) investigated the role of online strategies, specifically using social media advertisements and email messages, to increase tax compliance in a quasi-experimental setting in Venezuela. Even though both treatments had significant effects, the differences between E-Mail and Social-Media interventions were substantial. For debtors that received E-Mail reminders, the likelihood to make a tax-payment increased by 7.7 pp. (SE=0.008, $p<0.01$) compared to the control group. On the contrary, Facebook advertisement had a distinctively smaller effect size by increasing the likelihood by 1.1. pp. (SE=0.005, $p<0.05$). For individuals that received both treatments combined, the effect was the most profound, by increasing the likelihood of tax payments by 9.44 pp.. Additionally, when controlling for the payment method both individuals and combined treatments, were most effective for debtors paid with online methods (4.1 p.p and 4.3 p.p, $p < 0.05$). This suggests that online delivery methods are most effective for taxpayers who regularly use digital payment systems.

Perez-Truglia and Troiano (2018, p.130) measured the effects of shaming penalty interventions on delinquent tax payments in the USA. This was achieved by imposing a social costs within the behavioral intervention, in informing delinquent taxpayers about the visibility of an online list of tax delinquents. By comparing treatment effects for different income quartiles, a statistically significant effect was only found

for the lowest quartile of tax debt between \$250 and \$2273. The shaming penalty increased the payment rates by 2.1 pp. ($p < 0.01$). Relative to a baseline payment rate of 10% the increase represents an economically significant increase of 21%. For all other quartiles ranging between \$2273 and \$149.738 the effect was nearly zero. The salience of shaming as a form of social deterrence seemed only effective for smaller tax debt amounts, highlighting the importance of tailoring interventions, to effectively increase tax compliance rates.

Furthermore, Wenzel and Taylor (2004, p.2795) demonstrated that the tone of a letter can play a significant role, particularly when choosing between a softer or more deterrent tone. The observed interaction effects revealed that a harder letter tone led to significantly lower deduction claims for individuals claiming rental deductions for the first time, compared to those receiving a softer tone (Ms = 88.44 vs. 89.84, $p < 0.05$). Interestingly, the tone of the letter did not have a significant effect on second-time taxpayers (Wenzel and Taylor, 2004, p.2795-2796). This finding can be linked to the discussion in the previous chapter regarding first-time taxpayers, suggesting that letter tone may need to be considered when addressing heterogeneities within behavioral interventions.

An important consideration when examining heterogeneity in behavioral interventions is the potential for interactions between combined strategies. For instance, combining interventions, such as a treatment letter containing both deterrent and moral content, could offset potential effects on tax compliance behavior. Vainre et al. (2020, p.8) therefore, argue that it is not only insufficient to evaluate the average effects of individual interventions but also emphasize the need to investigate the interaction effects of combined interventions and developed a tailored compound intervention (TCI) focusing on the amount of income tax declared from Estonian employers in the construction industry. Their findings suggest that the TCI led to an increase in income tax declarations compared to the no-communication condition. The interventions significantly increased declared income by an average of 5.1-6.1% ($p \leq .0001$). It would be interesting at this point to compare these treatment effects with traditional behavioral interventions that target only one determinant of tax compliance behavior. Additionally, when comparing the implicit and explicit tones of the letters, the group receiving the implicit tone letter was slower to declare their income compared to the explicit group.

In conclusion, the effectiveness of behavioral interventions on tax compliance is influenced by factors such as timing, delivery method and frequency. Interventions

are more effective when delivered close to tax filing deadlines and when reminders are frequent. The delivery method also plays a critical role, with personalized and timely messages - whether through tailored letters or digital communication - proving to be more effective in increasing compliance.

Table 3. Within Behavioral Intervention Techniques

	Deterrence	***Public Good***	***Social Norm***	***Simplification***
Timing of intervention		Just before declaration ↑	Just before declaration ↑	Just before declaration ↑
Delivery method			In-Person ↑	Online ↑
Reminder frequency	Regularly ↑			Low frequency ↑ High frequency ↓

↑ = Positive; ↑↑ = Strong positive; ↓ = Negative; ↓↓ = Strong negative; Ø= No effect; □ = No evidence

5.4 Heterogenous Model of Behavioral Interventions on Tax Compliance

The economic analysis of individual tax compliance decisions was initially modeled using the expected utility framework, in which taxpayers maximize their expected utility given the probability of being audited and the potential penalties for evading (Allingham and Sandmo, 1972; Yitzhaki, 1974). A taxpayer chooses to evade when the expected utility of evasion exceeds that of compliance. Formally, a taxpayer's expected utility is given by:

$$EU = (1-p) \cdot U[y - tx] + pU[y - tx - f(y - x)] \tag{1}$$

In this formulation, p is the probability of detection, the taxable income is y, but only x is declared. If detected, the undeclared income is penalized at a rate f higher than the tax rate t. As the probability of detection p increases, the incentive to evade tax decreases, leading to a smaller difference between y and x. Subsequently, Gordon (1989) expanded the analysis by introducing nonpecuniary costs, such as individual morality and reputation, as additional determinants influencing tax compliance. The role of morality in tax compliance decisions has also been linked to psychic costs or the stress associated with violating social norms (Erard and Feinstein, 1994; Dulleck et al., 2016). Building on previous models, we extend the theoretical literature by introducing a heterogeneous model of behavioral interventions on tax compliance. As a first step, our model allows for heterogeneity in taxpayer characteristics, reflecting

the tax compliance determinants discussed in 3. In a further step, the determinants of each individual's tax compliance are modeled as a function of interaction terms to capture heterogeneous treatment effects on tax compliance behavior, following the results of our analysis. This is particularly important, as behavioral interventions can alter the individual's cost–benefit analysis and therefore the taxpayer's utility. A heterogeneous taxpayer's compliance utility is derived as follows:

$$EU = (1 - \tilde{p})U[y - tx] + \tilde{p}U[y - tx - \tilde{f}(y - x) + PG + S - PC] \tag{2}$$

Following Allingham and Sandmo (1972), individuals weigh the probabilities of paying taxes, tx, against the risk of being audited and fined, $\tilde{f}x$, where y represents income and x denotes the tax rate. Unlike the standard model, the probabilities are based on subjective beliefs, as individuals often struggle to accurately assess risks and corresponding fines. This is particularly the case when audit rates are undisclosed by tax administrations or when fines for tax evasion lack transparency. We denote subjective probabilities and fines as $\tilde{p}(p, v_p, i_p)$ and $\tilde{f}(f, v_f, i_f)$. Both variables are functions of objective probabilities p and fines f, respectively. In addition, v_p and v_f are defined as individual sensitivity parameters for being audited and fined, which mutually influence individual risk perceptions. To model behavioral interventions, we introduce i_p and i_f as intervention vectors, which contain a set of interventions aimed at *deterrence*. The inclusion of intervention vectors allows us to capture interaction effects between behavioral interventions and taxpayers perceptions of audit and penalty risk. In addition to risk assessment, tax compliance behavior is determined by an intrinsic motivation to contribute to the public good $PG(v_{PG}, i_{PG}, y, x)$; social utility $S(v_S, i_S, y, x)$ and psychic costs $PC(v_{PC}, i_{PC}, y, x)$ associated with tax evasion (in line with modeling approaches of Besley and Persson (2009) for tax morale; Bénabou and Tirole (2006) for pro social behavior; Erard and Feinstein (1994) for psychic costs). As tax morale can be considered to be two-folded, behavioral interventions can either target PG or S, while both variables can be defined as functions of respective sensitivity parameters. While v_{PG} reflects the sensitivity parameter of intrinsic motivation to contribute to the public good, v_S conveys the sensitivity parameter of social pressure and reciprocity with institutions. Again, both taxpayer's intrinsic motivation to contribute to the public good and social utility can be targeted by behavioral intervention vectors i_{PG} and i_S. Moreover, PC encompasses, v_S which is defined as a sensitivity parameter linked to psychic costs in case of evasion and the intervention vector i_S. Since it is not always clear which behavioral intervention targets which

variable, our model also allows for the interaction between individual intervention measures. For instance, it is possible that a deterrence intervention targeting $\tilde{p}$ and $\tilde{f}$ can also influence PG. Finally, y and x are mutually functions of PG, S and PC, as different individual financial conditions can lead to heterogeneous behavioral responses. Ultimately, our model incorporates the heterogeneous effects of behavioral interventions based on individuals' expected utility (EU) in tax compliance decisions. All tax compliance determinants are influenced by objective measures, sensitivity parameters, and intervention vectors, which capture heterogeneous interaction effects, as analyzed in Chapter 5.

6 Consequences on Inequality & Implications

In the preceding heterogeneity analysis of the meta-studies by Antinyan and Asatryan (2024), Alm and Malezieux (2021), and Zickfeld et al. (2024), we identified three key dimensions along which behavioral interventions exhibit heterogeneous effects: *(i) Sociodemographics and Regionality*, *(ii) Experience, Attitudes and Norms*, and *(iii) Behavioral Intervention Techniques*. The findings underscore the ineffectiveness of the frequently employed 'one-size-fits-all' approach in policymaking to improve tax compliance, as heterogeneous effects across these three dimensions can partially or entirely offset one another, which emphasizes the need for differentiated intervention strategies. Since data on individuals' tax compliance levels and motivation to pay taxes are unavailable to both policymakers and researchers, a taxpayer classification is needed to enable the implementation of group-tailored interventions. The classification approach of Torgler (2003) is based on four distinct types of taxpayers, each with unique characteristics and intervention needs. First, the *(i) honest taxpayer* is inherently compliant and would not consider tax evasion, which renders behavioral interventions unnecessary. Similar to the rationalist described by Bruns et al. (2023)[4] Torgler (2003)[5] outlines the *(ii) tax evader*, who aligns with the economic model of Allingham and Sandmo (1972) and responds primarily to extrinsic motivation. *(iii) Social taxpayers* is influenced by social norms and the behaviors of those within their social network. Their compliance is shaped by perceptions of others' honesty; when

[4] Bruns et al. (2023) quantitatively distinguish between two types of taxpayers: *rationalists* and *moralists*.

[5] A similar classification approach comes from Vogel (1974), who, building on the work of Kelman (1965), identified three types of taxpayers: *compliers*, *identifiers*, and *internalizers*. Along with the works of Braithwaite (2003) and Kirchler and Wahl (2010), there are only a few studies that examine differences in individuals' attitudes toward tax compliance.

peers are compliant, they are more likely to follow suit, but when underreporting occurs in their network, their own compliance tends to decrease. Finally, the *(iv) intrinsic taxpayer* operates independently of external influences but is sensitive to the institutional context. This taxpayer feels a moral obligation to pay taxes, which strengthens or weakens on the basis of perceptions of government fairness, efficiency, and treatment by tax authorities. Positive perceptions enhance compliance, whereas perceived unfairness or coercive measures (= deterrence) can lead to increased evasion. However, tax authorities are generally unaware of whether individual taxpayers are intrinsically or extrinsically motivated or their attitudes toward the government. Consequently, these classification frameworks are not feasible in practice[6]. Furthermore, this approach does not address inequality, which is problematic because behavioral interventions can exacerbate existing inequalities and potentially have negative impacts on voluntary tax compliance; this highlights the need for group-tailored behavioral interventions that account for inequality and heterogeneity, as we will demonstrate in the first step. To address this, we present a new taxpayer classification approach based on individual characteristics, such as income, gender, age, and residence. Compared with the established classification methods of Torgler (2003) and Bruns et al. (2023), this approach entails an advantage in that tax authorities already possess these data, which enables its political implementation. Regardless of taxpayer classification, in the second step, we outline how behavioral interventions should be implemented to further enhance their effectiveness. Drawing on insights from the heterogeneity dimension of *Behavioral Intervention Techniques*, we identify key characteristics that interventions should incorporate with respect to framing, communication channels, and frequency.

6.1 New Classification Approach

Having already introduced a theoretical model that accounts for heterogeneous responses, we now present a new classification approach that allows us to specifically leverage the heterogeneous effects of behavioral interventions for group-tailored solutions. Our analysis *(Sociodemographics and Regionality)* revealed systematic dif-

[6]The classification approach of Torgler (2003) acknowledges the existence of honest taxpayers who do not require any intervention. Therefore, the implementation of our approach carries the risk of backfire effects if interventions are applied to honest taxpayers. It may therefore be quite sensible for policymakers to utilize our taxpayer classification for group-tailored behavioral interventions until individualized data on the motivations and attitudes of individual taxpayers become available to enable precise interventions at the individual level.

ferences in responses to interventions, such as deterrence, public good, social norm, and simplification, across various subgroups, including (i) wealthy and middle- and low-income individuals, (ii) men and women, (iii) younger and older people, and (iv) urban and rural populations. The clustering of taxpayers on the basis of these inequalities is not only feasible owing to the availability of data on aspects such as income, gender, age, and residence—which are readily accessible to tax authorities—but also beneficial, as it helps mitigate the risk of exacerbating existing disparities in tax compliance levels through heterogeneous behavioral interventions. This approach is critical for the long-term maximization of tax compliance, as empirical evidence has demonstrated that inequality erodes trust in the government, which subsequently undermines voluntary tax compliance over time. This dynamic is described by Kirchler (2007) and Kirchler et al. (2008), and has been validated in numerous studies (e.g., Alm and Torgler (2011); Augustine and Enyi (2020); Batrancea et al. (2019); Kastlunger et al. (2013); Kogler et al. (2015)). Policymakers, therefore, have a vested interest not only in effectively combating tax evasion but also in mitigating the risk of amplifying inequality through these efforts. Since inequality is multidimensional[7], we first determine the relevance of each category of inequality before explaining how, on the basis of our analysis, these categories can serve as a foundation for the implementation of interventions. This classification approach provides policymakers with the option to either maximize tax compliance by addressing each socioeconomic group with targeted interventions or adopt a novel approach to combating inequality through income taxation. The latter could be achieved by conducting interventions only for wealthy individuals and men, as both groups exhibit low tax honesty, which in turn exacerbates the gender pay gap and inequality between the rich and the poor. We provide the necessary analysis and the corresponding theoretical model to support this political decision-making process.

Income - High and Low: While most studies on tax compliance have focused on the general population rather than specifically on wealthy individuals (Gangl and Torgler (2020)), several studies clearly indicate that high-income individuals tend to evade significantly more taxes (e.g. Alstadsæter et al. (2019); Doerrenberg and Peichl (2013)). A meta-study confirms this trend, showing a negative correlation between income and self-reported tax compliance (Hofmann et al. (2017)).
Why is the tax compliance of the wealthy so crucial? Wealthy individuals often serve

[7] Costa and Kahn (2003) show that there are additional characteristics to analyze inequality (e.g. race, ethnicity, education, or work experience). However, these socioeconomic factors are strongly correlated with income (Causa and Johansson (2009))

as role models, and their behavior influences others (Fassin (2005))); this reflects a phenomenon rooted in evolutionary biology, where mimicking successful behavior enhances survival (Henrich (2016)). Furthermore, while the top earners represent a small fraction of the population, they contribute disproportionately to total income and tax revenue, particularly in progressive systems (Atkinson et al. (2011)). For instance, the top 2.7% of U.S. income earners pay approximately 51.6% of total income taxes (Desilver (2016)). Increasing tax compliance among wealthy individuals not only boosts government revenue but also supports redistribution efforts and fosters broader compliance through imitative effects. A substantial body of empirical literature suggests that wealthy individuals perceive the tax system as unfair, both in terms of how taxes are collected (degree of progressivity) and how the revenue is ultimately spent (Fung and Au (2014); Reuben and Riedl (2013)). This perception may stem from the fact that wealthy individuals often lack a clear understanding of their actual tax rates; noncompliant wealthy individuals, in particular, tend to have less tax knowledge than those who comply (Gangl et al. (2015)). Compounding this issue is the fact that wealthy individuals have access to alternative political and legal means to avoid or evade taxes, legally or illegally (Gangl and Torgler (2020)). The capital of wealthy taxpayers is highly mobile (e.g., Akcigit et al. (2016); Kleven et al. (2013)), as they often have multiple sources of income from both domestic and international origins, such as self-employment income, which is not subject to automatic taxation; rental income; or itemized deductions, which allows them greater opportunities to optimize or evade taxes. In contrast, low- and middle-income earners typically derive their income solely from an employer, and taxes are automatically withheld, which leaves them with far fewer opportunities for such evasion strategies (Alm (2019)). Given the financial resources of wealthy individuals and their perceived sense of injustice, deterrence-based behavioral interventions aimed at increasing extrinsic motivation would likely be ineffective, as our analysis confirms. When individuals have the means to avoid consequences and feel that a measure is unjust, they are likely to react with resistance and seek ways to circumvent the situation (e.g., Agnew (1992); Agnew (2017)). This can be explained by the fact that a perceived violation of justice can be a powerful motivator for behavior (Tyler and Smith (1995)). In addition to our findings, Gangl and Torgler (2020) advocate alternative strategies for wealthy individuals, particularly strategies aimed at simplifying the process of understanding tax burdens and correcting misperceptions. However, their argument relies solely on theoretical plausibility, as they provide no empirical evidence to support this claim.

Simplification reduces the cognitive effort and misperceptions involved in assessing one's actual tax obligation. Information about the true extent of the tax burden, as well as the specific benefits the wealthy derive from taxes, can influence both their sense of justice and overestimation of their tax liability—two closely linked factors. In contrast, our analysis shows that for individuals with low and middle incomes—if politically desired—deterrence should be employed owing to its effectiveness.

Gender - Men and Women: The gender pay gap has been extensively examined in academic research and sociopolitical discourse and has gained increasing prominence in political tax debates in recent years (Gunnarsson et al. (2017)), as it undermines social justice and economic equality of opportunity. Much of this research has focused on factors such as societal norms (Bursztyn et al. (2023)), family responsibilities (Goldin et al. (2017)), pay transparency (Roussille (2024)), and occupational choices, particularly in STEM fields (Blau and Kahn (2020)).

The economic tax literature demonstrates that women exhibit higher tax compliance than men do[8] (e.g., Alm et al. (2009); Alm et al. (2010); Alm et al. (2012); Andrighetto et al. (2016); Friedland et al. (1978); Zickfeld et al. (2024)). This higher compliance is often attributed to women's tendency to overestimate both the likelihood of detection and the severity of penalties for tax evasion (e.g., Hasseldine (2002); Richards and Tittle (1981)). Additionally, women's generally greater risk aversion, as documented by Croson and Gneezy (2009), correlates negatively with tax evasion behavior (Finocchiaro Castro and Rizzo (2014)). In this context, additional extrinsic motivations should be critically assessed for women, whereas they can effectively enhance tax compliance among men, as our analysis has shown. In contrast, our analysis also shows that social norm interventions, which enhance the intrinsic motivation to pay taxes, appear to be more effective for women, which likely reflects their higher levels of prosocial attitudes and behaviors (Fortin et al. (2007); Grosch and Rau (2017)). However, this conclusion is nuanced, as our analysis also shows that public good interventions effectively increase tax compliance among men. This highlights why, in contrast to Antinyan and Asatryan (2024), we differentiate between social norm and public good interventions rather than referring broadly to moral interventions. Finally, the dimension of behavioral intervention techniques reveals that honesty oaths are particularly effective for men, although their impact on women varies. Depending on the specific design of the honesty oath, the intervention can

[8] A smaller body of literature reports no significant differences or even opposite trends (Gangl et al. (2013); Kirchler and Maciejovsky (2001); Muehlbacher et al. (2017)).

produce minor positive effects on women's tax compliance or, in some cases, even negative effects. This variability underscores the importance of tailoring behavioral interventions to gender-specific preferences to maximize their efficiency.

Age - Young and Old: Even though inequality between younger and older individuals does not inherently result in negative externalities, as economic differences are largely attributable to the longer professional experience of older individuals, this dimension nonetheless represents an important classification type for designing interventions to enhance tax compliance, as our analysis has identified clear patterns in this area. Once again, differences in tax compliance levels become apparent, with younger individuals in particular evading taxes significantly more often than older individuals (e.g., Andrighetto et al. (2016); Coricelli et al. (2014); Dulleck et al. (2016)). Two main explanations account for this trend, and they are not mutually exclusive. First, taxes can be declared incorrectly either intentionally or unintentionally. This is due to the complexity of the tax system and a lack of experience in completing income tax returns, which is a challenge that disproportionately affects young individuals (Choo et al. (2016)). In this context, our analysis shows that simplification is an effective behavioral intervention, as it helps alleviate the cognitive overload associated with tax filing. This is especially relevant for young parents, who not only lack extensive experience with tax returns but also face the added cognitive burden of raising children[9] (De Neve et al. (2021)). Second, deterrence-based behavioral interventions are clearly also effective among young individuals. It can be assumed that, similar to the case for men, risk preferences play a crucial role in this context. Young people tend to have a stronger preference for risk (Albert and Duffy (2012)), which makes deterrence—the extrinsic approach that relies on the threat of penalties—particularly effective. Simplification is a neutral intervention and can thus be combined with deterrence without significant risks of negative backfire effects, which could occur if moral and deterrence-based interventions are combined (Antinyan and Asatryan (2024)). This combined approach could address both cognitive compliance costs and risk preferences, potentially increasing tax compliance among young people while minimizing potential drawbacks. Nevertheless, some empirical evidence suggests that deterrence can be effective not only among younger individuals but also among those older than 60. This is not a contradiction but rather explains why deterrence was identified as the most effective form of intervention in the meta-study

[9] Hernandez et al. (2017) found that simplification was, on average, more effective for individuals without children than for parents. Nonetheless, simplification also significantly ($p<0.01$) increased tax compliance among parents

by Antinyan and Asatryan (2024), as outlined above. However, since income is positively correlated with age York (2019) and we have previously shown that deterrence should not be applied to high-income individuals, age should not be considered in isolation but should always be considered in conjunction with income level. For older individuals, extrinsic motivation through deterrence should be increased only if their income is below the average for their age group. As our heterogeneity analysis has also shown that social norm interventions are effective for individuals over 65 years of age, policymakers should ensure that these interventions are not combined with deterrence interventions (Antinyan and Asatryan (2024)).

Regionality - Urban and Rural: Regional disparities have become a critical dimension of inequality in the modern world (Nijman and Wei (2020)). The widening gap between rural and urban areas poses significant challenges to economic development, social cohesion, and political stability (Iammarino et al. (2019)), and are partly driven by marked differences in health conditions (Zhao et al. (2019)). Young (2013) estimates that the urban–rural divide accounts for approximately 40% of the average inequality within a country. Addressing this issue has become a political priority in many nations, with policies aimed at creating equal living conditions between rural and urban regions, for example, in Germany or the UK (Die Bundesregierung (2021); House of Lords (2019)). A key factor underpinning the urban–rural income gap is fiscal policy, particularly tax policies. As Bardhan (2002) and Hao and Wei (2010) argue, tax structures and fiscal measures play crucial roles in shaping the economic disparities between these regions. With respect to group-specific behavioral interventions, our analysis reveals that individuals in rural areas respond particularly strongly to moral interventions and thus intrinsic motivations, whereas extrinsic incentives in the form of deterrence prove more effective in urban regions. This can be attributed to the fact that behavioral interventions related to morality rely heavily on individuals' sense of belonging to their community and the extent to which they identify with it (Wenzel (2004)). Homeownership, which is often more prevalent in rural areas than in urban areas, tends to strengthen community identification (Blumenthal et al. (2001); Torgler (2013)). In addition, social norm interventions, a subset of moral-related interventions, have low effectiveness in heterogeneous peer groups (Alm et al. (2023)), which could be explained by the fact that high societal heterogeneity is generally linked to low levels of social trust and cooperation (Costa and Kahn (2003)). Given that rural areas typically have higher homeownership rates (e.g., Kempermann et al. (2020) for Germany; Mazur (2017) for the United States)

and are more socioeconomically homogeneous (Lichter and Brown (2011)) than urban areas, moral-related behavioral interventions are better suited for rural settings. People in these areas often exhibit strong community identification and belong to generally homogeneous peer groups, as demonstrated in field studies by Hernandez et al. (2017). To maximize their impact, such interventions should be implemented at the lowest administrative level possible, where connections to the community are typically strongest (Larkin et al. (2019); Torgler (2013)). In contrast, urban areas, characterized by great heterogeneity and low levels of community identification, are better suited for deterrence-based interventions.

6.2 Optimal Intervention Strategy

Behavioral interventions offer the theoretical advantages of being low threshold and simple, which make them potentially highly effective, as prior research indicates that tax incentives lose their effectiveness when their design becomes overly complex (Blaufus and Ortlieb (2009); Boylan and Frischmann (2006); Rupert et al. (2003); Rupert and Wright (1998)). However, the simplicity of behavioral interventions alone does not guarantee their effectiveness. Instead, based on the findings of our analysis of the dimension *Behavioral Intervention Techniques*, we present characteristics that an intervention should possess to maximize its effectiveness in improving tax compliance.

Intervention Framing: Perceived (un)fairness is a strong motivator for human behavior in general (Tyler and Smith (1995)) and can be a driving factor behind tax evasion, as most individuals whose taxes are directly withheld by their employer see the income tax return as their only opportunity to rectify perceived injustices (e.g., Tyler (1992); Tyler (2002)). In this context, it is crucial to recognize that perceived justice is influenced not only by the tax burden and the government's allocation of tax revenue but also by the design and framing of behavioral interventions, including the tone and style of communication (Wenzel (2006)). Assertive or highly directive standard letters may be perceived as overly restrictive, potentially triggering psychosocial reactance and backfire effects (Brehm and Brehm (2013)). To mitigate these risks, generalized informational messages and personalized, interpersonal letters are recommended. These principles hold true for both analog and digital communication (Wenzel (2006)).

Simultaneously, it is important to ensure that social reference points remain relevant when framing is considered. In their laboratory experiment, Lefebvre et al. (2015) provided participants with information about the compliance of others (i.e., the pre-

vailing social norm) and observed asymmetrical effects. The analysis revealed that instances of low compliance, or more broadly, negatively framed behavior, exerted a detrimental effect on overall compliance levels. The authors attributed this to the 'broken window effect', suggesting that negative examples exert a stronger influence than positive examples do. This is because negative examples can serve as a form of self-justification that protects an individual's self-image in cases of tax evasion. This finding shows that social norms often serve as a reference point, particularly in situations where decisions are made under uncertainty. Individuals tend to align their behavior with that of others under the implicit assumption that these others possess more information about the desired societal actions (Allcott and Mullainathan (2010)). This inherent tendency makes social norm interventions generally effective; however, it is crucial to ensure that examples of high tax compliance are emphasized.

Channels of Communication: Digital communication is particularly well suited for further reducing the cost associated with interventions (Wenzel (2006)). One key reason is that sending messages via e-mail or social media is significantly less expensive than sending traditional letters and offers greater potential for automation. Moreover, digital communication provides taxpayers with the advantage of potentially accessing additional information with just one click, which enables targeted responses to specific needs. For example, one link could direct users to simplified information, whereas another could provide more detailed explanations (Gallego and Ortega (2022)). However, the literature emphasizes the importance of the strategic coordination of different communication channels to maximize effectiveness. Gallego and Ortega (2022) demonstrated that emails are more effective than social media messages are. Specifically, behavioral interventions delivered via email had an immediate impact, peaking within the first week. In contrast, interventions conducted through social media had no effect during the first week but were effective in the second and third weeks[10]. This difference can be attributed to the unique role of social media, which functions as a calendar or reminder system for many users and prompts action closer to the relevant time. In contrast, email communication is more direct and prompts quicker responses. Notably, the combination of these channels did not lead to crowding-out effects but instead produced a positive temporal interaction effect. This highlights the importance of considering the dimension of time in the design of communication strategies.

[10]The study relates primarily to reminders, but it can be assumed that the underlying mechanism also applies to all other forms of behavioral interventions

Intervention Frequency: Future tax policy should account for not only the time delays associated with different communication channels but also the frequency and timing of the behavioral interventions. Interventions should not occur too frequently (Antinyan et al. (2021)) or too far in advance of the income tax return (Zickfeld et al. (2024)), as their effects are typically short-lived, and the long-term impacts remain insufficiently understood (Andersson et al. (2023); Del Carpio (2013)). Overly frequent interventions risk triggering backfire effects and diminishing efficiency as costs rise without a corresponding increase but rather a decrease in effectiveness. Conversely, a single intervention often proves insufficient, as it may be forgotten due to limited attention or memory. The evidence suggests that repeated interventions tend to be more effective than a single intervention, particularly because many individuals procrastinate or defer unpleasant tasks even after receiving an initial prompt (Antinyan et al. (2021)).While frequent behavioral interventions can be highly effective, the timing and combination of communication channels play crucial roles. Emails drive immediate responses, whereas social media interventions generate delayed effects, which underscores the importance of integrating both methods. The first intervention should therefore be conducted via social media and followed approximately two weeks later by a second intervention delivered via email. For older individuals or those without an email account, a personalized letter would be a suitable alternative, as it also relies on direct communication, unlike social media (Gallego and Ortega (2022)). To optimize outcomes, the final intervention should ideally occur just before individuals file their income tax return (Zickfeld et al. (2024)). Currently, income tax returns include a standard statement indicating that the provision of false information is punishable, and taxpayers confirm the accuracy of their submission through a signature. This existing oath to confirm the accuracy of the provided information can serve as a foundation for implementing the final behavioral intervention. Individuals could therefore receive three interventions in the three weeks leading up to the completion of their income tax returns. According to Antinyan et al. (2021), the delivery of one intervention per week constitutes a medium-frequency approach, which has been shown to increase tax compliance by 300%.

In summary, the heterogeneity of behavioral interventions can lead to reduced effect sizes and exacerbate existing inequalities if it is not accounted for in the intervention design. On the other hand, heterogeneity can be strategically leveraged through group-tailored behavioral interventions along relevant socioeconomic dimensions. Our heterogeneity analysis and theoretical model provide a foundation for policymakers to

either maximize tax compliance by targeting all socioeconomic groups or to deploy a novel instrument for combating inequality by focusing interventions on wealthy individuals and men, who demonstrate low tax compliance. The differing tax compliance levels and the heterogeneous effects among these socioeconomic groups undermine the intended redistributive impact of income taxation. Consequently, future inequality research should extend beyond the examination of net wages to include net wages post-income tax filings and the associated behavioral interventions. For the behavioral taxation literature, which remains relatively nascent regarding optimal income taxation (Kaplow (2024)), this highlights that the heterogeneity of behavioral interventions is not a limitation but rather an opportunity to enhance tax compliance effectively.

6.3 Research Outlook

Our findings reveal that heterogeneous effects, particularly along relevant inequality dimensions *(Sociodemographics and Regionality)*, are severely underexplored, which is problematic given that the relationship between inequality and tax compliance is well recognized in the literature. A contributing factor is that 70 of these studies were based on tax evasion games, which are typically conducted with small and fairly homogeneous samples. A further limitation of tax evasion games lies in their assumption that participants act in isolation, which reflects theoretical models that often predict tax compliance as an individual decision. However, this assumption does not hold for wealthy individuals, who frequently collaborate with tax advisors, banks, and lawyers in their tax-related decisions (Slemrod (2019)). This implies that holistic interventions targeting wealthy individuals are likely to have stronger effects in laboratory settings, where individuals act in isolation, than in field experiments, where group dynamics play a critical role. Regarding wealthy individuals, an additional question emerges concerning how the avoidance of deterrence-based strategies for this group might influence public perceptions of fairness. Our findings underline the importance of perceived fairness, not only in tax collection and expenditure but also in the design of behavioral interventions. It is therefore plausible that such differentiated treatment might be viewed as unjust by the broader population and potentially undermine tax morale. Therefore, further empirical studies are necessary to explore these potential backlash effects and to ensure that intervention strategies do not inadvertently erode public trust in the tax system. In addition, Antinyan and Asatryan (2024) demonstrated that deterrence and moral-related interventions are not neutral behav-

ioral strategies, unlike simplification measures, and should therefore not be combined. This insight from the literature poses an intriguing empirical question: How can policymakers effectively address overlapping behavioral profiles? For example, how can interventions be designed to target young men (for whom deterrence is effective) and those who live in rural areas (where moral-related interventions are more impactful)? Our classification approach thus supports group-tailored behavioral interventions.

However, further research is needed to address these conflicting predictions. In addition, machine learning methods could offer valuable insights by identifying patterns in taxpayer characteristics and their interactions with behavioral interventions to uncover heterogeneities. This, in turn, could support the implementation of group-tailored interventions and potentially increase their overall effectiveness. A key prerequisite for achieving this goal would be improving data availability and conducting country- or region-specific research. In the context of group-tailored behavioral interventions across age cohorts, policymakers and future researchers must also account for potential cohort effects. Societies and generations are dynamic, which means that future young or elderly individuals may respond to incentives differently than our analysis suggests in the context of the current young and old populations. Similar limitations arise regarding moral incentives, as their effectiveness may not only evolve over time but also vary across countries due to differing cultural norms and values. An in-depth understanding of heterogeneity is essential not only for optimizing behavioral intervention strategies and, consequently, enhancing the effectiveness and efficiency of combating tax evasion but also for addressing the broader issue of inequality. Given the methodological limitations of tax evasion games, it is essential to gain access to individual- or group-level data through field experiments. Researchers should be actively involved throughout the policy cycle, from designing and implementing natural experiments to collecting data and conducting evaluations. Such an approach would likely enjoy significant public support (Dur et al. (2025)). On the one hand, coordinated efforts between field and laboratory experiments could enhance our understanding of group dynamics compared with individual decision-making, as well as the complex interactions between inequality, perceived fairness, and tax compliance. On the other hand, field experiments could explicitly address the unresolved empirical questions surrounding our classification approach and existing frameworks (e.g., Bruns et al. (2023); Torgler (2003)). While the established classification schemes based on the findings from *Sociodemographics and Regionality* have thus far been politically infeasible owing to data availability, they avoid issues such as potential cohort

effects and overlapping sociodemographic profiles (e.g., young men in rural areas). As a starting point for future research, our heterogeneity dimension experience, attitudes, and norms could serve as a valuable foundation. Finally, we show that the timing of behavioral interventions plays a critical role in their efficiency *(Behavioral Intervention Techniques)*. However, a key gap remains in understanding when taxpayers actually file their returns. While it is reasonable to assume that most submissions occur close to the deadline, empirical studies are needed to confirm this assumption and refine the timing of interventions for maximum effectiveness. Although tax authorities possess these data and can thus implement the optimal intervention strategy, as they know when individuals submitted their income tax returns in previous years, it is equally important for researchers to have access to these data. This would allow intervention strategies to be empirically tested and improved.

7 Conclusion

Tax evasion is associated with significant social and fiscal costs. Given the low implementation costs and the high potential efficiency of successful measures, many governments utilize behavioral interventions. While numerous studies report positive effects of such interventions in combating tax evasion, effect sizes are often modest or even negative in some instances; this is potentially due to the partial cancellation of heterogeneous effects. In this study, we qualitatively analyzed 144 field studies and tax evasion games conducted between 1996 and 2024 for heterogeneity in behavioral interventions, as both the general literature on behavioral interventions (Bryan et al. (2021)) and the specific literature on tax compliance interventions (e.g., Alm (2019); Mascagni (2018)) emphasize the importance of considering heterogeneity in designing and evaluating these measures. Our findings reveal that the different types of behavioral interventions—deterrence, public goods, social norms, and simplification—generate heterogeneity across three key dimensions: (i) *Sociodemographics and Regionality*, (ii) *Experience, Attitudes, and Norms*, and (iii) *Behavioral Intervention Techniques*. A 'one-size-fits-all' approach not only reduces the effectiveness of behavioral interventions but also exacerbates inequality, which may further undermine voluntary tax compliance. Consequently, the literature calls for different behavioral interventions and offers various classification approaches for group-tailored interventions. However, limited data availability often challenges the practical implementation of such interventions. In contrast, our findings regarding heterogeneity *(Sociode-*

mographics and Regionality) demonstrate that women respond differently to various types of behavioral interventions than men do, and additional disparities are observed across income levels, age groups, and urban versus rural populations. These findings support the design of group-tailored interventions along the inequality categories of income, gender, age, and residence, as governments typically have access to these data. Ultimately, it remains a political decision whether to maximize tax compliance by addressing all inequality categories or to prioritize the reduction in inequality by targeting groups with low compliance levels (e.g., men, wealthy individuals). Regardless of this political trade-off, our findings on heterogeneity within behavioral intervention techniques highlight that effectiveness can be further enhanced by the consideration of specific characteristics, such as framing, intervention frequency, and communication channels. Finally, we introduce a theoretical model designed to facilitate group-tailored interventions and thereby equip policymakers with an effective and actionable strategy to combat tax evasion more efficiently.

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A Appendix

A.1 HTE of Behavioral Interventions on Tax Compliance: Literature

Appendix Table A1. Sociodemographics & Regionality

	Deterrence	*Public Good*	*Social Norm*	*Simplification*
Age	Cahlíková et al. (2021) ↑ Bott et al. (2020) ↑		Torgler (2004) ↑	De Neve et al. (2021); Hernandez et al. (2017) ↑↑ De Neve et al. (2021) ↓
Gender	Brockmann et al. (2016) ↓ Brockmann et al. (2016) ↑	Bruner et al. (2017); Hernandez et al. (2017) ↑↑ Bruner et al. (2017) ↑	Fortin et al. (2007) ↑; Okunogbe (2021) ↑	Brockmann et al. (2016) ↑
Citizenship	Bott et al. (2020) ↑		Bott et al. (2020) ↑	
Income	Slemrod et al. (2001) ↑ Slemrod et al. (2001) ↓		Bott et al. (2020) ↑	
Children	Hernandez et al. (2017) ↑			Hernandez et al. (2017) ↑ De Neve et al. (2021) ↑
Martial Status			Torgler (2004) ↓	
Geographic region	Fellner et al. (2013) ↑	Hernandez et al. (2017) ↑	Hernandez et al. (2017) ↑	
Population density	Okunogbe (2021); Brockmeyer et al. (2021) ↑↑	Brockmeyer et al. (2021) Ø		
Neighborhood compliance	Brockmeyer et al. (2021) ↑	Cruces et al. (2023) ↓	Fellner et al. (2013) ↑	

↑ = Positive; ↑↑ = Strong positive; ↓ = Negative; ↓↓ = Strong negative; Ø= No effect; □ = No evidence

Appendix Table A2. Experiences, Attitudes and Norms

	Deterrence	*Public Good*	*Social Norm*	*Simplification*
Public Good Consumption	Castro and Scartascini (2015) ↑	Castro and Scartascini (2015) ↑ Castro and Scartascini (2015) ↓		
Balance due	Cranor et al. (2020) ↑ Cranor et al. (2020) Ø		Cranor et al. (2020) Ø	
. **Compliance history**			Del Carpio (2013) ↑	
Self-preparer	Hasseldine et al. (2007) ↑		Hasseldine et al. (2007) ↑	
1st time taxpayer*Age*Native	Dong and Sinning (2022) ↑			
Taxpayer registration*Gender				Schächtele et al. (2022) ↑
Taxpayer registration*Age				Schächtele et al. (2022) ↑

↑ = Positive; ↑↑ = Strong positive; ↓ = Negative; ↓↓ = Strong negative; Ø= No effect; □ = No evidence

Appendix Table A3. Behavioral Intervention Techniques

	Deterrence	***Public Good***	***Social Norm***	***Simplification***
Timing of intervention		Zickfeld et al. (2024) ↑	Zickfeld et al. (2024) ↑	Zickfeld et al. (2024) ↑
Delivery method			Gallego and Ortega (2022) ↑	Gallego and Ortega (2022) ↑
Reminder frequency	Antinyan et al. (2021) ↑			Antinyan et al. (2021) ↑ Antinyan et al. (2021) ↓

↑ = Positive; ↑↑ = Strong positive; ↓ = Negative; ↓↓ = Strong negative; Ø= No effect; □ = No evidence

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